The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

CHINA'S AGRICULTURAL AND RURAL DEVELOPMENT IN THE EARLY 21ST CENTURY

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHINA'S AGRICULTURAL AND RURAL DEVELOPMENT IN THE EARLY 21ST CENTURY

EDITORS: BERNARD H. SONNTAG, JIKUN HUANG, SCOTT ROZELLE AND JOHN H. SKERRITT

Agricultural and Rural Development Task Force
China Council for International Cooperation on
Environment and Development

Center for Chinese Agricultural Policy
Chinese Academy of Sciences

AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURAL RESEARCH
CANBERRA 2005

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The Australian Centre for International Agricultural Research (ACIAR) was established in June 1982 by an Act of the Australian Parliament. Its mandate is to help identify agricultural problems in developing countries and to commission collaborative research between Australian and developing country researchers in fields where Australia has a special research competence.

Where trade names are used, this constitutes neither endorsement of nor discrimination against any product by the Centre.

ACIAR MONOGRAPH SERIES

This peer-reviewed series contains results of original research supported by ACIAR, or material deemed relevant to ACIAR's research objectives. The series is distributed internationally, with an emphasis on developing countries.

© Australian Centre for International Agricultural Research 2005

Sonntag, B.H., Jikun Huang, Rozelle, S. and Skerritt, J.H. 2005. China's agricultural and rural development in the early 21st century. ACIAR Monograph No. 116, xxxviii + 510p.

1 86320 501 2 (print)
1 86320 502 0 (electronic)

Editing and design by Clarus Design, Canberra

CONTENTS

Preface . . . . . **vii**
Editors and authors . . . . . **xi**
Executive summary . . . . . **xv**

PART ONE — CREATING A NEW ROLE FOR THE STATE IN THE EARLY 21ST CENTURY **1**
Chapter 1 — Policy options for a changing role of government **3**
1.1 Rural fiscal problems and policy reforms 4
1.2 Rural fiscal policy: the key to China's development in the 21st century . . . 12
1.3 Investment or subsidies: where should China be heading? 29
Chapter 2 — A better marketing environment for development: domestic markets **47**
2.1 China's grain marketing and reserve system 48
2.2 The emergence of agricultural commodity markets in China 55
2.3 Improving security and efficiency of the government grain reserve system 93
2.4 International experiences in grain-reserve management policies: lessons for China 115
Chapter 3 — A better marketing environment for development: international markets **125**
3.1 Trade liberalisation 126
3.2 Impacts of trade liberalisation on agriculture and poverty in China 133
Chapter 4 — Partnerships with farmer organisations **167**
4.1 Building partnerships with farmer associations 168
4.2 Producer associations: the international experience 174
4.3 Farmer professional associations in rural China: state-dominated or new state–society partnerships? 197

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PART TWO — INVESTING IN AGRICULTURAL AND RURAL RESOURCES 229

Chapter 5 — Preparing for labour migration 231

5.1 Preparing for migration off the farm 232

5.2 Self-employment, entrepreneurship and growth in rural China 239

Chapter 6 — Raising productivity on the farm 269

6.1 Agricultural research, extension and water management to raise farm productivity 270

6.2 China's agricultural research and development: reforms and challenges . . . 279

6.3 Some Canadian experiences in strengthening agricultural research and extension using public–private partnerships 304

Chapter 7 — Land security and markets 313

7.1 Encouraging security and rental markets for cultivated land 314

7.2 Rural land and labour markets in the process of economic development: evidence from China 318

Chapter 8 — Finance for rural development 353

8.1 Expanding finance options for rural development 354

8.2 Rural finance options to promote sustainable agriculture development and alleviate rural poverty in China 364

8.3 Promoting institutional innovation of rural finance in China 388

PART THREE — A NEW FRAMEWORK FOR CHINA'S GRAIN (FOOD) SECURITY 413

Chapter 9 — Food security 415

9.1 Food security successes and defining a new approach 416

9.2 China's food security 423

Chapter 10 — Managing conversion of China's cultivated land 445

10.1 Protection of China's cultivated land 446

10.2 Cultivated land conversion and bio-productivity in China 453

10.3 Land acquisition in China: policy developments and reform recommendations 469

PART FOUR — ENVIRONMENTAL CONSEQUENCES OF RURAL DEVELOPMENT 489

Chapter 11 — Rural development and the environment 491

Chapter 12 — Impediments to sustainable agriculture in China 497

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PREFACE

This monograph discusses several of the key agricultural and rural development policy issues faced by China in the first years of the 21st century. It derives from a series of workshops and meetings held in China in 2003 and 2004 under the aegis of a China Council for International Cooperation on Environment and Development (CCICED) task force on the subject.

CCICED was established in 1992 by the State Council of China. It is a high-level advisory body with approximately 40 Chinese and international members having knowledge and experience in many fields relevant to issues in environment and development. Its mandate is to 'further strengthen cooperation and exchange between China and the international community in the field of environment and development'. CCICED provides recommendations to the Government of China on policy and institutional change to support sustainable development.

CCICED is supported in its current phase by small task forces of Chinese and international experts who undertake specific short-term assignments to study issues of current interest to the Government of China. The Agriculture and Rural Development Task Force (ARDTF) was established in 2003 to investigate a series of issues affecting the incomes, development opportunities and living conditions of rural citizens. The specific issues included:

- reform of rural fiscal policy and public services
- grain marketing and grain-reserve management reform
- trade liberalisation and poverty
- farmer associations in agricultural and rural development
- labour migration off the farm
- agricultural research, extension services and water management
- land security and rental markets for cultivated land

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- reform of rural financial services
- food security
- cultivated land protection
- environment and rural development.

The ARDTF reported to the CCICED 2004 Annual General Meeting, at which the theme was agriculture and rural development. This publication is based on the ARDTF report to CCICED and contains the report executive summary, a set of policy briefs on the above issues and supporting research papers written by task-force members and invited Chinese and international experts. The papers arose from collaborative policy research carried out between Chinese government and university economists and social scientists and counterparts in a number of countries, in particular the USA, Canada and Australia.

ACIAR was invited to take part in the task force and to publish this monograph because of the large number of projects—pipeline, current and completed—it has facilitated and funded in the subject areas. These include the following collaborative projects on the topic areas designated:

Trade

- Achieving food security in China – implications of WTO accession (ACIAR project no. ADP/1998/128)
- Rural poor and smallholders in western China under WTO: a regional and community level analysis (ADP/2002/114)
- Economic analysis of technical barriers limiting agricultural trade of China (ADP 2004/044)

Food security and grain storage

- Emergence and integration of regional grain markets in China (ANRE1/1992/028)
- Chinese grain market policy with special emphasis on the domestic grain trade (ADP/1997/021)
- Outlying developing countries in world food consumption patterns (ADP/2002/049)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Livestock industry policy

- Economic aspects of raw wool production and marketing in China (ADP/1988/011)
- Analysis of socio-economic and agribusiness developments in the Chinese beef and cattle industry (ASEM/1995/002)

Natural resource management policy

- Institutions and policies for improving water allocation and management in the Yellow River Basin (ADP/2000/120)
- Sustainable land use change in the north west provinces of China (ADP/2002/021)

Research and extension policy

- Priorities for public investment in Chinese agriculture (ADP/1996/228)

The publication is available in Chinese and English and on the websites of the Australian Centre for International Agricultural Research at <www.aciar.gov.au>, the Center for Chinese Agricultural Policy, Chinese Academy of Sciences at <www.ccap.org.cn>, the China Council for International Cooperation in Environment and Development <http://www.cciced.org> and <http://www.harbour.sfu.ca/dlam/>, and China–Canada Cooperation in Agriculture <www.ccag.com.cn>.

We wish to acknowledge the excellent contributions of the members of the ARDTF and the many Chinese and international experts who participated in the writing and review of chapters of the monograph. We especially wish to thank staff at the Centre for Chinese Agricultural Policy, Chinese Academy of Sciences, for their dedicated support of the task forces.

Bernard Sonntag, Jikun Huang, Scott Rozelle and John Skerritt
February 2005

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Members of the CCICED Agriculture and Rural Development Task Force

Donato B. Antiporta	Senior Policy Adviser, Food and Agriculture Organization of the United Nations, Bangkok, Thailand
Jun Han	Director General, Rural Department Development Research Center (DRC) of the State Council, Beijing, People's Republic of China
Jikun Huang	(Task Force Co-chair) Director, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing, People's Republic of China
Bingsheng Ke	Director-General, Research Center for Rural Economy, Ministry of Agriculture, Beijing, People's Republic of China
Henry Rempel	Professor, University of Manitoba, Winnipeg, Manitoba, Canada
Scott Rozelle	Professor, University of California, Davis, California, USA
John Skerritt	Deputy Director, Australian Centre for International Agricultural Research, Canberra, Australian Capital Territory, Australia
Bernie Sonntag	(Task Force Co-chair) Former Director-General, Agriculture and Agri-Food Canada, Saskatoon, Saskatchewan, Canada
Edward Tyrchniewicz	Professor, University of Manitoba, Winnipeg, Manitoba, Canada
Linxiu Zhang	Deputy Director, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing, People's Republic of China
Funing Zhong	Dean, College of Economics and Trade, Nanjing Agricultural University, Jiangsu Province, People's Republic of China

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

EDITORS AND AUTHORS

Editors

Jikun Huang, Director and Professor, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, PR China

Tel: +86 10 6488 9440; fax: +86 10 6485 6533; email: <jkhuang.ccap@igsnrr.ac.cn>.

Scott Rozelle, Professor, Department of Agricultural and Resource Economics, 2147 Social Sciences and Humanities Building, University of California, Davis, One Shield Avenue, Davis, California 95616, USA

Tel: +1 530 752 9697; fax +1 530 752 5614; email: <rozelle@primal.ucdavis.edu>.

Bernard H. Sonntag, formerly Director-General, Agriculture and Agri-Food Canada; Sonntag Agricultural Services, Saskatchewan, Saskatoon, Canada

Email: <bsonntag@shaw.ca>.

John H. Skerritt, Deputy Director, Australian Centre for International Agricultural Research, GPO Box 1571, Canberra ACT 2601 Australia

Tel: +61 2 6217 0500; fax: +61 2 6217 0501; email: <skerritt@aciar.gov.au>.

Authors

Scott Rozelle, see Editors

Jikun Huang, see Editors

Linxiu Zhang, Deputy Director and Professor, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, PR China

Tel: +86 10 6488 9834; fax: +86 10 6485 6533; email: <lxzhang.ccap@igsnrr.ac.cn>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Shenggen Fan, International Food Policy Research Institute, 2033 K Street, NW, Washington, DC 20006-1002, USA

Tel: +1 202 862 5600; fax +1 202 467 4439; email <s.fan@cgiar.org>.

Funing Zhong, Dean and Professor, Nanjing Agricultural University, Weigang, Nanjing, Jiangsu Province 210095, PR China

Tel: +86 25 439 5735; fax +86 25 439 5649; email: <fnzhong@njau.edu.cn>.

Jing Zhu, Associate Professor, Nanjing Agricultural University, Weigang, Nanjing, Jiangsu Province 210095, PR China

Email: <crystalzhu@mail.edu.cn>.

E.W. Tyrchniewicz, Associate Dean, I.H. Asper School of Business, University of Manitoba, 304 –181 Freedman Crescent, Winnipeg, Manitoba R3T 5V4, Canada

Tel: +1 204 474 7463; fax: +1 204 474 7545; email: <ed_tyrchniewicz@umanitoba.ca>.

Zhigang Xu, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, PR China

Tel: +86 10 6488 9837; fax: +86 10 6485 6533; email: <zgx.ccap@igsnrr.ac.cn>.

Ninghui Li, Associate Professor, Institute of Agricultural Economics, Chinese Academy of Agriculture Sciences, 12 Zhongguancun South Street, Beijing 100081, PR China

Email: <lininghui@163.com>.

Minggao Shen, Associate Professor, China Center for Economic Research, Peking University, Beijing 100871, PR China

Email: <mshen@ccer.pku.edu.cn>.

Murray Fulton, Professor, Department of Agricultural Economics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Email: <Murray.Fulton@usask.ca>.

Jian Zhang, Department of Agricultural and Resource Economics, Social Sciences and Humanities Building, University of California, Davis, 1 Shield Avenue, Davis, California 95616, USA

Tel: +1 530 754 9530; email: <rhzhang@ucdavis.edu>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Ruifa Hu, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, PR China

Tel: +86 10 6488 9836; fax: +86 10 6485 6533; email: <hurf@public3.bta.net.cn>.

D.G. Dorrell, formerly Assistant Deputy Minister, Agriculture and Agri-Food Canada, 8 Stursberg Way, Kanata, Ontario K2L 3V7, Canada

Email: <gordon.dorrell@sympatico.ca>.

Klaus Deininger, Rural Development Group, Development Economics, World Bank – MSN 3305, Washington, DC, 20433, USA

Tel. +1 202 473 0430; email: <kdeininger@worldbank.org>.

Songqing Jin, Rural Development Group, Development Economics, World Bank – MSN 3305, Washington, DC, 20433, USA

Henry Rempel, Professor, Department of Economics, University of Manitoba, Winnipeg R3T 2N2, Canada

Tel: +1 204 474 9520; fax +1 204 474 7681; email: <hgrempel@mts.net>.

Yue Hongchen, Department of Economics, University of Manitoba, Winnipeg R3T 2N2, Canada

Fax: +1 204 474 7681; email: <umyueh@cc.umanitoba.ca>.

Hu Wanjing, Department of Economics, University of Manitoba, Winnipeg R3T 2N2, Canada

Fax: +1 204 474 7681; email: umhuw0@umanitoba.ca>.

Han Jun, Director and Professor, Department for Rural Economics, Development Research Center of the State Council, China, No. 255, Chaoyangmen Nei Dajie, Beijing 100010, PR China

Email: <hanjun@drc.gov.com>.

Cheng Yu, Renmin University of China, Beijing, PR China

Xiangzheng Deng, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Jia 11, Datun Road, Anwai, Beijing 100101, PR China

Tel: +86 10 6488 9019; fax: +86 10 -6485 6533; email: <dengxz.ccap@igsnrr.ac.cn>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Emi Uchida, Department of Agricultural and Resource Economics, University of California, Davis, 1 Shield Avenue, Davis, California 95616, USA

Tel: +1 530 752 151; fax +1 530 752 5614; email: <emi@primal.ucdavis.edu>; <eyoda@ucdavis.edu>.

Ke Bingsheng, Director-General and Professor, Research Center for Rural Economy, Ministry of Agriculture China, No. 56, Xi Si Zhuan Ta Hutong, Beijing 100810, PR China

Email: <ke@agri.gov.cn>.

Zhu Shouyin, Associate Professor, Research Center for Rural Economy, Ministry of Agriculture China, No. 56, Xi Si Zhuan Ta Hutong, Beijing 100810, PR China

Email: <shyzhu@hotmail.com>.

Bernard H. Sonntag, see Editors

David Norse, Professor, Department of Geography, University College London, 26 Bedford Way, London WC1H 0AP, UK

Tel: +44 20 7679 5500; fax: +44 20 7679 7565; email: <dnorse@geog.ucl.ac.uk>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

EXECUTIVE SUMMARY

INTRODUCTION

Remarkable achievement in the past

Two decades of reform have changed the economic landscape of China. In the 1990s, per-capita grain output reached a level similar to that in developed countries. Many farmers shifted into higher-value crops, making decisions increasingly on market-oriented principles. China's research system has steadily produced new technologies that have raised productivity at almost double the rate of population growth. The nation has by far the most sophisticated agricultural biotechnology program in the developing world—indeed, many of its breakthroughs are of global importance. Emerging domestic markets deliver new technologies to farmers throughout the nation and the output of farmers that use them is being delivered to consumers across ever-widening reaches of the nation. The markets for some agricultural commodities are among the least distorted in the world. Rising food exports demonstrate that China's farmers can now compete in international markets.

Off the farm, more than 40% of rural residents have employment; about 100 million of them have left home and moved to urban areas for employment, most of them young and eager to make new lives in the cities. Rural incomes have risen significantly and hundreds of millions of people have escaped poverty during this time. Growth in agriculture, non-farm employment and rural industry, and the transformation of domestic and international markets, have changed the face of rural China and are playing key roles in the nation's modernisation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

National development goals and challenges

While past accomplishments are impressive, there are still great demands ahead. With the transition from a planned to a market-oriented rural economy well advanced, China's main challenge has shifted to one of development. In the coming years, however, the development process will be fundamentally different from the efforts in previous times when meeting the nation's food needs, poverty reduction and economic growth were the main goals.

In China's new environment the main measure of success will be the extent to which the rural economy can become an integral part of the nation's push towards modernisation. For China to successfully modernise, the nation's economy will have to experience a fundamental transformation—from rural to urban and from agriculture to industry and services. The necessity of this shift is borne out by the development experience of every other high-income country in the world. There are no middle- or high-income countries in the world that have more than 10% of their population engaged in agriculture. Change in this direction is consistent with the nature of China's economy. Land holdings are so small and other resources are so scarce that farming activities alone cannot continue to raise the incomes of most rural households. The challenges are how China can establish effective linkages between rural and urban areas and encourage a large labour shift out of agriculture.

The new leaders of China have recognised that policy reforms, especially agricultural and rural policy reforms, have vital roles in the success of sustained rural development. The national development goals articulated in the 'Five Balanced Development Strategies' are ambitious and several of the strategies and reforms proposed are bold. National leaders nevertheless also realise that there are many barriers to achieving China's goals. Factors that contributed to the success of the nation's economy in the past have become obstacles to future progress. The new government is interested in new ideas to help China's economy make rapid and harmonious change. The policy suggestions in this summary raise new and practical ways for leaders to implement the Five Balanced Development Strategies.

The Agricultural and Rural Development Task Force

The China Council for International Cooperation on Environment and Development established the Agricultural and Rural Development Task Force in 2003 to produce policy-oriented ideas and recommendations that will help China's leaders to create

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

a vision for agricultural and rural development in the coming years. To that end, the task force undertook analyses of a specific set of policy issues of current interest within the Government of China. The mandate of the task force was to make policy change recommendations that are consistent with national goals of income growth and poverty reduction and environmental sustainability. The task force also examined how the proposed policy changes will affect food security given its prominence in current policy making and its inextricable relationship with the rural economy.

ASSESSING THE IMPACTS OF POLICY CHANGES

In an ideal world it would be possible to measure the rural economy's contribution to the modernisation of the overall economy and China's other goals. Unfortunately, no single such measure exists. In this section, three measures are discussed that can be used to measure progress towards China's goals.

Farm household income

The continued slow growth of the income of individuals in rural areas compared with those in urban areas is thought to pose a threat to both social and political stability and sustainable development. The growing income disparity between regions and among farmers within regions further threatens social stability. Among the points made in China's new Five Balanced Development Strategies, balanced development of rural and urban economies and balanced development of more-developed and less-developed regional economies are priorities. In this atmosphere, the level of rural income and its growth are fundamental measures of success.

The following are key questions in farmer incomes that need to be answered:

- Can farmers, particularly the poor, benefit from general economic growth so that income disparity between rural and urban, across regions, and among farmers within regions is reduced in the future?
- What policies (and their priorities) are appropriate for achieving agricultural/rural development and the income growth of farm households?
- What are the roles of agricultural development and off-farm employment in stimulating the income growth of farm households?

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Should China invest its limited fiscal and financial resources on improvement of the quality of rural China's human and physical resources or on income transfer and agricultural subsidies?
- What are the roles of marketing and government programs in achieving the goal of balanced income growth?
- Can the government develop and encourage new public–private partnerships to help accelerate income growth and extend it to those in poorer areas?

To create a new environment that enables the rural economy to become integrated into the nation's economic development generally, it should be recognised that, beyond income, the most important policy measures are those that raise the quality of rural China's human and physical resources and accelerate building of the infrastructure within which those in the rural economy operate. With better access to resources, rural residents will acquire the skills and abilities to integrate themselves into the nation's industrialising and commercialising cities. These changes will lead to increases in the income of, and consumption by, rural residents.

Successful development policy, however, also must recognise that modernisation (and long-run income growth) is a slow process that will depend on maintaining a healthy agriculture and rural economy. Rising incomes can fund household investments in education and health and other human and physical assets that will increase productivity in the longer run. While average farm income will continue to grow with the growth of the general economy, income disparity between rural and urban, among regions, and among farmers within regions will increase further in the coming years if appropriate policies and reforms are not implemented.

The nation's grain (food) security

Food security is an important national goal. With its unique historic legacy and the nation's large population and limited resources, it is understandable that China's leaders continue to place high priority on food security.

This issue was dealt with by the task force in a way that does not detract from the pursuit of income in either the short or long run. Since the traditional way of thinking about national food security was often at odds with the goal of improving rural incomes, the government is urged to reset the priority on food security from the current focus on both food and feed grain to food grain only. Also, policies that seek

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

to improve the access of households, especially poorer ones, to food, when domestic prices are either high or low will be effective in ensuring food security of another kind; that is, household food security. While the government needs to develop some welfare and insurance-oriented provisions in the pursuit of household food security, the best way to meet it may be to implement productivity-enhancing policies that are needed for rural income growth, and make sure that they are also targeted at households in poorer and vulnerable areas. If these suggestions can be accepted, most rural development policies focused on raising incomes are consistent with food security.

The following key questions in grain and food security need to be answered:

- Is China's food and grain supply security a serious problem now?
- Will China's food and grain security be a problem in the future?
- What should be the focus in China's food security? All grains or food grains? Should the focus be on national self-sufficiency or ensuring that all households have access to food?
- Is the conversion of agricultural land to other uses a serious problem? What impact will this have on China's grain security? Likewise, does the nation's program for setting aside cultivated land in poor and remote mountainous areas (the Grain for Green program) have a large negative impact on grain food security?
- What are the key determinants of China's future grain security? Can China rely on long-term productivity growth for grain security?
- How can the nation best manage its grain reserve system?

Environment

The enormous strides China has made in agricultural productivity, food output and poverty reduction are remarkable and well documented. However, these achievements have been made at a high cost to the environment. Farm incomes are now under pressure, in part because of degradation of the resource base. Environmental problems include desertification, soil erosion, grassland degradation, salinity on irrigated land, organic matter and fertility loss, burning of crop residues, aquifer depletion, high levels of heavy metals, nitrates and pesticide residues in soils and water, animal wastes and loss of biodiversity. Some environmental trends are still in the wrong direction.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Many current policies and practices are impediments to environmental sustainability because of their adverse effects on the land and water resource base. Environmental and economic objectives are frequently in conflict. Technological change, by itself, is unlikely to generate a sustainable agriculture sector. Policies and practices with complementary economic and environmental objectives are needed and are possible. The following are key questions in environmental sustainability of agriculture:

- Are R&D programs and extension services developing and delivering appropriate technologies and information?
- Are public-good services in rural China adequate to educate farmers in production technology, marketing and financial management in a market economy?
- When national and regional programs are set up to combat environmental problems, are sufficient fiscal resources and institutions in place to implement and enforce the policies?
- Are financial services in rural China adequate to enable farmers to adopt environmentally friendly practices and technology?
- Are policies and programs available to enable resource-limited farmers to leave agriculture?

A NEW FRAMEWORK FOR SUSTAINABLE AGRICULTURAL AND RURAL DEVELOPMENT

To meet the goals of more balanced development and raising farmer incomes, both policy shifts and changes in government services are needed. First, *reforms are needed in the organisation of government*. A new framework is needed for managing fiscal and other governmental matters, including the development of a plan to manage the environment and to generally meet the needs of China's modernising and increasingly market-oriented economy. New institutions need to instill a new ethic into government; officials need to change their roles, becoming facilitators of economic growth, equity and environmental protection, rather than direct actors. Reforms are also needed to encourage the emergence of new partnerships with rural citizens. China needs to promote voluntary, independent farmer associations and new arrangements with private enterprises that can help in the process of development and assist government in taking care of those who are in danger of being left behind.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Second, a concentrated effort is needed to *improve the resource base of the rural economy*. It is a government responsibility to prioritise and mobilise investments into those projects that have public-good characteristics and to encourage private firms and individuals to make productive investments that will raise incomes and provide employment. Despite the great progress of the past 50 years, many parts of the agricultural and rural sectors remain underdeveloped. There are 50 million more farmers in China than at the beginning of reform. Farms are fragmented, small and getting smaller. Other resources—such as water and forests—are becoming ever more scarce. Farm prices, at least for certain internationally traded commodities, will almost certainly fall as the nation implements its World Trade Organization (WTO) commitments.

In such an environment the state and its partners have much to do to help farmers increase their resource base. China's most abundant resource, the *labour* of its rural population, needs to be the target of a sustained drive to increase the value of its human capital, with investments into education, rural health and other areas. The *productivity* of agriculture and the rural sector will require modern technologies, those that are affordable and suitable to small farmers. *Land* and *water* also require large investments and new institutional arrangements that can increase the productivity and incomes of households; at the same time, rental markets for cultivated land are needed to allow those left behind in farming a way to access greater areas of China's most scarce resource. Finally, the rural sector needs a healthy and effective financial system to transfer capital from those who want to save to those who have an opportunity to invest.

In short, if the government can create new institutions to transform its role in development, foster a new partnership with the people and improve the nation's resource base, rural incomes can rise and the rural economy will be a force in China's modernisation drive. If appropriate decisions are made, the policies will not adversely affect national food security and many policies will enhance the security of households. There are few inherent conflicts with environmental concerns and, where they do exist, they can be offset by the adoption of appropriate complementary policies. Although complicated, these are essential components for successful implementation of the Five Balanced Development Strategies.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Creating a new role for the state

For the state to assume its new role as a facilitator of economic activity rather than as a direct economic actor, a new approach needs to be instilled. Key areas for policy initiatives are discussed below.

Changing government functions

The emphasis should begin to be on those activities that are truly for the public good; the private sector should be regulated, but the goal should be to allow individuals and private firms to provide quality goods and services on the basis of market-determined prices and quantities. Markets should be fostered and the sources of market failure should be a target of policy revisions to ensure better performance. The government needs to allow the private sector to take over many of the activities that are currently being carried out by state agencies and quasi-state organisations.

Clear division of central and local government roles

The roles of different levels of government need to be delineated. When a level of government has a particular set of duties, duplication of tasks should be avoided and resources needed for their timely and quality completion should be assured.

Poverty, equity and the environment

In addition to helping overcome market failure, the main set of tasks for the government includes measures for reducing poverty, maintaining equity and improving the environment. To carry out these policies, the government needs to focus on building a rural fiscal system, facilitating rural markets, and promoting farmer associations as a way to foster new relationships between the party and the people.

Rural fiscal policy

China needs a healthy public fiscal system to enable government to provide an environment for growth and development, including basic infrastructure and social services. For the rural sector, this includes providing or facilitating investments in farmland improvements, agricultural research and development, extension services, infrastructure such as roads and communications, and social services (such as education, health and social security). The fiscal system also sets incentives that guide the allocation of resources and influence development. Key areas for policy initiatives include the following:

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Fundamental restructuring of the fiscal system

Fundamental restructuring of the system is needed to set priorities on services to be provided and to organise the fiscal system in such a way that each policy function is fully funded. A new commitment to transferring more funds to the rural economy is needed.

Reform of the current tax system to suit each region of the country

The current tax reform and agricultural tax reductions, although useful and successful in many places, are restricting development and income growth in others. Allowances are needed for regional differences. The impact of agricultural tax reform needs to be carefully assessed.

Review critical services and make a clear division of responsibility between government and the private sector

An in-depth review is needed to assess the government tasks that are critical public services. Others should be dropped. Those remaining should be divided into those that must be delivered by the government (e.g. road building and maintenance, and the rural public-health system) and those that can be provided by the private sector (e.g. certain types of agricultural extension).

Need for new systems of governance

Lack of transparency and accountability in the local governance institutions is a fundamental problem in the management of fiscal resources and investment efforts. The creation of institutions that provide for more transparency and accountability is needed for any of the new initiatives to be successful.

Better marketing environments for development

Markets are needed for fostering specialisation and for allowing farmers to reap the benefits of increased access to urban consumers and international markets. In the past decades, despite attempts to control China's commodity markets, they have developed rapidly and have become increasingly efficient, competitive and integrated. Indeed, many of China's markets for agricultural commodities and basic inputs are among the least distorted in the world. Despite this success, markets for some commodities remain vulnerable to government intervention.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Labour markets are important in facilitating the flow of labour among regions, and have improved dramatically over time. However, there are still considerable barriers to movement that need to be eliminated.

The following are key areas for policy initiatives:

Fostering domestic commodity and labour markets

Initiatives needed include: enhancing grain market reform; removing special considerations that have given advantages to state marketers in long-distance grain trade; improving policies that will facilitate more-liberalised regional labour markets (for example, the elimination of the *hukou* system).

Deepening integration across the border

Initiatives needed include: accelerating technology transfer/imports; taking a pro-active role in the WTO Doha Round negotiation; implementing pro-poor policies to target those who are hurt and vulnerable during the course of trade liberalisation.

Market infrastructure development

Initiatives needed include: investments in transportation, communications and marketing information networks; the development of a futures market for major agricultural commodities.

Building partnerships with farmer organisations

In an economy with millions of smallholders and an emerging market economy, it is imperative that farmers be able to organise to facilitate their interactions in commercial and investment transactions. Organisation will help farmers in the adoption of new technology, access to inputs and marketing of their output. In particular, value-adding activities often benefit from cooperation. The following are key areas for policy initiatives:

Need for government support

Although the impetus to meet and act as a group must come from the farmers themselves, the government can create an environment in which independent associations can thrive. Government input could include legal support, financial aid, technical services such as training of leaders, and provision of technical and marketing information services provision.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

New laws and regulations are critically needed

China needs to speed up the formation of farmer associations (FAs). New laws and regulations should promote and protect FAs. The legal status of groups needs to be clear. FAs need to have the ability to enter into contracts, act as legal guarantors and take loans. In short, FAs need the authority to be able to act for the members of their group. Along with this new authority, responsibility is also needed. Hence, as well as additional authority, new rules and regulations are needed that protect the membership from the leadership, including the way in which the leadership is selected and monitored.

A catalyst is needed

The experience of FAs in other countries has shown that, even when a favourable legal and regulatory framework exists, an independent catalyst (that is, some person or group outside the government) is often needed to get FAs started, and to expand and perform better. While China has a number of FA-promoting agencies, they are controlled by government. Alternative models should be sought to create catalysts that are first and foremost responsive to the needs of farmers and FAs. In some nations, special services are set up to promote FAs; in others, cooperative extension agencies are created within the agricultural university system. The main role of such advocacy organisations is to facilitate the creation of associations and provide information that allows their members to promote their groups' interests. Training of FA leaders is also critical.

INVESTING IN AGRICULTURAL AND RURAL RESOURCES

Although there are many investment needs, four main categories of investment should receive special attention: investment in labour; technology for raising productivity and promoting water savings; land rental markets; and reforming rural financial markets.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Preparing for migration out of rural areas

Labour markets are the conduits for the forces of a nation's transformation from a rural to urban society. There are different channels: urban migration; local off-farm wage earning jobs; self-employment. All are needed to provide the enormous numbers of jobs that will allow farmers who do wish do so to move off the farm. Policies are needed to stimulate demand and encourage supply.

The following are key areas for policy initiatives on the demand side:

Restructuring China's economy

Encourage labour-using industrial development and discontinue policies that favour capital-intensive industrial expansion. Creating new and more non-farm jobs is essential for China to have a successful economic transformation from a rural- to an urban-based economy.

Eliminating restrictions on labour hiring

Remove barriers and regulations that prevent firms from hiring migrants; reduce regulations that are preventing employment from occurring in the manufacturing and service sectors.

Providing better financial services

Continue to improve the banking environment so banks can finance local enterprises and the self-employed.

The following are key areas for policy initiatives on the supply side:

The three most important policies are:

- improve rural education
- improve education of rural migrants in cities
- improve skills training of migrants in rural and urban areas.

Additional priorities should be to improve the provision of rural health services and health insurance, enforce land laws to encourage rental opportunities without threatening security of renters' land rights and eliminate barriers in cities that reduce the benefits of migrants and discourage farm families from moving to the city permanently.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Raising productivity on the farm

Land management

Successful transformation of China's economy has been based on agricultural growth. In the past three decades, agricultural growth has been remarkable. The growth has come from increases in material inputs and productivity as well as institutional changes. The already high input levels in many areas of China and diminishing marginal returns, however, mean that increasing inputs will not provide further large increases in output. Water shortages and increasing competition from industry and domestic use do not provide much hope for large gains in the area under irrigation and the total output from irrigation expansion. Incentives provided in the early 1980s resulted in large, one-time shifts in productivity, but this source has been shown to be largely exhausted in China.

Given current technology and policies, China's farmers are approaching an upper limit to their ability to supply greater quantities and higher values of foods from their current resources. In the future, almost all gains will have to come from second- and third-generation green revolution technologies such as biotechnology and agricultural structural changes. New research and development (R&D) and extension efforts are needed to create and spread the next generation of technologies.

Key areas for policy initiatives in land-enhancing technologies include the following:

- Deepening agricultural research and extension reforms

China's leaders should take a decisive step to further its reforms in agricultural R&D so that a modern and effective agricultural research and extension system can be created. Some research institutes need to be closed; others need to be commercialised; others need to be merged; yet others need to be expanded. There are too many poorly trained agricultural research scientists; current resources and additional new resources need to be focused on the best. China needs to clearly delineate public and private roles in agricultural R&D and establish effective mechanisms for public–private partnerships. The reforms should also recognise that not all agricultural research institutes and technologies can be commercialised. Commercial businesses of the research institutes require a market-oriented institutional and

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

management system. Human resource skills of most researchers and academics in marketing and business management are generally inadequate for successful enterprise development.

- China needs to substantially increase its investment in agricultural research and extension

Commercialising part of its current agricultural research and extension systems does not imply reducing the government's role in financing agricultural research and extension. Agricultural research driven by commercial interests would naturally be directed towards the most commercially viable products and technologies, and would leave research directed to food security, poverty reduction, and environmental sustainability seriously under-funded.

The current needs for agricultural research and extension indicate that public funding should be a primary source of support for these activities in the decade ahead. Difficulties in implementing and enforcing a strong intellectual property rights system also imply the importance of a viable public financial support system for agricultural research and extension.

Public agricultural research investment should be increased to 1% of total agricultural GDP in the near future, from the current level of less than 0.3%, with at least a similar public investment in agricultural extension. China should also continue to encourage the development of biotechnology and its application to agricultural production and processing.

Water management

Water shortages are a serious barrier to growth. They are limiting efforts to alleviate poverty, and are becoming a major source of environmental problems. Current policies have either not worked or have not led to real water savings. Many traditional strategies are unlikely to solve China's water shortages since there is little incentive to adopt new technologies or they do not lead to real water savings. Even with south to north transfer, there will still not be enough water to solve the crisis. A fundamental shift is needed in the way water is managed. The Chinese Government should consider taking the following steps in order to begin to manage north China's water resources:

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Water savings in irrigated agriculture need to focus on reducing the water consumed per unit of crop production. This requires an integrated approach of improvements in irrigation technology, agronomic practices, and farm water management.
- Water management agencies need more authority to implement the difficult measures that are needed.
- To achieve true water savings while avoiding inequitable outcomes, a system of water rights for *both* surface- and groundwater is needed, with rights extending to individuals that live in specific areas and the total amount of the rights limited to water availability after taking into account the environment and other needs.
- After water rights are established, China needs to begin the investments and management shifts that will allow for volumetric pricing and regulation of water.
- With the institutions and facilities in place to implement a system of water rights and volumetric charges for water, the nation can begin to move forward to take several concrete steps such as raising water prices, promoting new, water-saving technologies, and reforming management institutions in order to achieve cropping intensity levels and cropping patterns, as well as municipal and industrial use levels that will be sustainable.
- Efforts on the conservation side must be matched on the pollution abatement side in order to stop the mounting, and often irreversible, damage to China's water resources.

Encouraging land rental markets

China's size and the nature of its integration into the world economy imply that rural development has to respond to big challenges that cannot be solved by resorting to government intervention, but instead require the operation of well-functioning rental markets for cultivated land. For markets to work well, there must be an absence of barriers that are impeding the linkage of land and labour markets, such as market imperfections, institutional rigidities and other barriers.

A key area for policy initiative is guaranteeing permanent land-use rights. Several specific policies can facilitate the improvement of permanent use rights. First, the new *Rural Land Contracting Law* needs to be more rigorously enforced. The provisions are pro-rental, but understanding of the law is still weak. Second, a province-wide (or region-wide) system of land registration is needed to ensure the security

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of land holdings for the duration of rental arrangements. Finally, demand for land rental could increase if mortgages were allowed, since borrowing against land could break capital constraints that are dampening the demand for land and may facilitate out-migration by providing the liquidity needed for moving.

Experimenting with rural finance

Mobilising and efficiently using available financial resources is important for achieving high rates of economic growth, especially in developing countries where such funds are typically in short supply. As economies grow, financial institutions often play an important role in directing resources to their most productive use. As a result, greater financial intermediation (loans as a share of GDP) usually accompanies higher incomes. One of the most important lessons from other developing countries is that poorly functioning rural banking systems reduce growth and retard poverty-reduction efforts. This is almost certainly true for China.

Although China has made a number of efforts to reform its rural financial system in the past, most agree the measures taken so far have not been successful. The reforms have been incomplete, and rural bankers have little incentive to provide good service. China often uses state control of the banking system to pursue policy goals that are not always consistent with efficient intermediation. Recent state banking reforms in China have reduced access to commercial loans by rural borrowers. Informal institutions have thrived across China, replacing formal banking channels, in effect taking control over rural financial markets out of the oversight of the state. Competition from such sources is indirect and less effective in promoting efficient management.

The following are key areas for policy initiatives:

Promoting comprehensive reform of the rural financial system

Resolution of the outstanding problems of China's rural financial system cannot be confined to minor repairs and adjustments to the current system. It is necessary to take a holistic view and undertake comprehensive reform of rural finance across the institutional spectrum—the Agricultural Bank, the Agricultural Development Bank and the rural credit unions—with the aim of establishing a complete and more-vigorous rural financial system. Far-reaching reforms of Rural Credit Cooperatives (RCCs) are needed; experimentation should be allowed; it is critical to try to provide the new management teams with strong short and long-term incentives.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Enacting new laws and regulations to promote and formalise rural informal credit markets

In addition to RCCs, non-state banks should be encouraged. A regulatory environment that encourages safe and efficient banking practices is needed, but set up in a way that facilitates the entry of private banks and other moneylending and deposit-taking institutions. More flexibility is needed on the number of products and lending practices.

Enhancing micro-finance programs

The government should try to encourage micro-finance and allow localities to experiment with their own forms. Regulations that keep NGOs from operating and expanding their operations should be eliminated. Micro-finance units should be allowed to take deposits.

A NEW FRAMEWORK FOR THE NATION'S GRAIN (FOOD) SECURITY

China has a large resource base and a solid record of productivity in the past to ensure national grain and food security. China can achieve its high level of food grain security in the coming decades. There is a need to shift the focal point of China's grain and food security. China has been a net food-exporter since 1983. In recent years, China has become a net grain-exporter. From a national food-security point of view, China is probably the most secure nation in the developing world. In the future, even if the nation completely liberalised all trade (which is beyond its current trade commitments under the WTO), economists in China forecast that, in 2020, rice and wheat requirements will still be almost fully produced in China. In the coming years, China needs to make fundamental changes in national priorities on food and grain security and in the way that the grain economy is managed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The following are key areas for new initiatives or shifts in policy:

Shift in emphasis from food or grain security to food grain security

In order to maintain the spirit of China's food-security policies without imposing excessively costly and ineffective restrictions, the national government should redefine its food security goals in terms of rice and wheat, the two major food grains. This would provide considerable protection against any external economic threat while being attainable without causing major distortions.

Shift in emphasis from aggregate national food security to household food security

While China as a nation does not face a food-security problem (provided it continues to promote productivity-enhancing technologies and invest in its rural infrastructure), there are still tens of millions of households that live at or under the poverty line. For many of these poor households, there are significant risks that sooner or later they will not have sufficient food to keep their members healthy and productive. The main focus of national food-security policy should be on these households. The measures to make these households food secure are mostly consistent with the measures that are needed to increase income, promote movement into the off-farm sector and generally make rural households more productive and increase their access to resources. Supplemental measures are also needed in the short run to protect these households against large negative-income shocks. Policies that take away incentives for households to improve themselves must be avoided. Policies that provide good incentives include rural health insurance to help protect farmers from the effects of sickness and injury. Maintaining the ability of the government to deliver food in times of natural disaster also is needed. Such measures will be effective in raising incomes and promoting the transformation of the rural economy; they will also improve household food security.

Emphasising long-term productivity growth instead of short-term subsidy programs

China's food-grain security program will rely mostly on raising long-run productivity. Although well-intentioned and welcomed by farm households (every farm household likes receiving money), programs such as the grain direct subsidy that was implemented in 2004 could be very costly, reduce the government's fiscal resources for public services, and have much less effect on national grain security

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

than other measures. Unless the government commits to long-term subsidy programs, farmers will likely not spend much of their subsidy; they will save it. Hence, the return on such investments will be low. Instead, investments in R&D, extension, education, health, irrigation and other rural infrastructure, have been shown to have high multiplier effects, especially in poor areas.

Balancing land uses between agriculture and non-agriculture

Considerable quantities of land are being converted from agriculture into built-up areas. Although conversions may have increased since 2000, according to research by the Chinese Academy of Sciences using highly reliable Landsat data, the amount of land that was converted from cultivated to non-agricultural uses between 1985 and 2000 was more than offset by land converted for cultivation. China had 2% more cultivated land in 2000 than it did in 1985. Although the quality of the new cultivated land is lower than that of the land converted to non-agricultural uses, the fall in bio-productivity is less than 0.5%. Hence, far from losing production potential, between 1985 and 2000 China's output potential actually increased by 1.5%. At least until 2000 then, the conversion of cultivated land into non-agricultural uses has had no effect on grain production and prices.

With the future of China's development relying on rapid industrialisation, it is certain that there will be high demand for further conversions. Employment, income and productivity growth are all associated with the conversion of land from low-productivity agriculture to high-productivity industry and services. Compared with other nations (e.g. Japan, Korea, the US and many European countries), China's rate of cultivated land conversion is low.

While industrialisation and modern development demand that conversions continue, land-use policies need to promote rational use. The policies should not be across-the-board bans on conversions, but should emphasise long-run land-use planning. Modern urban-planning methods should be used to determine these needs. The incentives for local governments to convert land to non-agricultural uses for fiscal reasons can be reduced by reducing the role of the government in the conversion process. After land plans are in place, development should be done by the private sector, and negotiations for land purchase should be made directly with rural residents. To make this process work, rights need to be given to farmers to ensure that those who lose their land are directly and fairly compensated. New measures also are needed for improvement and enforcement of land laws and regulations to

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ensure that land acquisition is implemented fairly. These include a clear definition of land ownership and use rights; a clear differentiation of land acquisition for public uses and private business activities; market-based compensation for land acquisition; and awareness, transparency and accountability.

A system of land conversion permits that allows only a limited amount of land to be converted each year might be considered for use across China. It is important to make such permits tradable so that the locations of development are optimised.

Removal of fragile land from cultivation

Grain for Green, the nation's program to set aside cultivated land, has removed more than seven million hectares of land from cultivation. While there have been serious implementation problems, it should be recognised that, on the whole, the program has been successful in reducing soil erosion and increasing forested area and has done so by providing farmers with compensation that has led to higher incomes and rising asset values.

Despite its vast scope, there is no evidence that Grain for Green has had any substantive effect on grain prices and there is no basis for stating that the program would have any significant effect on national food security. While research shows that Grain for Green rather than land conversion to built-up area has caused most of the decline in cultivated land in recent years, the productivity of the land that was converted to forested area was extremely low. According to research conducted by the Center for Chinese Agricultural Policy using its policy analysis model, the price impact of Grain for Green was minimal. Of the 40% grain price increase that occurred between 2003 and 2004, less than 5 percentage points of the increase was due to the program. While the scope of the original program may need to be reevaluated because of implementation problems, the program should not be halted on the basis of food-security concerns.

Changing national grain reserve management practices

Although some aspects of the grain-reserve management system have improved in the past several years, it is still one of the weakest and least understood parts of China's food-security program. In many ways, despite the reforms, it is dysfunctional. The rules for management and release are unclear. There is confusion among the different holders of grain. The lack of transparency creates chaos in grain markets and contributes to greater variability in grain prices. Because no-one knows the level of

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

stocks or the quantities of planned (or actual) release, domestic producers and traders and international trading agencies cannot make decisions based on full information. Rules for purchases and sales need to be open; public information on markets can internalise all of the factors that will influence short- and long-run price expectations, which will affect production, storage and sales decisions.

ENVIRONMENTAL IMPACTS OF POLICY CHANGES

In all of the issues studied by the Task Force, the positive economic effects of recommended policy changes are likely to also result in better environmental management in rural China, though some regional impacts may be negative. Observations on specific aspects follow.

Rural fiscal policy

Implementation of recommendations on fiscal policy would increase resource allocation to rural China in public-good services such as education, health and rural infrastructure, redefine roles of the various levels of government and the private sector and develop more equitable, regionally sensitive tax policies. Given the established positive relationships between income and environment and education and environment, rural fiscal-policy reform should result in better environmental performance in rural China.

Better marketing environments for development

Competitive domestic commodity and labour markets, trade liberalisation and market infrastructure development are expected to increase rural incomes and positively affect rural resource management.

Building partnerships with farmer associations

Legislative changes to facilitate voluntary, independent farmer associations that can operate in the interests of their own members in adoption of new technology, access to inputs and marketing are expected to improve the incomes of farmers, as they have in developed economies. International experience demonstrates that farmer associations have been leaders in improved land and water-resource management. It is in farmers' own economic interests to improve the long-term productivity of their resource base.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Preparing for migration out of rural areas

The resource base of farmers who stay in rural areas will be augmented by the departure of their neighbours. This will improve their income potential and provide incentives for better stewardship of their land base.

Raising productivity on the farm

Increased public investment in R&D and extension services is expected to produce and extend environment-friendly technologies in areas such as pest and fertility management, conservation tillage and planting systems, grassland management and biotechnology; all of which can produce positive environmental outcomes.

Encouraging land-rental markets

Well-functioning land-rental markets and more-secure land-use rights will expand the resource base of farmers who remain in rural China. More-secure tenure will encourage improved stewardship of resources.

Experimenting with rural finance

Financial services to rural residents in China are weak. This discourages holding of savings as deposits and encourages savings to be held in assets such as animal herds/flocks, with consequent damage to grasslands and water resources. Reforms that would facilitate rural services such as credit unions and sustainable micro-finance programs would have positive environmental spin-offs. Better access to credit is needed to facilitate adoption of new technology for better land and water management.

Grain marketing

Greater transparency in management of grain reserves, enhanced private-sector participation in grain markets and narrowing of grain self-sufficiency targets to a national food-grain security target would reduce pressure on fragile landscapes and the consequent environmental costs.

Protection of cultivated land

Loss of cultivated land to urban and industrial uses is an inevitable and necessary cost of development. More-secure land-use rights and more-transparent and equitable processes for land acquisition would reduce excessive land taking and

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

mitigate environmental effects. The 'Grain for Green' program is targeted to remove fragile land from cultivated uses and thus should have positive environmental effects. Continuation of the program with more-effective implementation is needed.

Trade and poverty

Trade liberalisation has and will have mixed environmental effects. Changes in comparative advantage resulting from changes in relative input and product prices are expected to reduce output of some land-intensive products in north China, with consequent reductions in environmental pressure on land and water resources. Intensity of production is likely to increase in horticultural crops and rice in coastal provinces, with increased application rates of fertilisers and pesticides. Application of food-safety standards inherent in WTO accession may induce or force rationalisation of input application rates if Chinese farmers expect to compete in domestic and international markets. This could produce positive environmental effects.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PART ONE

CREATING A NEW ROLE FOR THE STATE IN THE EARLY 21ST CENTURY

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 1

POLICY OPTIONS FOR A CHANGING ROLE OF GOVERNMENT

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1.1 RURAL FISCAL PROBLEMS AND POLICY REFORMS

CCICED ARD Task Force members

The conduct of rural public finance is arguably China's biggest problem. The fiscal system, as designed, is out of date, generates inadequate revenues, poorly redistributes revenues collected and does not provide enough public goods. There are problems both on the revenue and expenditure sides and in the way public goods and services are financed.

We applaud the spirit of the recent tax-reform measures. The reduction of taxes and fees on rural people is welcome. The recent reduction and planned future elimination of the agricultural tax also sends a strong signal that the government is serious about shifting its priorities and is becoming more supportive of the rural economy. However, in the context of the broader fiscal environment in rural China, economists do not believe that the recent 'tax for fee' reforms can solve rural China's fiscal problems. Tax for fee is an attempt to reduce the tax burden on farmers in a system that is already characterised by insufficient revenue generation and public service spending at all levels. Studies have shown that savings to farm households are minimal and, when collections fall, public services fall. Fiscal resources in poor areas are already insufficient to meet investment requirements. Over 70% of counties and townships are in chronic deficit. While there are many adverse consequences of indiscriminate fee collection, the root cause may be the system's own design. Increased pressure on counties and townships to generate revenues to meet the system's unfunded mandates leads to excessive fee collection. The problem is most severe in China's poorest areas. The tax system, which remains heavily industry-based, can distort investment incentives and induce local governments to promote industrial development even in areas without a comparative advantage in

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

manufacturing. China's own economists have shown that these elements of the tax system retard development. The 1994 tax reform increased the tax-collection power of the central government to allow more equitable redistribution. However, while more revenues have flowed into central coffers (reducing local revenues), little has been shifted to poor areas, and the new tax policy continues to favour relatively affluent areas, exacerbating rather than alleviating the rural fiscal crisis.

Our main point is that rural fiscal reform needs to go beyond tax for fee reform and consider the way expenditures are managed. The first step needs to be a review of the public goods and services that are needed in rural China. Realistic goals and priorities should be established for their provision. Each level of government needs to be handed clear responsibilities for the provision of a subset of public goods. The resources required to provide public goods also need to be clearly defined. Leaders need to ensure that sufficient resources are available to support the expenditures needed to meet their mandates. In the process, expenditures also need to be reorganised. Many tasks can be delegated to non-state entities. Many countries in the world have used alternative institutional arrangements to deliver key rural public goods without the direct involvement of government. For example, a county school board with responsibility for running school services would not need to rely on cadres in the government, but instead would establish an office in each township staffed with personnel appointed by the board. The financial flows would be entirely within the system. Although there would have to be some coordination with government, most educational duties would be inside the school system. Similar changes could be made in the health and agricultural-extension systems. In doing so, the size of government could be better controlled and local governments downsized.

IMPACT ASSESSMENT

Provision of rural social services

Persistent fiscal gaps, or shortfalls between required expenditures and fiscal capacity, have several adverse effects. One is that many rural governments are unable to provide the level and quality of social services mandated by national policy.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Investments

Deferred investment is an immediate victim of fiscal shortfall. As officials struggle to meet wages and other immediate needs from diminishing revenues, these needs are displacing development-oriented investments. Even if budgetary officials are directed to allocate funds to fixed investment, the funds are often diverted or borrowed, and, if not returned, the investment is not just delayed but permanently deferred.

Rural education

Calls from the national government to bolster rural education only recently began to be matched by earmarked allocations. National officials have set high educational goals and an education expenditure target of 4% of GDP was to be met by 2000, up from 2.66% in 1994. Although spending has risen, the goal still has not been met. Pleas to local governments to increase education funding more rapidly than the growth in financial revenue have gone largely unheeded, and meeting the target appears improbable. Insufficient fiscal revenues have undermined the quality of education as measured by a number of human-capital indicators. For example, a State Statistical Bureau survey shows that 30 million Chinese students have never been to school or have dropped out, 4 million drop out of school each year because they cannot afford the cost, and only 64% of rural students complete primary education without repeating a year.

However, when funds do arrive, the outcome is dramatic. Visits to selected poor areas in recent years have found that education expenditure in the form of earmarked transfers has risen. While improvement is by no means universal, in some of the areas where tuition fees have fallen and the number and quality of teachers have risen, education rates have risen rapidly. In fact, compared with most countries in the world, China's primary education rates are not bad. Most educational rates are 100% in rich areas and over 90% in poor areas. Of course, in areas where not all children go to school, the incidence of drop out is not evenly distributed. *Han* girls in poor areas have schooling records far inferior to other groups.

The more problematic area has been in trying to promote universal middle-school education. Middle-school fees are high. Many parents who want to fund their children's education are unable to do so. In addition, there is a demand problem in some areas, especially those with poor quality of education and few outside employment

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

opportunities, as parents cast doubt on the return they can get for their educational dollars (even though nationwide the returns to education in both rural, migrant and urban labour markets have risen rapidly). A system of free education or, at the very least a needs-based system that provides scholarships for the poor, needs to be implemented by the government, so China can boast that anyone in the country that wants to go to school can do so!

Rural health

Ministry of Public Health goals call for 8% of rural budgets to be spent on health care. National officials have mandated improved facilities, expanded coverage, and minimum training for doctors. Rules describe what is expected of county and township leaders for establishing ideal rural-health systems. However, like education, the actual resources allocated to achieve national objectives fall far short of needs. The national government allocates only 2.4% of its recurrent budget for health-care services, and only 1.2% of the capital-construction fund. The situation is more severe in poor areas.

Extra-budgetary revenue sources

A second adverse effect of fiscal pressure is the growing reliance on off-budget finance. The ability of local governments to raise revenues varies greatly and determines the quantity and quality of local public services. County and township officials are evaluated on their fulfilment of mandates. This is an important reason for increasing local fee assessments, rising numbers of personnel and rising burdens.

To meet the revenue requirements of these expenditure demands, county and township governments attempt to increase revenue from off-budget sources. Without legal taxing authority or ability to borrow, counties and townships have developed off-budget sources, primarily extra-budgetary funds (EBFs) and self-raised funds (SRFs). The Ministry of Finance has reported that, nationally, off-budget revenues bring total revenue collection to about 30% of GDP.

Although the growth of off-budget revenues has eased fiscal pressures for many localities, it has also produced adverse consequences. It has hastened the decline of the formal fiscal system, by providing an alternative tax source that is fully retained. It has created a tax system that is ad hoc, nontransparent and regressive, and beyond the reach of the formal fiscal system. The lack of legitimacy may be a greater source

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of rural discontent than the total burden. It also has become more regressive, since poorer areas have fewer firms and less chance of collecting fees from the conversion of land to non-agricultural uses. In fact, poorer areas that have tried to replace the revenue of their failed or privatised firms with real-estate development have often failed and incurred losses. This has created part of the non-productive conversion of agricultural land to non-agricultural uses.

Perhaps the worst consequence of off-budget financing is the tendency of county and township governments to give policy and regulatory agencies control over the assets they regulate or operate (or the resources they are charged with protecting). Officials then encourage agency officials to use these assets to generate income for staff salaries and other expenses. There are many examples of misuse of these resources. Agricultural extension agents turn into pesticide salesmen; grain reserve managers become grain traders; those in charge of protected areas exploit them for their revenues.

POLICY RECOMMENDATIONS

Radical and bold experimentation needed

Although fiscal reforms are complicated and will entail fundamental reorganisation, their implementation may be China's greatest policy priority. While increased transfers to eliminate unfunded mandates are the key to the solution of the rural fiscal crisis, the reforms also need to completely restructure local government and fundamentally reorganise public finance. Such reforms will be disruptive, but they need to be implemented in a comprehensive way. To minimise the disruption for the nation as a whole, we believe rural fiscal reforms can begin with regional experimentation. New systems of tax assignments are needed. The roles of townships need re-evaluation. The relationship between provinces and counties needs to be reorganised.

Policy options for investments

Rapid economic growth has not benefited everybody equally, thus worsening income distribution and regional inequality. The Gini coefficient has risen from 0.33 in 1980 to 0.46 in 2000. The income difference between the rural and urban sectors has become increasingly large. The average rural income was 60% of urban income

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in 1984, but had declined to only 33% in 2002. The income gap between the coastal areas and the western region has also widened dramatically. With poor infrastructure and a shortage of human capital in less-developed regions, it will be hard for farmers to switch from grain production to high-value-added crops or to non-farm activities. All of these factors may lead to an even higher concentration of rural poor in these regions if proper government policies are not implemented.

There is considerable evidence that China is at a crossroads in agricultural development as the country appears to be moving from taxing to subsidising agriculture. How to design an agricultural support policy to achieve equitable and sustainable growth is a hotly debated topic. Based on the evidence from both China and India, we offer the following policy suggestions to achieve the stated national objectives.

More public spending in rural sectors. Empirical evidence has shown that investment in rural areas can yield large returns. The government should therefore continue its efforts to increase overall investment in rural areas. Rural investment accounted for only 19% of total government expenditures in 1997, but rural residents account for 69% of China's total population. Moreover, almost 50% of national GDP was produced by the rural sector (agriculture and rural enterprises) in 1997. The government's rural spending as a percentage of rural GDP is only about 5% compared with 11.6% for the whole economy. For the past several decades, China has implemented an investment policy that is urban and industry biased. As a result, the rural–urban income gap is large and has increased. Any policies that discriminate against the rural sector will worsen the disparities and should be discontinued.

More investment instead of more subsidies. The India case study clearly indicates that initial subsidies on inputs and output may help small farmers. As time passes, however, these subsidies become increasingly large and very difficult to remove. The subsidies, including those on fertiliser, irrigation, power, and credit, amounted to about 2% of the national GDP, and 8–10% of agricultural GDP in 2000. Such subsidies are in direct competition with long-term capital investment in roads, rural education and agricultural research. China has already reached the initial stage of the agricultural transformation even though it did not provide direct subsidies on either inputs or output. China should not follow India's path to subsidise its agriculture. Instead, the government should use its limited public resources for improving human and physical conditions in rural areas to enable farmers either to engage in production of higher-value commodities or to migrate to non-farm activities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Correcting regionally biased government policy. In addition to biased regional investment policy, predatory pricing policy on natural resources by the government has been a major culprit in worsening regional inequality. Under China's previous centrally planned economy, natural resources such as minerals and forests were owned by the central government. These resources were shipped to eastern China at low prices, thereby transferring rents to the coastal areas. The western provinces, although rich in these resources, benefited little from their exploitation. Even worse is the latest reform of these state-owned enterprises, which left millions of workers laid off and degraded environments under the responsibility of local governments. In response, the central government should redirect its public resources towards the western region where it has been shown the investments have high returns and large poverty-reducing effects. This is consistent with the national strategy to develop western China. Investment in agricultural research, education and rural infrastructure there should be the government's top priority. Among all the options, the most critical is universal and free primary (ideally 9 years) education funded by the central government.

CONCLUSION

Policy makers and researchers are debating how to increase farmers' incomes, and reduce regional inequality and rural poverty. There are several policy options. One option is to increase price and income support for farmers, as many OECD countries have done for the last several decades. Another option is to use trade barriers such as tariffs and import quotas to insulate the domestic market from international markets. But implementation of one or other of these two options will cause either a huge government financial burden or an increase in domestic food prices and higher costs for consumers. Adoption of these options would also lead to large net-social-welfare losses due to misallocation of resources among economic sectors. Also, before beginning subsidy programs, leaders should be aware of international experience: once programs are started they are difficult to stop; political support does not come from maintaining financial support to farmers, but only by increasing it. This will inevitably lead to an upward spiral of support with little benefit attached.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Another option is to liberalise the agricultural sector immediately, with no preconditions. This option will allow scarce resources to be allocated on the basis of the comparative advantage among sectors and between China and international markets. Overall efficiency and net social welfare will be gained. But we argue that there must be conditions accompanying liberalisation. One of the conditions is to increase investments in agricultural research, irrigation, and rural infrastructure. This is essential for long-term food security and is a critical precondition to improve overall efficiency of agriculture and increase the living standards of the rural population.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1.2 RURAL FISCAL POLICY: THE KEY TO CHINA'S DEVELOPMENT IN THE 21ST CENTURY

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

Jikun Huang and Linxiu Zhang
Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

China needs a healthy public finance system to enable government to provide an enabling environment for growth and development, including developing basic infrastructure and social services and alleviating poverty. For the rural sector, this includes providing or facilitating investments in farmland improvements, agricultural research and development, extension services, infrastructure such as roads and communications, and social services (such as education, health and social security). The fiscal system also sets incentives that guide the allocation of resources and influence development.[1]

[1] In this volume we have included two papers: this one on rural fiscal problems; and another by Shenggen Fan on public goods investment. This separation was made because of the complexity of the two sets of issues and the division of responsibility that was needed to pull together the information on both subjects. While these are presented separately, it should be emphasised that, in the long run, decisions on fiscal reforms and annual budgeting must be integrated with rural capital investment decisions. Currently, there is a great deal of separation between the two. It will only be after this artificial separation is removed that rural services, which are closely connected to both capital investment and rural fiscal management, can be rationalised.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China has one of the world's most decentralised systems for providing government services. In many countries, subnational governments provide day-to-day administrative and social services, but financing typically comes from the national treasury. Local governments in China, however, are largely self-financing, a trend that has increased during the reform period. China's provincial county and township governments in rural areas financed 48% of budgetary expenditures from local sources in 1990, but collected 66% of the revenues (Figure 1.1), a level much higher than in most countries.

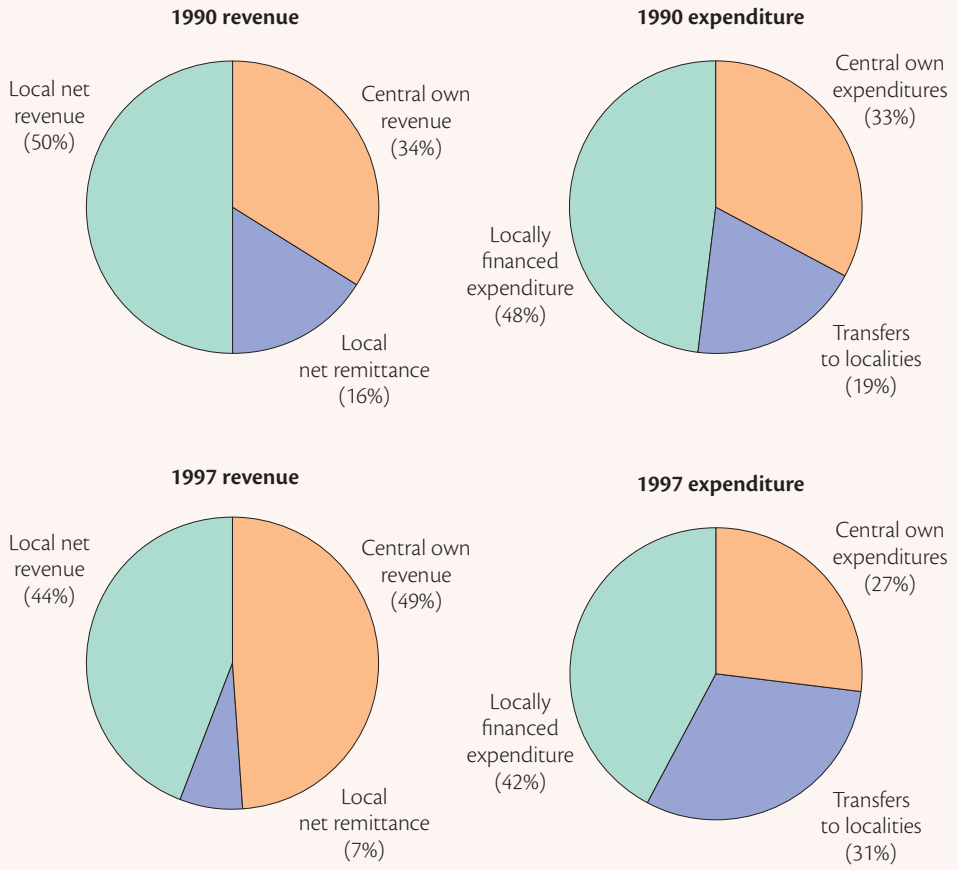

Figure 1.1 China: national and subnational shares of revenues and expenditures

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

THE CONDUCT OF RURAL PUBLIC FINANCE

A typical county budget is divided into three main parts, with roughly 40–45% of the total spent on social services, 25–30% on administration, and 10–15% on capital expenditures. The expenditure shares are changing as an increasing share of the budget is spent to meet social services mandated by the central government and pay nationally set salary levels. A distinguishing feature of China's fiscal system is that rural government functions overlap and are performed jointly by the county and the township or town, with some help from village committees and/or the local party. At the end of 1997, China had some 2100 counties and county-level cities, 44,700 townships and towns, and 740,000 village entities. This vast governmental apparatus is staffed by a large and rapidly growing number of officials, whose salaries and benefits have commanded an increasing share of the budget. In contrast, while agricultural investment absorbs an important share of both capital and administrative expenditures, its share has declined over time.

A big issue is whether China's local-level government has grown too large. There is great interest in understanding how to set up a framework for the right size of government. Researchers in China also are trying to understand the incentives for local governments to grow. Is it for efficiency, or is it a response of a self-protecting, self-perpetuating local bureaucracy? There also is a perception among observers that one of the main reasons for the fall of investment in the late 1990s was that funds were being diverted to pay the salaries of those in the bloated bureaucracy. Some have even gone so far as to suggest getting rid of some or all of township government, leaving, at most, a working office of the county bureaucracy. Work by Bai Nansheng (pers. comm.), however, suggests that one of the main reasons for the expansion of the bureaucracy was more demand driven by the tasks assigned by higher level governments. In his research he found that most government officials were carrying out productive tasks.

Traditionally, the expenditure responsibilities of township governments have two primary focuses: first, social services, principally education, health and welfare; and second, administration of law and order and disaster relief. In contrast, the expenditure responsibility of the county is primarily in providing infrastructural support to the economy—agricultural extension, water conservation, farm mechanisation and other capital investments in the rural sector. In recent years, there have been

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

attempts to bring the spending responsibilities for critical line items, such as rural education, back to the county. There is a perception among scholars that this is happening in some regions. However, it is by no means universal.

Although villages are not a formal part of the government and do not have independent fiscal power, they still play an important role in China's fiscal system. When people's communes were disbanded in the early 1980s, production brigades and teams reverted to their traditional name of 'village'. However, they inherited a framework of governance from the collectives, and exercise significant expenditure duties, such as salary or subsidy payments to village officials, social welfare for the aged and infirm, and sometimes supplementary education or health provision. Although in recent years in some places the flow of funds to schools from above has increased and teachers' salaries have begun to be paid in a timely fashion, villages still play an important role in building and maintaining schools. Most local health-care expenditure responsibilities (for hiring a village doctor and building a clinic) are left to the village. During the collective era, these obligations were financed from local proceeds. To the extent that many villages continue to carry on these functions, they often have had to find off-budget mechanisms for financing them, usually through non-tax levies on rural incomes and production. In recent years, especially in the area of health (but even in education in some villages, though still a very small share) villages have looked to the private sector to provide some of the services.

A legacy of the planned economy is the treatment of the agricultural sector as marginal to the fiscal system—it is neither a significant source of revenues nor a major recipient of fiscal transfers. In the planned economy, the real fiscal transfers took place through the price mechanism ('the price scissors') that extracted surpluses from the agricultural sector by setting low prices for agricultural raw materials and high prices for manufactured inputs and consumer goods (CCICED 2004). Support to agriculture included subsidies that were outside the fiscal system; they were provided through government-controlled low prices for some agricultural inputs (fertilisers, fuel and electric power) and investment in industries that produced agricultural inputs. As these price-based taxes and subsidies have disappeared, the tax contribution by agriculture, and allocations to the rural economy, have fallen.

Although the common perception of most is that the tax burden rose rapidly in recent years, Tao et al. (2005) have shown that this is, in fact, not so. Instead, as a percentage of rural per-capita incomes, the rural tax rate is about constant. However,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in examining China's regions by rich and poor, we find that, in some sense, China's tax system has become regressive. In richer areas, the share of income that is going for taxes has fallen. It has risen in poor, farming areas. One of the main findings of Tao's work is that taxes are associated with those left in the village, and those left in the village are mostly farming people. This is an unintended outcome. In contrast, few taxes are assessed on workers that earn a wage or those that go into petty self-employment. According to our data on self-employment, the median tax rate on a self-employed business is around only 5%.

In part in response to these findings and rising concern about the low incomes of those that are mostly engaged in farming, in recent years the government has taken a series of steps to cut taxes, both through reform of the local fiscal system and in directly reducing or eliminating taxes in the rural areas. In its tax for fee reform, officials sought to limit the total amount of tax burden on farmers to 5% of income per capita. This movement has run into many problems, and experiments have not been implemented nationwide. Although the reforms stopped tax and fee collections, services also fell. Instead, the government has reduced unilaterally the taxes that it has been assessing for many years and extracting from rural areas (so it will not have an impact on services). In 2002, the special product tax that was being assessed on horticulture commodities, cash crops and some livestock and aquaculture sales was eliminated. In recent months, the government has stated that it was eliminating the agriculture tax in many, mostly poor, farming areas. While not accounting for a great proportion of the tax burden on farmers, the tax-reduction effort is a powerful statement of the government in telling the farming community that the government is taking action.

These changes to rural public finance have occurred in the context of stop–start fiscal reform that has lagged behind China's transition to a market economy throughout the past two decades. During the entire early and middle-reform era, the revenue-generating capacity of the old system has been eroded with dismantling of planning mechanisms, and the nationwide budget (all jurisdictions) has declined from more than 30% of GDP in the late 1970s to the current 10 to 12% of GDP (Figure 1.2). In contrast, treasuries in other East Asian and developed countries command 20–30% of GDP (some highly socialistic nations such as Denmark and Israel approach 50%). This fiscal decline reduced the capacity and willingness of higher-level government to transfer resources to the rural sector.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

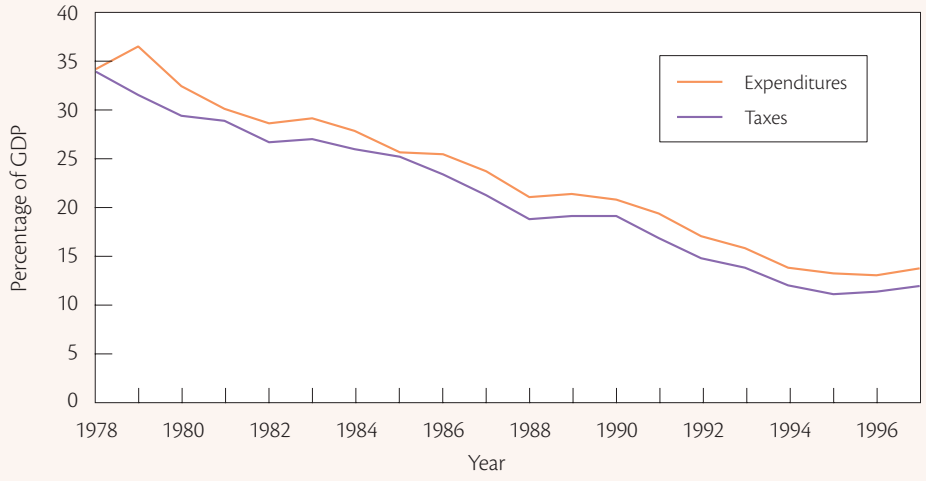

Figure 1.2 Taxes and expenditures in China as a percentage of GDP

TAX REFORM

Concern with central revenue decline led to a comprehensive reform of the fiscal system in 1993, as part of the effort to modernise macro-economic policy. The main issues were: defining a more stable and rising revenue base; making the tax structure more transparent and less distortional; and modifying national–subnational revenue sharing. Key provisions included the adoption of a value-added tax (VAT) and revenue-sharing arrangements. The new tax policy appears to have met some of its goals. It has stemmed the rapid fall of tax revenues as a share of GDP (Figure 1.2), and central government control of revenues and expenditures has reversed (Figure 1.3). In recent years, the central government has also been gradually establishing an income tax.

But while in recent years the central government has begun to extract more fiscal resources, and revenues have risen, redistribution from rich to poor has not occurred. While the resources have flowed back into the central government coffers, work by Wong and others (Wong et al. 1995; Wong 1997) shows that the flows back to the localities have been regressive. Tax rebates to local government have largely

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

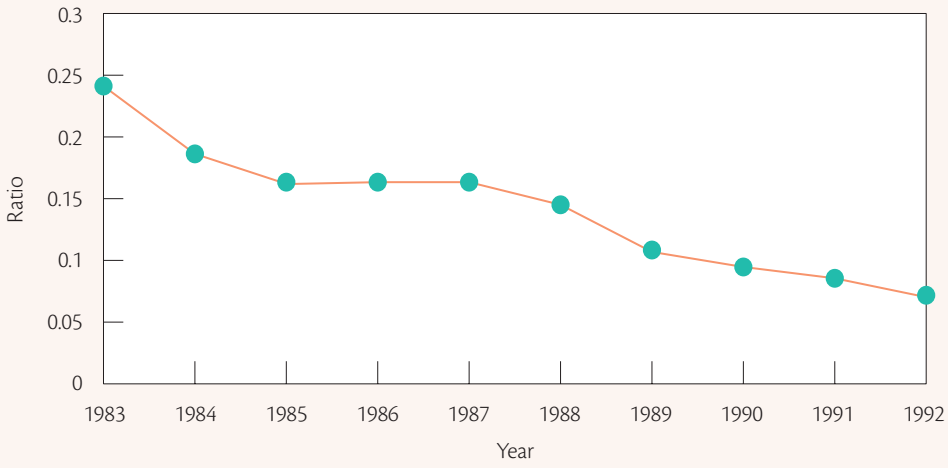

Figure 1.3 Investment to wage spending ratio, Shaanxi, 1983–92

favoured the rich provinces and lower jurisdictions. When asked to explain, most officials say that the sharing rule is in place to provide incentives for richer areas to expand economic activities and collect taxes.

The tax system remains centred on industry. (The VAT is assessed primarily on industrial products.) Rural governments have become increasingly dependent on VAT revenues generated by township and village enterprises (TVEs), and the increased remittances of VAT to the national government have almost certainly increased rural budget deficits, as little progress has been made in revenue redistribution. The reforms did not counter regressive intergovernmental tax sharing and redistribution issues, and thus created serious shortfalls in many rural counties and townships. Tax sharing is based on collection, so that rich provinces receive more central transfers and rebates than do poor provinces (Rozelle et al. 2003). Thus, overall intergovernmental transfers are strongly disequalising. For example, Guizhou, Shaanxi and Sichuan provinces had budget deficits exceeding 20% in the mid 1990s, even after including central government transfers.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

GOVERNMENT TRANSFERS

Subventions from national and provincial governments remain an important component of the budgets of counties and townships. However, the untied transfers that formerly provided resources to counties and townships for general expenditures are increasingly replaced by specific, earmarked transfers for agricultural infrastructure investment, education and health-care support, welfare and disaster relief. A 1988 national policy fixed general transfers in nominal terms, irrespective of requirements; in real terms, inflation has since eroded more than two-thirds of their value. The consequences of this erosion are most serious in poor counties.

Targeted transfers are eroding less rapidly, but the reforms have imposed greater fiscal demands on localities, as transfers are inadequate to meet mandated expenditures. Unfunded public-service mandates abound; for example, the central government often announces targets, such as specific reductions in school drop-out rates or improvements in infant mortality, but the funds to achieve the goals are not provided. To meet these obligations, county and township governments must raise the financial resources. Many observers have blamed the fee-grabbing and informal taxation, which is often idiosyncratic and non-transparent (and most hated by farmers), on the system of unfunded mandates.

There have been several efforts seeking to increase the transfer of funds to poorer, rural areas. The great western development plan is a typical example. The national Grain for Green program is another. There has been a push in recent years to increase the central government's earmarked transfer for rural education. In all of these efforts, however, there are questions about the program, the effectiveness of the investment and the appropriateness of the design of the projects. Resource-hungry local governments jump at the opportunity to receive such funds. Oftentimes, however, they come with strings attached, frequently requiring matching funds or at least project implementation effort. In many cases, the projects are focused on activities (e.g. airports or freeways) that do not meet the real needs of the villagers. In some cases for some villages, forestry projects require the abandonment of livestock operations. In short, one of the main problems of fiscal transfers today is lack of a clear governance process that gets the right amount of funding to the right project.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Indeed, the fiscal system is even more in need of reform. Most modern fiscal systems have a clear delineation of expenditure responsibilities and revenue source to fund each set of outlays. In China this is largely unclear, especially at the lower levels of government. In fact, lower levels of government have almost no tax base. One of the main goals of rebuilding the fiscal system is to create a scheme that is modern and sustainable.

IMPACT ON INVESTMENT AND THE PROVISION OF RURAL SOCIAL SERVICES

Persistent fiscal gaps, or shortfalls between required expenditures and fiscal capacity, have several adverse effects. One is that many rural governments are unable to provide the level and quality of social services mandated by national policy.

Investments

Deferred investment is an immediate victim of fiscal shortfall. As officials struggle to meet wages and other immediate needs from diminishing revenues, these needs are displacing development-oriented investments (Figure 1.3). Even if budgetary officials are directed to allocate funds to fixed investment, the funds are often diverted or borrowed, and, if not returned, the investment is not just delayed but permanently deferred.

Rural education

Calls from the national government to boost rural education only recently began to be matched by earmarked allocations. National officials have set high educational goals and an education expenditure target of 4% of GDP to be met by 2000, up from 2.66% in 1994. Although spending has risen, the goal still has not been met. Pleas to local governments to increase education funding more rapidly than the growth in financial revenue have gone largely unheeded, and meeting the target appears improbable. Insufficient fiscal revenues have undermined the quality of education as measured by a number of human-capital indicators. For example, a State Statistical Bureau survey shows that 30 million Chinese students have never been to school or have dropped out, 4 million drop out of school each year because they cannot afford the cost, and only 64% of rural students complete primary education without repeating a year.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

However, when funds do arrive, the outcome can be dramatic. Visits to selected poor areas in recent years have found that education expenditure in the form of earmarked transfers has risen. In some of the areas where tuition fees have fallen and the number and quality of teachers have risen, education rates have risen rapidly, but such improvement is by no means universal.

In fact, when compared with most countries in the world, China's primary education rates are not bad. Most educational rates are 100% in rich areas and over 90% in poor areas. Of course, in areas where not all children go to school, the incidence of drop out is not evenly distributed. Minorities, and *Han* girls in poor areas, have schooling records far inferior to those of other groups.

The more problematic area has been in trying to promote universal middle-school education. Middle-school fees are high. Many parents who want to fund their children's education are unable to do so. In addition, there is a demand problem in some areas, especially those with poor quality education and few outside employment opportunities, as parents cast doubt on the return they can get for educating their daughters (even though nationwide the returns to education in both rural, migrant and urban labour markets have risen rapidly).

Rural health

Ministry of Public Health goals call for 8% of rural budgets to be spent on health care. National officials have mandated improved facilities, expanded coverage and training standards for doctors. Rules describe what is expected of county and township leaders for establishing ideal rural health systems. However, like education, the actual resources allocated to achieve national objectives fall far short of needs. The national government allocates only 2.4% of its recurrent budget for health-care services, and only 1.2% of the capital construction fund. The situation is more severe in poor areas.

School fees and health charges have soared in recent years. West (1997) reports that, in many areas, there are both rising drop-out rates due to difficulty in meeting these new schooling costs, and falling maternal and infant health-care visits because of rising costs. In areas where funds cannot be raised, education and health services have disappeared or declined in quality, resulting in the large-scale departures of teachers, doctors and other professionals.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

EXTRA-BUDGETARY REVENUE SOURCES

A second adverse effect of fiscal pressure is the growing reliance on off-budget finance. The ability of local governments to raise revenues varies greatly and determines the quantity and quality of local public services. County and township officials are evaluated on their fulfilment of mandates. This is an important reason for increases in local fee assessments and rising burdens (Wen and Zhu 1998).

To meet the revenue requirements of these expenditure demands, county and township governments attempt to increase revenue from off-budget sources. Without legal taxing authority or ability to borrow, counties and townships have developed off-budget sources, primarily extra-budgetary funds (EBFs) and self-raised funds (SRFs). From the late 1980s through the early 1990s, the proportion of total funds from these sources rose continuously, reaching 28.6% in 1992 (Table 1.1). At the township level, EBFs are fewer (compared with cities) and consist mostly of rural education and agricultural tax surcharges. The majority of off-budget revenues come from SRFs, which include miscellaneous fees (assessed on local enterprises), rental income (from leased collective assets) and remittances from TVEs. The Ministry of Finance has reported that, nationally, off-budget revenues bring total revenue collection to about 30% of GDP (Nyberg and Rozelle 1999).

Although the growth of off-budget revenues has eased fiscal pressures for many localities, it has also had adverse consequences. It has hastened the decline of the formal fiscal system by providing an alternative tax source that is 100% retained. It has created a tax system that is ad hoc, nontransparent, regressive and beyond the reach of the formal fiscal system. The lack of legitimacy may be a greater source of rural discontent than the total burden. Also, in the late 1980s and early to mid 1990s, local officials came to rely almost exclusively on enterprises for SRFs; thus the poorest rural jurisdictions had the weakest potential for supplementing budgets from these sources. As privatisation has taken over and diminished the direct access that governments have to the funds of their firms, local governments have moved heavily into real-estate development. Like the promotion of industry, however, only rich areas have much of a chance to reap the benefits of land sales and development. In fact, in poorer areas that have tried to replace the revenue of their failed or privatised firms with real-estate development, much as in the past their investments have failed and cost the locality more than it has earned.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 1.1 Township finance in China, 1986–93. Values are percentages

	1986	1987	1988	1989	1990	1991	1992	1993
Total revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Budgetary revenue	83.3	82.7	80.0	75.9	74.6	72.0	71.5	73.8
Extra-budgetary revenue	5.0	4.7	5.6	6.0	6.4	6.9	7.1	6.5
Self-raised funds	11.7	12.6	14.4	18.1	19.0	21.1	21.5	19.8
Total expenditure	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Budgetary expenditure	77.4	76.6	74.3	69.4	69.0	66.4	65.9	67.6
Extra-budgetary expenditure	6.4	6.1	7.0	7.2	7.4	7.7	7.6	7.0
Self-raised funds	16.2	17.3	18.7	23.4	23.6	25.9	26.5	25.4

Source: Ministry of Finance, 1994.

Perhaps the worst consequence of off-budget financing is the tendency of county and township governments to give policy and regulatory agencies control over the assets they regulate or operate (or the resources they are charged with protecting). Officials then encourage agency officials to use these assets to generate income for staff salaries and other expenses. This is a pervasive issue that will resurface in subsequent discussions of natural-resource management and agricultural extension. There have been efforts to control it, but the reactions of local government have been almost as rapid as any action from above.

EQUALISATION ISSUES

Previous studies have noted unusually large differences in per-capita budgetary revenues among provinces (World Bank 1992; Wong et al. 1995). However, revenue and expenditure differences are also large at subprovincial levels and, with decreasing transfers, per-capita revenue and expenditure have become increasingly correlated. While the VAT was designed to permit the central government to control greater fiscal resources, negotiations have enabled provinces to keep a

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

large proportion of the taxes they generate. This retention of taxes, combined with the regressive rebate, mitigated the more progressive non-tax transfers and the intended redistribution impact. The subtle shift in resource flows that is shown in the report of the CCICED task force (CCICED 2004) may indicate a slight shift in priorities, but if the experience of other East Asian countries is useful, a much more fundamental shift of priorities is needed, as are massive investments of funds in many rural areas.

FISCAL CRISES IN POOR COUNTIES

In recent years deficits have become persistent in poor counties. In 1994, half of China's counties had difficulties meeting even basic expenditures such as wage disbursements (Park et al. 1996). Counties can generate extra revenues by selling urban permits, borrowing funds earmarked for other uses (such as family planning or school construction), or borrowing from local state-owned enterprises or banks—a frequent, although illegal, practice. Poorer counties are revenue-starved even more than is reflected in acknowledged net deficits; hidden deficits are represented by budgetary funds diverted from prescribed uses to pay salaries and wages. Salary and wage payments are often deferred, and some county and township governments have declined to pay for employee benefits such as health reimbursements. (Counties can appeal to upper-level governments for special subsidies or increases in fixed subsidies, but these adjustments are made in only special cases, such as natural disasters.) These hidden deficits indicate that financial statistics systematically underestimate true fiscal deficits.

EFFECT OF BUDGET PRESSURES ON PUBLIC EXPENDITURE PATTERNS

The pressure to eliminate deficits may result in underinvestment in public goods, especially in poorer areas (where needs are greatest) and increase incentives for local governments to maximise revenues rather than social welfare (Wu 1994). Local governments placing priority on meeting their wage bills has led to deferred maintenance and deteriorating capital stock in many of the poorer counties—and consequently to declining efficiency of resource use (Nyberg and Rozelle 1999).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The impact of fiscal reforms on the ability of county and township governments to make productive investments in infrastructure and social services has important implications for economic development in poor regions. Some of the fall in investment in poor counties might be expected to be compensated by increased spending through other channels, especially China's poverty program. Recent research in Sichuan, however, shows that local investments in education, health and agriculture do lead to growth, but poverty program investments typically replace, rather than supplement, budgetary investments (Rozelle et al. 2003); and on-budget investments and social services have declined from the mid 1980s to the 1990s.

Deficit counties have also begun to reduce their wage obligations through wage suspension, staff termination and reorganisations that reassign, but do not terminate, local government personnel. Some county and township government bureaus have been redesignated as companies, with worker pay linked to profits. Other bureaus and agencies have been urged to design and pursue revenue-generating activities; and many staff (both those reassigned and still in government) pursue entrepreneurial activities, such as opening restaurants and hotels, or engaging in trade.

As China moves into the 21st century, radical new policies are going to have to be used to confront problems in poor areas. Traditional programs, such as subsidised credit loans, dragon head firms and micro-credit-based investment schemes have all proved to be distorting and unsustainable. One of the biggest problems has been the mindset that all areas, no matter how poor or how remote, should seek to develop a sustainable economy. But development economics has shown that farm families in many regions are in a holding pattern. A vast majority of them need to move out. Factories in the cities and coastal areas will be the beneficiaries of the shifts of labour out of the regions. Hence, in almost all developed countries, poor areas need large, sustained transfers that are targeted at building-up human capital so the young and able can move, and at improving the agricultural and infrastructural base enough to allow households to live above poverty and provide themselves with a minimum standard of living and enough extra to accumulate sufficient assets to invest in their children's education and their own move out of the region. The current fiscal system in poor areas does not do this.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CONCLUSIONS AND RECOMMENDATIONS

The conduct of rural public finance affects the entire nation's stability and long-term growth prospects. However, the rural fiscal system generates inadequate revenues, and poorly redistributes those that are collected. Unless improved, many scholars believe that the fiscal system will likely constrain long-term development.

Fiscal decentralisation has transferred to subnational jurisdictions control over most resources and residual rights over most incremental revenues. National directives and tax-collection problems have also reduced resource redistribution (Wong 1997). Fiscal reforms have hardened budget constraints for all subnational jurisdictions, and fiscal sharing rules have increased tax-collection efforts in both rich and poor regions (Park et al. 1996; Wong 1997). Some scholars have identified growth-inducing effects in China's fiscal reform—supported by empirical evidence (Oi 1999; Lin et al. 1997). However, the reforms are incomplete. Indeed, they have hardly begun. Widespread fiscal crises suffered by so many rural governments have reduced potential economic growth, welfare and equity, and have led to investment starvation. Some 70% of the counties and townships have net-deficit budgets, and their policy obligations continue to rise.

China's tax system is characterised by deficient revenue generation and public-service spending at all levels. The tax system remains heavily industry-dependent and has neither made tax assignments clear, nor given rural communities a revenue base on which to build rational fiscal plans. The 1994 tax reform increased the tax-collection power of the central government, which would allow more equitable redistribution. However, while more revenues have flowed into central coffers (reducing local revenues), little of the increase has been shifted to poorer or deficit areas, and the new tax policy continues to favour relatively affluent areas, exacerbating rather than alleviating the rural fiscal crisis. If there is one policy prescription that should be brought forth to leaders, far more important than any reform of the mechanisms of the fiscal system, it is that there needs to be a new commitment from the very top to dramatically increase the flow of fiscal resources into rural areas. China is a rapidly growing country and is increasingly generating fiscal resources at the national level that could be used in rural areas, but which have, to date, only marginally been set aside for use in the rural fiscal system. China must shift increasingly more resources into its rural areas or it is taking a chance that they may become a source of irreversible problems.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Fiscal resources in poor deficit areas are insufficient to meet the rural sector's development–investment requirements. Increased pressure to generate revenues at county and township levels leads to biased development policies and may become distortionary and inimical to economic development. For example, investments in revenue-deficit regions may tend to be industry biased, because of the relative ease of tax and fee extraction, even if investments in agriculture might better serve growth and distributional goals. It should be noted that fiscal problems, while serious in the poorest parts of China, are equally serious in many areas that have not been targeted by leaders for massive investment. Specifically, no one will deny that the fiscal problems in poor areas of western China are serious. However, there is another argument that says that, since these areas have been the target of a large effort to increase public goods investment, they are not the worst areas of the country. There are many rural areas in central China—in Hunan, Hubei, Henan, Anhui and Jiangxi—that arguably face the most serious fiscal crises in China, since they are relatively poor and have not received the same attention of national poverty-alleviation efforts as have other parts of the country.

REFERENCES

CCICED (China Commission for International Cooperation for the Environment and Development) 2004. China's agricultural and rural development in the new era: challenges, opportunities and policy options: an executive summary of policy report. Beijing, CCICED Agricultural and Rural Development Task Force, September 2004.

Lin, J., Zhiqiang Liu and Funing Zhong 1997. Fiscal decentralization and rural development in China. Peking University, Center for Economic Research, Working Paper.

Nyberg, A. and Rozelle, S. 1999. Accelerating China's rural transformation. Washington, DC, World Bank.

Oi, J.C. 1999. Rural China takes off: the institutional foundations of economic reform. Berkeley, University of California Press.

Park, A., Rozelle, S., Wong, C. and Changqing Ren 1996. Distributional consequences of reforming local public finance in China. China Quarterly, 147, 751–778.

Rozelle, S., Zhang, L. and Huang, J. 2003. China's war on poverty: assessing targeting and the growth impacts of poverty programs. Journal of Chinese Economics and Business Studies, 1, 301–317.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Tao, Ran, Lin, J.Y., Mingxing Ling and Qi Zhang 2005. The problem of taxing farmers in China. Agricultural Economics, in press.

Wen, Tiejun and Shouyin Zhu 1998. Reform of agricultural tax system and 'farmer's burden'. Beijing, Ministry of Agriculture, Research Center of Rural Economy, July 1998, mimeo.

West, L.A. 1997. Provision of public services in rural PRC. In: Wong, C.P.W., ed., Financing local government in the People's Republic of China. Hong Kong, Oxford University Press.

Wong, C.P.W., ed. 1997. Financing local government in the People's Republic of China. Hong Kong, Oxford University Press.

Wong, C.P.W., Heady, C. and Wing Thye Woo 1995. Fiscal management and economic reform in the People's Republic of China. Hong Kong, Oxford University Press.

World Bank 1992. China: strategies for reducing poverty in the 1990s. Washington, DC, World Bank.

Wu, Guobao. 1994. Difang zhengfu xingwei yinxiang: yusuan shouru, zengzhang, yu tupin mubiao de chongtu [Goal conflicts, budget solvency, and poverty alleviation in China], *Kaifa luntan* [The Tribune of Economic Development], Volume 6.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1.3 INVESTMENT OR SUBSIDIES: WHERE SHOULD CHINA BE HEADING?

Shenggen Fan
Institute of Agricultural Economics, Chinese Academy of Agricultural Sciences, Beijing, People's Republic of China, and International Food Policy Research Institute, Washington, DC, USA

INTRODUCTION

Economic reforms initiated in 1978 have brought rapid economic growth in China and fundamental changes in the national economic system. The role of the agriculture sector has declined as manufacturing and service sectors have grown much faster than the rest of the economy.[1] Due to the declining comparative advantage of the agriculture sector, the resource base to sustain agricultural production has declined. For example, employment of land, labour, capital and water has shifted from agricultural to non-agricultural uses. Agriculture and food production are currently threatened by these changes. China's entry into the World Trade Organization (WTO) in December 2001 has accelerated this process. As supply tightened, domestic prices of major agricultural products have exceeded international levels for the past several years. Various measures of protection and support such as aggregate measure of support and producer subsidy equivalents show that China is in transition from taxing to subsidising agricultural production. Is this new development a short-term phenomenon or the beginning of long-term protection following the path of the OECD countries? Implementation of either of these approaches would have profound and long-term implications for China's agricultural and general economic development.

[1] In 2003, agricultural GDP accounted for only 15% of the total GDP while it was more than 50% in 1952.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The rapid economic growth has not benefited everybody equally, thus worsening income distribution and regional inequality. The Gini coefficient, which measures the inequality of income distribution within a country, has risen from 0.33 in 1980 to 0.46 in 2000. The income difference between rural and urban sectors has become increasingly large. The average rural income was 60% of urban income in 1984, but had declined to only 33% in 2002. The income gap between the coastal areas and the western region has widened dramatically over the past two decades. In 2002, per-capita gross domestic production (GDP) in Shanghai was 9–10 times higher than Guizhou. With poor infrastructure and a shortage of human capital in less-developed regions, it will be hard for farmers to switch from grain production to higher-value crops or to non-farm activities. All of these factors may lead to an even higher concentration of rural poor in these regions, if proper government policies are not implemented.

Policy makers and researchers are debating on how to increase farmers' incomes, and how to reduce regional inequality and rural poverty. There are several options facing Chinese policy makers. One option is to increase price and income support for farmers, as many Organization for Economic Cooperation and Development (OECD) countries have done for the past several decades. Another option is to use trade barriers such as tariffs and import quotas to insulate the domestic market from international markets. But adoption of either of these options would lead to a huge government financial burden or an increase in domestic food prices and higher costs for consumers. Both of these options would also lead to large net-social-welfare losses due to misallocation of resources among economic sectors.

Another option is to liberalise the agricultural sector immediately, with no preconditions. This option would allow scarce resources to be allocated on the basis of comparative advantage among sectors and between China and international markets. Overall efficiency and net social welfare will be gained. But we argue that there must be conditions to liberalisation. One of the conditions would be to increase investments in agricultural research, irrigation and rural infrastructure. This is essential for long-term food security and a critical precondition to improve overall efficiency of the agriculture sector and increase the living standards of the rural population.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The objectives of this paper are to review recent information from China and India on measures of government support to agriculture and to analyse how this support, including subsidies and investments, has contributed to growth and poverty reduction in rural areas. As China is at the crossroads in supporting its agriculture, the information provided will contribute to the debate on future reforms of the Chinese agriculture sector. The rest of the paper is organised as follows. First there is a review of different estimates of support to agriculture in China. The paper then presents the evidence on how subsidies and investments have contributed to growth and poverty reduction, using the cases of India and China. The paper concludes with some policy implications.

LEVELS AND CHANGES OF AGRICULTURAL SUPPORT

To measure the exact amount of support or taxing in agriculture is difficult, and it is even more difficult to compare these measures between countries due to complexity of policies and policy instruments implemented over time in various countries. There are several ways to measure the support or tax levels in the agricultural sector. In the past 10 years, one indicator that has become increasingly popular is the producer subsidy equivalent (PSE). The PSE is an indicator of the value of the monetary transfers to agriculture resulting from agricultural policies in a given year. Both transfers from consumers (through domestic market price) and transfers from taxpayers (through budgetary or tax expenditures) are included. Five categories of agricultural policy measures are usually included: transfers to producers affecting producer and consumer prices simultaneously (market price support); transfers directly from taxpayers to producers without raising prices to consumers (direct income payment); transfers to producers through lowering input costs; reductions in costs to the agricultural sector as a whole that are not received directly by producers (general services); and other measures such as subnational supports funded by provincial or local governments or certain tax concessions.

Due to the different data and methods used, the estimates for Chinese agriculture vary greatly. Cheng (2001) estimated the PSEs for China over the period 1985–95. His results show that Chinese support to agriculture was still negative until 1994, but in 1995 it became positive at 4% of total production value. Tian et al. (2002) also estimated PSEs for Chinese agriculture (Figure 1.4). Although their estimates were negative even until 2000, there was a clear declining trend in the taxing of agriculture.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

From 1990 to 1993, the implicit taxes in Chinese agriculture as percentages of agricultural production value were in a 14–22% range. But from 1994 to 2000, the percentages declined to 1–8%. Regardless of data sources and methods, the implicit taxes on agriculture have declined in the 1990s. Using a different method and adjusted price data, Mullen et al. (2004) found a similar trend. In 2001, the protection on Chinese agriculture for five commodities included in their studies was approaching zero.

A more-recent development in the measurement of agricultural support is the aggregate measure of support (AMS), which measures only support related to trade distortions, but very few countries have reported such measures. It is even more difficult for China to make such measures due to lack of the data needed. The only estimate we found is that of Sun (2001). They found that the AMS in 1998 was about 2% of total production value for Chinese agriculture. This again indicates that the level of protection of Chinese agriculture has been minimal or negative in recent years.

There are various pieces of evidence that the Chinese Government has increased its support to agriculture through several means such as income support to boost grain production, poverty relief funds and public investment. But these different avenues of support may result from different policy objectives. The efficiency of these support measures deserves greater attention.

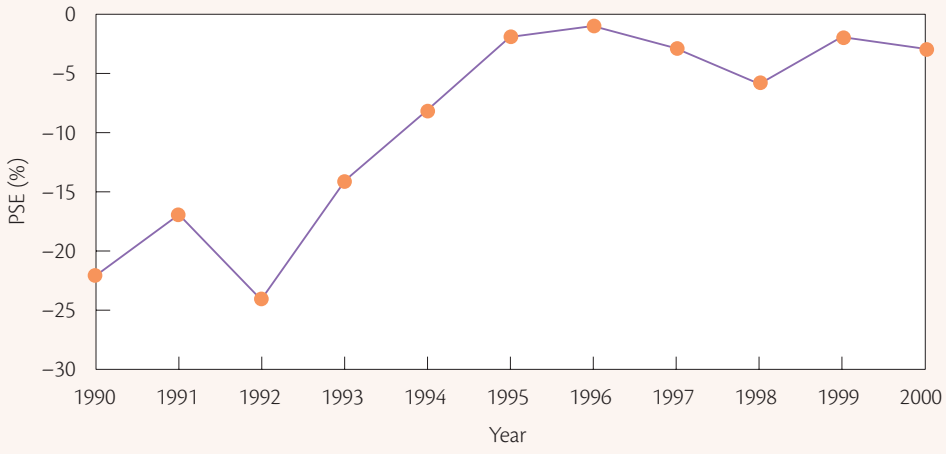

Figure 1.4 Producer subsidy equivalent (PSE) to agriculture in China, 1990–2000

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

INVESTMENT VERSUS SUBSIDIES: EMPIRICAL EVIDENCE FROM CHINA AND INDIA

In this section, we use case studies from China and India to show how different government support mechanisms (investment, subsidies or anti-poverty programs) may result in different development outcomes. For the past several decades, there have been many attempts to estimate the impact of public spending (including investment and subsidies) on economic growth and poverty reduction. A significant feature in the literature is that most of the previous studies have considered only one type of government spending or investment at a time. As a result, it is difficult to compare the relative returns to both growth and poverty reduction of different types of spending or investment. Most studies have also used a single-equation procedure. There are at least three disadvantages to this approach. First, investment or spending affects poverty through multiple channels. For example, improved rural infrastructure due to government spending will not only reduce rural poverty through improved agricultural productivity, but also affect rural poverty through improved wages and non-farm employment. It is difficult to capture these different effects in a single-equation approach. Second, including only one type of public spending in estimating poverty reduction will lead to an upward bias in the estimated impact of that particular spending. Finally, it is difficult to compare the effects of different types of spending on both growth and poverty reduction.

In order to systematically assess the impact of different types of public spending on both agricultural growth and poverty reduction, the International Food Policy Research Institute (IFPRI) has undertaken several case studies that take account of the multiple pathways by which spending can influence growth and poverty. The underlying conceptual framework is summarised in Figure 1.5.

Public spending affects rural poverty through many channels. It increases farmers' incomes directly by increasing agricultural productivity, which in turn reduces rural poverty. Indirect impacts come from higher agricultural wages and improved non-farm employment opportunities induced by growth in agricultural productivity. Increased agricultural output due to public investment often yields lower food prices, again helping the poor indirectly because they are often net buyers of food grains. In addition to its productivity impact, public spending directly promotes rural wages, non-farm employment and migration, thereby reducing rural poverty.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

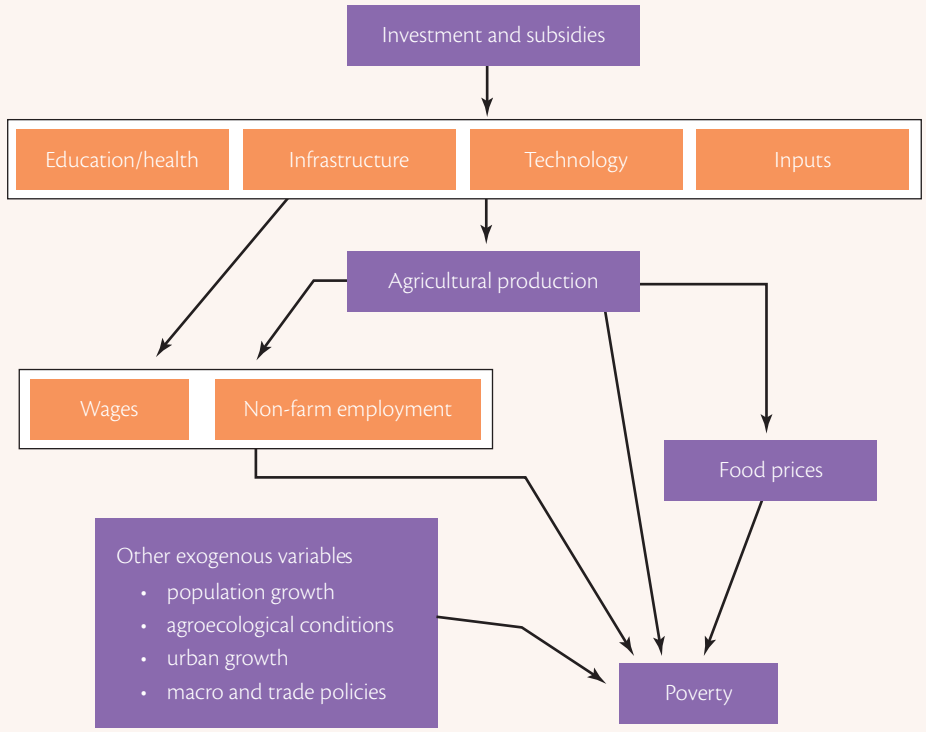

Figure 1.5 The channels through which public spending affects rural poverty

For example, improved road access helps farmers set up small, rural, non-farm businesses such as food-processing and marketing enterprises, electronic repair shops, transportation and trade, and restaurant services.

To capture all these various pathways, the IFPRI studies use a simultaneous-equation approach to model agricultural production, rural wages, non-farm employment, agricultural prices, and the relationships between government spending and physical stocks of public capital, considering the lead and lag effects of various investments. The model is estimated econometrically using time-series data at sub-regional levels for case-study countries. Once estimated, the model can be used to calculate the marginal impacts of additional units of investment in different types of infrastructure, human capital and technology.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

India

Poverty in rural India has declined substantially in recent decades; from about 60% of the population in 1970 to about 25% today. This steady decline was strongly associated with agricultural growth, particularly the green revolution, and with expansion of non-farm rural activities. Both increased in response to massive public investments in agriculture and rural infrastructure. Using a multi-equation model, the marginal returns to different types of government spending on agricultural growth and poverty reduction were estimated (Table 1.2). The marginal impact and elasticity of different types of government subsidies and expenditures on rural poverty were calculated for four decades: 1960s (1967–70), 1970s, 1980s, and 1990s (1990–97). In terms of returns to agricultural GDP, most of the investments and subsidies in the 1960s generated returns that were larger than their costs. In particular, roads and education investments had benefit–cost ratios of 6 to 9. Subsidies on irrigation, fertiliser and credit yielded benefits that were 2–4 times the amount spent. Agricultural research also had very favourable returns with a benefit–cost ratio of 3. This is the time when India began to introduce high-yielding varieties, fertiliser and credit as a technology package, which yielded high pay-offs. In the 1970s, the returns to these subsidies and investments declined, but most of them remained positive. Education generates a high return, followed by agricultural research, whereas most subsidies showed lower returns compared with the previous decade.

In the 1980s, a similar pattern of returns continued, except for credit and fertiliser subsidies. Credit subsidies showed an increasing return while fertiliser subsidies became uneconomic in the 1980s. At the same time, investments in roads, education, irrigation and agricultural research and development (R&D) still showed very high returns. In the 1990s, most of the subsidies became uneconomic, with the exception of credit subsidies. Subsidies on irrigation have no significant impact on agricultural production, and fertiliser and power subsidies have returns lower than their costs. On the other hand, investments in roads, education, irrigation and agricultural research still generate high returns, and there is no sign that these returns will decline in the near future.

As regards the poverty-reduction impact, most government investments and subsidies had a large impact in the 1960s and 1970s, and even into the 1980s. In the 1960s, it was investment in roads that had the largest poverty-reduction effect. For every million rupees spent on roads, 1272 rural poor were lifted above the poverty line in the 1960s.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 1.2 Returns in growth and poverty reduction to investments and subsidies in India

	1960s	1970s	1980s	1990s
Returns in agricultural GDP (rupees per rupee spending)				
Roads	8.79	3.80	3.03	3.17
Education	5.97	7.88	3.88	1.53
Irrigation investment	2.65	2.10	3.61	1.41
Irrigation subsidies	2.24	1.22	2.28	n.s.
Fertiliser subsidies	2.41	3.03	0.88	0.53
Power subsidies	1.18	0.95	1.66	0.58
Credit subsidies	3.86	1.68	5.20	0.89
Agricultural research and development (R&D)	3.12	5.90	6.95	6.93
Returns in rural poverty reduction (number of poor reduced per million rupees spending)				
Roads	1272.29	1345.68	295.43	334.98
Education	411.03	468.65	447.21	108.75
Irrigation investment	182.73	125.49	197.27	66.91
Irrigation subsidies	149.11	67.51	113.50	n.s.
Fertiliser subsidies	165.87	180.88	48.14	23.67
Power subsidies	78.68	52.31	82.52	26.90
Credit subsidies	256.60	92.54	258.51	41.73
Agricultural R&D	207.30	325.57	345.24	323.01

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Education spending had the second-largest impact, and more than 400 poor would be lifted above the poverty line for every million rupees spent. Subsidies on credit, fertiliser and irrigation also resulted in very favourable returns for poverty reduction. For every million rupees spent, 256, 180, and 149 poor, respectively, were lifted above the poverty line. In the 1970s, roads, education and agricultural research yielded the largest poverty-reduction impact, ranging from 300 to 1400 poor lifted above the poverty line per million rupees spent. Subsidies on fertiliser also showed a strong poverty-reduction impact. However, in the 1980s, while roads, agricultural research, education, and credit subsidies and irrigation investments continued to have a strong effect on poverty reduction, the impact of subsidies on irrigation, fertiliser and power had declined drastically to only 48–113 poor reduced per million rupees spent. By the 1990s, all subsidies had become insignificant, while investments in roads, education, and agricultural research still showed large poverty-reduction impacts, and there is no sign that these effects will decline in the near future.

Two conclusions can be drawn from this study. First, initial subsidies for credit, fertiliser and irrigation were crucial for small farmers to adopt the new technologies. Small farms are often losers in the initial adoption stage of a new technology as prices are pushed down by greater supply of agricultural products coming from large farms benefiting from the new technology.

Second, agricultural research, education and rural infrastructure are the three most-effective public-spending items for promoting agricultural growth and poverty reduction throughout all the periods under study. On the other hand, in more recent years, input subsidies (including fertiliser, electrical power, credit and irrigation) yielded very low marginal returns in both agricultural growth and poverty reduction, despite their large impact in earlier decades.

The results have important policy implications. For the last two decades, we have seen a declining trend in government investment in the agricultural sector and an increasing trend in government subsidies. These subsidies, including those on fertiliser, irrigation, power and credit, amounted to about 2% of the national GDP (Figure 1.6), and 8–10% of agricultural GDP (Gulati and Narayanan 2003). These subsidies are in direct competition with long-term capital investment in roads, rural education and agricultural research. To sustain long-term growth in agricultural production and thereby a long-term solution to poverty reduction, the government should cut these subsidies and increase investments in agricultural R&D, rural infrastructure and education.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

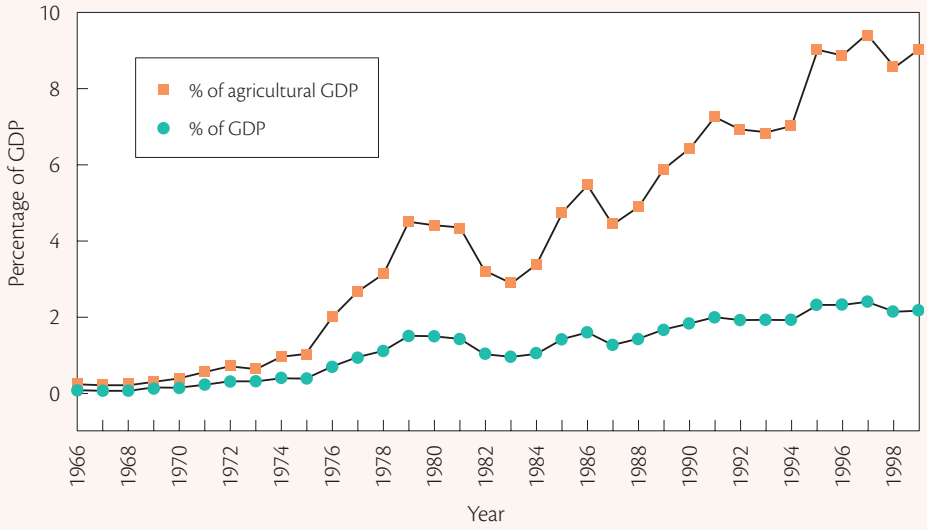

Figure 1.6 Input subsidies as a percentage of GDP and agricultural GDP in India, 1966–1998

China

China has been very successful in reducing its rural poverty during the past two decades, the number of poor falling from 250 million in 1978 to 29 million in 2001. Contributing to this success were a series of policy and institutional reforms, promotion of equal access to social services and production assets, and public investments in rural areas. Yet, as China's economy continues to grow, it is becoming harder to further reduce poverty and inequality. How the government can better design its policies, particularly public-investment policy, to promote growth while reducing poverty and regional inequality is hotly debated in both academic and policy circles.

Using provincial-level data for 1970–97, Fan et al. (2005) used a simultaneous-equation model to quantify the effects of different types of government expenditure on growth and poverty reduction. The results (Table 1.3) show that government spending on rural infrastructure (roads, electricity, and telecommunications) had

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

substantial impacts in reducing poverty, owing mainly to improved opportunities for non-farm employment and increased rural wages. However, these impacts were not as large as from investments in education and agricultural R&D. Disaggregating the analysis into different regions reveals that, for all types of government spending, the poverty-reducing impacts were highest in the west (the least-developed region), while impacts on agricultural production growth were the highest in the central region (more-developed region) for most types of spending. Furthermore, investments in the western region led to the greatest reductions in regional inequality for all types of government spending, while investments in either the coastal or central regions exacerbated existing regional inequalities.

Table 1.3 Returns to rural investment in China, provincial-level analysis

	Coastal	Central	Western	Average
Returns to agricultural GDP (yuan per yuan expenditure)				
Research and development (R&D)	8.6	10.02	12.69	9.59
Irrigation	2.39	1.75	1.56	1.88
Roads	1.67	3.84	1.92	2.12
Education	3.53	3.66	3.28	3.71
Electricity	0.55	0.63	0.4	0.54
Telephone	1.58	2.64	1.99	1.91
Returns to poverty reduction (no. of poor reduced per 10,000 yuan expenditure)				
R&D	1.99	4.4	33.12	6.79
Irrigation	0.55	0.77	4.06	1.33
Roads	0.83	3.61	10.73	3.22
Education	2.73	5.38	28.66	8.8
Electricity	0.76	1.65	6.17	2.27
Telephone	0.6	1.9	8.51	2.21
Poverty loan	0.88	0.75	1.49	1.13

Notes: Marginal returns are calculated for 1997.
Sources: Fan et al. 2005.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The above study involved highly aggregated types of investment. The high aggregation may mask important differentials even within the same type of investment. For example, within roads, different types may have different impacts on growth as well as on poverty reduction. For this reason, Fan and Chan-Kang (2004), using provincial-level data for 1982–1999, developed an analytical framework to estimate the effects of different types of roads on growth and poverty reduction in China. Their study differs from the previous study in two aspects: first by differentiating high and low-qualtity roads, and second by expanding the measured impacts from just rural areas to both rural and urban areas.

The most significant finding of this study is the high returns from low-quality roads, which are mostly rural roads (Tables 1.4 and 1.5). The marginal impact of investments in low-quality roads is more than four times greater than that for high-quality roads. Even in terms of urban GDP, the return from low-quality roads (or rural roads) was greater than that of high-quality roads. While high-quality roads do not have significant impact on agricultural GDP, low-quality roads can generate more than 1.48 yuan worth of agricultural GDP for every yuan invested. Investment in low-quality roads also generates a high return in rural non-farm GDP. Every yuan invested in low-quality roads yields more than 5 yuan of non-farm rural GDP. In terms of urban poverty reduction, the impact from low-quality roads is larger than the corresponding impact from high-quality roads. Likewise, the effects of low-quality roads on rural poverty reduction are larger than those from high-quality roads.

TOWARDS A MORE-EFFICIENT AND EQUITABLE DEVELOPMENT STRATEGY

There is considerable evidence that China is at a crossroads in agricultural development, as the country has moved from taxing to subsidising agriculture. How to design an agricultural support policy to achieve long-term, sustained, equitable and sustainable growth is a hotly debated topic among Chinese policy makers and researchers. Based on the evidence from both China and India, the following policy suggestions to achieve the stated national objectives are offered.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 1.4 Returns to GDP of road investment in different regions in China

	High-quality roads	Low-quality roads
Returns in total GDP (yuan per yuan)		
Average	1.55	5.99
Northeast	1.35	3.61
North	1.48	6.11
Northwest	1.13	1.44
Central	1.71	6.57
Southeast	1.61	18.63
Southwest	1.91	7.47
South	1.29	7.57
Returns in urban GDP		
Average	0.99	3.53
Northeast	0.95	2.33
North	0.97	3.70
Northwest	0.69	0.81
Central	0.90	3.18
Southeast	1.07	11.45
Southwest	1.05	3.78
South	0.88	4.78

	High-quality roads	Low-quality roads
Returns in agricultural GDP		
Average	n.s.	1.48
Northeast	n.s.	0.64
North	n.s.	1.26
Northwest	n.s.	0.45
Central	n.s.	2.50
Southeast	n.s.	2.85
Southwest	n.s.	3.23
South	n.s.	1.77
Returns in rural non-farm GDP		
Average	0.65	5.34
Northeast	0.51	2.38
North	0.63	4.74
Northwest	0.45	1.19
Central	0.85	7.97
Southeast	0.75	15.01
Southwest	0.54	5.39
South	0.51	6.21

Note: Except returns in agricultural GDP to high-quality roads, all estimates are statistically significant at the 10% level.

Sources: Fan and Chan-Kang (2004).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 1.5 Returns to poverty reduction of road investment in different regions in China

	High quality roads	Low quality roads
Returns in urban poverty reduction (number per 10,000 yuan)		
Average	0.05	0.19
Northeast	0.11	0.30
North	0.03	0.12
Northwest	0.15	0.19
Central	0.05	0.21
Southeast	0.01	0.15
Southwest	0.11	0.40
South	0.01	0.03
Returns in rural poverty reduction, official data		
Average	0.08	1.12
Northeast	0.04	0.36
North	0.07	0.97
Northwest	0.28	1.30
Central	0.05	0.64
Southeast	0.01	0.32
Southwest	0.40	5.70
South	0.02	0.45
Returns in rural poverty reduction, Xian and Sheng data		
Average	0.31	5.67
Northeast	0.14	1.46
North	0.52	8.61
Northwest	0.59	3.39
Central	0.35	7.20
Southeast	0.10	4.70
Southwest	1.01	22.18
South	0.08	2.16

Note: All estimates are statistically significant at the 10% level.

Sources: Fan and Chan-Kang (2004).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

More public spending in rural sectors

There is empirical evidence (e.g. Fan et al. 2004) that investment in rural areas can yield large returns. There is therefore good reason for government to continue its efforts to increase overall investment in rural areas. Rural investment accounted for only 19% of total government expenditures in 1997, but rural residents accounted for 69% of China's total population. Moreover, almost 50% of national GDP was produced by the rural sector (agriculture, and rural township and village enterprises) in 1997. Government rural spending as a percentage of rural GDP is only about 5%, compared with 11.6% for the whole economy. For the past several decades, China has implemented an urban and industry-biased investment policy. As a result, the rural–urban income gap is large and has increased over time. Any policies that discriminate against the rural sector will heighten the existing disparity and should be discontinued.

More investment rather than more subsidies

The India case study clearly indicates that initial subsidies on inputs and output may help small farmers adopt new technologies and gain access to markets. But, as time passes, these subsidies have become increasingly large and very difficult to remove. The subsidies, including those on fertiliser, irrigation, power and credit, amounted to about 2% of the national GDP and 8–10% of agricultural GDP in 2000 (Gulati and Narayanan 2003). They are in direct competition with long-term capital investment in roads, rural education and agricultural research. China has already reached the initial stage of the agricultural transformation even though it did not provide direct subsidies in either inputs or output. Therefore, China should not follow India's path to subsidise its agriculture. Instead, the government should use its limited public resources for improving human and physical conditions of rural areas to enable farmers to engage in high-value production or migrate to non-farm activities.

Correcting government regional biased policy

In addition to biased regional investment policy, predatory pricing policy on natural resources by the government has been the major culprit in worsening regional inequality. For the past several decades, particularly under the previous centrally planned economy, natural resources such as minerals, oil, gas and even land have been owned by the central government. These resources were shipped to the eastern regions at low prices or even gratis, thereby transferring rents to the coastal areas.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The western provinces, although rich in these resources, benefited very little from their exploitation. Even worse is the latest reform of these state-owned enterprises, which laid off millions of workers and left local governments with the responsibility for degraded environments.

In particular, the central government should redirect its public resources towards the western region. The western region shows the highest returns to all kinds of public investments targeted at reducing rural poverty and regional inequality. This is consistent with the national strategy to develop western China. Investment in agricultural research, education and rural infrastructure there should be among the government's top priorities. The most critical need is universal and free primary (ideally 9 years) education funded by the central government.

Promoting a more sustainable and environmentally friendly development strategy

China's agriculture has been growing at more than 4% per annum. However, this rapid growth has been achieved at the cost of a degraded environment and exploitation of natural resources. Soil erosion, acid rain, water and air pollution, land degradation, soil salinisation, desertification, deforestation, grassland destruction and loss of biodiversity and wildlife habitat are widespread in China. Western China's environment is fragile. Most of the cultivated land is prone to wind and water erosion. Desertification and grassland destruction are concentrated in the region.

The vast western region hosts the majority of China's wildlife, and thus provides important potential for tourism in the future. This will be crucial for China's future economic development and the wellbeing of all Chinese citizens. Therefore, protection of the environment in western China needs to be a priority in future development initiatives.

Reforming the fiscal system for more-equitable regional growth

China is highly decentralised in its government spending. Local governments account for more than 70% of total government spending. The central government plays a limited role in equalising regional development through its financial transfers. Most of the transfers from central government to local governments are tax rebates. This mode of transfer is seriously biased against the poor provinces in western China. In fact, this may be one of the major factors underlying the increased

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

regional inequality after 1988 when China introduced its new financial responsibility system. Under this system, every province signs a contract with the government covering the obligations and responsibilities of each party. This system gives each province more incentive to develop its economy through retention of more revenue. However, poor provinces suffer because their tax bases are low. As a result of this policy, inequality in per-capita government fiscal resources has increased dramatically. For example, the gap in per-capita expenditure between the richest and poorest provinces increased from 6.1 times in 1990 to 19.1 times in 1999 (Wong 2003).

CONCLUSIONS

As the industrial sector continues to expand and the comparative advantage of the agriculture sector continues to decline, Chinese policy makers are facing a critical choice in agricultural and rural policy. There are several options that can be drawn from the experience of other, more developed countries. One option is to increase price and income support for farmers as many OECD countries have done for the past several decades. Another option is to use trade barriers such as tariffs and import quotas to insulate the domestic market from international markets. But both of these options will cause either huge government spending or sharp increases in domestic food prices and higher costs for consumers. Both of these options will also lead to large net-social-welfare loss due to misallocation of resources among sectors.

A third option is to liberalise the agricultural sector immediately, with no preconditions. This option will allow resources to be allocated on the basis of comparative advantage among sectors and between China and the international market. Overall efficiency and net social welfare will be gained. But we argue that liberalisation must have conditions, which raises a fourth option. One of the conditions is to increase investments in agricultural research, irrigation and rural infrastructure. This is essential for long-term food security, but is also a critical precondition to improve overall efficiency of the agricultural sector and to increase the living standards of the rural population.

The recent trend of government investment in agriculture and rural areas is troubling. Due to the public-goods nature of government investment, the private sector and farmers are not willing or able to offset the investment gap left by the government. Thus, they need favourable policies in order to induce investment. The government

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

needs to maintain or even increase such investment if China is to achieve long-term and sustained food security and overall economic development. As the country moves to a new development stage, poverty reduction should continue to be one of the top development priorities. The pro-poor fiscal policy should focus on the development of the rural sector in the western region, and increase central government investment in education and infrastructure there. In particular, the central government should gradually increase its education investment in western rural areas to provide free education for all children to the ninth grade as a minimum standard.

REFERENCES

Cheng, G., 2001. WTO's rules for agricultural trade and China's agricultural development. Beijing, China Economic Press.

China State (National) Statistical Bureau 1982–2003. China statistical yearbook. Beijing, China Statistical Publishing House.

Fan, S. and Kang-Chan, C. 2004. Road development, economic growth and poverty reduction in China. Washington, DC, International Food Policy Research Institute, mimeo.

Fan, S., Thorat, S. and Rao, N. 2005. Investment, subsidies, and pro-poor growth in rural India. Washington, DC, International Food Policy Research Institute, Mimeo.

Fan, S., Zhang, L. and Zhang, X. 2004. Investment, reforms and poverty in rural China, Economic Development and Cultural Change, 52, 395–422.

Gulati, A. and Narayanan, S. 2003. The subsidies syndrome in Indian agriculture. New Delhi, Oxford University Press.

Mullen, K., Sun, D., Orden, D. and Gulati, A. 2004. Produce support estimates (PSEs) for agriculture in developing countries: measurement issues and illustration from India and China. Washington, DC, International Food Policy Research Institute, MTID Discussion Paper 74.

Sun, D. 2001. Study on Chinese agricultural trade under WTO. Beijing, China Agricultural Publishing House.

Tian, W., Zhang, L. and Zhou, Z. 2002. The experience and issues in measuring the level of agricultural support in China. Paper presented in workshop on agricultural policy adjustments in China after WTO accession, 30–31 May 2002, Beijing, China.

Wong, C. 2003. China: national development and sub-national finance. Beijing, CITIC Publishing House.

World Bank. 2001. China: overcoming rural poverty. Washington, DC, World Bank.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 2

A BETTER MARKETING ENVIRONMENT FOR DEVELOPMENT: DOMESTIC MARKETS

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2.1 CHINA'S GRAIN MARKETING AND RESERVE SYSTEM

CCICED ARD Task Force members

Few accomplishments can rival the government's liberalising of domestic grain markets. China's grain markets today are among the most competitive and integrated in the world. The cost of shipping goods across China has fallen; the cost of shipping maize, rice and soybeans in many parts of China is about equal to the cost of shipping grain down the Mississippi River in the US. Markets also have integrated rapidly; by 2002, prices between almost all pairs of markets across China—even those as distant from one another as Xian and Guangzhou or Heilongjiang and Shanghai—move consistently together. Much of the gain is due to the construction of roads and improved communications. The improvements in China's market also arise from increased competition; since the mid 1990s, thousands of private traders have entered the commodity markets and actively trade. Thousands of wholesale and retail trading companies currently trade into and out of all major metropolitan markets, a fact that makes competition in China's grain markets much more intense than in most developed countries where typically a handful of firms dominate national grain trade (e.g. in the US, the market share of the top five grain-trading firms is more than 80%; in China, the market share of the top five trading firms is certainly less than 5%).

The emergence of domestic agricultural commodity markets is playing a major role in transforming the landscape in rural China. There is a sharp move towards specialisation. In the same way that specialised agricultural villages and regions appeared in Japan in the 1920s, 1930s and 1950s, and in South Korea and Taiwan in the 1970s and 1980s, specialised villages in every conceivable commodity are appearing in China today. Such specialisation facilitates the adoption of new

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

technologies, improvement in product quality, greater access to markets and overall higher incomes. Certainly, this shift needs to be encouraged in the future. Based on this, China deserves market status under the World Trade Organization.

With such well-functioning domestic output markets, it is not surprising that the government is considering implementation of a new set of grain policy reforms. The main target of the reforms is the reversal of the national grain-procurement and marketing policy regime that has been built up since 1998. Initiated in 1998, the grain policy, called the 'Three policies agenda' (or *Sanxiang Zhengce*) has cost the national government hundreds of billions yuan. Most economists and policy officials recognise, however, that there has been little positive return. Fiscal expenditures have built nothing and productivity has not been enhanced. Little of the funding has gone to farmers. Instead, the policy built-up a large grain inventory and a growing set of bad loans in the Agricultural Development Bank. Although there has been little effect on national markets, grain policies and institutions have slowed down (or halted) the development of efficient private-sector storage and behaviour that will help markets smooth price fluctuations across seasons and over longer periods.

Recognising these shortcomings, the State Council ordered a bold new set of reforms in June 2004, called the new 'Regulations on grain circulation management'. The new regulations provide guidelines for the full liberalisation of China's domestic grain markets. The task force believes these changes are positive, assuming they are implemented, but additional policy changes are needed to ensure that several major issues are dealt with completely.

MAJOR ISSUES

China's grain system: 'old debt, old grain and old people'

The high level of accumulated debt, perhaps more than any single issue, hampers the state grain sector from moving toward more market-oriented reform. Statistics from various sources indicate the magnitude of losses in grain marketing, including losses resulting from price interventions and deficits from business operations, at 300 to 600 billion yuan. The losses come from a variety of sources, including misappropriation or illegal diversion of budgetary allocations to other uses and losses from the payment of interest, reserve management and asset depreciation from

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's large grain reserves. Most of the expenditures were funded by bank loans. The size of this accumulated debt is such that local governments and grain bureaus could never absorb it.

At one point before 2003, the quality of China's grain in the state-run grain reserve system was also a major issue. After purchasing enormous quantities of grain in the late 1990s, reserve officials had no option but to hold stocks for many years. Stocks deteriorated in quality. More recently, the low quality of grain in the national stocks has become a less pressing issue.

Dealing with the large number of workers in the grain system is another challenge in implementing new grain-marketing reforms, despite progress in the past. Although the state grain system reduced its staff by more than 1 million employees between 1999 and 2002 (mostly by commercialising certain functions), there are still more than 2 million employees. The main area of redundancy is the 1.4 million people who are still engaged in procurement and marketing activities. This part of the grain system is performing functions that are being carried out by hundreds of thousands of private traders. The annual volume of procurement is less than 90 tonnes of grain per person, which, given the level of budgetary support for the procurement bureau, is grossly inefficient and leads to high losses in China's competitive grain markets.

Grain direct subsidy

During the past two decades, China stands out as a country that has used little in the way of agricultural subsidies. While many other countries have heavily subsidised their farmers, China has had one of the lowest levels of aggregate measure of support in the world; between 0 and 2% of agricultural gross domestic product. Subsidies are not effective tools to promote long-run development. Instead, they are costly, and in almost all nations have a tendency to become permanent programs. International experience has shown that farmers, after they have received subsidies for several years, begin to believe that the government is not helping them, that they are entitled to the payments and will credit policy makers only if subsidies continue to rise, a phenomenon that never stops until the budget gives out. Moreover, phasing out subsidies almost always leads to serious social and political upheaval. Hence, one of the major issues for grain policy is to decide how to move in the future in the area of grain subsidies.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

National grain reserve issues

China's policy towards its national grain reserve is not well defined and almost certainly is hindering the development of efficient marketing institutions. National grain reserves in China focus excessively on holding large-scale strategic reserves. While one approach is to ensure that there are stocks of food to smooth prices across seasons and years, the costs of China's strategy are too high. The high costs are due, among other things, to the excessive quantity of grain reserves, the inefficient location of stocks (international best practice dictates most reserves be held in production regions, while much of China's stocks are held in consumption regions) and the absence of a clear set of rules and regulations to manage procurement, release and pricing. Because of poor system design, inappropriate management typically fails to smooth short-term fluctuations in grain prices and has been shown to make them worse at times. Grain stocks should be used to smooth only short-term fluctuations in market supply; they should not be expected to cover long-term shortfall. Instead, to ensure long-term grain supply, the nation needs to rely on a set of policies that uses financial reserves (instead of grain reserves) with international markets and increases the efficiency of domestic production by allocating funds to productivity-enhancing investments.

Understanding the level of China's grain stocks is a major issue. Nowhere else in the world is the level of grain reserves regarded as a state secret. Not knowing the level of stocks and the rules governing their release are circumstances incompatible with a market-oriented agriculture economy. The task force believes that much of the recent rise in grain prices would have been avoided if grain stocks had been managed in a transparent and open manner. The lack of transparency in reserve quantity, throughput and operation misleads producers, consumers and grain traders and thus hinders the prediction of short and long-term grain price. As long as the government manages its stocks in this way, it will never get help from the private sector in holding and managing a large share of grain stocks for the nation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

POLICY RECOMMENDATIONS

Grain market reforms

Three major sets of policies are critically needed:

1. Resolve old debt

This is a precondition for grain market reform. The large amount of debt hampers initiation of reform of the grain bureaus. With so much debt, there is little or no incentive for the state grain enterprises under the grain bureau to reform. The task force suggests that the government issue a public bond to absorb and eliminate most of the 'old debt'. Currently, China's public debt accounts for less than 20% of GDP, which is much less than in countries belonging to the Organization for Economic Cooperation and Development (average 74% of GDP).

2. Reduce redundant staff

Successful reform of the state-owned grain system depends on how the overstaffing issue is resolved. We estimate that 60–70% of the existing staff needs to be reassigned to make the current state-owned grain-trading enterprises competitive. This should be implemented carefully through a one-time early retirement payment or some alternative mechanism that minimises the potential for social destabilisation. The grain enterprise should not be responsible for the welfare of former employees. Grain trading is so competitive that firms must be allowed to compete as if they were in the private sector. The budget to support such a program could come from various sources, including government budgets or auctioning some of the system's assets and subsidiary firms.

3. Deepening reform of state-owned grain enterprises

Once the debt and overstaffing problems are resolved, there is one more policy to implement: complete and unconditional commercialisation of state-owned grain-trading and marketing enterprises. The experience of China to date is that, if firms are given complete property rights, commercialisation leads to more-efficient operation, higher employment and higher profits. The break with the state needs to be clear and final. Currently, grain-procurement enterprises have control over large

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

volumes of fixed assets, to which they usually do not have official title. Title issues need to be clearly resolved, with few or no residual ties. It is better to give the assets away than to have lingering title issues.

Eliminate the 'Grain direct subsidy' program and reallocate the budget to the provision of rural public services

The task force suggests that the government consider phasing-out the current 'Grain direct subsidy' program. Instead, the current and future funds that are earmarked for subsidies should be reallocated to support additional investments in rural education, agricultural research and extension, irrigation and other rural infrastructure. The rates of return to a number of investments in the rural economy are high and lead to reduction in poverty. We do not believe fragmented payments of 20–30 yuan per mu given to households will have a large multiplier effect. In fact, unless households believe these payments are permanent, economic logic (the permanent income hypothesis) suggests there will be no return.

National grain storage/reserve

Three sets of policy initiatives are needed:

1. Clarifying policy objectives for the government grain storage/reserve program

This is a major policy measure to ensure food security, to help stabilise the market price and to aid farmers with production decisions. However, this does not mean that the government must run the reserve system. With appropriate policies, it can entrust much of the actual operation to commercial enterprises through competitive bidding. Although grain reserves can be used to smooth sharp, short-term fluctuations in market price when necessary, it is recommended that the band of fluctuation not be set too narrow. Government involvement also must be made clear and done according to simple and well-thought-out rules. Price fluctuations are an effective signal to achieve dynamic balance between demand and supply. Seasonal differences in price are necessary for commercial enterprises to maintain 'normal' stocks in running their business (and they must have good profit-maximising incentives to seek profits from storage). Eliminating price differences by managing a buffer stock system with a narrow price band will make commercial enterprises unwilling to keep their own stock.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2. Consolidating measures to achieve food security effectively and efficiently

A new plan is needed for a nationally integrated grain reserve. To achieve a particular level of self-sufficiency, a nationwide unified reserve program incurs much less cost than segmented programs run by each province. In fact, it has been estimated that the national grain-reserve system could be less than 80 million tonnes, only a small fraction of current reserves. China's grain output displays the least amount of variability in the world and with a modest-size reserve, fluctuations of greater than 20–30% could be eliminated more than 95% of the time. If management of the domestic grain system were coordinated with international trade (which can rely on private and commercialised enterprises), the policy costs for grain reserves could be further reduced (with a holding of only 30 million tonnes) and the level of security enhanced. In contrast, according to estimates by China's economists, to smooth output fluctuations completely in each province (as is mostly done now), the reserves managed by each province would total 346 million tonnes (with no help from international markets). The criteria to trigger an increase or decrease in grain reserves should be set objectively. Full 100% smoothing of annual output fluctuations is too costly and also may distort price signals, leading to continued imbalance in the grain market, and may actually reduce the degree of food security.

3. Disclosure of the grain reserve quantity, throughput and operation

The reserve requirement, throughput and operating rules need to be transparent. Transparency is absolutely critical. It is conducive to the formulation of price expectations in the short- and long-run, which is needed to help make better decisions about grain production, consumption, storage and marketing.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2.2 THE EMERGENCE OF AGRICULTURAL COMMODITY MARKETS IN CHINA

Jikun Huang
China Center for Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, China Academy of Sciences, Beijing, People's Republic of China

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

China's reformers, more than anything, have followed a strategy based on providing incentives through property-rights reforms, even though in China the shift to private ownership is today far from complete. The reforms started with the household responsibility system (HRS), a policy of radical decollectivisation that allowed farmers to keep the residual output of their farms after paying their agricultural taxes and completing their mandatory delivery quotas. Farmers also began to exercise control over much of the production process (although in the initial years, the local state shared some control rights and in some places still does today). In this way, the first reforms in the agricultural sector reshuffled property rights in an attempt to increase work incentives and exploit the specific knowledge of individuals about the production process (Perkins 1994). In executing the property-rights reforms, leaders also fundamentally restructured farms in China. Within a few years, for example, reformers completely broke up the larger collective farms into small household farms. In China today there are more than 200 million farms, the legacy of a HRS policy that gave the primary responsibilities for farming to the individual household. McMillan et al. (1989), Shenggen Fan (1991), Lin (1992) and Jikun Huang and Rozelle (1996) have all documented the strong, positive impact that property-rights reforms had on output and productivity.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In addition to property-rights reform and transforming incentives, the other major task of reformers is to create more-efficient institutions of exchange. Markets—whether classic, competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialisation and trade, and by providing, through a pricing mechanism, information to producers and consumers about the relative scarcity of resources. But markets, in order to function efficiently, require supporting institutions to ensure competition, define and enforce property rights and contracts, ensure access to credit and finance and provide information (McMillan 1997; World Bank 2002). These institutions were either absent in the Communist countries or, if they existed, were inappropriate for a market system. Somewhat surprisingly, despite their importance in the reform process, there is much less work on the success that China has had in building markets and the effect that the markets have had on the economy.

In part in response to the lack of research on markets and their impacts on China's rural economy, in this paper our major goal is bring together the facts on the emergence of China's markets. To do so, we will have four specific objectives. First, we document the policy environment that has unfolded during the reform era. Second, we examine the data, looking at spatial patterns of market price contours over time. Third, we examine the extent to which market prices are integrated—both between regions and between regional marketing centres and villages. Finally, we examine how the emergence of markets has affected the behaviour of producers and their productivity.

In order to examine so broad a topic, we need to limit the scope of the analysis. To do so, we primarily restrict ourselves to China's main staple commodities—rice, maize and soybeans. These commodities—especially maize and soybeans—are ideal, since the quality differences among regions are relatively narrow, a characteristic that facilitates integration analysis. Because of regional quality differences, analyses on rice markets are performed on a regional basis. Data on the major commodities also are more readily available over time and across space. As their share of the economy grows, more work is needed on cash crops, livestock and aquaculture products.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

COMMODITY PRICE AND MARKETING POLICIES

Price and market reforms are key components of China's strategy to shift from a socialist to a market-oriented economy. The price and market reforms initiated in the late 1970s were aimed at raising farm-level procurement prices and gradually liberalising the market. These reforms included gradual increases in the agricultural procurement prices toward market prices, reductions in procurement quota levels, the introduction of above-quota bonuses for cotton, tobacco and other cash crops, negotiated procurement of surplus production of rice, wheat, maize, soybean, edible oils, livestock, and most other commodities at price levels higher than those for quota procurement, and flexibility in marketing of surplus production of all categories of agricultural products by private traders. It is interesting that, in the initial years, there was little effort to move the economy to one in which almost all resources and factors were allocated according to market price signals.

As the right to private trading was extended to include surplus output of all categories of agricultural products after contractual obligations to the state were fulfilled, the foundations of the state marketing system began to be undermined (Rozelle et al. 2000). After a record growth in grain production in 1984 and 1985, a second stage of price and market reforms was announced in 1985, aimed at radically limiting the scope of government price and market interventions and further enlarging the role of market allocation. Other than for rice, wheat, maize and cotton, the intention was to gradually eliminate planned procurement of agricultural products; government commercial departments could continue to buy and sell only at the market. For grain, incentives were introduced through the reduction of the volume of the quota and increase in procurement prices. Even for grain, after the share of compulsory quota procurement in grain production reached 29% in 1984, it fell to 18% in 1985 and 13% in 1990. Concomitantly, the share of negotiated procurement at market price increased from only 3% in 1984 to 6% in 1985 and 12% in 1990.

Because of the sharp drop in the growth rate of grain output and the rise in food prices in the late 1980s, the pace of marketing reform stalled. Mandatory procurement of rice, wheat, maize, soybean, oil crops and cotton continued. To provide incentives for farmers to raise productivity, and to encourage sales to the government, quota procurement prices were raised over time. The increase in the nominal agricultural procurement price, however, was lower than the inflation rate, which led to a decline in the real grain price (Jikun Huang et al. 2004).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

As grain production and prices stabilised in the early 1990s, however, another attempt was made to abolish the grain ration system. Urban officials discontinued sales at ration prices to consumers in early 1993. For a year and a half, the liberalisation move succeeded. Then, while it appeared that both the state grain distribution and procurement systems had been successfully liberalised, food prices rose sharply, as did other prices in the economy. Some people blamed the nation's inflation on the rises in food prices. As a result, the state compulsory quota system was re-imposed in most parts of China in 1995, but at a lower procurement level. The share of grain compulsory quota procurement in total production stayed at only 11% in 1995–97.

Since the middle 1990s, several new policies—some pro-market, others anti-market—were implemented. Immediately after the price rises in the middle 1990s, China started the provincial governor's 'Rice bag' responsibility system. The policy was designed to strengthen national food self-sufficiency by making provincial governors and governments responsible for balancing the supply and demand of cereals in their provinces and for stabilising local food markets and prices. Policies under the system included re-imposing grain rationing to poor consumers, investing in production bases inside the province and attempting to keep grain from being shipped out of the province. If implemented, this policy may have reduced short-run agricultural price fluctuations, but it would not have been without costs. It has been widely believed that the policy may have adverse impact on the efficiency of resource allocation, diversification of agricultural production and farmers' incomes. Moreover, a great number of efforts to restrict the flow of grain were not successful. Market flows continued as the share of total government procurement (both quota and negotiated procurement) in domestic production fell from 26% in 1994 to 22% in 1996, being driven by the profits that traders could earn by shipping grain from low to high-price areas (Jikun Huang et al. 2004).

With three record levels of grain production in China in the late 1990s, and almost zero or negative inflation since 1997, rising grain stocks and declining food prices showed the economy had bounced back. However, in some sense, the government's policies were a victim of their own success. With prices falling sharply, leaders worried of a repeat of the mid 1990s. Instead of proceeding with market reform, leaders actually opted to try to exercise greater control over grain prices by price protection policy.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In fact, leaders in the late 1990s attempted to curb market forces more than in earlier retrenchments but by a completely different measure. Market intervention policy shifted from taxing grain producers through lower government quota procurement price (lower than market price) to prevent the grain price falling through implementation of grain protection price (higher than market price). To reduce the financial burden of the protection price policy, in 1998 the central government initiated a controversial policy change prohibiting individuals and private companies from procuring grain from farmers.[1] In contrast to past policies, grain quota procurement prices were for the first time set at a level more than market prices, which meant a transfer in favour of those farmers able to sell at that price (Jikun Huang and Chen 1999). Leaders expected that they could monopolise grain markets through the commercial arms of the grain bureaus, and that the grain bureaus would be able to sell the grain procured at an even higher price in the market and meet the nation's goal of raising farmer income. If the state could have exercised monopoly power in grain markets, it is possible that they could have implemented the price supports while enabling the state grain companies (i.e. the commercial arms of grain bureaus) to earn a profit while reducing the government's financial burden of maintaining the state-run grain procurement and marketing system. The loser under this policy would have been the consumer, who would have had to pay a higher price for grain.

The win–win (from the government's point of view) policies, however, did not work, primarily because the government could not suppress market activities of traders and employees of the commercialised grain system. While the above-market prices were offered to farmers in some years, cash-strapped grain bureaus could not procure all of the grain that farmers wanted to sell. Grain production increased, but since grain bureaus were trying to sell grain to urban and commercial users at above-market prices, they had few takers. Unable to stop the activities of millions of private grain traders, urban users continued to buy from their original channels at market-set prices. Not surprisingly, stocks started to accumulate, the real price in the market fell even further, and the commercialised grain bureaus that had been forced to buy grain at high prices, now had huge stocks of grain that was worth less than they had bought it for and their debts became higher than ever.

[1] Farmers were supposed to deal solely with the commercial arms of grain bureaus and the grain reserve system—although traders were allowed to operate in wholesale and retail markets.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In the early 2000s, marketing reforms were once more launched. Restrictions on marketing were removed. New efforts to commercialise the grain bureaus were begun. The support prices that had been given to some farmers in some areas were eliminated. In short, a new effort was made to push the policy environment to be even more market-oriented. In fact, as seen from this recounting of nearly 25 years of reform, marketing reform has been an on-again/off-again policy effort. When grain prices are low and grain relatively abundant, markets are liberalised. But in times of rising prices, policy makers make efforts to curb market actions. What is unclear, however, is how effective policy was in dampening market activity or facilitating the operation of well-functioning markets. It is to this question that we turn in the next three sections.

DATA

To assess the nature of China's markets in the past 10 years, we use data from a number of different sources.[2] First, we use a set of price data collected by China's State Market Administration Bureau (SMAB—*data-set 1*). Nearly 50 sample sites from 15 of China's provinces report prices of agricultural commodities every 10 days. This means there are 36 price observations available for each market site for each commodity each year. The prices are the average prices of transactions that day in the local rural periodic market. The Ministry of Agriculture assembles the data in Beijing and makes them available to researchers and policy makers. Unfortunately, the quality of the data has deteriorated since 2000.[3]

[2] Although it would be ideal to use a single data-set for examining all markets for all crops for all time periods, such a data-set does not exist, unfortunately. Instead, we use available data. However, as is seen in the analysis, there is enough overlap in the data-sets to allow us to compare answers using alternative sources of information. In nearly every case, the results are robust to the choice of data-set.

[3] After 2000, the data series are characterised by many missing values and data entries that obviously are not correct. It is unclear why the quality deteriorated after 2000, but it could be due to the fact that, with the rise of alternative data sources (collected by the private sector), these data (which were collected by several government agencies) were less necessary.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Using the SMAB data, we can examine rice, maize and soybean prices from 1996 to 2000 (except for maize data, which were available only through 1998). The three crops are produced and consumed in nearly every province in China. Rice price data are available for 31 markets. Because of quality differences among rice varieties in different regions of China, we look at price integration among markets within four regions: South China (South), the Yangtze Valley (YV), the North China Plain (NCP, including Northwest China) and Northeast China (NE). For the provinces included in the sample, rice prices are available for over 90% of the time periods. Prices for maize and soybean data are available for 13 and 20 markets, respectively.[4] Product homogeneity in the case of maize and soybeans makes it possible to examine price integration among markets across a broader geographic range. We compare our results for the late 1990s (1996 to 2000) to results from 1988 to 1995 that were produced with the same data and published in Park et al. (2002).[5]

The second source of data on China's domestic market (*data-set 2*) comes from a price data-set collected by the Jilin Province Grain and Oil Information Center (GOIC). For maize, weekly between 10 August 1998 and 24 February 2003, prices are reported for 15 of China's main maize production and consumption provinces, including

[4] Since we use data over time, we need to convert prices to a real basis. Nominal prices from our data-set are deflated using monthly consumer price indexes calculated and reported by the China National Statistical Bureau. Deflation facilitates transaction-cost comparisons across time and allows us to disregard transaction-cost increases within periods associated with inflation.

[5] To produce the results, we run co-integration tests on each pair of markets using the data for each year. So, in other words, we use 36 observations (since the price data are available every 10 days) and count the number of pairs of markets that are co-integrated in a statistically significant way (see footnote 6 and text for explanation of testing). For example, for the case of soybeans, for the late 1990s (1996 to 2000), this means that we are examining the extent of integration between 190 ($20 \times 19/2$) pairs of markets in each of 5 years, which equals a total of 950 pairs of markets. Hence, since we found that prices in 646 markets were integrated (according to the testing procedure), we report that 68% of markets are integrated in the late 1990s. Since we use only 36 observations per test, and since co-integration tests typically perform better with longer time series, by splitting our data into annual increments, we are biasing the results against accepting integration. We do this in order to make our analysis comparable to that of Park et al. (2002) who followed a similar procedure.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Heilongjiang, Jilin, Liaoning, Hebei, Shandong, Jiangsu, Zhejiang, Shanghai, Hubei, Sichuan, Hunan, Fujian, Guangdong, and Guangxi (Meyer 2002). Since 7 September 1998, there is a price from Liaoning for Dalian, the main port from which exports to foreign and domestic markets served by ship.

To examine maize markets more carefully in the northeast region of the country and through the country in the post-accession period, we used another data-set collected by the Jilin Province GOIC (*data-set 3*). The data in this set are first available after 26 October 2001, and they continue through 25 February 2003. This data-set is more detailed for two reasons. First, it includes prices from three markets in Heilongjiang, three markets in Jilin, three in Liaoning (including Dalian and two in production regions), and market sites in Guangdong, Fujian, Jiangsu and Hubei. Second, the data-set reports data more frequently, typically twice a week (every third day, then every fourth day).

The data from the Jilin Province GOIC appear to be high quality compared to the price series in data-set 1.[6] Unlike the other price data-sets that are available in China, there are few missing observations. There are also relatively few inconsistencies in the data. In other data-sets, corrections frequently need to be made to the data to account for missing observations and to adjust for prices when they are written down in price 'per jin' even though the data category is supposed to be price 'per kilogram'. Unlike our previous analyses of prices using other data-sets from China, we made *no* correction to the data after they were provided to us by the US Grains Council.

In our discussions with the Monitoring and Marketing Divisions (MMD) of the National Grain and Oilseed Information Corporation (the division in charge of collecting the data) we discovered that the data were mostly from members of the marketing arms of local grain-storage bureaus (that are making daily maize and

[6] For illustrative purposes (e.g. for our coefficient of variation analysis and for the determinants of price analysis), we compare some of our results to results from 1988 to 1995 that were reported in Park et al. (2002) and to results from 1996 to 2000 for Huang et al. (2004). Note, however, the data sources, while attempting to measure the same prices, may be different, and hence not entirely comparable, due to differences in data-collection methods. In other words, while illustrative of changes over time, the comparisons should be used only generally to help put the situation in the post-accession period into the context of China's maize and other markets during the 1990s.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

soybean sales), traders in major ports (Dalian and Guangzhou) and end users (in the south). In the most common way in which data are collected, a member of MMD will make a call to the grain bureau personnel, trader and end user twice a week (Monday and Thursday). For example, in Dalian we were told that each Monday and Thursday about nine traders who are involved with shipping grain from Dalian to South China are called. These traders tell the MMD official the average price at which maize is leaving Dalian at a FOB price. In the northeast (e.g. Jilin), we were told that the MMD calls several grain bureaus in a region and has them provide unit value prices (value of shipments divided by volume) for the day. The MMD official averages the price in the district.

The soybean data come from the same source, the Jilin Province GOIC, but are collected somewhat differently (data-set 4). Only monthly soybean data are available. There are data for more than 30 markets. The data series are complete and, overall, the quality of the data appears to be equal to the maize data-set.

PRICE TRENDS AND SPATIAL PATTERNS OF MARKET EMERGENCE

In this section, we use the data on prices to describe China's agricultural markets. To do so, we first plot the data over time and examine how prices move together in markets in the same geographic region and in markets separated by long distances.[7] Next, we more rigorously examine transportation gradients in China's rice, maize and soybean markets. To put the results in perspective, we examine these over time and compare those of China with those of the US. Our hypothesis is that if prices in markets in different parts of China move together and if they create spatial patterns similar to those found in more market-oriented economies, then our data are producing quantitative evidence that China's markets are emerging as functional and increasingly efficient.

[7] It is possible that prices move together because they are planned. However, this hypothesis is tested in the market integration analysis section of the paper. If prices are planned, in all likelihood the price series would be stationary and the differences between them could be defined by a set parameter. As seen in the analysis, this not the case. Market analysis would suggest a market process is underlying the creation of the prices, not planning.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Price trends

Maize

Using data-set 3, we can see how closely prices in northeastern China track each other (Figure 2.1, Panels A and B). In Panel A we plot the Dalian domestic price versus the prices in the three Heilongjiang market sites (chosen because they are the northeastern markets furthest from Dalian). While varying over time, the Dalian domestic price remains at about US$127/tonne between December 2001 and February 2003. During the same period, the prices in each of the three Heilongjiang markets move almost in perfect concert with one another. While also varying over time, the prices in Heilongjiang during the post-accession period are around US$110–155/tonne. Visual inspection also shows that although the market in Dalian and those in Heilongjiang are more than 1000 km apart and prices vary by US$12–17/tonne, the prices in many periods are moving together. When the prices in Dalian move up (down), the prices in Heilongjiang tend to move up (down).

Similar patterns of price movements are found to exist between the two markets in western and central Liaoning and Dalian (Panel B). In fact, the prices in the two Liaoning producing areas track each other even more closely than the markets in Heilongjiang, a finding that perhaps is not surprising given that Liaoning is a smaller province with better transportation and communication infrastructure. The co-movements of prices among the producing areas in Liaoning and the consumption centre of the province, Dalian, are readily perceptible. The narrower price gaps among producer (lower trend lines) and user areas (higher trend line) are a reflection of the smaller distance (compared with the Heilongjiang–Dalian figure).

Using data-set 1, the patterns of movement across further points of China display similar patterns of close movements of prices (Figure 2.2, Panels A and B). While prices have moved together since the mid 1990s between Dalian and Guangdong and between Dalian and Fujian, the tracking among markets appears to be even closer in recent years. Almost every turning point (a shift from low to high or high to low) in Guangdong and Fujian can be found in the Dalian market. The close movement of prices occurs even though the main way in which grain moves between the two sets of markets is by sea. With the advent of private shipping and commercial trading, there are now many shipping lines and trading companies that move grain between the northeast and southern China's main consumption

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

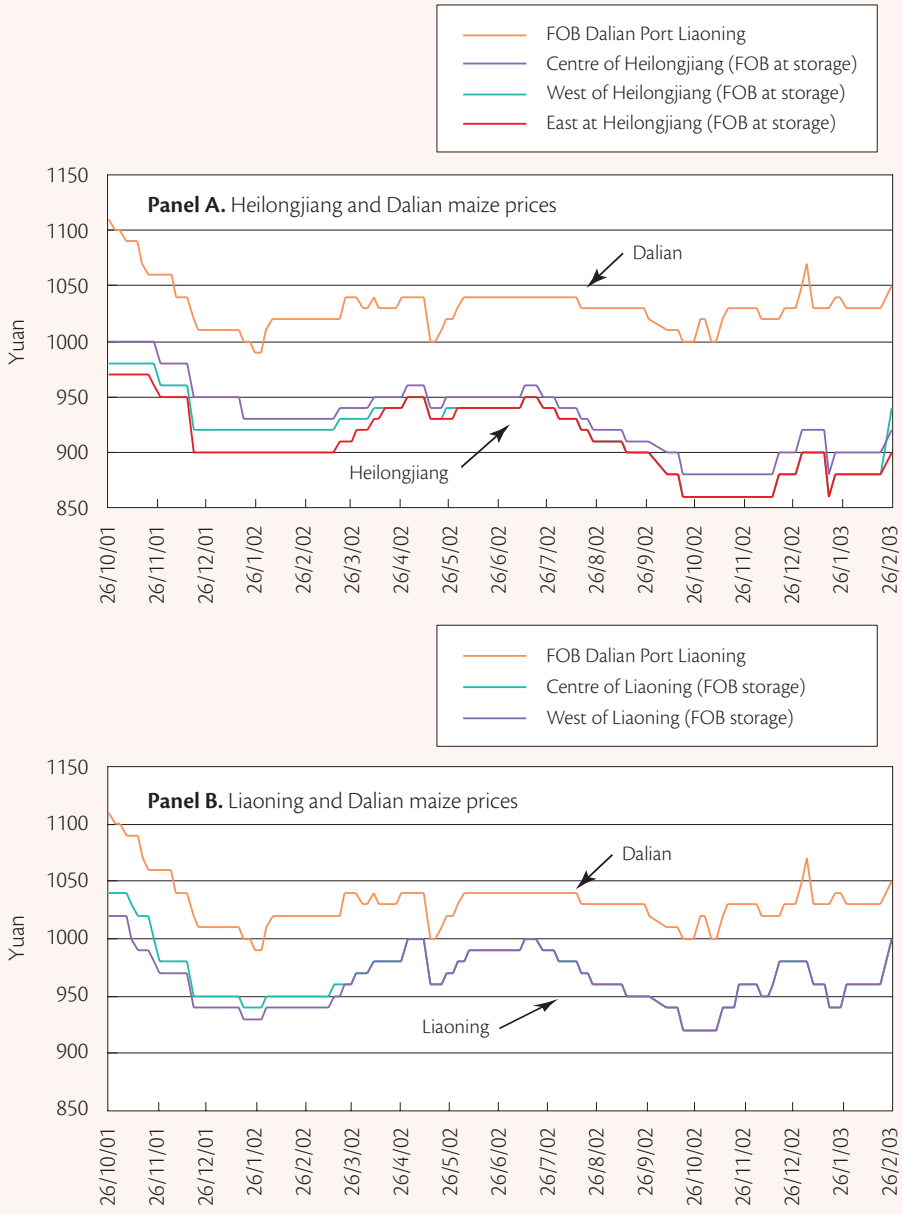

Figure 2.1 Maize prices (yuan/tonne), in Heilongjiang, Liaoning and Dalian, October 2001–February 2003

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

areas. The results from Figure 2.1, Panels A and B, when linked with those from Figure 2.2, demonstrate that prices in Heilongjiang appear to depend on shifts in feed demand and maize availability in Guangdong and Fujian.

Soybeans

Using data-set 4, we find soybean prices similarly move together for pairs of markets, both in the same region and across more-distant locations. The bottom two price series in Panel A of Figure 2.3, trace the price trends for soybeans in Heilongjiang and Jilin. The two series are almost indistinguishable, with Heilongjiang prices slightly lower for almost the entire period. The Guangdong price, the top line in Panel A, also shows that prices move in concert with one another inside China's domestic market, even though the markets are thousands of kilometres apart. In only two short periods—early 2000 and late 2002—does that gap between the two markets deviate from a fixed margin which is almost equal to the transport price between the northeast and the south.

Panel B in Figure 2.3 shows that prices appear to be even more integrated in the south. The prices throughout the entire period are so close that it is difficult to distinguish the individual price series. This degree of apparent integration is almost certainly a function of the nature of the market. During the period for which we have data (1999–2003) more than half of the soybeans in southern China were from imports. According to traders in the US and China, the price for landing a shipload of soybeans in Shanghai is virtually the same as doing so for a shipload in Guangdong.

Cross-commodity trends

In addition to observing co-movements of maize prices between regions over time during the post-World Trade Organization (WTO) accession period, our data (data-set 3) also show that prices of different feed types move together (Figure 2.4). In south China, early rice is frequently used as a feed, albeit a slightly inferior one in the view of most livestock producers. However, even though the price of maize is higher than feed rice across China, the ratio of maize to feed rice is almost identical in markets in different provinces. Figure 2.4 illustrates that even though the ratio of maize to feed rice varies over time in Guangdong and Fujian, the trends in the ratios in each of the provinces are almost identical.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

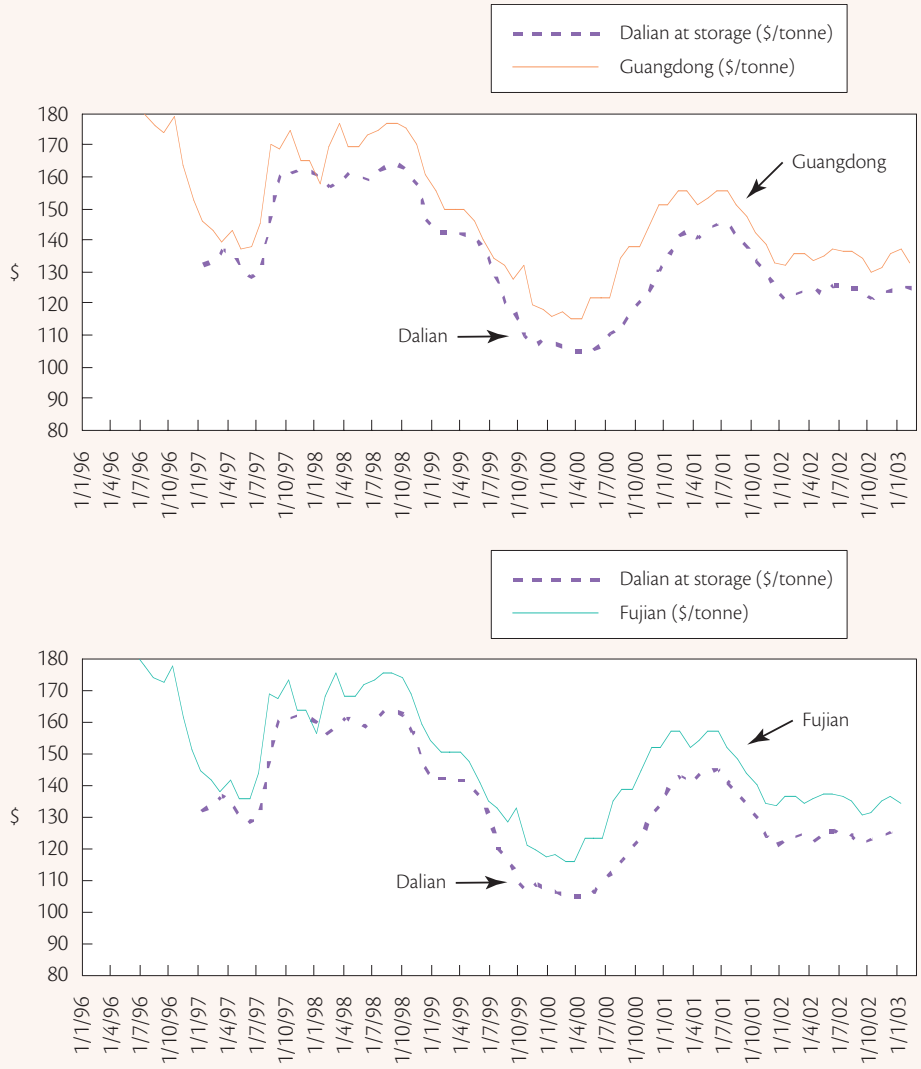

Figure 2.2 Maize prices ($/tonne) in Guangdong, Fujian and Dalian January 1996–February 2003

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

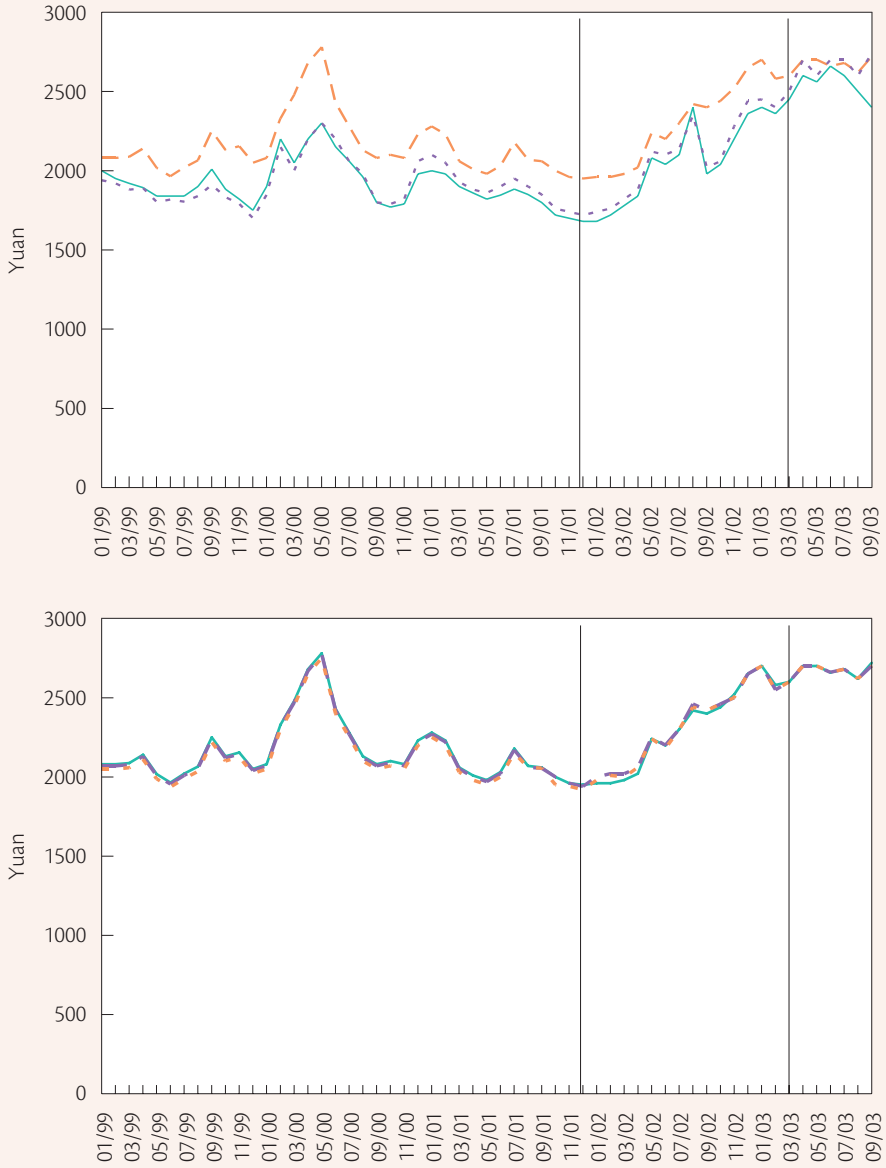

Figure 2.3 Soybean prices (yuan/tonne) in Heilongjiang, Jilin, Guangdong, Shanghai and Jiangsu, January 1999–September 2003

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

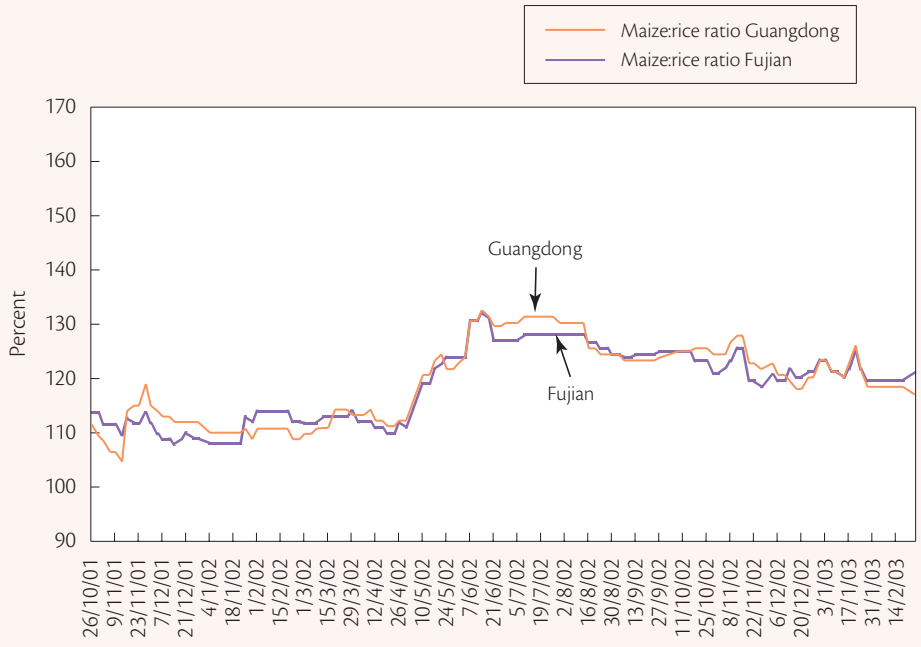

Figure 2.4 The ratio of maize to feed rice (paddy) prices in Guangdong and Fujian provinces between October 2001 and February 2003

Figure 2.5 shows the same co-movement of prices occurs in the soybean market. The prices of soybeans and soybean meal almost perfectly track one another for the entire sampling period between 1999 and 2003. Interestingly (although not shown), when the price of soybean oil is added, oil prices (albeit higher) after 2000 also move together with soybean and soybean meal. Before 2000, restrictions in the import market for oil kept the soybean oil price *abnormally* above the price of soybeans and soybean meal.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

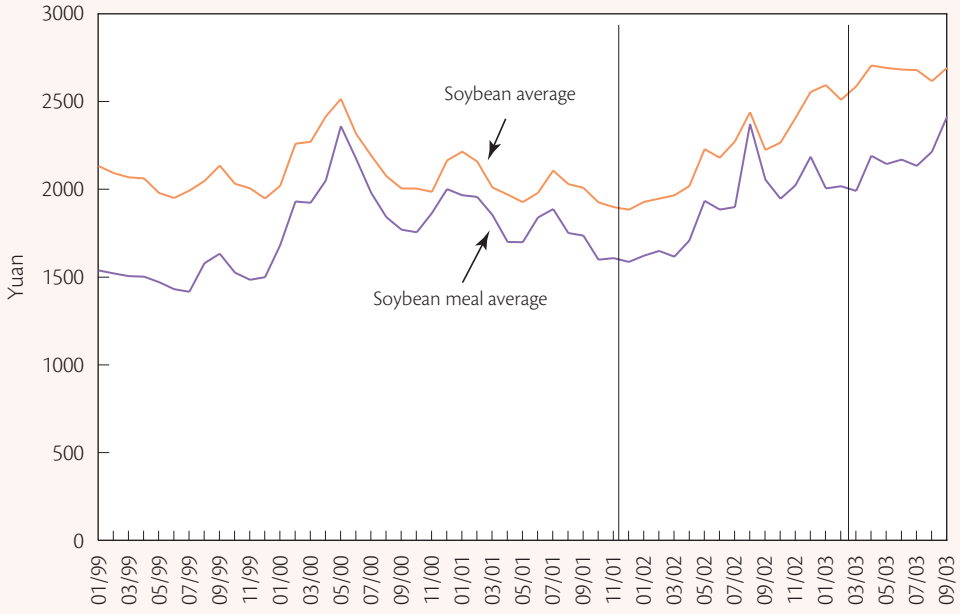

Figure 2.5 Comparisons of China's average soybean and soybean meal prices (yuan/tonne), January 1999–September 2003

Price determination

We also can statistically analyse of the behaviour of prices of China's major commodities in another dimension. In this subsection we examine price behaviour across space, holding time constant. If China's markets function well, then there is a greater likelihood that when a price changes in one region of the country (e.g. there is a price shock arising in Dalian that occurs from increased demand for exports or shipments to elsewhere in China), that prices will change throughout the rest of China. If price formation does not appear to be consistent with the existence of adequately functioning markets, price shifts at the border (e.g. Dalian) may not be experienced elsewhere in China. Indeed, if markets in China are fragmented, shifts in prices in the coastal areas near the border could be sharper (for a given shift in demand), while in large regions of the country away from the border, producers could be shielded from them. Hence, the hypothesis to be tested is that

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

price relations across China's regions exhibit characteristics that make it appear as if China's domestic producers, consumers and traders face price pressures created in part by market forces. As a standard, we compare our results from northwestern China with those from the Mississippi Valley in the USA.

A simple plotting of the relationship between the price of maize in Dalian and prices in Liaoning, Jilin and Heilongjiang during the post-accession period (December 2001–February 2003) illustrates a price contour that is consistent with the existence of well-functioning markets (Figure 2.6). Since the main demand centre in the northeast and point of export for maize to foreign markets and to southern China is Dalian, one would expect that, in an integrated marketing system, as a market became more remote, the price should fall. Indeed, the price in a market 1000 km from Dalian (e.g. the Jilin market) is, on average, about RMB70/tonne lower than the price in Dalian. In percentage terms, this equates to a price for maize in Jilin that is 6% lower than that in Dalian.

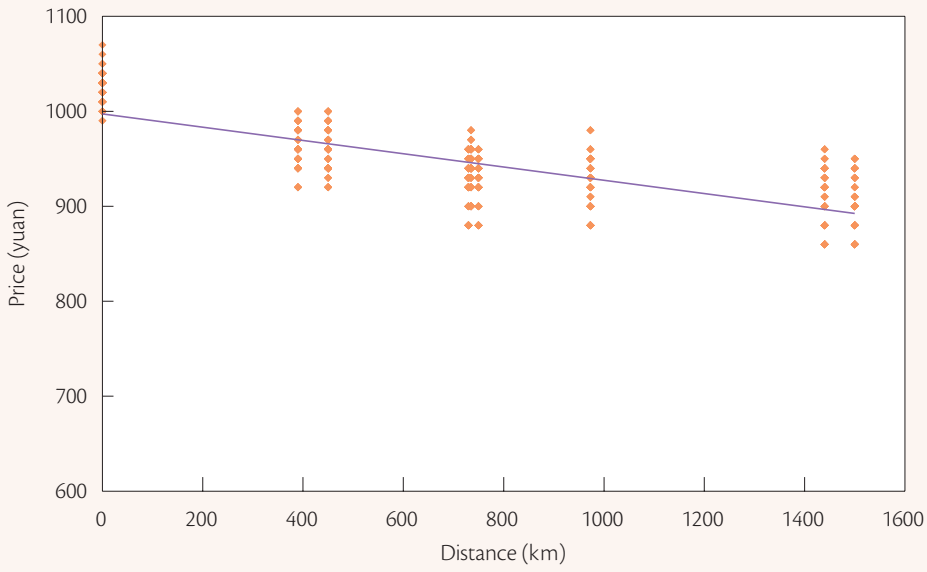

Figure 2.6 Change in maize price across northeastern China as markets increase in distance from the port of Dalian, 2000–2003

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The spatial graph is even more evident when using data-set 1 to look at the price of rice as markets become more distant from the coastal benchmark markets (Figure 2.7). For example, the prices for indica rice in markets in southern China are plotted on the basis of their distance from Guangzhou. Prices for the Yangtze River Valley marketing sites are plotted with reference to Shanghai; those for northern China against Tianjin; and those for the northeast against Dalian. Plotted this way, price relations clearly show the fall in prices as markets move inland, away from the coast. In Figure 2.7, a random period (July 1998) was chosen, although the exact same figure can be drawn with the data from any marketing period. Although not shown here, similar spatial patterns are found for soybeans.

Multivariate spatial analysis

The results of regression analysis of the relationship between prices (entered in the equation in either linear or log form) in the local market and the distance from port and a series of time period dummies (one for each time period of analysis—that is, one for every ½ week in the sample and an interaction term) are similar for maize

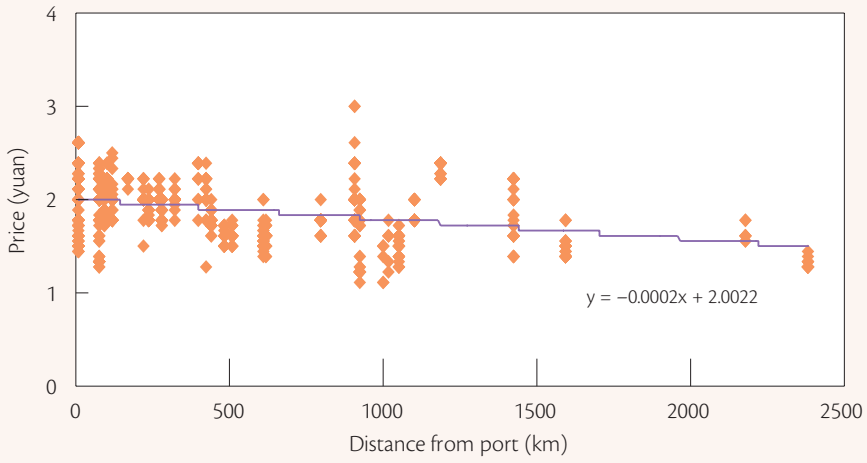

Figure 2.7 Changes in rice price across China as markets increase in distance from port (in four marketing areas — southern China, Yangtze River Valley, northern China and north-eastern China), July 1998

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in the northeast (Table 2.1). Holding all other factors constant, as maize-marketing sites become more distant from Dalian, the price falls (row 1). The magnitudes of the coefficient on the distance from Dalian change for each of the periods, but their sizes still fall in a reasonable range (for each 1000 km, the price of maize falls by RMB54.4/tonne (column 1)). In log form, our results show that, for each 1000 km, the price falls by 5.6% (column 2). We also ran similar regressions with data-set 1 for 1998 to 2000 and generated similar results (not shown). In fact, the coefficient on the distance variable in the logarithmic equation was even lower for all of China, most likely reflecting the higher costs of transportation in the northeast, a place in which transportation has always been relatively constrained.

The spatial pattern of rice prices (Table 2.2) is similar to that of maize. A similar set of regressions was run for our rice price for 2000. In the case of rice, however, we had to account for quality differences that essentially segment China's rice markets. In column 1, we use data for all regions but include location dummy variables, one for markets in southern China, one for those in the Yangtze River Valley, one

Table 2.1 Price and log price determination regression for all periods (10/2001–3/2003)

Explanatory variables	(1) Dependent variable: price at level (yuan)	(2) Dependent variable: log price
Distance from Dalian (1000 km)	−54.4* (30.2)	−0.056* (30.35)
Distance × group dummy	−0.0235* (9.66)	−0.00003* (10.54)
Group dummy	−89.55* (9.90)	−0.093 (10.02)
Constant	1058.84* (165.24)	6.97* (1064.88)
Time period dummies	Included	Included
Adjusted R-square	0.82	0.83
No. of observations	1152	1152

Note: Values in parentheses are *t* statistics. Coefficients marked with an asterisk are statistically different from zero at the 1% level of significance. The group dummy (gd) picks up a time period effect. When gd = 0, the time period is early in the WTO accession period (that is, before October 2002), gd = 1 indicating the recent period (that is after October 2002). The F-test statistic in (1) is F[2, 1022] = 120.87, in (2) is F[2, 1022] = 133.66. Both models reject the null hypothesis that there is no structure change.

Data source: data-set 3 (see text for details).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

for those in northern China (included as the base location) and one for those in northwestern China. The results of location-specific regressions are in columns 2 to 4 (though because there were not enough observations, results could not be reported separately for the northeastern region). In addition, a square term was included in the rice regressions to allow for non-linear shifts over space, a term that could help account for quality differences also. However, even with these modifications, the spatial patterns came through clearly. As markets move progressively further away from China's major port cities, the price falls. Since these ports (Guangzhou, Shanghai, Tianjin/Beijing and Dalian) are also major consumption centres, this price pattern is exactly what would be expected in a market economy.

When examining the magnitude of the transportation gradients estimated in Table 2.2 (and similar ones estimated from regressions for rice in 1998 and 1999 and for maize and soybeans for 1998 to 2000—not shown), we find three characteristics (Table 2.3). First, and interestingly because they build the case for robustness, the

Table 2.2 Ordinary least squares regression explaining rice prices in China's main marketing regions, 2000 (data source: data-set 1)

Explanatory variable	Full sample	South China	Yangtze River	Yellow River
Dist-port	−0.00004** (-1.89)	−0.0004** (-4.38)	0.0001 (1.30)	-0.00007** (-2.13)
Dist-port^2	+1.9*e−8** (2.99)	+2.7*e−7** (5.59)	−1.5e−7** (5.02)	2.8*e−8** (3.31)
Dist-road	−0.005** (11.6)	−0.004** (7.10)	−0.008** (5.36)	0.0003 (0.31)
Dist-rail	−0.001** (5.60)	−0.001** (7.18)	−0.0001 (0.06)	−0.002** (3.22)
Region dummies				
South	0.20**			
Yangtze	−0.04**			
Northeast	−0.06**			
Period dummies	Included	Included	Included	Included
No. of obs.	1132	304	327	501

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

magnitudes of the transportation/transaction costs are similar to those reported in Park et al. (2002). Using a completely different methodology, a method that uses a maximum likelihood estimator examining the price differences between markets when traders arbitrage away price difference between markets, our estimates in Table 2.3, which were generated from regressions similar to those in Table 2.2, are almost the same. Second, the transportation gradients are falling over time. Although we can not pinpoint the exact source of the fall in the transportation gradient, as in Park et al. (2002), the patterns are consistent with a marketing environment in which there is an improving infrastructure and more competitive markets. Finally, the results show that the transportation gradients in China are similar to those found in the US. When plotting similar data and running similar regression on maize in the Mississippi valley we find a pattern of spatial price spread similar to that in China. In other words, assuming our findings are representative of average transportation gradients in China and the US, these results show that the time when China's inland markets were isolated by poor transportation and other infrastructure weaknesses may be past. In other words, it appears as if the aggressive investment in roads and other infrastructure projects in the past decade has dramatically improved the ability of traders to move agricultural commodities, at least staple crops, around China at costs that rival those of the US.

Table 2.3 Percentage change in maize, soybean and rice prices for every 1000 kilometres of distance from port

	Maize	Soybean	Rice
China 1998	−4	−10	−10
China 1999	−4	−11	−9
China 2000	−3	−8	−7
USA 1998	−5	−3.5	n.a.

Note: Values for column 3 (rice, China) from Table 2 (and similar regressions for 1998 and 1999); values for columns 1 and 2 (maize and soybeans, China) from regressions for maize soybeans for China that are similar to those for rice. Values for US from spot market prices reported by the Chicago Board of Trade for 15 markets in 1998.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

MARKET INTEGRATION IN CHINA

In this section we use more-formal tests of market integration. In the first subsection we use traditional co-integration analysis to examine how prices move together over time. We do the analysis in several periods; the late 1990s for rice, maize and soybeans (using data-set 1) and, because we use the same data as used in Park et al. (2002), we can compare the results with those from the early 1990s. Using data-sets 3 and 4, we also examine co-integration for maize and soybean markets.

Co-integration analysis

Co-integration means that, although many developments can cause permanent changes in the individual elements of tested series, i.e. grain price in this paper, there is some long-run equilibrium relation tying the individual components together, represented by the linear combination, as in equation (1). Here we apply the Engle-Grange co-integration approach (Engle and Grange 1987) to test China's market integration. The basic intuition behind this is that if one can write two price series in the following way:

$$U_t = P_t^i - bP_t^j \qquad (1)$$

if each price series is stationary, then this condition implies the existence of a long-run equilibrium. In other words, in the long run, the two series will eventually return to a constant mean and there is a long-run, deterministic relationship between them. Two stationary series are not co-integrated. Moreover, a linear combination of these two prices shows that it is efficient to predict one market's price based on the information of another market's price.[8] If the price series are not stationary, we then need to test whether each of the elements of the price series are co-integrated and, if they are, at what order are they co-integrated (i.e. co-integrated to the order 1, I(1) or higher). This is done by applying a unit root test. Our analysis shows that all price series for the commodities in China's grain markets in the late 1990s are stationary.

[8] Note that we do not need to have the *b* coefficient equal to unity to conclude co-integration and integrated markets (which is only needed if one wants to apply the much more restrictive criteria of the Law of One Price).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Using our stationary price series, the next step uses the ordinary least squares regression of one price series on another to test for co-integration:

$$P_t^i = \alpha + \lambda t + \beta P_t^j + e_t \qquad (2)$$

where t is the common trend of the two price series (which can also be thought to be the difference between time trend in one series and that of the other) and where e_t is the error term. The main reason for running equation (2) is that it provides the residuals, e_t, to use in the augmented Dickey-Fuller (Engle and Grange 1987) test:

$$\Delta e_t = \ + \delta e_{t-1} + \sum_{j=2}^{N} \gamma \Delta e_{t-j} + \xi_t \qquad (3)$$

If the test statistic on the δ coefficient is less (i.e. more negative) than the relevant critical value from the Dickey-Fuller table, the null hypothesis ($e_t = 1 \times e_t - 1$) may be rejected and the two series are said to be co-integrated to order (1,1). According to Engle and Grange, this implies that the two markets from which the price series come are integrated. In our analysis, we assume markets are integrated when the test statistic demonstrates that the two series move together at a 10% level of significance.

Results—increasing integration during the 1990s

The results of the co-integration analysis illustrate that China's markets have continued to develop in the late 1990s, especially when the results are compared with the market integration research in the late 1980s and early 1990s (Table 4). In middle part of the reform era (1988–1995), a time when markets were starting to emerge, 20–25% of markets showed signs that prices were moving together during the study periods and sub-periods (Park et al. 2002). According to the findings of Park et al. (2002), although there were many market pairs in which prices did not move together, between the late 1980s and mid 1990s, there was evidence of rising integration.

Using the results from the early 1990s as a baseline and using data-set 1, our current analysis shows that, during the late 1990s, China's markets continued along their previous path of maturation. In the late 1990s, examining the co-movement of prices among pairs of markets in our sample, we see a significant increase in the fraction of market pairings that are integrated. In fact, some markets in China are remarkably integrated. In the case of maize, for example, in 89% of the cases, prices in one market

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

move at the same time as they do in another (Table 2.4, column 2). This is up from only 28% of the time in the early 1990s. The share of market pairings (for soybeans, japonica rice and indica rice) that exhibit price integration also increases (rows 2 to 4). The integration of these markets is notable because, in many cases, the pairs of markets are separated by more than 1000 km. For example, we find soybean and maize prices in many years to be integrated between markets in Shaanxi and Guangdong provinces and between those in Sichuan Province and southern Jiangsu.

Table 2.4 Percentage of market pairs that test positive for being integrated based on Dickey-Fuller Test in rural China, 1988 to 2000

Commodity	1989–1995	1996–2000
Maize	28	89
Soybeans	28	68
Rice, Yellow River Valley (mostly japonica rice)	25	60
Rice, Yangtze Valley and South China (mostly indica rice)	25	47

Note: results for the two periods both use data from the State Market Administrative Bureau (SMAB). For results from 1989–1995 for maize and rice, see Park et al. (2002). Rice results are for the whole country in 1989–1995. Results from soybeans for 1989–1995 from Wang (1998). Results from 1996–2000 are by authors using data-set 1 (see text for details).

Despite the significant progress in terms of integration, our results do also show that there are pairs of markets during different years that are not integrated. For example, in one-third of the cases, japonica rice prices moved in one market but did not in another. The case of indica rice trade is even more notable. One explanation for such a result is that there is some kind of institutional breakdown or infrastructure barrier (e.g. some policy measure or a weak link in the transportation or communication infrastructure) that is fragmenting China's markets for certain commodities, as shown by Park et al. (2002). Nevertheless, it might also be that, since every province in China both produces and consumes rice, the following circumstance might arise. If, during a particular year in a particular area, supply is just equal to demand and price differentials between regions stay within the band between regional 'export' and 'import' prices, moderate price movements in another area may not necessarily

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

induce a flow into or out of the region that is in equilibrium. Hence, even with the non-trivial number of cases in the late 1990s in which market prices in pairs of markets do not move together, based on each of the market performance analyses, one must conclude that the impacts of WTO on China's agriculture will increasingly be experienced across wide regions of the nation, from coastal to inland areas.

Results—maize and soybeans, 2000–2003

The results of the co-integration analysis for maize in the post-2000 period (using data-set 3) also support both our descriptive findings and the conclusions of the determinants of commodity price analysis. Using the Dickey-Fuller tests, all pairs of markets in the northeast are integrated in a statistically significant way (Table 2.5). Compared with the results in the late 1990s (reported in Table 2.4 and discussed in the previous subsection) our analysis shows that, since 2000, maize markets in China have continued to become more integrated. Literally all pairs of markets (100%) in the northeast sample are integrated.

In addition, the other pairs of key maize markets on the national level, for example, between Dalian and Guangzhou and Dalian and Fujian, also are integrated (Table 2.6). The integration of these markets is notable because the pairs of markets are separated by more than 1000 km in many cases. During the post-2000 period, the co-movement of prices between pairs of markets in a national sample of prices showed that maize markets were almost fully integrated (about 93% of the pairs). [Interestingly, although the linkage of price movements in the Dalian and Hubei and the Dalian and Jiangsu markets is not statistically significant, we do find that the Dickey-Fuller statistic is not far from the critical value.] These results show that maize markets nationally have continued along their previous path of maturation. Compared with the late 1990s, the percentage of integrated markets rose from 89% to 93%.

Soybean markets in the post-2000 period are also integrating rapidly. Correlation coefficients among all major soybean markets show a high degree of price co-movement (Table 2.7). In 28 of 36 unique pairs of markets, the correlation coefficient exceeds 0.9. In most cases, the coefficients are above 0.95. In the other eight cases, the correlations are still high. In no case does the coefficient fall below 0.86. Clearly, even between markets as far apart as Heilongjiang and Guangdong, prices are correlated.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.5 Co-integration tests on northeast maize markets and Dalian market

Region	Test statistics	Lags	5% critical value	Conclusion
Augmented Dickey–Fuller tests				
1. Centre HLJ	−1.98	9	−2.89	Each one is unit root and proved to be I(1), stationary at 1st difference
2. East HLJ	−1.99	9		
3. West HLJ	−1.78	9		
4. Centre JLN	−1.99	9		
5. East JLN	−1.72	9		
6. West JLN	−1.62	9		
7. Centre LNG	−2.24	10		
8. West LNG	−2.07	10		
9. Dalian port	−2.80	16		
Augmented Dickey–Fuller tests for paired markets				
1. Centre HLJ/Dalian	−3.34	9		All paired markets are co-integrated Dalian market is integrated with all other regional markets.
2. East HLJ/Dalian	−3.49	9		
3. West HLJ/Dalian	−3.16	9		
4. Centre JLN/Dalian	−3.49	9		
5. East JLN/Dalian	−3.24	9		
6. West JLN/Dalian	−3.33	9		
7. Centre LNG/Dalian	−3.98	9		
8. West LNG/Dalian	−3.84	9		

Notes: 1. Augmented Dickey-Fuller test was implemented over the paired markets. 2. Guass program file 'adf-test.prg' is used. 3. Data-set 2 used (see text for details). Price series is bi-weekly and data are analysed at the market level (that is, there is more than one observation per province).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Formal co-integration analysis confirms the results of the correlations. According to our results using data-set 4, all of China's major soybean markets are now integrated with markets in two regions, Heilongjiang and Guangdong (Table 2.8). We use the Heilongjiang market as a benchmark since Heilongjiang is by far the nation's top producer–marketer of soybeans. Guangdong, in contrast, is China's largest consumer of soybeans, for both oil and feed. The other markets in our sample represent all of the other soybean using markets for which data are available. In the top part of the table we show that each series has a unit root and follows a I(1) pattern, or is stationary in first differences.

Table 2.6 Co-integration tests on major maize consumption markets and the Dalian market, 1999–2003

Region	Test statistics	Lags	5% critical value	Conclusion
Augmented Dickey-Fuller tests				
1. Dalian port	0	7	–2.89	Each one is unit root and proved to be I(1), stationary at 1st difference
2. Hubei	–0.8	4		
3. Jiangsu	–1.89	10		
4. Fujiang	–1.8	7		
5. Guangdong	–1.71	7		
Augmented Dickey-Fuller tests for paired markets				
1. Hubei/Dalian	–2.46	6		Hubei and Dalian are not co-integrated
2. Jiangsu/Dalian	–2.71	6		Paired markets are co-integrated with Dalian, 5%.
3. Fujiang/Dalian	–5.09	6		
4. Guangdong/Dalian	–6.15	6		

Notes: 1. Augmented Dickey-Fuller test was implemented over the paired markets. 2. Guass program file 'adf-test.prg' is used. 3. Data-sets 2 and 3 used (see text for details). Price series are monthly and at the provincial level. 4. Johansen test on all markets confirmed the results that there are three co-integrating equations.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.7 Correlation coefficients between each price series for all soybean markets in data

	Guangdong	Shanghai	Jiangsu	Jiangxi	Hebei	Henan	Shandong	Tianjin	Heilongjiang
Guangdong	1	0.998	0.997	0.996	0.874	0.914	0.916	0.865	0.926
Shanghai	0.998	1	0.999	0.998	0.874	0.918	0.920	0.863	0.926
Jiangsu	0.997	0.999	1	0.998	0.877	0.923	0.924	0.867	0.927
Jiangxi	0.996	0.998	0.998	1	0.891	0.933	0.935	0.881	0.940
Hebei	0.874	0.874	0.877	0.891	1	0.956	0.965	0.992	0.956
Henan	0.914	0.918	0.923	0.933	0.956	1	0.990	0.948	0.966
Shandong	0.916	0.920	0.924	0.935	0.965	0.990	1	0.955	0.971
Tianjin	0.865	0.863	0.867	0.881	0.992	0.948	0.955	1	0.946
Heilongjiang	0.926	0.926	0.927	0.940	0.956	0.966	0.971	0.946	1

Data source: data-set 4 (see text for details).

Examined in this way, we find that all markets are co-integrated with both Heilongjiang and Guangdong. The Dickey-Fuller test statistics of co-integration are all significant for all pairs of markets. This means that, in the post-2000 period, if the price moved in either Guangdong (from a consumption shock) or in Heilongjiang (from a production shock), prices moved in all other China soybean markets. Clearly, when compared with the results in Table 2.4 (which showed 68% of China's soybean markets to be integrated in the late 1990s), soybean markets have become more integrated. Although we do not pinpoint the precise reason for the rising integration—see Park et al. (2002) for a more complete analysis—the rising integration is likely due to improved infrastructure (transportation and communication), more competition in the transport sector (with the rise of private trucking) and the emergence of a huge cohort of small, private traders.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.8 Co-integration tests on China's soybean markets with Heilongjiang and Guangdong markets as centre markets

Market	Test statistics	Conclusion
Augmented Dickey-Fuller tests (5% critical value with constant)		
Heilongjiang	−1.05	Each one is unit root, and thus, I(1).
Tianjin	−0.48	
Hebei	−0.26	
Shanghai	−1.15	
Jiangsu	−1.08	
Jiangxi	−1.09	
Shangdong	−0.33	
Henan	−0.17	
Guangdong	−1.22	
Augmented Dickey-Fuller tests for paired markets (critical value with constant and trend: (5%) −3.46; (1%) −4.06)		
Centre markets: Heilongjiang		
Tianjin	−3.87*	All markets are integrated with Heilongjiang market
Hebei	−3.73*	
Shanghai	−4.11**	
Jiangsu	−4.07**	
Jiangxi	−4.23**	
Shandong	−4.77**	
Henan	−4.8**	
Guangdong	−4.01*	

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.8 (continued)

Market	Test statistics	Conclusion
Centre markets: Guangdong		
Heilongjiang	−4.1**	All markets are integrated with Guangdong market.
Tianjin	−3.6*	
Hebei	−3.54*	
Shanghai	−3.61*	
Jiangsu	−3.63*	
Jiangxi	−3.67*	
Shandong	−4.27**	
Henan	−4.52**	

Notes: 1. Augmented Dickey-Fuller test was implemented over the paired markets. 2. Program in Eviews. 3. Data source: data-set 4 (see text for details).

Assessing village-to-regional market integration

The inter-regional integration of markets, however, is only half of the story. While the analysis in the previous section demonstrates a remarkable degree of integration between markets on the coast and those inland, such an analysis is still not sufficient to be able to state with confidence that households in China's villages are integrated into the nation's marketing network. To complete our integration analysis, we also need to examine the extent to which villages are integrated into regional markets.

Our test of village–regional market integration tests if farmers in China's villages are price takers or if they reside in villages that are isolated to the extent that local prices are determined by local supply and demand. The equation to test for village–regional market integration is:

$$P_i = a_0 + a_1 A_i + b_1 T_i + d_1 D + e_i \qquad (3)$$

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In briefest terms, if variables that affect local grain availability, A_i, in village *i* significantly affect the village's price, P_i, we will assume villages are isolated and markets do not extend into China's villages; in contrast, if the variables that affect local availability do *not* affect the price, we conclude that villagers are price takers and markets can be thought to be integrated. Availability in each village during the survey year is measured as the sum of production, P_i, and storage, S_i. We would expect that a rise (fall) in availability would negatively (positively) affect the village's price if markets are isolated. In contrast, we would expect changes in local availability to have no effect on the village's price if markets are integrated. Since it is total availability that matters (note that $A_i = P_i + S_i$), it is total availability (or production plus storage at the beginning of the period) that should enter equation (3). In our analysis, we run equation (3) separately for rice, wheat, maize and soybeans.

When examining the impact of local grain availability on the household's grain price in equation (3), other factors, D_i, need to be controlled in our cross-sectional analysis. In equation (3), we assume that D_i includes two components, one spatial—measured as the distance of the village from the county seat (the typical site of the regional market; the further the village is from the county seat, the lower the price); and the other temporal—the timing of the grain sale (if the sales of grain by the households in the village were during the first three months after the harvest, we would expect a lower price). Because village price levels in different provinces also are expected to vary due to each province's location (with respect to the port) and infrastructure (e.g. the quality of its road and rail network), we also include a provincial dummy. In the case of rice, since quality varies so much from region to region, we include regional quality dummies (one for each of south China; the Yangtze River Valley; and north/northeast China).

The data for this study were collected in a randomly selected sample of 60 villages in 6 provinces of rural China (henceforth, the China National Rural Survey—CNRS). The sample approached national representativeness. To accurately reflect varying income distributions within each province, one county was randomly selected from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were randomly selected within each county. The survey teams used village rosters and our own counts to randomly choose 20 households, both those with their residency permits (*hukou*) in the village and those without. A total of 1199 households was surveyed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The data from the survey allow us to construct a number of variables that potentially could affect the price that the farmer received in the village. The CNRS project team gathered detailed information on both the production and marketing behaviour of all of the farmers in the sample and the characteristics of each village and its relationship to the nearest regional market. From each individual respondent in the survey in each village, we know the price and timing of the sale for each commodity. We average the price associated with all of household sales in the village, weighting each sale by its size in kilograms. With the information on timing, we can construct a set of variables that measures the proportion of village sales that occurs within each of the first three months after the harvest. From a community questionnaire, we know how far, in kilometres, the village's centre is from the nearest paved road and the distance to the county market. Finally, for each crop that the farmer cultivates, we know if the farmer's crop suffered a shock, recording both the incidence and the percentage by which the yield fell. These are aggregated to the village level. We do not include any variable that controls for the presence of a community buffer-stock system, primarily because such an institution is almost never observed in modern China. However, farmers, at least in the past, have been known to hold large stores of grain. It is possible that, in an isolated village, if a production shock occurred and the local price began to rise, farmers could draw on their own stocks and the local price could fall and exhibit no net change (thus making it appear that villages were integrated into the regional market, when in fact they were not). We use beginning of year stocks of farm households, aggregated to the village level, to measure the potential that household stocks could play in increasing availability. We can ignore sales among farmers within a village, since such transactions are rare (according to our data, less than 4% of sales are among farmers in the same village).

To test our hypothesis, we regress grain price, P_i, on total grain availability, A_i, for each of the i main staple crops (where $i = 1$), holding the other variables, T_i and D, constant. In our analysis, we measure total grain availability in three ways: as the production shock, P_i, by itself; as the production shock, P_i, and grain storage, S_i; and as the interaction between the grain storage variable and the production shock variable (or a direct proxy of $A_i = P_i + S_i$). Since the third definition (the interaction effect) is the most intuitive (because it captures total grain availability of the village in one variable), we report in Table 2.9 the results from the regressions that use this version of the variable [the results of the regressions using the alternative variables are reported in Jikun Huang et al. (2004)]. If villages are isolated from the regional markets, when there is a positive production shock and high levels of grain

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

storage—that is, when the interaction term is large—the coefficient on the interaction term should be negative and significant. If markets are integrated into China's larger marketing networks, the coefficient should be insignificant.

Our analysis clearly shows markets in China are integrated down to the village level (Table 9). The signs of the coefficients (and levels of significance in some cases) on the variable measuring the distance of a village from the regional marketing centre demonstrate that the further a village is from a market, the lower the price the farmer receives. More importantly for our purposes, the *t*-ratios of the coefficients of the village supply shock variables are all small, signifying that the output of the local village's crops does not affect the local price. The main implication of this finding is that it is primarily factors outside the village that are affecting the prices that farmers receive, making them price takers. Moreover, when we interact our main variables of interest with a dummy variable that equals one when a village is poor (i.e. a village that is in the bottom two income deciles), the coefficient is still insignificant. In other words, farmers in China's villages, even remote, poor ones, are linked to China's regional markets.

EFFECTS OF MARKET EMERGENCE

Few authors have attempted to quantify the gains from market liberalisation. Part of the problem may be the short period of analysis, the inability of standard methodologies and measures or indicators of market liberalisation to separate efficiency gains of market reform from overall gains in the reforming economy, and the breadth of the studies. For China, Guangzhong Wen (1993) found total factor productivity (TFP) growth had stopped in the post-1985 period, a trend he blames on the failure of the market liberalisation stage of reform. Wen's conclusions have two shortcomings. First, his analysis ends in 1990, a period that might be too early to have allowed the liberalisation reforms to take effect. Second, he is examining the net change in TFP only and does not account for other factors that could be affecting productivity. Holding the effect of technology constant and using data through 1995, Songqing Jin et al. (2002) find that TFP growth restarts in the 1990s, a finding that they claim could be linked to increased liberalisation of the economy. Like Wen, however, they do not explicitly examine the improvements in efficiency that are associated with market development. Shenggen Fan (1999) uses stochastic, frontier production, decomposition analysis to isolate the efficiency gains of Jiangsu provincial

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

rice producers in the late reform era, a time when most of the property-rights reforms had already been implemented and a time when market liberalisation was just getting started. Fan finds that there have been only limited gains in allocative efficiency since 1984, a result that he suggests is due to the partial nature of China's market liberalisation. Unfortunately, Fan does not explicitly model the interactions

Table 2.9 Ordinary least squares regression explaining effect of local grain availability on the price level of major crops in China's villages in 2000 (dependent variable: village-level price).

Explanatory variable	Rice	Wheat	Maize	Soybean
Local grain availability				
Village-level climate shocks (production shock)[a]	–	–	–	–
Village-level grain storage at the beginning of year (grain storage)[a]	–	–	–	–
Interaction: production shock * grain storage[a]	–3.15e–06 (1.31)	7.50e–07 (0.37)	–3.91e–07 (0.33)	0.000045 (0.15)
Control variables				
Distance to the nearest county (km)	–0.00074 (0.74)	–0.0079 (2.1)*	–0.0005 (0.55)	–0.032 (2.76)*
Variables representing proportion of grain marketed during each of first three months after harvest	–	Included	Included	Included
Quality dummies	Included	–	–	–
Provincial dummies	Included	Included	Included	Included
Adjusted R-square	0.16	0.38	0.50	0.15
No. of observations	31	30	28	17

Note: T-ratios in parentheses. Coefficients marked with an asterisk (*) are statistically significant from zero at the 5% level.

[a] Independent measures of production shocks and grain storage are not included in this version. See Appendix Tables 1 and 2 in Jikun Huang et al. (2004) for versions that include these variables.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

between property-rights reform and market liberalisation. Also, his study examines only one crop in one province, a fact that limits the generalisation of his study, since it is possible that many of the gains from market liberalisation may come from shifting among crops (and between cropping and non-cropping activities).

The only truly systematic attempt to measure the returns to market liberalisation in China is in our papers with de Brauw (de Brauw et al. 2000, 2004). These papers develop measures of increased responsiveness and flexibility within a dynamic adjustment cost framework—as developed by Epstein (1981)— to estimate the return to market liberalisation reforms, holding the incentive reforms and other factors constant. The authors find that the behaviour of producers in China has been affected by market liberalisation, but that the gains have been relatively small. Small gains in responsiveness (that are measured by price elasticities of factor demand for variable inputs—in this case, fertiliser) between the early and late reform periods are attributed to the gradual market liberalising changes of the late 1980s. Farmers also have increased their speed of adjustment of quasi-fixed factors (which, in the case of China's agriculture, include labour and sown area) to price changes (and other shifts in exogenous factors) between the early and late reform period.

The research reported in de Brauw et al. (2004) also measures the effects on overall welfare of the increased flexibility and responsiveness. The research found that the magnitude of the gains in efficiency from increased responsiveness and flexibility in the late reform period is positive and significant. However, the magnitude is substantially less in percentage terms (less than 1% *per year*) than that from the incentive reforms in the early reform period (up to 7% per year or about 40% over the whole period). In conclusion, it is argued that although the gains are small, they are still positive and China's gradual market reform policy appears to have avoided the collapse that was experienced throughout central and eastern Europe and Commonwealth of Independent Sates nations. It is also quite feasible that additional gains have occurred as integration has continued in the late 1990s and post-2000 period.

Unfortunately, the results of the de Brauw et al. paper cannot examine the interactions among property-rights reform and market liberalisation effects since they rely on the assumption that the time period of the reform identifies the effect of individual policies (that is, all of the property-rights reforms were complete before 1984 and market liberalisation did not begin until after 1985). The results also only

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

examine the effect of market liberalisation. In Lin (1991) and Jikun Huang and Rozelle (1996), however, it is shown that the effects of property rights are enhanced when coupled with market liberalisation. If so, then the gains that were measured in de Brauw et al.'s paper and attributed to property rights, should be attributed, at least in part, to improvements in markets.

CONCLUSIONS

In this paper, we have shown, in a number of ways, the steady improvements in agricultural commodity markets that have occurred in China during the past decade. Whether we use descriptive statistics or more formal techniques, our results are consistent with the emergence of markets for rice, maize and soybeans. Moreover, markets are robust, even when looking across long distances and at different times. Transaction costs also appear to have continued to fall.

Although people who visit rural China are not surprised at these findings, such a picture of markets may be surprising when juxtaposed against the policy background. During this period when we have measured the steady increase in performance of markets, there has been an unbroken cycle of reform and reversal. Hence, despite attempts to slow down or stop the operation of markets during this time commodity markets have steadily strengthened in rural China.

The power of markets to continue to integrate, despite policy intervention attempts, perhaps more than anything shows the power of China's gradual method of transition. As argued by McMillan (1997), China's market reform has really been one of entry-driven competition. In the case of China, entry has come from both the commercialisation of the state and the emergence of a private trading sector. In doing this, China enfranchised millions of individuals in commodity trading. While this has produced the rise in integration and fall in transaction costs that have been documented in the paper, it also has eroded the power of the state to control the markets with the traditional command and control methods. Our results suggest that if the nation's leaders want—for whatever reason—to affect the price generated by the market in the future, they are going to have to devise new ways of influencing prices. Undoubtedly, as in other economies, China will increasingly have to use more indirect methods (such as floor-price supports), instead of trying to suppress trade. This means, of course, that traditional ways of dealing with markets administratively

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

(such as the rice bag responsibility system) do not work and should be discontinued. There are now just too many traders to deal with, as shown by the integration trends that continued to increase even when the nation tried to stop trading.

Indeed, one of the real messages from our work is that China's leaders, domestic and foreign traders and other observers should all realise that rural China now has among the least-distorted and most-integrated agricultural markets in the world. Of course, for poverty alleviation and other purposes this is often a two-edged sword. However, with good markets, if policy makers make good investments and execute good policies, those that are involved with the production and consumption activities will benefit and such policies can be executed with a minimum amount of distortion.

ACKNOWLEDGMENTS

The authors acknowledge the comments of Belton Fleisher, Nick Hope, Hehui Jin, Phil Laney, Will Martin, Todd Meyer, Albert Park and T. Srinivassan, and the insights of participants at workshops and seminars in the University of Illinois, the University of California, Berkeley, the International Food Policy Research Institute's workshop on China and India, the 2002 International Rice Congress, the World Bank and other places. The research assistance of Min Chang, Hengyun Ma and Yuping Xie was invaluable. Scott Rozelle is a member of the Giannini Foundation.

REFERENCES

de Brauw, A., Jikun Huang and Rozelle, S. 2000. Responsiveness, flexibility and market liberalization in China's agriculture. American Journal of Agricultural Economics, 82, 1133–1139.

— 2004. Gradualism and China's agricultural transition. Economics of Transition, 12, 427–466.

Engle, R.F. and Grange, C. 1987. Co-integration and error correction: representation, estimation and testing. Econometrica, 55, 251–276.

Epstein, L. 1981. Duality and functional form for dynamic factor models. Review of Economic Studies, 48, 81–95.

Guangzhong Wen 1993. Total factor productivity change in China's farming sector: 1952–1989. Economic Development and Cultural Change, 42, 1–41.

Jikun Huang and Chen, C. 1999. Effects of trade liberalization on agriculture in China: commodity and local agricultural studies. Bogor, Indonesia, United Nations ESCAP CGPRT Centre.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Jikun Huang and Rozelle, S. 1996. Technological change: rediscovering the engine of productivity growth in China's rural economy. Journal of Development Economics, 49, 337–369.

Jikun Huang, Rozelle, S. and Min Chang 2004. The nature of distortions to agricultural incentives in China and implications of WTO accession. World Bank Economic Review, 18, 59–84.

Lin, J.Y. 1991. Prohibitions of factor market exchanges and technological choice in Chinese agriculture. Journal of Development Studies, 27(4), 1–15.

—1992, Rural reforms and agricultural growth in China. American Economic Review 82, 34–51.

McMillan, J. 1997. Markets in transition. In: Kreps, D. and Wallis, K.F., ed., Advances in economics and econometrics: theory and applications. Cambridge, Cambridge University Press, 2, 210–239.

McMillan, J., Whalley, J. and Lijing Zhu 1989. The impact of China's economic reforms on agricultural productivity growth. Journal of Political Economy, 97, 781–807.

Meyer, T. 2002. Moving China's maize: a descriptive survey of China's corn supply. Working Paper, US Grains Council.

Park, A., Hehui Jin, Rozelle, S. and Jikun Huang 2002. Market emergence and transition: transition costs, arbitrage, and autarky in China's grain market. American Journal of Agricultural Economics, 84, 67–82.

Perkins, D. 1994. Completing China's move to the market. Journal of Economic Perspectives 8.2, 23–46.

Rozelle, S., Park, A., Jikun Huang and Hehui Jin 2000. Bureaucrat to entrepreneur: the changing role of the state in China's transitional commodity economy. Economic Development and Cultural Change, 48, 227–252.

Shenggen Fan 1991. Effects of technological change and institutional reform on production growth in Chinese agriculture. American Journal of Agricultural Economics 73, 266–275.

— 1999. Technological change, technical and allocative efficiency in Chinese agriculture: the case of rice production in China. Washington, DC, International Food Policy Research Institute, EPTD Discussion Paper, January 1999.

Songqing Jin, Jikun Huang, Ruifa Hu and Rozelle, S. 2002. The creation and spread of technology and total factor productivity in China. American Journal of Agricultural Economics, 84, 916–930.

Wang, Li. 1998. Soybeans, diversity and productivity in China. Unpublished Masters thesis, Center for Chinese Agricultural Policy, Chinese Academy of Agricultural Sciences, Beijing, China.

World Bank 2002. Building institutions for markets. Washington, DC, World Development Report 2002.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2.3 IMPROVING SECURITY AND EFFICIENCY OF THE GOVERNMENT GRAIN RESERVE SYSTEM

Funing Zhong and Jing Zhu
College of Economics and Management, Nanjing Agricultural University, Nanjing, People's Republic of China

CLARIFYING THE POLICY OBJECTIVE OF A GOVERNMENT GRAIN RESERVE

According to the definition of the Food and Agriculture Organization of the United Nations (FAO), the ultimate objective of food security is to ensure that 'all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO 1983). Undoubtedly, the primary goal of food security is to ensure long-term grain supply capability for the whole nation through domestic production and reliable imports. However, even with sufficient total supply from a long-term perspective, shortages may still occur from time to time at various locations. At the same time, there always exist disadvantaged groups of people who lack the capability to access 'sufficient, safe and nutritious' food, even in a country with high income and surplus supply. To ensure that all people have access to adequate food at all times requires various policy measures, one of which is the establishment of a grain reserve to stabilise grain supply against significant short-run fluctuations. Obviously, the grain reserve, since it is not for profit, has to be established by the government.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Annual grain supply consists of three components: total output, total net imports and changes in reserve stocks. From a long-run point of view, ensuring grain supply in an importing country requires imports and, if possible, expansion of domestic production. In a country like China, with a large and growing population facing limited and falling land and water-resource bases, expansion of domestic production requires increasingly greater efforts and costs, and increases in imports may be inevitable. Keeping a large reserve, no matter how big it is, cannot increase long-run supply, as the grain in reserve has itself to come from either domestic production or imports. Changes in reserve stocks can only be used to smooth short-term fluctuations in domestic markets; they are not capable of covering long-term supply shortages. However, though it might have secondary importance, grain reserve is still crucial to food security, and how to improve its efficiency to better serve its policy objective is the focus of this paper.

There are different reasons for storing grain: to match continuing consumption demand all year round with periodical harvests (and imports); to ensure smooth operation of processing and marketing within individual enterprises; and to safeguard national supply against unknown potential significant shocks in domestic production and/or irregular supply in the international market. Under a market system, commercial enterprises may be motivated to run their own working stocks serving the first two purposes, if the price differences among seasons make this operation profitable. In order to smooth large and uncertain fluctuations in market supply, a certain quantity of grain must be stored as reserves. Storage involves various costs including interest and losses in both volume and value due to quality deterioration etc. Price risk is also a potential cost of keeping grain stocks for reserves. However, commercial enterprises are not likely to be interested in running grain reserves to safeguard food security against uncertain inter-temporal output fluctuations as it does not necessarily bring profit but often incurs financial losses (Zhong 1995).

As commercial enterprises are generally not willing to perform this function, the responsibility for maintaining grain reserves usually rests with government. However, this does not necessarily mean that the government has to run the reserve system itself. As cost efficiency is an important, sometimes dominant, factor that determines the fate of any major policy, the government may entrust the operation to commercial enterprises through competitive bidding, in order to reduce the policy costs and to increase the actual security level.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The objective of government reserves should be food security rather than price stabilisation and/or support. However, as the operation of government grain reserves does affect market price, it is therefore often regarded in China as a policy measure to achieve price stabilisation and/or support objectives. But it should be noted that serious problems would occur if price stabilisation was set as the objective of a government grain reserve. First, to stabilise price under any situation requires that more grain be stored than that simply needed for smoothing significant fluctuations in physical supply. Thus, costs increase. In addition, the subsequent, smaller seasonal price difference will make it less profitable for commercial enterprises to operate working stocks for their own business. They may reduce the size of their working stocks and rely on the government to provide supply at any time. Therefore, the government may have to take over the responsibility as a final supplier for all needs, implying an even higher burden on its budget.

Second, the objective of food security would be undermined if price stabilisation were set as the goal for a government reserve. Price fluctuation is often an efficient signal to guide subsequent production, consumption and trade. Its proper functioning is essential to ensure long-run balance in the grain market. If price signals are disturbed by the operation of the grain reserve to achieve price stabilisation, increasing and accumulating imbalances in the grain market are likely to be observed in subsequent years. In this case, not only will the policy costs of the grain reserve increase, but also its function will be disturbed. The government may face the risk of insufficient stocks when real need actually arises.

Although a grain reserve could be used to moderate sharp price fluctuations in the short run, it is not recommended that this be done frequently. Price fluctuations are an effective signal to bring dynamic balance between demand and supply, and seasonal price differences are necessary for commercial enterprises to maintain 'normal' stocks in running their own business. Eliminating such price differences will lead to an accumulated imbalance in the market and commercial enterprises unwilling to keep their own stocks, relying rather on government to take over the responsibility for all types of stocks and to bear the costs. In this case, the policy costs of a grain reserve will increase for other goals, and the function of the grain reserve will be disturbed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In summary, different policy measures are required to achieve different food-security objectives. A grain reserve serves the purpose of balancing year-to-year market demand and supply by smoothing out large variations in grain production over the years. Therefore, the changes in grain reserves should be determined mainly by the difference between actual and expected total output, with certain considerations for the cumulative changes in stock. They should also be coordinated with annual imports and exports in both types and volumes. A competitive mechanism should be introduced into the operation of the reserve system, in order to bring down the operational costs and to enhance food security in an economically sustainable manner.

IMPROVING EFFECTIVENESS AND EFFICIENCY OF THE GOVERNMENT GRAIN RESERVE THROUGH INTEGRATED APPROACHES

As with any other policy, the success of the grain reserve program depends largely on whether or not the policy costs are kept at an acceptable level. There is no doubt that reducing costs of running the grain reserve will ensure success of the program and hence raise the food-security level. The primary objective of the grain reserve is to smooth inter-temporal and inter-regional output fluctuations, i.e. sharing production fluctuations among different time periods and regions just like an insurance program. As in any insurance program, the cost of running grain reserves depends on the preset security level as well as the area covered by the reserve system. To achieve a certain security level, a unified, nationwide reserve program is likely to incur much lower costs than segmented programs run by each province to smooth local fluctuations. In addition, proper utilisation of international markets may actually substitute for part of the domestic reserve, further reducing policy costs for running the grain reserves.

However, use of the international market would be feasible and beneficial only if there is enough long-term supply in the international market, and the fluctuation of supply in the international market is not positively correlated with that in the domestic market. In the next section, we will analyse the feasibility of China using the world market for food-security purposes, and compare national versus regional reserve programs in the section after that.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1. Potential long-run supply in the world grain market

The world's food-security status has improved in recent decades. The world total and per-capita grain outputs were 553 million tonnes (t) and 234 kg, respectively, immediately after World War II. Those values increased to 1.84 billion t and 380 kg in 1985, representing increases of 245% and 62%, respectively, in 40 years. World total grain output increased further to 2.07 billion t in 1997. Table 2.10 shows that world grain production averaged 1.76 billion t per year for the first three years of the 1990s and 1.88 billion t for the last three years of the decade, an increase of 7.1%. The world end stock of grain also increased with output, from 250 million t in 1996 to 313 million t in 1998, equivalent to 14.2% and 16.8%, respectively, of total annual consumption.

Table 2.10 World grain production and consumption trends

	1990–1991	1991–1992	1992–1993	1993–1994	1994–1995	1995–1996	1996–1999	1997–1998	1998–1999	1999–2000	2000–2001
Sown area (million ha)	694	692	694	686	687	681	702	693	685	673	667
Output (million t)	1768	1708	1790	1714	1763	1711	1870	1890	1873	1873	1839
Growth rate (%)		3.4	4.8	4.2	2.8	3.0	9.3	1.1	0.4	0.0	1.8
Export (million t)[a]	202	221	219	202	216	204	210	207	223	240	233
Consumption (million t)[b]	1724	1722	1752	1760	1777	1764	1837	1862	1842	1876	1876
End stock (million t)[c]	339	325	363	317	303	250	284	313	524	520	494
Stock/consumption (%)	19.7	18.9	20.7	18.0	17.1	14.2	15.5	16.8	28.4	27.7	26.3

Source: World economic yearbook, various issues. Beijing, China Economic Press.

Note: Rice statistics in this table refer to milled rice, not paddy. The value would be more than 100 million t larger if measured as paddy.

[a] Intra-EU and intra-CIS trades are not included.

[b] Changes in stock are included.

[c] Measured in various marketing years; data are missing for some countries.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

It is estimated that the world grain output will continue to increase at a rate of 1.8% per year, with annual consumption increasing by less than 1.6%. Assuming the same trade dependency rate of grain as at present, world grain exports in 2010 will reach 328 million t. According to the FAO, there are no insurmountable technological and resource constraints in grain production from a global perspective. While the annual output increase of grain could be as high as 1.8%, the annual growth rate of population could decline to 1.3% or even lower (Lin 1996). Based on those studies, the growth rate of grain production is likely to continue to surpass that of population, resulting in increased per-capita supply over time.

There are still rich resources under-utilised in many parts of the world. According to the United Nations, more than 360 million hectares of arable land remain idle, much of which could easily be brought into cultivation. One example is idle land in North America and the EU; if brought into production, it may yield some 40 million t of grain. Besides, the land productivity in many countries is not as high as it could be, due to the low returns at current low prices. Grain price increases in the face of a possible shortage in supply would prompt a large supply response.

The impact of technology innovation on grain output should not be neglected either. The world average yield is not at all as high as it could be. If in the next few decades it reaches that of the US at the present time, total world grain output would reach 3.3 billion t (Xu 1998), enough to satisfy global demand for grain. The development and application of suitable technology to increase yield will occur when it is profitable to do so. Additional potential exists with the development and application of modern biotechnology.

2. Correlation of output fluctuations between China and the rest of the world

The long-run supply capacity in the world market does not necessarily guarantee that imports will be available to China at all times. As grain production fluctuations occur in both China and the rest of the world, it is important that they do not occur simultaneously and in the same direction if the world market is to be used as a substitute for domestic grain reserves.

An analysis has been made of the correlation of grain output fluctuations between China and the rest of the world (ROW), using data from the past two decades. Since soybean is used in large quantities as a feed grain in China, it is also included in our

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

study. It should be explained that the output fluctuation is defined as the difference between the actual and expected 'normal' outputs of the year. In other words, it is taken as the variation of the actual output compared with the long-term trend.

Table 2.11 shows the expected 'normal' output of grain and the fluctuation for China and ROW (cereals output is used for ROW) during 1978–2001.

From Table 2.11 it can be seen that the directions of fluctuations in China and the ROW are opposite for 14 of the 24 years. The calculated correlation coefficient shows that there is no significant correlation between the two series of fluctuations (see Table 2.12 for details). The result is in line with a common understanding that the wide diversity of climatic, topographical, technological, institutional and policy factors in different countries should mitigate against convergence of production fluctuations. Table 2.12 lists the correlation coefficients between output in China and ROW for the major grains—rice, maize, wheat and soybean. It can be seen that there is no significant correlation between the production fluctuations for most of the commodities. The sign of coefficients for rice and maize is negative, showing different directions of fluctuations in the two markets, and suggesting that international markets could profitably be used to smooth domestic fluctuation. A more-detailed study will be carried out to analyse the coefficient for wheat, 0.36, which is relatively higher than all other values in the table.

Since most grain exports come from a few exporting countries, a study was made of the correlations between fluctuations in China and the major exporting countries. The results are given in Table 2.13.

The results show negative correlation coefficients for maize and rice between China and major exporters, while those for soybeans are higher but not significantly so. For these commodities there is little correlation of output fluctuations between China and major exporters.

Wheat is the major grain that China imports. The results in Table 2.13 show relatively high positive fluctuation coefficients between wheat outputs in China and some major exporters. However, although the coefficients of output fluctuation between China and Canada, China and EU-15 are above 0.4, the coefficients between China and other major exporting countries—USA, Australia and Argentina—are either lower or negative, implying no statistical correlation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.11 Fluctuations in cereals output (million t) in China and the rest of the world, 1978–2001

	China			World, excluding China		
Year	Actual output	Expected output	Variations	Actual output	Expected output	Variations
1978	273.0	290.2	−17.2	1309.1	1278.6	30.5
1979	292.7	297.5	−4.8	1244.9	1296.2	−51.2
1980	280.3	304.8	−24.5	1269.9	1313.7	−43.8
1981	286.4	312.1	−25.7	1346.3	1331.2	15.1
1982	315.4	319.4	−4.0	1377.2	1348.7	28.5
1983	345.6	326.7	18.9	1281.2	1366.2	−85.0
1984	365.9	334.0	31.9	1420.7	1383.7	37.0
1985	339.9	341.3	−1.4	1481.2	1401.2	79.9
1986	352.1	348.6	3.5	1481.5	1418.8	62.8
1987	359.2	355.9	3.3	1411.9	1436.3	−24.4
1988	351.8	363.2	−11.4	1375.2	1453.8	−78.6
1989	367.6	370.5	−2.8	1503.3	1471.3	32.0
1990	404.4	377.8	26.6	1547.1	1488.8	58.3
1991	398.5	385.1	13.4	1490.9	1506.3	−15.4
1992	404.3	392.4	11.9	1569.0	1523.8	45.2
1993	407.9	399.7	8.3	1495.0	1541.3	−46.4
1994	396.5	407.0	−10.5	1560.3	1558.9	1.4
1995	418.7	414.3	4.4	1478.2	1576.4	−98.2
1996	453.7	421.6	32.1	1617.4	1593.9	23.6
1997	445.9	428.9	17.1	1648.2	1611.4	36.8
1998	458.4	436.2	22.2	1627.9	1628.9	−1.0
1999	455.2	443.4	11.7	1629.8	1646.4	−16.6
2000	407.3	450.7	−43.4	1652.5	1663.9	−11.4
2001	398.4	458.0	−59.6	1702.4	1681.4	21.0

Note: Expected output is measured by linear regression against time.

Data source: FAO production yearbook, various years.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.12 Correlation of grain and soybean output fluctuations between China and the rest of the world

	Cereals	Rice	Maize	Wheat	Soybeans
Correlation coefficient	0.09	−0.20	−0.15	0.36	0.01

Data source: FAO production yearbook, various years.

Table 2.13 Correlation coefficients for grain and soybean output fluctuations between China and major grain exporting countries

Maize	Major exporters −0.08	USA −0.05	Argentina −0.13	South Africa −0.19		Thailand −0.17
Rice	Major exporters −0.20	Thailand −0.28	USA −0.55	India −0.02	Pakistan −0.08	Vietnam −0.28
Wheat	Major exporters 0.44	USA 0.27	Canada 0.43	Australia −0.06	EU−15 0.43	Argentina −0.02
Soybeans	Major exporters 0.02	USA 0.004		Argentina −0.13		Brazil 0.18

Data source: FAO production yearbook, various years.

A similar study has been conducted to analyse the correlation between wheat output fluctuations in China and other major importers. The low correlation coefficients (Table 2.14) show that the probability of other major world importers having abnormally low outputs, and turning to the international market for imports at the same time as China, is very low.

Table 2.14 Correlation of wheat output fluctuations between China and major importers

	Major importers	Japan	Italy	Brazil	Former USSR
Correlation coefficient	−0.17	0.24	0.25	0.15	−0.2

Data source: FAO production yearbook, various years.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHINA'S CAPACITY FOR FOREIGN EXCHANGE PAYMENT

Besides the availability of grain in the world market, in terms of both long-run supply capacity and short-run output fluctuations, another important concern for China's use of international grain markets is the availability of financial resources. This concern is basically related to China's foreign exchange earnings (FEE) flow in each year, as well as China's foreign exchange reserve (FER) stock accumulated in any given year when China has a high demand for grain imports.

China's foreign exchange earnings and foreign reserve levels for the 1990–2001 period are summarised in Table 2.15.

Table 2.15 China's foreign exchange earnings (FEE) and reserves (FER), 1990–2001 (US$ billion)

Year	1990	1993	1995	1996	1997	1998	1999	2000	2001
FEE	57.37	86.56	147.24	171.68	207.25	207.59	220.96	279.56	229.40
FER	11.09	21.20	73.58	105.03	139.89	144.96	154.68	165.57	212.17

Data source: China foreign economics and trade yearbook, various years. Beijing, China Economic Press.

China's trade has increased very rapidly in the past 20 years. However, the imports of food, and grain in particular, did not increase at the same pace as total imports. Their shares in total imports declined from 10–20% in the early 1980s to less than 10% and 5%, respectively, in the mid and late 1980s, and then to less than 5% and 2%, respectively, in the 1990s. In the first years of the 21st century, the proportion of grain imports in the total is below 0.5% (see Table 2.16 for details).

In the 1990s, the foreign exchange payment needed for grain imports was around US$1–2 billion, only 2.5% of the annual exchange earnings, and of the FER. Even if grain imports rise substantially in the future, there should be no FER shortage for their purchase.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.16 China's total and food imports

Year	Total imports	Food and live animals used chiefly for food		Grains		
	US$ billion	US$ billion	% as total imports	US$ billion	% as total imports	% as food imports
1980	20.02	2.96	14.79	2.48	12.39	83.78
1981	22.01	3.62	16.45	3.24	14.73	89.50
1982	19.28	4..0	21.78	3.41	17.69	81.19
1983	21.39	3.12	14.59	2.48	11.59	79.42
1984	27.41	2.33	8.50	1.83	6.68	78.54
1985	42.25	1.55	3.67	1.00	2.37	64.52
1986	42.90	1.62	3.78	1.08	2.52	66.67
1987	43.21	2.44	5.65	1.75	4.05	71.72
1988	55.28	3.48	6.30	1.90	3.44	54.60
1989	59.14	4.19	7.08	3.00	5.07	71.60
1990	53.35	3.34	6.26	2.35	4.40	70.36
1991	63.79	2.80	4.39	1.64	2.57	58.57
1992	80.59	3.15	3.91	1.75	2.17	55.56
1993	103.95	2.21	2.13	1.01	0.97	45.70
1994	115.69	3.12	2.70	1.32	1.14	42.31
1995	132.08	6.13	4.64	3.61	2.73	58.89
1996	138.84	5.67	4.08	2.58	1.86	45.50
1997	142.36	4.30	3.02	0.92	0.65	21.40
1998	140.17	3.79	2.70	0.72	0.51	19.00
1999	165.699	3.62	2.20	0.52	0.32	14.48
2000	225.094	4.76	2.11	0.59	0.26	12.48
2001	243.613	4.98	2.04	0.63	0.26	12.74

Data source: China foreign economics and trade yearbook, various years. Beijing, China Economic Press. China statistical yearbook, various years. Beijing, China Statistical Press.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

SUMMARY

The foregoing analysis shows that there is no significant correlation between grain output fluctuations in China and the rest of the world over the past few decades. In the future, the magnitude of fluctuations in domestic production caused by policy changes is not likely to exceed that in the past 20 years in both China and other major grain producers. Improved decision-making in grain production will confine output fluctuations more to the domain of natural conditions. The wide diversity of geographical positions and natural conditions among different countries in the world makes the probability of natural disasters occurring in all countries at the same time very low. On the other hand, development of science and technology will enable humankind to better fight unfavourable natural conditions for better harvests.

All of these factors indicate that the fluctuation of grain output between China and the rest of the world in the future should not be large compared with previous experience. Assuming future production fluctuations follow the previous trend, the availability of grain in the world market for China's import needs should be assured, and China has sufficient foreign exchange earnings to import the quantities of grain and other food items that it needs.

ESTIMATING THE LONG-RUN LEVEL OF GOVERNMENT GRAIN RESERVE NEEDED

Given the security objective set, the level of grain reserve needed is determined by the level of annual fluctuations and the distribution of the fluctuations over time, as well as the area covered by the reserve program. If a reserve program is set to smooth out all fluctuations completely, the quantity required must be larger than for a program with the lesser objective of smoothing out only part of the fluctuation and leaving the rest to the market. If a grain reserve program is set to smooth output fluctuations in each province independently, the sum of the required maximum capacity will be much larger than the quantity required by an integrated, nationwide reserve program. If the world market is used to absorb part of the domestic fluctuations, then the grain reserve needed is smaller than that required under a closed market/reserve situation.

The following study shows that the establishment of an integrated national market with partial use of the world market is one of the most important policy measures to improve food security in terms of stabilising domestic supply at low cost.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1. Regional versus national grain reserve programs

There are different ways to measure fluctuation between years and hence the suggested quantities of stocks to absorb it may vary. Our attempt to determine the fluctuation is based on the difference between the actual and expected outputs each year, with the latter estimated by a simple, linear regression against time.

The estimate in this study is made for the years 1965–99. China experienced extreme disasters in grain production during the early 1960s, largely due to policy failures. It is generally recognised that China recovered from the crisis in 1965, when economic growth returned to normal patterns. Grain production dropped sharply in the past few years; since that might exaggerate the time trend, figures for recent years are excluded.

The actual grain output, the estimated expected values, the calculated annual fluctuations, and the accumulated fluctuations are given in Table 2.17. The largest accumulated positive fluctuation occurred in 1967 at 31.50 million t, and the largest accumulated negative fluctuation in 1981 at 53.71 million t. If we assume that the reserve is able to provide normal supply in all bad years and absorb surplus output in all good years, the maximum capacity should be 85.21 million t.

However, the above analysis is made under the assumptions of an integrated national grain market and an effective and integrated grain reserve program. If the grain market is segmented at provincial level, and/or if the grain reserve programs are managed independently by provincial governments, to smooth out production at provincial level the maximum capacity of grain reserves required will be much larger. The same estimation approach is applied to each province in China for the same time period. The results are summarised in Table 2.18.

It is understandable that the ratio of variation is much higher at the provincial level than at the national level: it is determined by the size of coverage if other conditions are the same. Of the total 29 provinces, there are 20 that have a maximum ratio of variation exceeding 20% of output, and 6 provinces where it exceeds 30%. Some provinces have a ratio of variation greater than 50%. Without an inter-regional transfer scheme, the maximum capacity of grain reserves would be 346 million t under segmented provincial grain reserve programs, almost four times as high as that required under an integrated, national reserve program. It can be expected that the reserve capacity required would be even larger if segmented programs ran at sub-provincial levels.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.17 Variations in China's grain output, 1965–1999

Year	Actual output (million t)	Expected output (million t)	Variation (%)	Ratio of variation	Accumulated variation
1965	194.50	188.7	5.8	3.10	5.8
1966	214.00	198.3	15.7	7.93	21.6
1967	217.80	207.9	9.9	4.78	31.5
1968	209.10	217.5	−8.4	−3.87	23.1
1969	211.00	227.1	−16.1	−7.09	7.0
1970	240.00	236.7	6.2	2.64	13.2
1971	250.10	246.3	3.9	1.57	17.1
1972	240.50	255.9	−15.4	−6.02	1.7
1973	264.90	265.5	4.7	1.77	6.4
1974	275.30	275.0	0.2	0.08	6.6
1975	284.50	284.6	−0.1	−0.05	6.5
1976	286.30	294.2	−7.9	−2.70	−1.4
1977	282.70	303.8	−21.1	−6.95	−22.5
1978	304.80	313.4	−8.7	−2.76	−31.2
1979	332.10	323.0	9.1	2.81	−22.1
1980	320.60	332.6	−14.4	−4.33	−36.5
1981	325.00	342.2	−17.2	−5.03	−53.7
1982	354.50	351.8	1.6	0.46	−52.1
1983	387.30	361.4	25.9	7.16	−26.2
1984	407.30	371.0	36.3	9.78	10.1
1985	379.10	380.6	−1.5	−0.39	8.6
1986	391.50	390.2	1.3	0.34	9.9
1987	403.00	399.8	4.9	1.24	14.8
1988	394.10	409.4	−10.1	−2.46	4.7
1989	407.60	419.0	−4.6	−1.09	0.2
1990	446.20	428.6	23.3	5.43	23.5
1991	435.30	438.2	−2.9	−0.66	20.6

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.17 (cont'd) Variations in China's grain output, 1965–1999

Year	Actual output (million t)	Expected output (million t)	Variation (%)	Ratio of variation	Accumulated variation
1992	442.70	447.8	−5.1	−1.14	15.5
1993	456.40	457.4	−0.9	−0.19	14.6
1994	445.10	467.0	−21.9	−4.68	−7.3
1995	466.60	476.6	−9.9	−2.09	−17.2
1996	504.50	486.2	18.4	3.78	1.2
1997	494.20	495.7	−1.6	−0.32	−0.4
1998	512.30	505.3	7.0	1.38	6.6
1999	508.40	514.9	−6.6	−1.27	0.0
Maximum capacity required					85.21

Data source: China agricultural yearbook, various issues. Beijing, China Agricultural Press.

2. Complete versus partial absorption of supply fluctuations

The policy objective of the reserve program may not necessarily be complete absorption of all fluctuations; instead, the government may choose a lower food-security goal, allowing a certain degree of fluctuation in grain supply to be absorbed by the market. First, grain and food-processing industries could serve as a buffer for the fluctuations, and animal production could also adjust to a large extent to the changing grain supply in the market. Second, consumption of grain is elastic to price change resulting from supply fluctuation. A well-functioning market itself is an effective instrument to absorb fluctuations.

If the policy goal allows the market to absorb part of the fluctuations, say 2% of the variation in the normal output, then the reserve program regulates the variation above 2% and does not further interfere with the market. Under this assumption, the reserve level needed would be much lower than that for a 100% absorption program. A further step will be the integration of the domestic market with the rest of the world. If surplus grain is sold onto the world market during good harvests and additional supply is bought during bad harvests, the international spatial market is actually turned into an inter-temporal one, or a kind of reserve.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.18 Variations in China's grain output at provincial level 1965–1999

Region	Maximum variation (%)		Accumulated variation (million t)		Reserve capacity required (million t)
	Positive	Negative	Positive	Negative	
Beijing	17.40	−27.24	1.61	−0.67	2.29
Tianjin	43.44	−29.89	0.80	−0.98	1.79
Hebei	14.84	−15.46	6.11	−7.96	14.07
Shanxi	15.39	−18.81	2.55	−2.90	5.45
Inner Mongolia	109.77	−38.43	10.54	−12.83	23.37
Liaoning	23.33	−29.97	7.11	−6.18	13.29
Jilin	39.69	−27.89	8.71	−8.34	17.05
Helongjiang	53.47	−32.86	15.75	−19.67	35.42
Shanghai	19.49	−17.30	0.97	−1.24	2.21
Jiangsu	22.36	−15.97	15.52	−13.27	28.78
Zhejiang	28.96	−16.71	12.28	−11.12	23.40
Anhui	13.28	−24.86	8.63	−5.47	14.11
Fujian	13.56	−19.13	3.00	−3.16	6.16
Jiangxi	21.39	−12.72	5.45	−5.28	10.73
Shangdong	24.58	−12.93	7.28	−8.75	16.03
Henan	16.33	−10.98	5.62	−7.67	13.29
Hubei	13.49	−20.11	7.25	−6.96	14.21
Hunan	20.17	−14.55	13.51	−10.93	24.45
Guangxi	10.92	−11.44	4.79	−3.39	8.18
Guangdong	23.41	−19.60	5.44	−3.79	9.22
Sichuan	15.47	−13.25	11.99	−14.48	26.46
Guizhou	21.71	−22.50	3.35	−5.65	9.01
Yunnan	10.85	−12.41	2.18	−3.21	5.39
Tibet	22.72	−28.21	0.34	−0.41	0.74
Shaanxi	12.77	−19.96	3.59	−2.45	6.04
Gansu	22.27	−18.29	2.76	−2.49	5.25

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.18 (cont'd) Variations in China's grain output at provincial level 1965–1999

Region	Maximum variation (%)		Accumulated variation (million t)		Reserve capacity required (million t)
	Positive	Negative	Positive	Negative	
Qinghai	16.45	–23.74	0.23	–0.35	0.58
Ningxia	78.85	–30.83	1.27	–1.60	2.87
Xinjiang	72.50	–22.75	3.60	–2.94	6.54
Sum					346.4

Data source: China agricultural yearbook, various issues. Beijing, China Agricultural Press.

Two scenarios are simulated in this study. Scenario I assumes that the reserve regulates only when fluctuation exceeds 2% of normal output, while scenario II further assumes that the reserve regulates only half of the fluctuation exceeding the 2% level, leaving the other half to the international market. The results of the simulation are given in Table 2.19.

It can be seen from Table 2.19 that scenario I requires a maximum reserve capacity of 59.34 million t, 26 million t lower than that in the case where the reserve is to absorb 100% of output fluctuations (see Table 2.17), while scenario II requires only 29.8 million t of reserve capacity. Under this scenario, the international market functions as a reserve facility to regulate domestic supply, with lower costs to provide the same level of food security. The combined utilisation of both domestic and international markets, complementary with the government reserve program, should be considered as one of the optimal alternatives to enhance food security in terms of stabilising domestic supply.

3. Cost comparison

A rough, categorised comparison of the policy costs is provided below. First, the difference between the costs of infrastructure investment is quite significant. If the maximum level of smoothing annual grain supply is the policy goal set for the reserves, the total storage capacity should be 85 million t or 346 million t, respectively, depending on whether the reserve program is integrated at national or segmented at provincial levels. In the former case, possible additional costs are related to transportation facilities required to link spatial markets. However,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.19 Simulations of grain reserve operations (million t)

Year	Scenario I[a]		Scenario II[b]	
	Annual change	Accumulated changes	Annual change	Accumulated changes
1965	2.07	2.07	1.03	1.03
1966	11.75	13.82	5.87	6.91
1967	5.78	19.60	2.89	10.10
1968	−4.07	15.53	−2.03	8.02
1969	−11.56	3.97	−5.78	2.13
1970	1.51	5.49	0.76	2.90
1971	0	5.49	0	2.90
1972	−10.28	−4.79	−5.14	−2.29
1973	0	−4.79	0	−2.29
1974	0	−4.79	0	−2.29
1975	0	−4.79	0	−2.29
1976	−2.05	−6.83	−1.02	−3.32
1977	−15.03	−21.87	−7.52	−10.83
1978	−2.40	−24.26	−1.20	−12.02
1979	2.63	−21.64	1.31	−10.71
1980	−7.75	−29.39	−3.87	−14.57
1981	−10.35	−39.74	−5.18	−19.70
1982	0	−39.74	0	−19.70
1983	18.64	−21.10	9.32	−10.48
1984	28.88	7.78	14.44	3.78
1985	0	7.78	0	3.78
1986	0	7.78	0	3.78
1987	0	7.78	0	3.78
1988	−1.90	5.88	−0.95	2.85
1989	0	5.88	0	2.85
1990	14.69	20.57	7.35	10.06
1991	0	20.57	0	10.06
1992	0	20.57	0	10.06

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 2.19 (cont'd) Simulations of grain reserve operations (million t)

Year	Scenario I[a]		Scenario II[b]	
	Annual change	Accumulated changes	Annual change	Accumulated changes
1993	0	20.57	0	10.06
1994	−12.52	8.05	−6.26	3.94
1995	−0.41	7.65	−0.20	3.73
1996	8.66	16.31	4.33	8.06
1997	0	16.31	0	8.06
1998	0	16.31	0	8.06
1999	0	16.31	0	8.06
Maximum capacity required		59.34		29.8

[a] Scenario I assumes that no change occurs in the government grain reserve if the annual fluctuation in grain output is less than 2% of the expected one, and all excessive fluctuations will be balanced by operations of grain reserves.

[b] Scenario II assumes that all excessive fluctuations will be balanced by operations of grain reserves and international trade in equal shares.

Data source: China agricultural yearbook, various issues. Beijing, China Agricultural Press.

transportation facilities are used by all sectors for different purposes, so their costs are also shared by other economic activities. The part of the costs to be shared by grain reserves is likely to be reduced gradually, as the growth of the whole economy is much faster, and as transportation conditions improve accordingly. In the latter case, the costs of building warehouses to store an additional 261 million t of grain, as well as the costs of maintenance and depreciation associated with the storage facilities, are extra, and are much greater than the abovementioned additional costs for transportation facilities. And these costs are likely to increase, as the maximum reserve capacity is likely to increase with total grain production and supply.

Second, the difference between direct annual storage costs is likely to be huge. The day-to-day operation of the reserves requires physical storage and financial costs, and incurs losses in both quantity and quality. Altogether, such costs are likely to be as high as 20% of the grain in reserves, in value terms. Therefore, the additional operational costs for segmented reserve programs are likely to be equivalent to 52 million t

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of grain, or around 10% of annual production, or several times total annual imports. Thirdly, the difference between marketing costs is not negligible. Grain must be collected and delivered to elevators and then shipped to final warehouses to be stored as reserves, and the procedure will be later reversed. An integrated program might lead to longer shipment distances; however, the larger quantity of grain to be shipped under a segmented arrangement would incur much greater marketing costs. If the marketing costs are equivalent to 10% of the grain marketed in value terms, and the average duration in reserves is assumed to be two years, then the additional annual marketing costs would be equivalent to 13 million t of grain for programs segmented at provincial level (216 million t of extra reserves, measured in maximum capacity, divided by 2 to yield the average quantity in storage, and then increased by 10%).

4. Summary

Compared with segmented grain reserve programs, a unified, national program requires a much lower reserve level and maximum reserve capacity to ensure the same level of food security, with only one-quarter of the maximum reserve capacity needed by segmented provincial programs. Furthermore, if part of the production fluctuation, say 2% of the annual expected output, is left to the market, the maximum reserve capacity needed would be further reduced by 30%. If the international market is also utilised, regulating 50% of the output fluctuation on top of the 2%, the maximum reserve capacity needed would be further reduced by another half.

POLICY IMPLICATIONS

An optimal government reserve program requires efficient use of scarce resources. This implies minimisation of cost or maximisation of net gains in achieving the specified objective. The grain reserves discussed in this paper are used to serve the policy goals of ensuring food security, defined as smoothing significant annual fluctuations in grain supply. As such, certain policy costs are inevitable and acceptable to the public. However, it is socially and politically desirable that the costs be minimised for the same level of food security. To a certain extent, the sustainability of a reserve program depends on keeping the policy costs at an acceptable level.

Obviously, the policy cost is determined by goals. In order to pursue a food-security objective, other goals should be excluded from the reserve program. Although grain reserve could be used to moderate sharp, short-term fluctuations in market

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

price at any time when necessary, it is not recommended that this be done often. The objective of government reserves should be focused on smoothing significant inter-temporal fluctuations in market supply caused by crop failures.

It is also obvious that policy costs incurred with a grain reserve program depend on the coverage of the program. An integrated reserve program with proper use of both domestic and international markets is the most cost-efficient way to smooth inter-temporal output fluctuation and achieve the same level of food security.

The ultimate goal of a grain reserve program should be restricted to ensuring relatively stable food supply against inter-temporal fluctuations in domestic grain production and, to a lesser extent, against big fluctuations in the world market. The reserve should be operated as a unified national program and integrated with the world market. The physical operation of the reserve may be entrusted to commercial enterprises, and diversified international suppliers should be sought.

REFERENCES

Editorial Committee Various years. China agricultural yearbook. Beijing, China Agricultural Press.

— Various years. China foreign economics and trade yearbook. Beijing, China Economic Press.

— Various years. World economic yearbook. Beijing, China Economic Press.

FAO (Food and Agriculture Organization of the United Nations) 1983. Approaches to world food security. Rome, FAO.

— Various years. Production yearbook. Rome, FAO.

Lin, Z. 1996. The increasingly serious situation of world food security (shijie liangshi anquan xingshi riqu yanzhong). Reform (Gaige), 2, 32–38.

National Statistical Bureau Various years. China statistical yearbook. Beijing, China Statistical Press.

Xu, G. 1998. World grain demand and supply and China's countermeasures (shijie liangshi gongqiu xingshi yu woguo de duice). World Economy (Shijie Jingji), 3, 6–11.

Zhong, F. 1995. The impacts of stable policy and integrated market on food security in China (wending de zhengce he tongyi de shichang dui woguo liangshi anquan de yingxiang). Chinese Rural Economy (Zhongguo Nongcun Jingji) 7, 44–47.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

FURTHER READING

Carter, C.A. et al. 1996. China's ongoing agricultural reform. San Francisco, The 1990 Institute.

Casley, D.J. et al. 1984. Instability of production and its impact on stock requirements. Rome, FAO Monthly Bulletin of Agricultural Economics and Statistics.

Crosson, P. and Anderson, J.R. 1992. Resources and global food prospects: supply and demand for cereals to 2030. Washington, DC, World Bank Technical Paper 184.

Eaton, D.J. 1980. A system analysis of grain reserves. Washington, DC, US Department of Agriculture.

FAO (Food and Agriculture Organization of the United Nations) 1993. Agriculture towards 2010. Rome, FAO.

FAO (Food and Agriculture Organization of the United Nations)/WHO (World Health Organization) 1992. Nutrition and development: a global assessment. Rome, FAO.

Hazell, P., ed. 1986. Summary proceedings of a workshop on cereal yield variability. Washington, DC, International Food Policy Research Institute.

Islam, N., ed. 1995. Population and food in the early twenty-first century: meeting future food demand of an increasing population. Washington, DC, International Food Policy Research Institute 2020 Vision.

Mitchell, D. and Ingco, M. 1993. The world food outlook. Washington, DC, World Bank.

Valdes, A., ed. 1981. Food security for developing countries. Boulder, Colorado, Westview Press.

World Bank 1999. Global commodity markets. Washington, DC, World Bank.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2.4 INTERNATIONAL EXPERIENCES IN GRAIN-RESERVE MANAGEMENT POLICIES:

LESSONS FOR CHINA

Ed Tyrchniewicz
University of Manitoba, Winnipeg, Manitoba, Canada

INTRODUCTION AND CONTEXT

Understanding the evolution of the 'geopolitics' of food security in China is a precondition to making meaningful recommendations on lessons from other countries. The core of China's food-security policy objective appears to have been maintenance of a stable grain supply at relatively low and stable prices in urban areas rather than a focus on poor rural areas. This has been done through a system of policies and institutions relating to grain marketing, government-held grain reserves and grain self-sufficiency targets at national, provincial and local levels.

Part of the lingering geopolitics of basic food supply (in terms of calories from grain) can be traced back to the 1949 revolution. Mao took over a starving nation. Political stability required stability in the food supply, including regional considerations, in an era of poor communications and transportation. Regional food shortages are often the seeds of revolution. Furthermore, isolation from the rest of the world required a home-grown food supply. The policy response was a target of 95% local and regional food-grain self-sufficiency. This became part of the ideology and remnants of it remain in some political circles.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The current situation is best summarised as follows. Although some aspects of the grain-reserve management system have improved in the past several years, it is still one of the weakest and least-understood parts of China's food security program. In many ways, despite the reforms, it is dysfunctional. The rules for management and release are unclear. There is confusion among the different holders of grain. The lack of transparency creates chaos in grain markets and contributes to greater variability in grain prices. Because no-one knows the level of stocks or the quantities of planned (or actual) release, domestic producers and traders and international trading agencies cannot make decisions based on full information. Rules for purchases and sales need to be open; public information on markets can internalise all of the factors that will affect short- and long-run price expectations which, in turn, will affect production and storage and sales decisions.

Even a cursory review of grain marketing and food-security issues in China and how these are dealt with in other countries suggests that there are no ready-made solutions to be found elsewhere. This paper attempts to identify some dimensions of other countries' approaches that may be relevant to a 'made in China' approach to grain-reserve management. It should be noted that grain-reserve management and food-security issues are part of a larger set of economic development and poverty-reduction issues, as well as reflecting changing roles of government and implementing agencies. Of necessity, not all of these dimensions can be fully explained (or understood!) in the review that follows. This paper focuses on circumstances in Asian countries, with only brief opening comments on the situation in exporting countries and Africa. It concludes with some general observations and recommendations.

EXPERIENCES IN OTHER COUNTRIES AND REGIONS

Exporting countries: North America, Australia and the European Union

The focus of most exporting countries' grain policies is on farm-income stabilisation and support, coupled with the objective of marketing surplus grain production through various export-enhancement schemes. Furthermore, the United States and the European Union do not view state-trading enterprises (STEs), such as the Canadian Wheat Board, with favour in the context of World Trade Organization

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

(WTO) rules. This is especially true with the recent (July 2004) framework agreement for WTO negotiations in agriculture. Consequently, there isn't much to be drawn upon from grain-exporting countries' experience that would be relevant to China's grain-reserve management policies.

Africa

The situation in most African countries is not comparable to China's problem, in that the policy instrument for dealing with unstable domestic grain supplies tends to be foreign food-aid. This is a highly improbable policy option for China. Also, for the foreseeable future at least, the prospects for most African countries of achieving food-grain self-sufficiency to the degree that exists in China are not promising.

Asia

Indonesia

This section is a synthesis of information drawn from Bappenas (2001), Barichello (2000) and Suryana and Erwidido (1996). In Indonesia, the state trading enterprise Badan Urusan Logistik (BULOG) has played a pivotal role in the country's approach to managing grain reserves. More than 30 years ago, BULOG essentially was given the power to import and export a variety of agricultural products, including rice and wheat, with the general objective of stabilising prices. Initially, BULOG's objectives with respect to rice were to provide monthly rice rations to certain 'budget groups' and to stabilise rice prices. The initial emphasis was on ration provision, but this shifted to price stabilisation. Within price stabilisation, the priorities have shifted from maintaining a ceiling price for consumers towards maintaining a floor price for rice producers.

From an operational standpoint, BULOG set a price band within which domestic prices were maintained, often without regard to world prices of rice. The price floor was set to ensure that the real price of unmilled rice did not fall below approximately US$250 per tonne (in 1985). The ceiling price was set on the basis of domestic inflation targets and sufficiently above the floor price to encourage the private sector to hold rice stocks between harvests. Within a season, the domestic market was effectively closed, and storage and variable quotas were used to keep prices within the price band. When prices threatened to fall below the floor price, BULOG would raise prices by buying and storing rice. If stocks became too large, or

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

if storage facilities were in short supply, BULOG would export rice. When domestic prices threatened to rise above the ceiling price, BULOG would release rice from storage or import rice from world markets to augment domestic supplies and hold down prices.

Although largely successful in stabilising domestic rice prices, as well as tracking world rice prices, the price-stabilisation program was very expensive in budgetary terms, because large subsidies had to be provided to BULOG to maintain large stocks, and to subsidise exports and imports. Successful stabilisation of rice prices enhanced the profitability of growing rice and biased farmers' decision-making towards rice. This discouraged diversification into higher-value crops and livestock. It also discouraged off-farm employment and migration out of agriculture. For a variety of reasons, including the financial crisis of 1997 and an unstable political and macro-economic environment, rice policy in Indonesia created an unbalanced and inconsistent set of programs for both producers and consumers (Bappenas 2001). A National Rice Policy Team was set up in 2001 to formulate a new rice policy approach. One of the recommendations from the team was that at least 90% of domestic rice consumption should come from domestic production—an objective that would be achievable most years. This is a useful reminder that rice from international markets can (and should) play a crucial role in a country's food-security strategy.

Malaysia

This section draws heavily on Wong (2004). Malaysia provides an excellent example of one of the few national food-grain agencies in Asia that has been commercialised. This commercialisation began in the mid 1960s and was stepped up in the early 1970s, coinciding with the advent of double-cropping brought on by irrigation development projects and the international rice-market crisis. The major privatisation drive occurred in the early 1990s, and was prompted by rapid trade liberalisation and government privatisation policy.

A key element of Malaysia's food-security strategy is a continuing policy of targeting a self-sufficiency ratio of 65%. This clearly signals that Malaysia will be a net importer of rice. Besides managing the grain supply, government has also intervened in increasing local rice production and promoting growth in the rice industry. These interventions include the implementation of a guaranteed minimum price, the establishment of the National Paddy and Rice Authority (Lembaga Padi dan Beras Negara, LPN), and promoting and developing local paddy farmers and

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

rice millers through various social schemes. The government also maintains a rice stockpile to ensure that the country has a sufficient supply of rice at all times. LPN was dissolved in June 1994 and the Ministry of Agriculture assumed the regulatory functions, while the commercial activities were taken over by Padiberas Nasional Berhad (BERNAS). BERNAS was expected to operate strictly as a business, but was required also to carry out certain duties and responsibilities on behalf of the government. These included: ensuring a sufficient supply of rice at a fair and stable price while maintaining rice quality and standards; the management of the national rice stockpile; the disbursement of paddy subsidy payments; and the procurement of paddy from farmers as the buyer of last resort. BERNAS was privatised in 1996 because of its continuing lacklustre performance and the need to address the basic weaknesses and deficiencies of its operations, namely excess staff, non-business-oriented personnel, lack of research and development initiatives, and continuous losses from local rice production.

India

Although there appears to be a strongly held view among Chinese colleagues that 'India is different' and that nothing can be learned from that country, we have chosen to comment briefly on the Indian approach to food security, given that India has a very large population, an evolving set of agricultural policies and a huge food-security issue.

There are three main forms of intervention by the Government of India in the food-grain system: the procurement of food grains from farmers, storage and management of stocks of grain, and food-grain delivery to different parts of the country through the Public Distribution System (PDS) and other welfare programs (Swaminathan 2003). In response to severe crop failures and subsequent food shortages in the mid 1960s, the Indian Government established the Agricultural Prices Commission to design a policy of support prices for agricultural crops. The Food Corporation of India (FCI) was set up to implement procurement policies as well as handle the storage, transport, and distribution of food grain. At the same time, the PDS was expanded from selected food-deficit regions to become a universal welfare program under which all households were entitled to buy specific quantities of selected commodities (including wheat and rice) through a network of fair-price shops.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Although a detailed assessment of India's food-security system is beyond the scope of this paper, some observations can be made (Mitra 2003). There have been successes, including the doubling of domestic food-grain production during the period 1975 to 2001 and a rise in the level of buffer stocks; indeed, during the 1990s, India actually exported food grains, albeit in very small quantities. Admittedly, this was happening during the green revolution, so it would be fallacious to attribute all of the growth in domestic production to the price-support policies. It would appear that the FCI and the PDS were reasonably successful in transferring grain from regions of surplus production to those where there were food deficits. Also, through buffer stocks, open market operations, and distribution through the PDS, variations in domestic prices were less than international price fluctuations. Regional and seasonal variations in price have also diminished over time. An important feature of the Indian system is that, while the supply of grain and associated subsidies are provided by the central government, actual implementation is the responsibility of state governments. Not surprisingly, the performance has varied significantly among states. Corruption and bad administration have led to large 'leakages' in certain regions. This, plus the high costs and the distortions in market functioning, have led to increased pressures to dismantle the system, or at least change it. Incompatibility with the requirements of the WTO on the matter of eligible subsidies has added to the pressures for reform.

By the late 1990s, India found itself in an anomalous situation where the central government (along with state agencies) had accumulated stocks of around 65 million tonnes of rice and wheat. This was about 40 million tonnes above the buffer requirements. [It should be noted that the poor growing season in 2002–03 has reduced stocks considerably.] At the same time, chronic food insecurity and undernourishment plagued millions of Indians, and agricultural prices had fallen dramatically. The FCI was under increasing attack for being too costly and inefficient. This led to the establishment of a High Level Committee on Long Term Grain Policy whose task was to examine all major aspects of grain policy, including procurement and price support to production, storage and distribution. The committee reported in 2002 with a wide-ranging set of recommendations. Some of these relate specifically to the FCI and may be insightful for the Chinese situation. The committee felt that the FCI had performed its core functions reasonably well and that it should remain in existence but should change the way it does business. A specific recommendation was that state agencies and private traders should play a greater role in the management and operation of the grain system. National-level legislation should

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

remain in place to regulate the operation of state agencies and the private sector to ensure some consistency throughout the country. The committee did not support the complete privatisation of the FCI, because it felt that this would seriously erode its ability to provide price stabilisation on a national level. It would be useful for Chinese authorities to maintain a watching brief on how India proceeds with its reform of food-grain security.

Japan

The Japanese experience has little similarity to the situation that China faces in the management of its grain reserves. It does illustrate very graphically, however, the complex and costly situation that can arise when food self-sufficiency for political and cultural purposes is masked as food security. Just after World War II, the principal objectives of Japanese agricultural policy were to provide staple food supplies through the implementation of the 1942 *Food Control Law*, and to alleviate hunger, to carry out national land reform, and to create employment opportunities, as well as to democratise rural society (Meyerson 2000). As the Japanese economy grew, the government continued to support farmers' incomes, attempted to preserve Japan's self-sufficiency in consumer commodities such as rice, but came to rely heavily on foreign sources for many agricultural products. One of the foundations of the one-party dominance that emerged during the 1960s under the Liberal Democratic Party (LDP) was a rice-price policy that adhered to self-sufficiency in rice, virtually forbade rice imports, and supported the income of farm households to such an extent that the government's purchase price for rice rose to several times the world price. During the late 1970s to the mid 1980s, efforts were made to create a system of full-time commercial farming that would more closely match domestic production with consumption. At the same time, partially as a result of pressure for access to Japanese markets by the United States and other countries, gradual structural adjustments occurred, such as the beginning of the liberalisation of imports of beef and oranges.

In Japan, food security is often used as a major rationale for high levels of agricultural support. In reality, Japan has the wealth and ability to ensure its food-security needs through food imports to supplement domestic production. When there is a desire, politically and culturally, to protect agriculture, it is sometimes convenient to confuse self-sufficiency with food security (Bull and Roberts 2001). Japan's pricing policies have resulted in chronic overproduction of rice. This led to rising govern-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ment stocks, and measures such as exporting into world markets or using it for feed. These measures proved to be very expensive and generated opposition from countries whose exports of rice or feed grains were hurt by Japan's actions. Although Japan has consistently resisted rice imports, it agreed to an import quota of almost 700,000 tonnes annually as part of the 1995 Uruguay Round of global trade negotiations. Most of this rice is not released directly into Japan's domestic market. Rather, imported rice often remains in government stocks until it is released as food aid to developing countries or sold as an input to food processors (Fukuda et al. 2003). The Japanese Government has also emphasised the 'multifunctionality' of domestic rice production, namely that rice cultivation is environmentally and aesthetically more beneficial than non-agricultural uses of land.

OBSERVATIONS AND CONCLUSIONS

It should be noted that grain-reserve management and food-security issues are part of a larger set of economic development and poverty-reduction issues, as well as reflecting changing roles of government and implementing agencies. Making policy recommendations for grain-reserve management in isolation is not likely to lead to useful results. However, it can be concluded that reforming grain marketing and food-security systems is very difficult, even in developed 'market' economies. China's food-security objectives, and the role of grain reserves in meeting those objectives, need to be clearly identified.

Constraints to a transition to more market-oriented policies for managing grain reserves include:

- financial — inadequate budget resources to fund either consumer or producer programs at levels that would have a significant impact
- strategic — terms of reference of implementing agencies are often internally contradictory and directly in opposition to basic market forces
- institutional — implementing agencies often have inadequate capacity and institutional incentives to fulfil their terms of reference.

The use of state trading enterprises similar to the Canadian Wheat Board and BULOG, are unlikely to be a viable policy instrument, given the opposition to them in the WTO context. Zhong and Zhu (2002) reviewed the literature on buffer stocks

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in India, Indonesia, the Philippines and Bangladesh and concluded that domestically owned buffer stocks are the costliest way of achieving price stability. More cost-effective policy instruments for price stability include open-market sales and imports.

The challenges to developing policies for managing grain reserves for food security in China are many and complex, and some are listed below. Lessons from other countries should be applied where appropriate.

- What, and how much, should be the grain reserve target? This needs to take account of international comparative advantages in grain production, policies on imports, the source of feed for animals, and quantity versus quality considerations. China, given its range of soils, climates and north–south geographic coverage (temperate to tropical), has among the most-stable grain production capabilities anywhere in the world. This suggests that the target can be quite low and still ensure supply security. It should be noted that over one-third of China's grain output is used for animal feed.
- Where should the reserves be located/controlled — national, provincial or local level? This needs to take account of regional comparative advantages in grain production, as well as adequacy of storage and transport infrastructure. In general, transportation and communications capability are improving, suggesting that dispersed storage is probably less important.
- What should be the role of privately held commercial stocks and the private sector in meeting food-security objectives? There are considerable holdings of private stocks in individual households now. The private grain trade is developing, but until government grain reserve systems are rationalised, its development will be hampered.
- What is the cost-effectiveness of various grain marketing and grain-reserve management options as they might be applied in China? Analyses conducted by the Center for Chinese Agricultural Policy and Nanjing Agricultural University indicate that, with a national rather than regional grain-reserve system and judicious use of the international market, the size and cost of the grain reserve could be quite low and still provide for a high level of food-grain security.
- What are the environmental implications and costs of various grain-marketing and grain-reserve management options? Elimination of regional self-sufficiency targets, as has already been done in some regions, would support environmental

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

objectives. Options are available for China to simultaneously achieve its food-grain security goals at lower costs and reduce environmental costs associated with land and water management.

- Finally, how politically palatable is reform of the grain-marketing and grain-reserve systems? What is the process of transition? Without political will the grain-marketing and grain-reserve systems will not change as recommended or as suggested by experiences of others.

REFERENCES

Bappenas (National Development Planning Board, Indonesia) 2001. Reformulating national rice policy. Washington, DC, Bappenas/USAID Food Policy Advisory Team, Policy Brief No. 10.

Barichello, R. 2000. Evaluating government policy for food security: Indonesia. IAAE workshop on food security, Berlin.

Bull, T. and Roberts, I. 2001. Agricultural trade policies in Japan—the need for reform. Canberra, Australian Bureau of Agricultural and Resource Economics, Research Report 01.5.

Fukuda, H., Dyck, J. and Stout, J. 2003. Rice sector policies in Japan. Washington, DC, ERS/USDA, RCS 0303-01.

Meyerson, C. 2000. Domestic politics and international relations in trade policymaking: the United States and Japan in the GATT Uruguay Round agriculture negotiations. International Studies Association Annual Meeting, Los Angeles.

Mitra, S. 2003. Food security concerns in India as buffer stocks plummet. New Delhi, Government of India, Department of Food and Public Distribution, Foodgrains Bulletin.

Suryana, A. and Erwidido 1996. Agricultural policy reforms in Indonesia: accelerating growth with equity. Bogor, Indonesia, Food and Fertilizer Technology Center.

Swaminathan, M. 2003. Liberalization and policies of food security: the Indian experience. Addis Ababa, meeting of the Ethiopian Economic Association.

Wong, L.C.Y. 2004. Foodgrain marketing reform in Malaysia: the BERNAS experience. Beijing, CCICED, paper presented at the 2nd Expert Meeting of the Agriculture and Rural Development Task Force.

Zhong, F. and Zhu, J. 2002. Food security and optimization of grain reserves in China. Nanjing Agricultural University, unpublished report.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 3

A BETTER MARKETING ENVIRONMENT FOR DEVELOPMENT: INTERNATIONAL MARKETS

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

3.1 TRADE LIBERALISATION

CCICED ARD Task Force members

China has promoted international trade aggressively in the past two decades. At one time in the early 1980s, China was one of the most isolated nations in the world, with high rates of protection. Since then, leaders have reduced tariffs, removed licensing requirements, reduced the role of state trading and allowed thousands of enterprises to engage in import and export of most goods. In doing so, China has become a more open place. For example, average tariffs fell from more than 50% in 1991 to around 20% by the end of the 1990s. During this period, the total value of China's agricultural trade grew by about 6% annually and the growth of agricultural exports has exceeded that of imports.

Although there are concerns about the impact of an increasingly open economy on some groups of China's producers, there are many reasons to believe that the nation will benefit by carrying out its trade liberalisation plan. Workers gain access to employment; consumers benefit from lower prices; all producers benefit from lower fertiliser prices. If trade liberalisation leads to greater exports, farmers can benefit from higher prices.

In assessing China's current trade policy, we examined two sets of issues:

1. What will be the effect of the nation's accession to the World Trade Organization (WTO) and the extent of its participation in future trade liberalisation talks?
2. How will trade affect the poor?

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHINA AND THE WTO: NOW AND IN THE FUTURE

While it is well-established that the economy as a whole benefits from accession to the WTO, the case of agriculture is somewhat mixed. Producers of rice, most vegetables and fruits, many livestock and aquatic products and other higher-value, labour-intensive goods will benefit if trade liberalisation leads to higher exports. While producers of barley, soybean and other edible oils were hurt by liberalisation during the 1990s, most of the fall in the prices of these commodities had already taken place before recent trade reforms, so the agreement will have little effect. Predominantly maize, cotton and wheat farmers will be adversely affected, but because most farmers are diversified and are able to change product mix when relative prices change, the overall cost will be small. The only groups that are likely to be adversely impacted are a subset of poor, inland farmers.

To get the most out of its trade policy, China needs to make complementary policy changes. Chief among these is to allow farmers to have access to the lowest-priced and most-productive inputs and technologies from inside or outside China. The WTO agreement challenges China's farmers with competition in output markets from producers in the rest of the world. To compete, farmers need to have access to the same low-cost inputs and high-quality technologies. There are many restrictions keeping seeds and other inputs from moving around the country. Also, there are barriers against the importation of inputs and technologies or investment by foreign technology firms. These should be sharply reduced and eventually eliminated in order to improve the income of farm households. According to international experience, the entry of foreign seed and technology firms into the country could lead to more competition and better transfer of technology.

Assessing China's position toward future trade talks—two years after WTO accession

While most of the facts on the accession to the WTO are well known, China faces another set of issues in thinking about how it should move forward in the next round of international trade talks. While there will always be uncertainty, research by economists inside and outside China is producing many ideas with broad consensus.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- **Doha talks.** On the three 'pillars' of WTO agriculture negotiations now under way—market access, reducing export subsidies, and reducing domestic supports—China's interests lie in a robust liberalising outcome to negotiations.
- **Proponent of reform.** China is already bound by commitments that put it ahead of other countries in terms of openness, and neither a collapse of talks nor a modest outcome will put it on a more even footing—only an ambitious reform outcome will do that.
- **New analytical capacity.** China's analytical capabilities in agriculture policy making have increased significantly in recent years. Although still far behind many nations, including some developing ones, for the first time China has the expertise to make quantitatively derived choices about the best directions for its welfare. Chinese leaders know what is good for the country and can pursue policy choices with new confidence as a result.
- **Comparative advantage.** China's agriculture is evolving in the direction of national comparative advantage, in terms of sown area, investment in R&D and exports. China is shifting towards labour-intensive, high-value-added production, instead of the land-intensive crops it emphasised in the past and where it has less comparative advantage.
- **WTO has not been a killer of the rural economy.** The net negative impact on China's agriculture that some expected has not occurred; China's agriculture is doing well post-WTO accession.
- **Foreign market access.** China is increasingly concerned about market access problems abroad, as its competitive exporters bump into tariff and non-tariff barriers.
- **Free-trade agreements.** In regional free-trade agreements, China is showing its readiness for early and aggressive agricultural trade liberalisation, more so than almost all other developing countries, especially in the Asia–Pacific region.
- **Domestic adjustment.** Like all economies, China must address concentrated economic pain from structural adjustment at home if it is to push further reform; but China has sufficient WTO-consistent means to do so while remaining a good international player.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- **Alternatives to farm employment.** Rural development is benefiting from strong industrial and tertiary services sector growth, gradually reducing the urgency of sustaining millions of farmers through agricultural supports.
- **Disputes manageable.** A number of residual non-WTO-compliant practices in China fuel disputes with trading partners; but the list of such problems, while more transparent and reported today, is shrinking relative to the volume of agriculture trade that is trouble-free. If China can continue to improve in managing ongoing trade problems, it could gain in credibility, which will allow it to be a positive player in future trade-reform efforts.

TRADE AND POVERTY

In the same way that the forces of development have generated progress and problems, the nation's efforts at pushing ambitious market-liberalisation policies have had both positive and negative consequences. Although the nation's accession to WTO will help rural residents and improve incomes generally, with competitive markets that extend to most parts of China, the effects of trade liberalisation—both those that raise and lower domestic prices—will be transmitted throughout the economy and could hurt subsets of households.

Unfortunately, until recently, researchers rarely tried to analyse how different types of households in different regions of China have been affected. Specifically, there has been almost no research to measure the effects of trade liberalisation on a commodity-by-commodity basis. Likewise, few researchers have tried to assess the effects of trade-policy changes on different types of households in different regions of the country. Without this type of analysis, it is difficult to assess household impacts. However, according to a new analysis by the task force that does trace trade effects to specific groups of farmers, the subset of all farmers that gets hurt from trade liberalisation is small, and is quite specific. In particular, *poor* maize, cotton and wheat-producing areas in the central and western parts of the nation are the ones that have suffered the most.

Several factors are responsible for these adverse effects. First, households in these poor areas—due to lower social capital—are less likely to be diversified into the off-farm sector. Thus, while richer households are able to offset the loss from trade liberalisation with gains from their participation in the off-farm sector, some poorer

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

households are less able to do so (although the rise in migration is making this less of an issue). Second, it is often farmers in poor areas who grow the crops that are uncompetitive—maize, cotton and wheat. They are less likely to be in sectors in which China has a comparative advantage—e.g. horticulture and aquaculture. Finally, because farmers in poorer areas have less physical and human capital (including less access to credit) than those in richer areas, they often have difficulties in shifting from the agricultural commodities that are hurt by trade liberalisation into those that benefit.

According to China's own estimates, the annual loss to these households (which are the most vulnerable of all households) due to WTO accession is small. Research shows that the overall impact on the poorest of the poor averages only about RMB50 per household. A policy that compensated such households by RMB50 per year for the first several years after WTO (e.g. through a policy that eliminated tuition and school fees for households in these areas or paid the premium of rural-health policies) would offset the negative consequences. Therefore, given so small an impact on so small a part of China's rural sector, there are no grounds for slowing trade liberalisation based on the negative impacts of increased international trade. The negative effects are far outweighed by the positive ones.

There are some actions, however, that policy makers can take. For example, they need to try to encourage farmers in poorer, inland areas to shift their production (where appropriate) to more-competitive crops. This can be done with well-targeted investments and training programs. Investments should emphasise productivity-enhancing activities. Market information should be provided and farmers should make their own decisions. Officials may need to take other, non-trade actions to improve the livelihood of farmers in these areas. In many areas, farmers do not have an advantage in any farming activity. In such areas, rural education, better communications and other policies that might facilitate their shift into the non-farm sector may be the most beneficial policy.

FUTURE DIRECTIONS AND POLICY IMPLICATIONS

This summary of trends in China's agriculture sector after the nation's accession to the WTO does not dispute that China faces massive challenges in the agriculture sector. While overall welfare has improved in all income deciles, important local

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

dislocations exist due to domestic adjustment and opening to foreign competition. China's system of agriculture-sector financial support and adjustment is primitive and in need of dramatic improvement. The private and public financial infrastructure to permit capital upgrading and rationalisation in the agriculture sector is not in place, thus constraining growth and adjustment. Vested interests, especially in niches in production or distribution still heavily influenced by state entities, cannot be properly contested due to the lack of political liberalisation needed to encourage competitive interest group politics.

But despite these problems, the direction of change in China's agriculture is manifestly towards reform, structural adjustment and economic rationalisation. China is closer to the end-point of that process than generally recognised, and shows a deep, probably irreversible, commitment to the process. China can point to demonstrated successes in raising incomes, overall welfare and productivity to justify (to itself) the pain of further adjustment, and has the policy skills to manage (if not minimise) adjustment costs.

In manufacturing, China did not need to 'make rules' in the international system to enjoy its comparative advantage as a factory to the world; it merely 'took rules' and adapted its domestic economy in such a way to profit from them. In agriculture the situation is different. Having moved well ahead of requirements in its commitments to join the WTO in 2001, it stands more liberal than other countries—especially many developing countries—on the major agriculture policy fronts. A collapse of WTO efforts to accelerate liberalisation for developed and developing countries—that is, the status quo—will leave China out on its own and fail to meet its interests. A diluted WTO outcome with modest reduction in protection by developed economies (the biggest distorters) and weak new commitments by developing countries would do little more for China than no agreement at all. Only a robust agriculture trade liberalisation agreement would allow China to actualise its agricultural comparative advantage in the same way that its manufacturing industries have benefited.

That outcome is not the default case for current WTO talks on agriculture. Privileges secured by developed economies and exceptions to WTO disciplines for many developing economies (exceptions which China has already largely foregone) are likely to be sustained. To avoid that scenario, China needs to get actively involved in WTO talks not as a follower or taker of rules, but as a proponent of reform.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

While new to the WTO, China has leverage usable for such an endeavour. China can concede still further liberalisation, for example by reducing subsidy ceilings or opening trade in commodities for which it has no advantage (e.g. sugar, dairy or wool) as a contribution. It can further increase the size of its tariff rate quotas on some of its major commodities (e.g. maize, wheat and rice). China can remind WTO members eager to sell it Airbuses, BMWs, GE power plants and Toshiba laptops that it has comparative advantage in higher-value-added, labour-intensive agriculture, and that this should be taken into account.

In short, China needs to be bold during the next round of the trade talks. It is in its interest to play an active role. It needs to press other nations to reduce barriers. It needs to stand with other developing countries to put pressure on developed countries to drop the excessive levels of subsidies that are distorting international trade. In pursuit of its interests and in a leadership role in the talks, it should press for developing countries to open their markets, using their own nation as an example.

Problems will occur because of new trade reforms. Some may suffer from increased openness. China needs to take actions to minimise the effects—on both the poor (discussed above) and on the environment (discussed in another brief).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

3.2 IMPACTS OF TRADE LIBERALISATION ON AGRICULTURE AND POVERTY IN CHINA

Jikun Huang and Zhigang Xu
China Center for Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

Ninghui Li
China Center for Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

INTRODUCTION

China's economy has experienced remarkable growth since the economic reform was initiated in the late 1970s. This has led to significant decline in the nation's poverty. The annual growth rate of gross domestic product (GDP) was nearly 9% in 1979–2003 (NSBC 2003a). In the past two and half decades, based on China's official poverty line, more than 230 million Chinese rural residents have escaped poverty, and the absolute level of poverty has fallen from 260 million people in 1978 to fewer than 30 million in 2002 (NSBC 2003b). The incidence of rural poverty has fallen equally fast, plunging from 32.9% in 1978 to less than 3% in 2002.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

While economic growth and reduction of rural poverty in the past are impressive, there are still great challenges ahead. Agricultural growth rate has declined since the late 1980s. High input levels in many areas of China, and diminishing marginal returns, mean that increasing inputs will not provide large increases in output. Water shortages and increasing competition from industry and domestic use do not provide much hope for large gains in area and yield from irrigation expansion. In the future, many have predicted that almost all gains will have to come from new technologies that could significantly improve agricultural productivity (Huang et al. 2002).

The economic growth is accompanied by large income disparities. The income gap among regions, between urban and rural, and among households within the same location has been continually increasing since the mid 1980s (Rozelle 1996). The rural-to-urban income ratio exceeded 3.4 in 2002 (NSBC 2003a). Income disparities have risen in rural areas. The rising income disparity in rural areas is indicated by rising Gini coefficients. The coefficient rose from 0.24 in 1980 to 0.35 in 2000 and 0.32 in 2001 (NSBC 2003b).

Trade liberalisation further challenges China's agricultural and rural economy. Agriculture has been at the centre of discussion of China's entry into the World Trade Organization (WTO), due in part to the vulnerability of parts of the rural economy and in part to the importance of agriculture in the political economy of a number of developed nations with which China negotiated its accession to WTO. However, debates on the future of China's agriculture continue. Some argue that the impact of WTO accession on China's agriculture will be substantial, adversely affecting hundreds of millions of farmers (Li et al. 1999; Carter and Estrin 2001). Others believe that, although some impacts will be negative and even severe in specific areas, the overall effect of accession on agriculture will be modest (Martin 2002; Anderson et al. 2004). In part, the confusion about the ultimate impact of WTO accession on agriculture can be traced to a general lack of understanding of the policy changes that accession will engender (Huang et al. 2004). Perhaps to a greater degree, the lack of clarity of the debate can be traced to a lack of understanding of the fundamentals of the distortions to China's economy on the eve of its WTO entry.

Although China's joining the WTO may have significant implications for world trade and China's economy, little empirical work has sought to answer basic questions about the expected effects of China's entry on the poor. In our previous work (Huang et al. 2003), we showed that, on balance, the nation's accession to WTO helps rural

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

residents and improves incomes. Despite our earlier impact studies, which were conducted for 11 rural income groups of farmers in 3 regions (western, central and eastern China), the analyses are still too aggregated, as farmers and agricultural production differ significantly among provinces within the same region.

The overall goals of this paper are to develop a better understanding of China's agriculture and examine the impacts of trade liberalisation on China's agriculture and poverty. While this study focuses on agriculture, it does not mean that the effects on other sectors are not important. Indeed, several recent studies (Wang 2003; Anderson et al., 2004; Ianchovichina and Martin 2004) have shown that the impacts of trade liberalisation on the rest of the economy are substantial. In this study, the impacts on agriculture are analysed by commodity. Because different provinces and different farmers in the same province produce diverse commodities, we analyse the effects on households—and their implications for poverty—through simulation of household production and consumption changes in response to market price changes.

The paper is organised as follows. In the next, second section, we briefly give an overview of China's trade liberalisation. China's WTO accession and future trade liberalisation are described in the third section. The fourth section describes the methodologies and data used in this study. The results on the impacts of trade liberalisation on China's agriculture and poverty in China's post-WTO era are presented in sections 5 and 6. In the final section we draw some conclusions.

FOREIGN TRADE LIBERALISATION BEFORE CHINA'S WTO ACCESSION

1. Foreign exchange policy

China's open-door policy contributed to the rapid growth of its external economy. The expansion of the external economy has become one of the major driving forces of China's economic growth. The growth of trade also results in greater reliance on both domestic and international trade to meet consumer demand. Historically, the overvaluation of domestic currency for trade protection reduced agricultural incentives. Real exchange rates remained constant and even appreciated during the 30 years before reforms. Tradable commodities in the agricultural sector encountered a high level of state intervention (Huang and Chen 1999). After reform, however, the

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

exchange rate depreciated rapidly, with the exception of several years of domestic price inflation during the mid 1980s. From 1978 to 1992, the real exchange rate depreciated 400%. Falling exchange rates increased export competitiveness and have contributed to China's phenomenal record in growth of exports of non-grain food products and the spectacular national economic performance of the 1980s.

The situation, however, has changed since the early 1990s. From 1992 to 1997, the real exchange rate appreciated by about 30%. Moreover, the pressure to appreciate the RMB (or Chinese yuan) from the major trade partners, particularly the USA, is growing. The Chinese Government, however, has insisted on maintaining its current exchange-rate policies, as the national leaders consider that a stabilised foreign exchange rate is a key to national economic stabilisation. Meanwhile, China has been accelerating the reform of foreign-exchange management through further liberalisation of foreign-exchange demand and supply and is considering gradually eliminating export tax rebates in order to avoid sharp increases in its foreign-exchange reserve.

2. Liberalising international trade

Changes in the exchange-rate system occurred at the same time that China also began to liberalise its international trading system. In the initial years, most of the fall in protection came from a reduction in the commodities that were controlled by single-desk, state traders (Huang and Chen 1999). For many products, competition among non-state foreign-trade corporations began to stimulate imports and exports (Martin 2002). Although several major agricultural commodities were not included in the move to decentralise trade, the moves spurred the export of many agricultural goods. In addition, policy shifts in the 1980s and 1990s also changed the behaviour of state traders. Leaders allowed the state traders to increase imports in the 1980s and 1990s.

Maize and cotton are two major commodities in which liberalisation had been minimal. For example, China used export subsidies in the years before its WTO accession to increase exports of maize and cotton. By providing exporters with payments to encourage the export of maize, leaders had increased the protection of domestic producers by raising the price of domestic commodities. In field interviews during 2001, we found that maize and cotton exporters received subsidies that averaged 34% and 10%, respectively, of their export prices. However, China eliminated export subsidies for cotton in 2002 and those for maize in early 2004.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Moves to relax rights of access to import and export markets were matched by actions to reduce the taxes that were being assessed at the border. After the fall of restrictions on imports and exports of many of China's agricultural commodities, a new effort began in the early 1990s to reduce the level of formal protection. The simple, average agricultural import tariff fell from 42.2% in 1992 to 23.6% in 1998 and 21% in 2001 (MOFTEC 2002).

3. Impacts on trade

In the same way that trade liberalisation has affected growth in the domestic economy (Lardy 2001), changes in the external economy have affected the nature of China's trade patterns (Huang and Chen 1999). Whereas the share of primary (mainly agricultural) products in total exports was over 50% in 1980, it fell to only 10% in 2002 (NSBC 2003a). Over the same period, the share of food exports in total exports fell from 17 to 5%, and the share of food imports from 15 to 2%.

Disaggregated, crop-specific trade trends show equally sharp shifts and suggest that exports and imports increasingly are moving towards products in which China has a comparative advantage and therefore have also facilitated structural changes in its agriculture (Anderson et al. 2004). Net exports of land-intensive bulk commodities such as grains, oilseeds and sugar crops have fallen; exports of higher-valued, more labour-intensive products, such as horticultural and animal (including aquaculture) products, have risen. The proportion of grain exports, which was around only 20% of total agricultural exports in the 1990s, is less than half of what it was in the early 1980s. By the late 1990s, horticultural products and animal and aquatic products accounted for about 80% of agricultural exports (Huang and Chen 1999). These trends are even more evident when the trade data are grouped on the basis of factor intensity, as in Figure 3.1. Figure 3.1 also shows that trade liberalisation has improved resource allocation and increased China's net agricultural exports.

4. Nominal protection rates

Nominal protection rate (NPR) is defined as the percentage difference between the price at domestic market and the price at board for the same commodity. NPRs for each commodity were estimated in 2001 when China joined the WTO. For those commodities that either they simultaneously import and export significantly or for which the differences in imports and exports was not large in past decades, we estimated NPRs based on both cost, insurance and freight (CIF) (imported

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

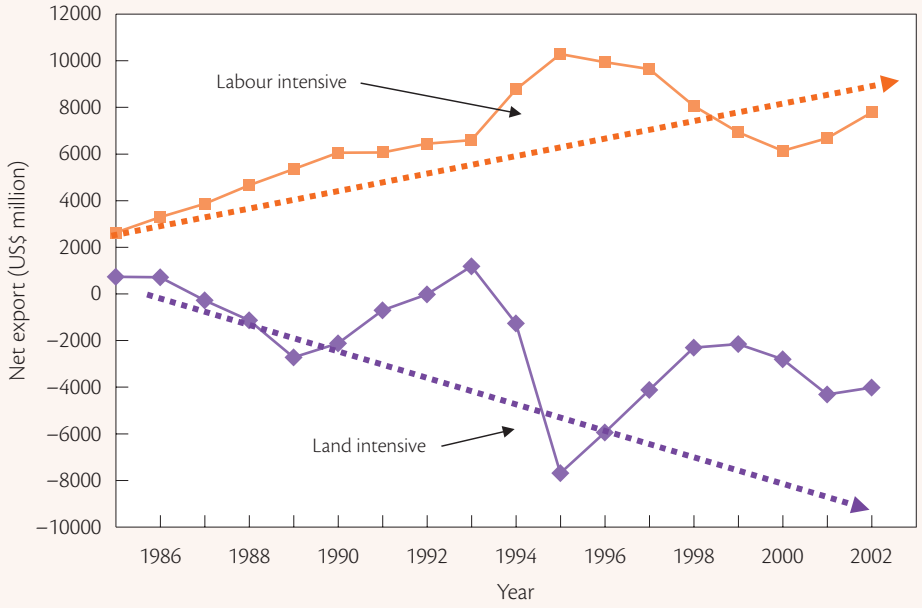

Figure 3.1 China's agricultural trade balance (US$ million) by factor intensity, 1985–2003. Data are from various publications of China's National Statistical Bureau and China's Customs Authority. Land-intensive products include grains, oils, sugar, cotton and wool. Labour-intensive products include livestock, fish, horticulture and beverages.

commodity) and free-on-board (FOB) (exported commodity) prices. These include rice, maize, cotton and beef. Because there are differences among major types of any individual agricultural commodity, we weighted to get average NPRs by either their sown area (for crops) or production shares (for meats), creating sets of more traditional, by commodity, aggregate NPRs. Wheat, for example, has a NPR of 15% when the individual NPRs are weighted by their area shares. On average, the price of all varieties of domestically produced wheat that are sold in the domestic markets of China's major port cities are 15% above the average CIF price of all types of imported wheat varieties. The results are summarised in Table 3.1.

Our findings show not only that significantly positive rates of protection exist for a number of China's major field crops, but also that they vary according to the position in which China finds itself (as a net importer or as a net exporter). Maize prices,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.1 Net protection rate (NPR) and sources of policy distortion for various commodities in China, 2001

	Import-tariff equivalent				Export-subsidy equivalent			
	Tariff rate	Value-added tax	Net trade balance China	NPR	Tax rebate	Subsidy	Net trade balance abroad	NPR
Rice	1	13	3	17	1	0	−9	−8
Wheat	1	13	1	15				
Maize	1	13	8	22	32		0	32
Other grains	1	13	1	15				
Soybean	3	13	1	17				
Cotton	3	13	2	18	5	10	0	20
Oilseed	13	13	21	47				
Sugar crops	25	15	10	50				
Vegetables					1	0	−11	−10
Fruits					1	0	−11	−10
Pork (meat)					5	0	−25	−20
Beef	45	15	0	60	5	0	−13	−8
Mutton					5	0	−10	−5
Poultry (meat)	20	15	0	35	13	0	−30	−17
Eggs					1	0	−5	−4
Milk	50	17	0	67				
Fish					5	0	−20	−15

Source: Huang et al. (2004) and author estimates.

according to exporters, were more than 30%, on average, above world prices. In other words, traders would have lost more than 30% of the value of their shipment if the government did not subsidise the transaction. It is interesting to note that the level of protection of maize almost exactly corresponds to total export subsidies and tax rebates that were being paid to exporters of maize during the (northern) autumn of 2001 (Table 3.1). Protection rates when considering maize as an import differed among regions, however. For example, traders in the northeast told our survey team that, if they were not exporting and foreign maize were to come into China, the importer could make, on average, 22%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.1 also shows that, despite the large volume of increase of soybean imports in recent years, there is still a difference between the CIF and domestic price in the port. The average difference between the domestic price and the international price was 17%. In one sense, the fact that there is a remaining price gap is remarkable given that China imported 20 million tonnes of soybeans in 2003, the official tariff is only 3%, and the commodity can be traded by any foreign trade company (that is, trading firms do not need to secure a license or quota allocation). On the other hand, the remaining price gap reminds us that there may be other reasons for distortions, beyond tariffs and state trading. In fact, the gap between the domestic and international price fully demonstrates the effect of China's policy of assessing a value-added tax on imported soybeans at the border (13% of CIF).

Besides maize, some other commodities such as cotton, edible seeds and sugar were also fairly highly protected in 2001 (Table 3.1). The distortions for these commodities in the autumn of 2001 came from the official tariff rate, value-added tax, and the net trade balance (for sugar and edible oil seeds).

Our results also show that there are a number of commodities, besides rice, that had negative NPRs in 2001. Vegetable, fruits, pork and poultry producers are facing significant non-trade tariff barriers from the rest of the world when they are exporting these commodities.

CHINA'S WTO ACCESSION

In its most basic terms, the WTO commitments in the agriculture sector can be classified into three major categories: market access, domestic support and export subsidies. The commitments on market accession will lower tariffs on all agricultural products, increase access to China's markets by foreign producers of some commodities through tariff-rate quotas (TRQs) and remove quantitative restrictions on others. In return, China is supposed to gain better access to foreign markets for its agricultural products, as well as a number of other indirect benefits. Domestic support and export subsidies are the other two critical issues that arose during the course of negotiations. Together with a number of other market-access commitments, these make China's WTO accession unique among all other developing countries that have been admitted to the WTO's new environment.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Some of the direct import market access commitments that China has made to WTO members actually do not appear to be substantial. Overall, agricultural import tariffs (in terms of a simple average) declined from about 21% in 2001 to 17% by 2004. This was a continuance of earlier trends; the simple average agricultural import tariff fell from 42.2% in 1992 to 23.6% in 1998. Although important, when taken in the context of the discussion in the previous section about China's external economy reforms of the last two decades, one would have to conclude that the commitments are merely an extension of China's past changes. The WTO commitments can, in this way, be thought of as just another step on China's road to opening up its economy.

Except for national strategic products such as grain, cotton, edible oil and sugar, other agricultural products (horticulture, livestock, wine, tobacco, soybean and barley) have become part of a tariff-only regime (Table 3.2). For most commodities in this group, effective protection fell by varying amounts by January 2002; most tariffs were set to fall even further by 2004. To the extent that tariffs are binding for some of these commodities, the reductions in tariff rates should stimulate new imports.

It is important to note, however, that although published tariff rates on all of these commodities will fall, imports will not necessarily grow summarily. Indeed, China has comparative advantage in many commodities under the single-tariff regime. For example, lower tariffs on horticultural products and meats might affect only a small portion of the domestic market (e.g. those parts of the market that buy and sell only products of very high quality—meats for five-star hotels that cater to foreigners). Although tariffs fall for all products, since China produces and exports many commodities at below world market prices, the reductions will not affect producers or traders.

Such movements, however, will almost certainly be (and can legally be) limited for a class of commodities called 'national strategic products'. China's WTO agreement allows officials to manage trade of rice, wheat, maize, edible oils, sugar, cotton and wool with TRQs. These commodities are covered under a special set of institutions. As shown in Table 3.3, the in-quota tariff is only 1% for rice, wheat and maize. However, the amount brought in at these tariff levels is strictly restricted. The in-quota volumes, however, are to grow over a three-year period (2002–2004) at annual rates ranging from 4% to 19%. China does not have to bring in this quantity, but provisions are

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in place that there is supposed to be competition in the import market, so if there is demand inside China for the national strategic products at international prices, traders will be able to bring in the commodity up to the TRQ level.

At the same time, there are, theoretically, still ways to import these commodities after the TRQ is filled. Most poignantly, tariffs on out-of-quota sales will drop substantially in the first year of accession and fall further between 2002 and 2005. But, during the transition period, most people believe such rates are so high (e.g. 65% for grains and sugar in 2004 and edible oils in 2005) that in the coming years they will not bind (Table 3.3).[1]

After the first four to five years of accession, a number of other changes will take place. For example, China agreed to phase out, after 2006, its TRQ for edible oils. But China is likely to maintain the TRQ for maize after 2005, though the amount of TRQ will certainly be raised. State trading monopolies also will be phased out for wools after 2004 and gradually disappear for most other agricultural products (Table 3.3). Although the China National Cereals, Oil and Foodstuffs Import & Export Co. will continue to play an important role in rice, wheat and maize, there will be an increasing degree of competition from private firms in the importing and exporting of grains in the future.

In its commitments to WTO accession, China also agreed to a number of other items, some of which are special to the case of China. First, China must phase out all export subsidies (most subsidies were used in maize export in 2001) and not introduce any new subsidies on agricultural products in the future. Moreover, despite clearly being a developing country, China's exemption for product-specific support is minimal and equivalent to only 8.5% of the total value of production of a basic agricultural product (compared with 10% for other developing countries). Some measures, such as investment subsidies for all farmers and input subsidies for the poor and other resource-scarce farmers, that are generally available for policy makers to use in developing countries, are not allowed in China (i.e. China must include any such support as part of its aggregate measure of support, which should be less than 8.5% of agricultural output values).

---

[1] Although 65% above tariff rates seem high, it is important to note that, when compared with other countries, this is in fact low. In most Asian countries that have a TRQ system, high tariff bindings are at least twice as high as this.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.2 Import tariff rates on major agricultural products subject to tariff-only protection in China

	Actual tariff rates in 2001	Effective as of 1 January	
		2002	2004
Barley	114 (3)[a]	3	3
Soybean	3[b]	3	3
Citrus	40	20	12
Other fruits	30–40	13–20	10–13
Vegetables	30–50	13–29	10–15
Beef	45	23.2	12
Pork	20	18.4	12
Poultry meat	20	18.4	10
Dairy products	50	20–37	10–12
Wine	65	45	14
Tobacco	34	28	10

[a] Barley was subject to licensing and an import quota. The tariff rate was 3% for imports within the quota, and no above-quota barley with a 114% tariff was imported in 2001.

[b] The tariff rate was as high as 114% before 2000 and lowered to 3% after early 2000.

Source: China's WTO Protocol of Accession, November 2001.

Table 3.3 China's tariff rate quotas (TRQ) on imports of various agricultural products

	TRQ (million tonnes)		Tariff (%)		Quota for non-state-owned enterprises (%) 2000–2005
	2002	2005	In-quota	Above-quota	
Wheat	7.3	9.6	1	65	10
Maize	4.5	7.2	1	65	25–40
Rice	2.6	5.3	1	65	50
Cotton	0.743	0.894	–	–	67
Soybean oil	1.7	3.2	9	121	50–90

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Because of its socialistic background and the difficulty that the world has had in assessing the scope of the government's intervention into business dealings of all types, China was forced to accept a series of measures governing the way that it will deal with the rest of the world in cases of anti-dumping and countervailing duties. Most simply, special anti-dumping provisions will remain for 15 years. According to these provisions, in cases of anti-dumping China will be subject to a different set of rules that countries can use to prove their dumping allegations. In addition, the methods that countries can use against China to enforce anti-dumping claims when they have won will differ from most of the world. In essence, this set of measures makes it easier for countries to bring, prove and enforce dumping cases against China. It should be noted, however, that although the rules differ from those governing trade among other countries, China will get the same rights in its dealings with other countries, an element that could help it in some cases in its dealings with dumping matters.

METHODOLOGY AND DATA

In order to evaluate the impact on agriculture and poverty of China's WTO accession in 2001–2005 and further trade liberalisation until 2010, a quantitative method has been developed based on the China Center for Agricultural Policy's agricultural policy simulation and projection model (CAPSiM). CAPSiM developed from a need to have a framework for analysing policies affecting agricultural production, consumption, price and trade at the national level. CAPSiM is a partial equilibrium model. We estimated most of the elasticities used in CAPSiM econometrically, using state-of-the-art econometrics and with assumptions that make our estimated parameters consistent with theory. Both demand and supply elasticities change over time. Income elasticities depend on income level, and cross-price elasticities of demand (or supply) depend on food budget shares (or crop area shares). Details of the model description can be found in Huang and Li (2003, in Chinese with updated version) and Huang and Chen (1999, in English in simplified version).

The analysis based on the original CAPSiM framework can be done only at the national level because it was designed to simulate the future effects of policy shifts in China as a whole. We modified the original model to allow us to disaggregate the national impacts into household production, consumption and poverty effects at the provincial level and to assess the impact that trade liberalisation will have on households in different income groups in the same provinces. Major modifications include

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the development of a price transmission model (transmit prices from implicit national market to local or provincial markets) and a household agricultural production and food consumption database, arranged by province and income categories.

Two scenarios were formulated. The baseline scenario assumes that China's economy continues to operate during the next 10 years as if there were no trade reform. The alternative, trade-liberalisation scenario assumes that China's NPRs move over the next 10 years to levels that are consistent with its WTO accession agreement to further cut remaining import tariffs by half between 2005 and 2010.

China's regional agricultural production differs largely due to its vast variation in climate and natural resources. For example, rice is the most important crop in southern China and accounts for more than half of the cropping areas in Jiangxi and Hunan, while wheat is the more important crop in the north China plain (e.g. Henan, Shangdong and Hebei) and northwest China (e.g. Qinhai, Gangsu and Ningxia), and soybeans dominate in Heilongjiang. Eastern China produces more vegetables and fruits than central and western China.

In order to make the analysis manageable, we classify all commodities into 12 crops or crop-groups and 7 livestock-product and fish groups. Presenting the results for all 19 commodities and groups is difficult. To simplify the presentation, we aggregate all commodities into two groups: importable and exportable. Exportable commodities are those that have negative NPRs and importable commodities are those with positive NPRs (see Table 3.1). We include beef and poultry, which are both exported and imported, in the exportable category.

IMPACTS OF TRADE LIBERALISATION ON CHINA'S AGRICULTURE

According to our analysis, China's WTO accession and further trade liberalisation will have impacts on the prices for nearly all crop and livestock commodities. Compared with the baseline (without WTO accession and any further trade liberalisation after 2001), the prices of most crop commodities decline in the coming decade (Table 3.4). For vegetables, fruits, meats and fish, however, the prices increase. While the declining patterns over time for most crops (exceptions are japonica rice, vegetables and fruits) are similar, the extent of price decline due to trade liberalisation varies significantly

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

among commodities (Table 3.4). For example, for the commodities with small NPRs in 2001—such as indica rice, wheat, coarse grains, soybean and cotton—although trade liberalisation will affect domestic prices, the size of the effect is much less than those that had higher NPRs in 2001 (e.g. maize, oil and sugar crops). Compared with the baseline, China's WTO accession and further trade liberalisation will lower domestic prices of wheat, soybean and cotton by about 2–4% in 2005–2010. The impacts could be as high as 7–20% for maize, oil and sugar crops in the same time period.

On the other hand, trade liberalisation will increase domestic prices of those commodities in which China has comparative advantage in the international market. The expected rise in exports of these commodities increases their domestic prices. For example, we estimate that the prices of vegetables will be about 4–6% higher in the trade liberalisation scenario than the baseline in 2005 and 2010. Over the same period, the prices of pork and poultry will rise even more (by 7–14%; Table 3.4). A similar pattern of increase will occur in fish prices. Among all animal products, milk is an exception. Its domestic price will decline with trade liberalisation.

Overall, agricultural product and food prices are projected to rise slightly over the projection period. A Stone price index (in which prices of individual commodities are aggregated using weights constructed with value shares) was used to generate aggregated agricultural (crop + meat + fish) output prices, crop output prices and food prices. While the aggregated crop output price level falls by 2.26% in 2005 and 2.18% in 2010 under the trade liberalisation scenario (compared with the baseline scenario), overall agricultural prices will rise by 0.48% in 2005 and 1.8% in 2010. That overall agricultural prices do not fall with more trade liberalisation when the crop output prices do is simply because the prices of most meats and fish rise with trade liberalisation (Table 3.4). For aggregated food prices, we estimate a higher rate of increase under the trade liberalisation scenario because some crops with falling prices (e.g. cotton and most of maize) are not consumed as food. Compared with the baseline scenario, overall food prices with trade liberalisation will rise by 2.36% in 2005 and 4.37% in 2010.

The shift in prices due to trade liberalisation means that the incentives for agricultural producers will change, but unlike sector-wide policies, trade liberalisation policies are unique in that they frequently change the relative prices of domestic agricultural commodities because the impacts of trade policy differ among commodities. In general, trade liberalisation stimulates domestic production of

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

sectors that are producing commodities in which the nation has a comparative advantage while dampening those in which producers do not have an advantage. As a result, trade policies can lead to different impacts, sometimes negative and sometimes positive. Moreover, because most of the commodities are competing for domestic resources such as land, labour and capital, cross-commodity substitutions could result from a policy targeting one commodity having an effect on another.

Table 3.4 Impacts of China's World Trade Organization and further trade liberalisation on agricultural output prices in China; percentage compared with the baseline, 2005–2010

Commodity	2005	2010
Rice	1.5	2.3
japonica	6.8	10.2
indica	−0.4	−0.6
Wheat	−1.7	−1.7
Maize	−6.6	−6.6
Sweet potato	−0.9	−0.9
Potato	−0.9	−0.9
Other cereals	−0.9	−0.9
Soybean	−0.9	−2.6
Cotton	−3.4	−3.4
Oil crops	−16.7	−20.2
Sugar crops	−9.3	−16.7
Vegetables	3.7	6.2
Fruits	3.7	6.2
Pork	8.3	13.9
Beef	2.9	4.8
Mutton	1.8	2.9
Poultry	6.8	11.4
Eggs	1.4	2.3
Milk	−9.9	−13.7
Fish	5.9	9.8

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.5 presents the results of our simulations on the impacts of China's WTO accession and further trade liberalisation on agricultural production in 2005 and 2010. The analyses show that trade liberalisation will affect domestic production moderately. The signs of impacts due to trade liberalisation are as expected. Overall, the impact on production is negative for wheat, maize, cotton, oil crops and sugar crops. In contrast, the impact is positive for those commodities in which China has comparative advantage, such as rice, vegetables, fruits, meat and fish (Table 3.5). Increased prices of these commodities due to trade liberalisation will generally stimulate their domestic production.

It is worth noting that domestic production will not increase for all commodities with higher prices. The production impacts are associated with both own-price and cross-price substitution impacts. Soybean, a crop that had been liberalised before China's WTO accession in 2001, is an interesting case for understanding the impact of trade liberalisation. Liberalisation of the soybean trade had led to a substantial increase of imports and a decline in the domestic price and production before China's WTO accession. Imports reached more than 15 million tonnes, to a level

Table 3.5 Impacts of China's World Trade Organization accession and further trade liberalisation on agricultural production; percentage change compared with the baseline, 2005–2010

Commodity	2005	2010
Rice	1.5	2.3
Wheat	−0.2	0.1
Maize	−3.5	−3.1
Soybean	1.0	0.2
Cotton	−0.3	0.1
Oil crops	−7.5	−9.0
Sugar crops	−2.5	−5.6
Vegetables	2.9	4.9
Fruits	3.3	5.4
Pork	7.6	11.0
Beef	3.5	4.8
Poultry	6.9	9.7
Milk	−5.6	−8.4
Fish	4.3	6.6

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

similar to domestic production at the time China joined the WTO. While further trade liberalisation after China's WTO accession will reduce soybean price marginally (Table 3.4), the decline in soybean price is so small that the impact of its own price is less than the impacts due to changes in the prices of substitute commodities such as vegetables, fruits, rice and some coarse grains, and changes in input prices (e.g. fertiliser and pesticide) in the post-WTO-accession era.

As there are both positive and negative impacts of trade liberalisation on China's agriculture, we estimate overall positive impacts for the whole agricultural sector for average farmers (Table 3.6). When examining the overall effects of trade on agricultural production, several facts become clear. In contrast to some of the commodity-specific effects that were presented above, the overall effects of China's WTO accession and further trade liberalisation are positive. According to our analysis, agricultural output value for the average farm will rise 191 yuan (per capita about 46 yuan or US$5.60), accounting for 2.8% of total agricultural output in 2005 (Table 3.6). The net benefits in terms of output values will increase to 460 yuan in 2010, which is about 5.6% of household agricultural output values. These results are consistent with other studies that applied general equilibrium models such as the global trade analysis program, GTAP (Hertel 1997), which showed that the impacts of China's WTO accession on its agricultural output range from 4% to 6% (Wang 2003; Anderson et al. 2004; Ianchovichina and Martin 2004; van Tongeren and Huang 2004). About 20–30% of the benefit is due to the rise in prices and the other 70–80% to the growth in real output through changes in production patterns—movement from agricultural products with a lower comparative advantage to those with a higher comparative advantage. The importance of accounting for production responses to changing prices can be seen by noting the rise in overall production that occurs when imports rise and exports expand. Facing the price shifts, producers in China will, according to our simulation, respond by moving into the production of commodities that experience price rises and out of commodities that experience price falls. We forecast that, at the end of the period, enough structural change will have occurred to generate an overall rise in agricultural output. By 2005, while the output value of importable products will decline by 7.2% under the trade liberalisation scenario (compared with the baseline scenario), exportable products will rise by 9.3% (Table 3.6, column 2).

Between 2005 and 2010, the fifth and tenth years after the implementation of WTO rules, the rate of rise of household's agricultural output accelerates (Table 3.6, columns 3 and 4). Because liberalisation continues for both those products that are

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

protected (especially for maize, sugar and edible crops) and those that are exportable (e.g. livestock, fish, vegetables and rice), agricultural output will continue to increase under a more liberalised trade environment in 2005–2010. However, because we have not accounted for the increased production output values that occur due to the higher inputs, increases in agricultural output values should not be considered as increases in agricultural income. When comparing our results to those of other trade models that have simulated the impact of the accession to WTO on China's agriculture, our results (which are couched in terms of output rather than income) are fairly consistent (around 2–3% agricultural income changes in 2005–2010; if one takes a fraction of output—say 50%—as increased profits).

Table 3.6 Impacts of China's World Trade Organization and further trade liberalisation on agricultural output value and food-consumption expenditure for average farm households in China in 2005 and 2010, compared with the baseline

	2005		2010	
	Changes in value (yuan/household)	Percentage change (%)	Changes in value (yuan/household)	Percentage change (%)
Agricultural output	191	2.8	460	5.8
Importable sector	−198	−7.2	−264	−8.5
Exportable sector	389	9.3	723	15.1
Food consumption	44	1.1	102	2.3
Importable sector	−16	−2.0	−17	−1.9
Exportable sector	61	1.9	119	3.3

Note: The importable sector includes wheat, maize, all coarse grains, soybean, edible oil, cotton, sugar and milk. The exportable sector includes rice, vegetable, fruits, all meats and fish.

Our simulations show that per-capita food consumption of importable commodities rises as their prices fall with trade liberalisation, while per-capita food consumption of the exportable commodities will decline. The larger impacts are found in edible oils, sugar, vegetables, fruits, livestock products and fish. The overall effects of trade liberalisation on food expenditures for average rural households are summarised in Table 3.6. Compared with production impacts, the overall effects of China's WTO

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

accession on food consumption are more modest (Table 3.6, rows 4–6). By 2005, total household food expenditure will be 1.1% higher in the trade liberalisation scenario than that under baseline. The impact will rise to 2.3% in 2010.

Because overall food prices change with trade liberalisation, to examine the impacts of trade liberalisation on food consumption, we need to compare the food expenditure share changes with the overall food price changes in the projection period. Because aggregate food prices will rise by 2.36% in 2005 and 4.37% in 2010 under the trade liberalisation scenario (compared with the baseline scenario), this implies that increases in food expenditure due to trade liberalisation are all from the rise in food prices. Indeed, real levels of food consumption at constant prices will decline by about 1% in 2005 and 2% in 2010 due to trade liberalisation. Baseline projections show that, except for rice, self-sufficiency of all land-intensive crops will fall in the coming decade, and WTO membership will further lower the self-sufficiency levels of these commodities (Table 3.7). Under the trade liberalisation scenario, cereal imports will rise from 3 million tonnes in 2001 to 41 million tonnes in 2010. Most of the imports are feed grain. Although exports (mainly rice) will also increase, net imports will reach 32 million tonnes in 2010, accounting for about 7% of domestic consumption. In other words, the self-sufficiency level of cereals will fall from 101% in 2001 to 93% by 2010, which would be 96% if China were not a member of the WTO in 2001–2010 (Table 3.7).

The self-sufficiency levels of other land-intensive crops such as oilseed and sugar crops, will fall even more than those of cereal crops. The imports of edible oils will account for 31% (100 minus 69%, Table 3.7) of domestic consumption under the trade liberalisation scenario in 2010, about 20% (89 minus 69%) higher than that under the baseline scenario. By 2010, China will also have to import nearly 30% of its sugar from the world market.

On the other hand, China can benefit substantially from trade liberalisation for rice and labour-intensive products such as vegetables, fruits, meats and fish. Self-sufficiency in rice will be improved by 4% with its WTO membership (107 minus 103%, Table 3.7). China can export 5–6% of its horticultural products to international markets, compared with the baseline of nearly zero net exports. Export expansion of meat and fish products will be even larger than in horticulture. In sum, while grain self-sufficiency levels will fall with trade liberalisation, food grain (excluding feed grain) and overall food self-sufficiency will rise. Trade liberalisation will facilitate China's agricultural diversification and transformation of China's agriculture from lower comparative advantage sectors to higher comparative advantage ones.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.7 Self-sufficiency in China under the baseline and trade liberalisation scenarios in 2005 and 2010

Commodity	2001	2010	
		Baseline	WTO
Cereal crops	101	96	93
Rice	101	103	107
Wheat	100	97	96
Maize	105	90	80
Soybean	53	49	47
Oil crops	83	89	69
Sugar crops	89	80	71
Vegetables	101	100	105
Fruits	100	99	106

IMPACTS OF TRADE LIBERALISATION ON CHINA'S RURAL HOUSEHOLDS AND POVERTY

1. Characteristics of rural households

Because all rural households have access to land, farm sizes in China are small by international standards. For the nation as a whole, the average size of farm is 7.9 mu, or 0.53 hectare (15 mu = 1 ha). With farms so small, households in China have to intensively use their land resources. They use their land both to produce their own staple food and for cash crops for sales into the market. Sustainable increases in rural labour productivity and household income, however, will require more than income from the average farm in China. As a result, farm households need to find employment in the off-farm sector. In fact, this is what has been happening in rural China since the early 1980s (de Brauw et al. 2002). By 2003, the average farmer allocated 35.6% of their time to off-farm activities and earned 56% of the family's income from the non-agriculture sector. Most of the off-farm earnings were in the form of wages.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There is significant regional variation in economic activities, sources of income and patterns of spending. Income levels in the eastern region are twice as high as those in the west. The average farmer in most of the west earned more from agriculture than other sources. Income variation among regions means too that the patterns of spending by farmers also differ. Poverty incidence is higher in western and central regions than in the east. Our analyses also indicate that the agricultural income of the poor depends more on the less-competitive commodities than does that of the richer groups. To show this, we divide household agricultural production into two groups: importable and exportable commodities. Prices for importable commodities will decline with trade liberalisation, while prices will rise for the exportable commodities (or their NPRs were negative in 2001; see previous section for detail). The results of this analysis are presented in Figure 3.2, which shows that, overall, as farmers move from the lower income categories into the higher ones, the shares of their importable commodity output in total production decline while exportable commodity production increases.

Production patterns that we have observed by income category for the nation (Figure 3.2) do not appear in each region. Careful analysis of production of different farmers by province reveals some key differences. For example, in Shanxi and Jilin, nearly all farmers (except the richest) produce more commodities in which China has lower comparative advantage, while farmers in all categories, poorer or richer, in Zhejiang Province produce commodities for which prices will rise with trade liberalisation. These results suggest that future trade liberalisation will disadvantage poorer farmers in the poor areas since it will invariably lead to lower prices for the products they are highly reliant on. On the other hand, all farmers may gain equally in many coastal and southern provinces with China's WTO membership.

2. Impacts on rural households by income group and region

In order to understand the impact of WTO accession and further trade liberalisation on household welfare, we report the results of our simulation analysis for three sets of households (Table 3.8). The three sets of households include those that are very poor (those that earn less than US$1/day, the designated international poverty line), those in the average income category, and those that are in the top decile of income in China. We also disaggregate the impact of trade liberalisation by reporting how much the households in each category are affected by liberalisation in the importable and exportable sectors. The welfare effects are simulated for both agricultural output value and food consumption expenditures.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

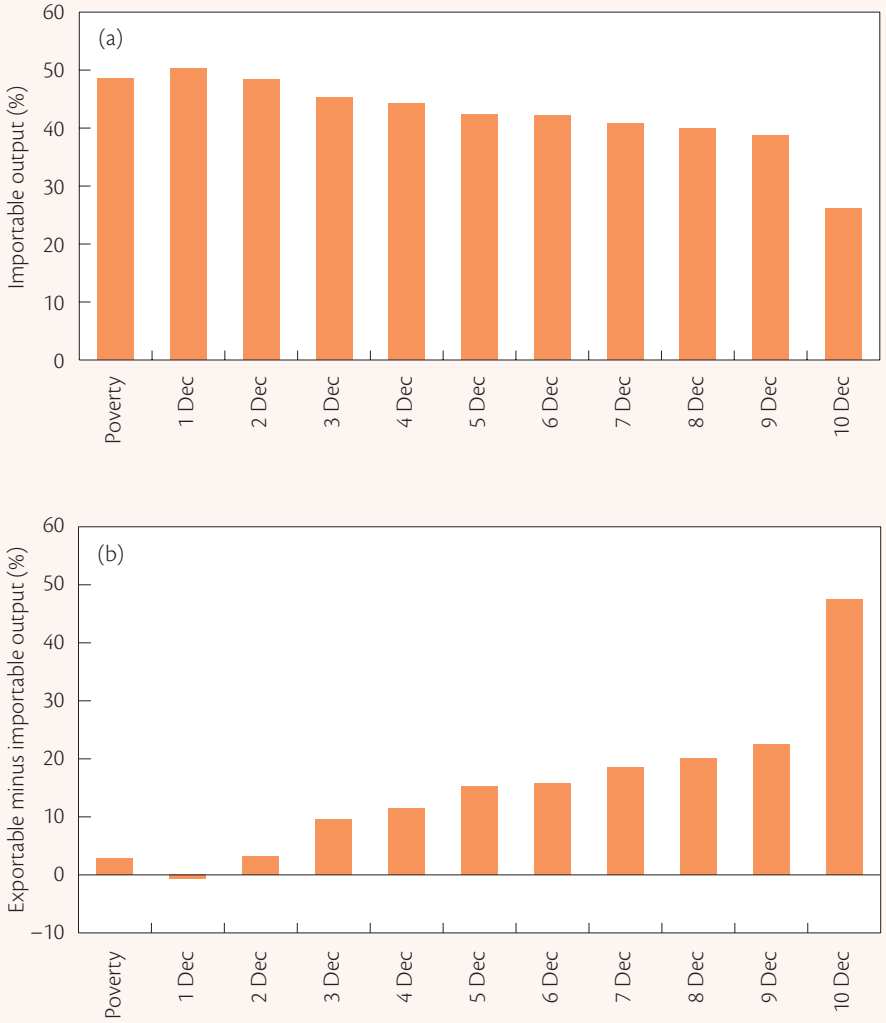

Figure 3.2 Agricultural production structure in China by income group (poverty to 10th decile) in 2003: (a) importable output; (b) exportable minus importable output.
Source: NSBC (2004).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

According to the analysis, if China implements its promises for the WTO agreement, the changes in domestic prices will affect both production and consumption of all rural households (Table 3.8). As discussed above, our simulation analysis predicts that, after five years for the average farm, agricultural output value will rise 2.8% (Table 3.8, row 4). During the same period, food expenditures will rise by 1.1% (Table 3.8, row 13), albeit a rate less than production output value increase. Aggregate food expenditures also rise as the results of overall food-price increase and changes in total food consumption. For importable commodities, falling prices increase their consumption. Reduction of expenditure on importable foods means that consumers gain from both increased consumption and decline in price. For exportable commodities consumers lose from rising prices.

Not all farm households, however, benefit equally from China's trade liberalisation. Our results show that in 2005 and 2010, the poorest farmers gain much less than the average and richer farmers. Agricultural output values for the poor will increase by 77 yuan per household in 2005, while they will be 191 yuan for the average farmer and 583 yuan for the top 10% richest farmers (Table 3.8, column 1). Even in the percentage changes, the rise in agricultural output values for the poor is less than those for the richer. On the other hand, food expenditure increases for all farmers, but in percentage terms the rates of rise are nearly identical in 2005 and fall from rich to poor in 2010 (albeit the difference is very small). Despite the gains from trade liberalisation for average farmers in each group at the national level, farmers in western and northern China are disadvantaged. Indeed the gains we estimated for China as a whole are due mainly to the positive effects that occurred in southern and coastal provinces. Agricultural output value per household will decline as much as 100–340 yuan (or 1–4.5% of output) in northwest and northeast China, while it will increase 100–500 yuan (1–8%) in southern China (Table 3.9). This is not surprising, as the production patterns differ significantly across regions. The provinces with positive effects from trade liberalisation are those that produce greater volumes of exportable than importable commodities (Table 3.9). At the national level, we show that average farmers, including the poor, will gain from trade liberalisation, but, this result does not hold for every province (Table 3.10). From Table 3.8 we see that, at the national aggregate levels, the overall impact is small. The main reason is that there are offsetting effects among provinces. But from Table 3.10, the impacts differ significantly across provinces even for farmers in the same income categories.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.8 Impacts of China's World Trade Organization accession and further trade liberalisation on per household food expenditure by income category in China in 2005 and 2010, compared with the baseline scenario

	2005		2010	
	Change in value (yuan)	Percentage change (%)	Change in value (yuan)	Percentage change (%)
Agricultural output value				
Below the international poverty line[a]	77	1.7	221	4.4
Importable sector	−138	−6.3	−177	−7.2
Exportable sector	215	9.6	399	15.5
Average farmers	191	2.8	460	5.8
Importable sector	−198	−7.2	−264	−8.5
Exportable sector	389	9.3	723	15.1
Top 10% richest farmers	583	5.3	1205	9.3
Importable sector	−212	−7.5	−304	−9.3
Exportable sector	795	9.7	1509	15.6
Food consumption				
Below int'l poverty	25	0.9	76	2.4
Importable sector	−20	−2.3	−21	−2.2
Exportable sector	45	2.4	97	4.4
Average farmers	44	1.1	102	2.3
Importable sector	−16	−2.0	−17	−1.9
Exportable sector	61	1.9	119	3.3
Top 10% richest farmers	62	1.0	134	2.0
Importable sector	−13	−1.5	−12	−1.3
Exportable sector	75	1.4	146	2.6

[a] The international poverty line is defined as an income of US$1/day in purchasing power parity terms.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Because trade impacts are commodity-specific, and because farmers in different income groups in different provinces grow different sets of commodities, there are sharp regional and income-class-specific impacts (Table 3.10). This also means that they affect equity. While nearly all farmers in many provinces in the east and south will benefit from trade policy, liberalisation will hurt producers in the west and north primarily because those regions are the largest producers of maize, wheat, cotton, edible oil, sugar and soybean, the sets of commodities that are most hurt by trade liberalisation.

Interestingly, not all of the poor will gain or lose income with trade liberalisation. Our analyses show that the poor in the rich areas (again in the south and east) gain from trade liberalisation, while the poor in the poor area (west and north) are hurt (Table 3.10). Therefore, trade liberalisation may contribute to poverty alleviation in some parts of China, but it may worsen income distribution in other parts of the nation. Another important finding is that the poor will gain (or lose) less than the rich for each sector because, despite having farms that are of a similar size, their land produces less than that of the richer producers. It could be that lower production is due to inferior land and climate resources. It could also be that poorer producers have access to fewer inputs. If so, the clear policy implications are that the government needs to provide ways for farmers to access better technology, water control and credit.

The impacts of trade liberalisation on food consumption by income group in the selected provinces are shown in Table 3.11. Several observations can be made from these results. First, the effect on rural residents as producers is typically larger than the effect on them as consumers. Production shifts (both positive and negative) are larger than shifts in expenditures because, while the rural resident as producer enjoys (suffers) all of the gain (loss) from the price rise (fall), the rural resident as consumer is affected only marginally since much of the output is sold to consumers in the city. Second, the difference in consumption effects among income groups within the same province (Table 3.11) is much less than those of production impacts (Table 3.10). Finally, our analysis also shows that the trade effects on commodity type are more important than the region of the country in terms of expenditure impacts (Table 3.11). In other words, when examining our results by province, we find that there are only slight differences among provinces. Evidently, because markets are fairly well integrated, all consumers in China consume a basket of goods that is fairly similar, but production baskets differ greatly. The farm households in the north and west of the country obviously produce a commodity mix that will be hurt more by trade liberalisation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.9 Agricultural production structure, importable and exportable shares (%), by province in China in 2001

	Agricultural sector			Crop sub-sector		
	Importable	Exportable	Net exportable	Rice	Horticulture	Importable
Tibet	88	12	–75	0	1	99
Xinjiang	72	28	–44	2	9	90
Gansu	67	33	–35	0	3	97
Inner Mongolia	66	34	–31	2	3	96
Heilongjiang	65	35	–30	12	3	86
Hebei	63	37	–27	1	4	95
Jilin	60	40	–20	14	4	82
Shanxi	57	43	–13	0	6	94
Henan	56	44	–13	4	5	91
Qinghai	56	44	–12	0	2	98
Ningxia	53	47	–7	7	8	86
Shandong	53	47	–6	0	18	81
Shaanxi	48	52	3	2	7	91
Anhui	41	59	18	29	8	63
Liaoning	40	60	19	14	8	78
Tianjin	39	61	23	0	1	99
Beijing	31	69	37	1	13	87
Hubei	31	69	37	38	7	55
Yunnan	30	70	40	25	9	66
Jiangsu	28	72	45	33	11	56
Guizhou	27	73	45	23	12	65
Chongqing	24	76	51	30	21	49
Sichuan	24	76	51	25	14	61
Guangxi	23	77	54	51	9	40
Jiangxi	10	90	79	77	8	15
Hunan	10	90	79	70	9	21
Hainan	10	90	80	62	14	24

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.9 (cont'd) Agricultural production structure, importable and exportable shares (%), by province in China in 2001

	Agricultural sector			Crop sub-sector		
	Importable	Exportable	Net exportable	Rice	Horticulture	Importable
Shanghai	9	91	81	56	17	27
Guangdong	8	92	85	64	21	15
Zhejiang	4	96	91	34	58	8
Fujian	3	97	93	70	14	16
National	40	60	19	18	8	74

Source: Computed by the authors, based on the rural household income and expenditure survey conducted by the National Statistical Bureau of China (NSBC 2004).

Table 3.10 Impacts of China's World Trade Organization accession and further trade liberalisation on per household agricultural output value by income category in selected provinces in 2005 and 2010, compared with the baseline scenario

	2005		2010	
	Change in value (yuan)	Percentage change (%)	Change in value (yuan)	Percentage change (%)
Zhejiang				
Below the international poverty line[a]	157	6.8	309	11.4
Average farmers	397	7.6	752	12.5
Top 10% richest farmers	951	8.2	1786	13.5
Guangdong				
Below the international poverty line	163	4.4	323	7.7
Average farmers	684	7.6	1348	12.8
Top 10% richest farmers	2936	11.0	5799	17.9
Jilin				
Below the international poverty line	−77	−1.3	61	0.9
Average farmers	−128	−1.2	105	0.9
Top 10% richest farmers	370	1.8	1165	5.0

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.10. (cont'd) Impacts of China's World Trade Organization accession and further trade liberalisation on per household agricultural output value by income category in selected provinces in 2005 and 2010, compared with the baseline scenario

	2005		2010	
	Change in value (yuan)	Percentage change (%)	Change in value (yuan)	Percentage change (%)
Jiangxi				
Below the international poverty line	187	4.7	368	8.3
Average farmers	278	4.5	549	8.0
Top 10% richest farmers	476	4.9	913	8.2
Henan				
Below the international poverty line	−7	−0.2	77	1.7
Average farmers	80	1.2	296	3.8
Top 10% richest farmers	818	5.8	1685	10.5
Sichuan				
Below the international poverty line	164	3.8	355	7.2
Average farmers	389	5.9	789	10.6
Top 10% richest farmers	683	7.5	1339	12.7
Ningxia				
Below the international poverty line	42	1.0	166	3.4
Average farmers	−3	0.0	88	0.9
Top 10% richest farmers	−119	−0.7	−238	−1.1
Shaanxi				
Below the international poverty line	27	0.7	123	2.9
Average farmers	101	2.0	280	4.8
Top 10% richest farmers	297	3.5	664	6.7
Guizhou				
Below the international poverty line	138	3.4	317	6.9
Average farmers	270	5.0	565	9.2
Top 10% richest farmers	471	6.8	941	12.0

[a] The international poverty line is defined as an income of US$1/day in purchasing power parity terms.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.11 Impacts of China's World Trade Organization and further trade liberalisation on per household food expenditure by income category in selected provinces in 2005 and 2010, compared with the baseline scenario

	2005		2010	
	Change in value (yuan)	Percentage change (%)	Change in value (yuan)	Percentage change (%)
Zhejiang				
Below the international poverty line[a]	65	1.4	133	2.5
Average farmers	88	1.4	170	2.3
Top 10% richest farmers	105	1.1	200	1.8
Guangdong				
Below the international poverty line	67	1.2	141	2.3
Average farmers	123	1.5	243	2.7
Top 10% richest farmers	151	1.4	283	2.4
Jilin				
Below the international poverty line	46	1.5	97	2.8
Average farmers	41	1.3	88	2.6
Top 10% richest farmers	34	0.9	79	2.2
Jiangxi				
Below the international poverty line	32	1.0	70	1.9
Average farmers	47	0.9	98	1.9
Top 10% richest farmers	50	1.0	99	1.8
Henan				
Below the international poverty line	–1	0.0	18	0.7
Average farmers	13	0.4	43	1.3
Top 10% richest farmers	70	1.3	149	2.6
Sichuan				
Below the international poverty line	50	1.4	106	2.7
Average farmers	65	1.6	129	2.9
Top 10% richest farmers	68	1.4	130	2.6

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 3.11 (cont'd) Impacts of China's World Trade Organization and further trade liberalisation on per household food expenditure by income category in selected provinces in 2005 and 2010, compared with the baseline scenario

	2005		2010	
	Change in value (yuan)	Percentage change (%)	Change in value (yuan)	Percentage change (%)
Ningxia				
Below the international poverty line	7	0.2	49	1.4
Average farmers	24	0.7	91	2.4
Top 10% richest farmers	38	1.0	149	3.7
Shaanxi				
Below the international poverty line	−5	−0.3	11	0.4
Average farmers	−1	−0.1	17	0.6
Top 10% richest farmers	2	0.1	22	0.7
Guizhou				
Below the international poverty line	42	1.3	95	2.7
Average farmers	56	1.6	115	3.1
Top 10% richest farmers	64	1.6	126	2.9

[a] The international poverty line is defined as an income of US$1/day in purchasing power parity terms.

CONCLUDING REMARKS AND POLICY IMPLICATIONS

China's trade liberalisation has progressed smoothly since the late 1980s. Through nearly 20 years of external reform, China's foreign-trade regime has gradually changed from a highly centralised, planned and import-substitution regime to a more decentralised, market-oriented and export-promotion regime.

Although the effects of China's WTO accession and trade liberalisation on the rural economy from other subsectors may be equally large or even larger in the future, this study's focus on the agriculture sector showed that there will be effects and that the net effects will be positive for average farmers in China. Our findings on the

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

NPRs show that, for some agricultural commodities, WTO accession will lead to a fall in prices and a rise in imports. Edible oils, sugar, maize and cotton may be most affected. There are also commodities in which China has considerable comparative advantage—e.g. japonica rice, meats, and horticulture products—and, hence, WTO accession could provide benefits to those engaged in these activities. The prospect of increased imports of feed grains (e.g. maize and soybeans) at lower prices means that livestock producers could become even more competitive.

Our study also shows that as some prices rise and others fall, trade liberalisation is encouraging farmers to adjust their agricultural production structure towards products for which they have a higher comparative advantage. In response to overall food-price rise, consumers reduce their consumption. However, with the increased incomes that accompany the shift of farmers to more-profitable agricultural products, most of the farming sector likely will be better off (although we do not measure the indirect rise in consumption due to the income effects of higher agricultural profits). We demonstrate that, although the absolute effects of trade liberalisation will not be very large, policy makers should be concerned about poverty and equity effects. We show this through several findings. First, although farmers at the national level will, on average, benefit from trade liberalisation, it does not hold for all provinces. Farmers in many less-developed provinces in the west and north will not gain from trade liberalisation. The main reason is that farmers in the east and south produce more of the products for which China has a comparative advantage. Indeed, the net impacts on agricultural production of average farmers in several western and northern provinces are negative.

Second, while for the nation as a whole the poor will benefit, not all of the poor in each region will gain from trade liberalisation. We find that the poor in many provinces in the west and north will lose in agricultural production (income).

Third, in nearly all provinces where there are gains, the richer will gain more than the poor. The main reason for the advantage of rich farmers in the same province is that the rich farmers produce higher yields for the same commodity and more output (e.g. more horticulture, meats and fish). As a consequence of equity issues, policy makers need to take one of two actions. First, they need to try to encourage farmers in poorer, inland areas to shift their production (where appropriate) to more-competitive crops. Second, officials may also need to take other, non-trade actions to increase the livelihood of farmers in these areas. In many areas, farmers

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

do not have profitable opportunities in any farming activity. In such areas, rural education, better communications and other policies that facilitate their shift into the non-farm sector may be the most beneficial approach.

The impact on agriculture, however, is only part of the story. Although we do not analyse the non-farm impacts, trade liberalisation is expected to also affect the access of households to non-farm employment and the wages they earn for being in the off-farm market. In general, China will gain a great deal from trade liberalisation. Rising exports of manufactured goods will need much rural labour. In a country like China, raising the demand for off-farm labour is probably the most important thing that can happen in the economy. The nation needs to keep promoting policies that facilitate investment and allow rural households to move to these jobs without constraints.

REFERENCES

Anderson, K., Huang, J. and Ianchovichina, E. 2004. Will China's WTO accession worsen farm household income? China Economic Review, 15, 443–456.

Carter, C.A. and Estrin, A. 2001. China's trade integration and impacts on factor markets. Davis, University of California, mimeo.

de Brauw, A., Huang, J., Rozelle, S., Zhang, L. and Zhang, Y. 2002. China's rural labor markets. The China Business Review, March–April, 2–8.

Hertel, T.W., ed. 1997. Global trade analysis: modeling and applications. Cambridge University Press.

Huang, J. and Chen, C. 1999. Effects of trade liberalization on agriculture in China: commodity and local agricultural studies. Bogor, Indonesia, United Nations ESCAP CGPRT Centre.

Huang, J. and Li, N. 2003. China's agricultural policy analysis and simulation model—CAPSiM. Journal of Nanjing Agricultural University, 3(2), 30–41.

Huang, J., Li, N. and Rozelle, S. 2003. Trade reform, household effects and poverty in rural China. American Journal of Agricultural Economics, 85, 1292–1298.

Huang, J., Rozelle, S. and Chang, M. 2004. Tracking distortions in agriculture: China and its accession to the World Trade Organization. The World Bank Economic Review, 18, 59–84.

Huang, J., Rozelle, S., Pray, C. and Wang, Q. 2002. Plant biotechnology in China. Science, 295, 674–677.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Ianchovichina, E. and Martin, W. 2004. Economic impacts of China's accession to the WTO. In: Bhattasali, D., Li, S. and Martin, W., ed., China and the WTO: accession, policy reform, and poverty reduction strategies. Washington, DC, World Bank and Oxford University Press.

Lardy, N. 2001. Integrating China in the global economy. Washington, DC, Brookings Institution.

Li, S., Zhai, F. and Wang, Z. 1999. The global and domestic impact of China joining the World Trade Organization, a project report. China, Development Research Center, State Council.

Martin, W. 2002. Implication of reform and WTO accession for China's agricultural policies. Economies in Transition, 9, 717–742.

MOFTEC (Ministry of Foreign Trade and Economic Cooperation) 2002. Foreign trade and economic yearbook of China. Beijing, China Statistical Press.

NSBC (National Statistical Bureau of China) 2003a. Statistical yearbook of China. Beijing, China Statistical Press.

— 2003b. China rural household survey yearbook. Beijing, China Statistical Press.

— 2004. Rural income and expenditure survey. Beijing, China, Statistical Press.

Rozelle, S. 1996. Stagnation without equity: changing patterns of income and inequality in China's post-reform rural economy. The China Journal 35, 63–96.

van Tongeren, F. and Huang, J. 2004. China's food economy in the early 21st century. The Hague, Netherlands, Agricultural Economics Research Institute (LEI), Report # 6.04.04.

Wang, Z. 2003. WTO accession, the greater China free-trade area, and economic integration across the Taiwan Strait. China Economic Review, 14, 316–349.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 4

PARTNERSHIPS WITH FARMER ORGANISATIONS

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

4.1 BUILDING PARTNERSHIPS WITH FARMER ASSOCIATIONS

CCICED ARD Task Force members

In a modern society that is dominated by markets and where most assets and information are in the hands of private individuals and enterprises, the government needs partners to engage in the development process. It is important at this point that China encourages the establishment of truly independent non-state organisations, including those that will act as information networks, business-support groups, and providers of technical and marketing systems. Cooperatives played major roles during the rapid growth periods in all European and North American nations. In Japan, Korea and Taiwan, the development of the rural economy was guided by cooperatives and farmer associations (FAs). In a number of developed countries, as the government reduces its commitment to rural extension, FAs are taking over information dissemination and service provision.

THE ABSENCE OF FARMER ASSOCIATIONS: LEGACY OF THE PAST

Farmer associations have a relatively low profile in China and little is known about them.[1] In the mid 1990s it was estimated that there were more than 100,000 farmer associations in China. The Ministry of Agriculture claimed that, during the 1990s, up to 5% or more of all farmers belonged to associations. Because the source of these numbers is unclear, those familiar with rural China often cast doubt on the figures. Field workers during the 1990s rarely encountered such associations. Retrospective information from a recent community-level, national representative survey in 2003 confirms that, even by as late as 1995, only a small number of villages and a smaller number of farmers participated in FAs.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The conditions in rural China have changed markedly in recent years and there is now an increasing need for institutional change. Almost certainly the poor record in establishing FAs during the 1980s and 1990s was due to China's unique legacy of planning, an environment characterised by poorly developed markets and the lack of a legal and institutional support framework. In the past, government agencies were responsible for delivering and financing inputs and technology, and for procuring and marketing output. Markets and price signals were weak. The demand for agricultural products was dominated by the need to purchase the basic commodity; there was almost no emphasis on quality or value-added services. In the old environment there was little need for FAs to aid farmers in accessing technology and inputs, or for marketing their products.

Since the mid 1990s, the situation has changed. The legacy of planning had been fading for some time but this process accelerated in the first half of the 1990s. Markets started to become the dominant source of technology and inputs, and the demand for higher quality, safer and fresher food products from farmers began to grow rapidly. Despite the sharply increased need for organisations such as FAs in the new market-driven environment, there has been little on-the-ground response outside a few notable experimental areas. The slow emergence of FAs is not surprising, given the absence of many of the basic conditions that facilitated the emergence of FAs elsewhere in the world.

NEW URGENCY, NEW EFFORTS

China's government has begun to take steps to promote FAs in recent years, following a change in attitude. While in the past FAs were viewed with ambivalence, or even as a threat, they are now embraced. The beginning of a new phase of FAs is best marked by the revision of the Agricultural Law in 2002. The new version provides the fundamental legal basis for the development of FAs in China. Article 14

[1] In this chapter and the others we are careful to draw a distinction among those entities that are called farmer associations or farmer professional associations inside China. In particular, in the chapter on farmer professional associations (FPAs) by Shen et al. we enumerate all of those entities in China that call themselves FPAs and then categorise them into those that are functional and those that are formal and those that are both or neither (that is, nominal-only FPAs).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of Chapter 2 stipulates that 'farmers and farmer production and marketing organizations may establish various kinds of agricultural commodity sector associations, to provide services to members in production, marketing, information, technology and training, to bring into play the functions of coordination and self-control, to submit applications for support in agricultural trade related issues, and to protect the interest of members and the sector'.

In a document of the Communist Party of China (CPC) and the State Council for guiding agricultural and rural work in 2003, the important roles of FAs and other cooperative organisations are also recognised. Finally, and perhaps most importantly, in the 2004 No. 1 Document of the CPC and the State Council, the prominent role of FAs has been promulgated as well as more concrete measures designed to promote their development. The document states, 'The development of various kinds of agricultural professional cooperative organizations … should be encouraged. The formulation of the law for farmer professional cooperative organizations should be advanced … To accommodate the new development situation of world agricultural trade, the establishment of sector or commodity associations for major export products including poultry, vegetable and fruits should be accelerated'.

A recent nationwide survey by economists in China confirms the recent surge in FA activity. FAs do exist in China, but they are still in an early stage of development. From less than 1% in the mid 1990s, it is now estimated that about 7% of villages in China have functioning FAs. Around 2–3% of China's households participate in some type of FA. Although the level of participation is low, in recent years their emergence is accelerating.

The expansion of FAs is not spread evenly across China. FAs appear in greater numbers in richer villages, but surprisingly there are also substantial numbers in poorer areas. While the relative wealth of the area is not correlated with the formation of FAs, the distance from a major economic centre is strongly correlated. Where villages are further away from major economic centres, FA activity falls rapidly. This suggests that, if households in more remote areas are going to start FAs, they will require substantially more help than in the past. Finally, most of the associations are in areas where there are more higher-value crops, such as fruits and vegetables, and non-cropping activities such as livestock production.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REMAINING CONSTRAINTS

There are still shortcomings that are restricting the development of FAs and constraining their spread to new communities. Above all, there are legal constraints. Despite the new laws and higher policy status, today FAs have no legal status. Members are unable to sign contracts as an organisation. They cannot take out loans or act as a guarantor. In the vast majority of cases studied by two separate Ministry of Agriculture and Peking University research teams, the lack of legal status has been identified as the most severe constraint to the expansion of FA activity.

The other pressing need is to find the right group, agency or institution to act as a catalyst to promote FAs. While it is almost universally known that although cooperation and collective action among farmers will lead to rising welfare for the entire group, it often is difficult to overcome group dynamics and to achieve cooperative behaviour. In such cases, the input of an outsider (or a champion/leader from the group) is needed to get the group going and to mentor it, especially in its early years. However, though it is necessary to have a catalytic agent, it is difficult to establish the right balance between encouragement and domination. Farmers need to be encouraged and, indeed, sometimes pushed into such organisations but, to be successful, FAs need to be voluntary. In other countries, various agencies have taken responsibility for promoting and managing cooperative movements. In the US, the agricultural university system has a network of cooperative extension agents. In Japan, there is a special ministry-level cooperative commission. In Europe, the cooperative movement is quite mature and local cooperatives are bound together by informal networks of upper-level, pan-national cooperative associations. In China there is now really no single group that has responsibility for promoting and fostering the nation's FA movement.

The record in China shows that such a service (government or not) is needed, but that it is difficult to find the right balance. According to a survey by economists, the actions of local governments often dampen the enthusiasm of farmers. In many places, the government has put in place regulations for registration and the establishment of charters—when these rules are followed the FAs become *formally established*. In other areas, the emergence of less-formal FAs has been allowed or encouraged. In many cases, even without being formally established, farmers cooperate in their input purchasing and marketing activities, in organisations that are called functioning FAs. Research shows that there is some overlap between

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

formal and functioning FAs, but most non-functioning ones are actually formal ones. In contrast, most informal FAs function well. This indicates that strict regulations may retard FA growth. As is the case in a number of developed countries, the best-practice legislation is less prescriptive and more enabling. It also suggests that, in some areas, fewer detailed rules may not harm the growth of the FA movement.

On the other hand, the government clearly has an important influence on the emergence of FAs. Government involvement in promoting FAs within a locality is the single-most important factor that explains why FAs exist in some communities, but not in others. Such a finding suggests that China may consider adopting a system like that used in other countries, in which government employees are hired with the explicit job to be an advocate for FAs. Such an official would be rewarded for rapid expansion of FAs, as long as they developed in a way that was pro-farmer and positively affected rural welfare.

Finally, research has found that lack of resources—both financial and information—in the hands of FA leaders constrains their growth. The success of the influential FA movement in East Asian economies is often attributed to the fact that there was a great deal of motivation for members to participate in and contribute to the leadership of the local FA. The association had the support of the government and was the recipient of investment funds from budgetary authorities and financial support from the banking system. Many government rural-development initiatives have worked through FAs and, due to the high level of participation of farmers, even the poorest and most land-constrained households could benefit.

POLICY OPTIONS

Although the impetus to meet and act as a group must originate from the farmers themselves, the Chinese Government can create an environment in which FAs can thrive.

First, leaders need to develop laws and regulations that promote and protect FAs. The legal status of groups needs to be clear. FAs need to have the ability to enter into contracts and take loans. FAs need the authority to be able to act for the members of their group, as well as to be subject to well-designed regulations that protect the membership from the leadership, including the way in which the leadership is selected and monitored. There is now a working group that is pushing for a new law by 2006. The law should include clear and unambiguous language giving FAs full

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

legal status. Efforts are needed to ensure that the law is well-written in other dimensions and immediately implemented. When it is final, there should be no expense or effort spared in promoting and implementing the law.

Second, the experience of FAs in other countries has shown that even when a favourable legal and regulatory framework exists, an independent catalyst is also often needed to get FAs started, growing and performing better. While China has a number of FA-promoting agencies, these institutions are controlled by the government. Alternative models should be sought to create catalysts that are first and foremost responsive to the needs of farmers and FAs. The main role of such an advocacy organisation is to facilitate the creation of FAs and provide information that allows its members to promote the interests of the association—usually the FAs that survive are those that provide economic gain to farmers as a result of their involvement.

Third, new measures should be enacted immediately to provide more technical and financial support to FAs. Technical support from government is needed for sound development of FAs and good functioning of those associations. The technical support can be in the form of: training members, leaders and staff of the associations in establishing an efficient and democratic internal management system; technical services provision by public agricultural extension systems/units to members of farmer associations; and a marketing information service from governmental organisations. It is also possible to offer financial and economic support. Care, however, is needed to ensure that the incentives for establishing FAs are not so great that fake FAs appear solely to take advantage of the benefits.

Fourth, there is a great deal of accumulated experience and knowledge about FAs in many other countries. China should take advantage of this experience and expertise to further its own development and utilisation of this valuable tool. Many countries and their FAs are willing to share their knowledge and experience with China.

Fifth, although having FAs provide credit services before rural financial reform may not be a viable alternative, in the long run this may be one of the most effective ways for FAs to grow. In many countries and regions (e.g. Japan, Canada and Taiwan), FA activities often revolved around credit provision. In many areas of China, access to credit may relieve major constraints to production and investment activities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

4.2 PRODUCER ASSOCIATIONS: THE INTERNATIONAL EXPERIENCE

Murray Fulton
Department of Agricultural Economics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Producer associations are a common feature in market economies. Found throughout the world, they initially emerged in the late 1800s in northern Europe, North America and Australia/New Zealand to address problems faced by farmers in the market economy that was then developing. Known as small-group voluntary organisations, grassroots organisations, local organisations and institutions, and collective organisations, producer associations have a wide variation in size and in the forms and activities they undertake. Among other things, producer associations provide goods and services to their farmer members (often through formal business structures such as cooperatives), lobby government, set standards, fund research, administer programs and manage local resources (e.g. water).

Producer associations play a critical role in a market economy. They are a mechanism by which market and government failure are addressed, and they allow adaptation to changing economic and social conditions. The success of producer associations depends on the existence of a formal legal framework within which they can be structured, the development support they receive, their organisational independence—which effectively means they have the freedom to succeed and to fail based on the decisions they make, proper internal property rights and benefit structures, and effective governance and management.

The purpose of this paper is to examine the historical and international experience associated with producer associations. Although examples of producer associations can be found from around the world, the examples will primarily be taken

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

from North America and northern Europe. The next section of the paper provides a definition of a producer association. That is followed by an examination of the economic and social reasons for producer associations. The focus of examination is on the role of market and government failure, as well as the nature of different types of goods and services, in creating the conditions necessary for the formation of producer associations. With these conditions as background, the section also provides a number of examples of producer associations that have been formed and links their formation to the underlying factors discussed in the previous section. The paper then goes on to argue that the formation of producer associations is not automatic, but rather involves a complex mix of players and factors. The examination of the conditions required for the successful formation of producer associations is the focus of the next section of the paper, and is followed by an examination of the challenges facing producer associations. A short summary concludes the paper.

WHAT IS A PRODUCER ASSOCIATION?

Producer associations comprise many different forms of organisations. Their key feature is that they are a form of collective action—they involve a group of producers/farmers coming together to form an organisation that in turn provides goods or services to the producer-members. Examples of producer associations include agricultural cooperatives formed to supply inputs to their members or to market their members' output, informal groups of farmers that provide credit to their members or that meet to discuss the latest agricultural technology or environmental problems, and organisations formed by producers to fund research and development or to administer government programs. What is not included in this paper is any discussion of national sectoral associations that are formed by government and charged with implementing one or more elements of agricultural policy.

Producer associations are typically formed under legislation that provides them with the legal power to enter into contracts and to borrow money. They are typically self-governed, with the members of the association providing the leadership for the organisation. While day-to-day management of the association is often left with employees, the producer-members typically set the policy direction for the association, usually through an elected board of directors.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REASONS FOR PRODUCER ASSOCIATIONS

The development of producer associations is closely associated with the formation of market economies. Market economies arise hand-in-hand with a growing demand by the members of the economy for a wider set of goods and services and for a greater freedom in the social and economic activities that are undertaken. These developments create the conditions necessary for the formation of producer associations. On the economic front, market economies often give rise to either market or government failure; simply put, for-profit firms and governments are often unable to provide the full range of goods and services desired or required by the population. In addition, a number of the goods and services demanded are often supplied most efficiently through producer associations. On the non-economic front, market economies may also create social conditions/factors that serve as the backdrop for the formation of producer associations.

Market failure

Market economies do not always work efficiently and the outcomes are not always beneficial to all groups. The failure of the market economy to effectively meet the needs of the people participating in the economy stems from potential problems that two of its key institutions—for-profit firms and governments—have in supplying goods and services.

Under the conditions of a perfectly competitive economy, for-profit firms are expected to be able to supply goods and services at the lowest cost possible. The conditions of a perfectly competitive economy, however, do not always exist. In particular, the firms participating in a market are often not price takers and freedom of entry and exit does not exist. In such situations, markets are said to be monopolistic or oligopolistic. One outcome of this market structure is that products are sold for more than the marginal cost of producing them. For agricultural producers, the result is what is termed market failure—higher than competitive prices for their inputs and lower than competitive prices for their outputs.

This form of market failure is often cited as a key reason for the formation of agricultural cooperatives, which are one form of producer association. For instance, the agricultural structure that emerged in northern Europe, North America and Australia/New Zealand in the late 1800s was one of relatively small, family-owned

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

enterprises producing raw agricultural products, and relatively large companies that handled and processed this raw product. The consequence of this imbalance in scale economies was the creation of oligopolistic firms that farmers believed did not price their goods and services competitively.

To provide more competitive prices, farmers formed cooperatives that invested in these handling and processing activities. With ownership and control of these activities, farmers were in a position to price the processing and handling services more competitively (Cook 1995; Hansmann 1996). Indeed, agricultural cooperatives have often been billed as the 'competitive yardstick' (Cotterill 1984; Torgerson et al. 1998).

Many examples exist of agricultural cooperatives that were formed to address problems of non-competitive pricing. They include dairy cooperatives, grain handling co-ops, vegetable and fruit marketing co-ops, and input (e.g. fuel, fertiliser, feed) supply co-ops. While agricultural producers often used co-ops to overcome problems of non-competitive pricing, their response was not always to take ownership and control of the processing or handling facilities. For example, bargaining associations—another form of producer association—have been used in a number of countries to provide a group of producers with greater control over the pricing and marketing of their output (Hueth and Marcoul 2003; Hendrikse and Bijman 2005).

Other forms of market failure can also arise in market economies; the ones that are of interest are the lack of provision of goods and services, and informational asymmetries.

Consider first the lack of provision of goods and services. For-profit firms, by their very nature, require a certain expected rate of return before they will undertake an investment. In situations where the size of the market is limited and firms are required to make substantial investments to provide a good or service, the earnings from the sale of the good or service may not be sufficient to cover the cost of the investment or, if the investment cost can be covered, to earn a rate of return that is better than what can be earned elsewhere. In such situations, the outcome is that the good or service in question will not be supplied.

Despite the fact that it may not be profitable to provide this good/service, the consumers of the good/service may nevertheless find it desirable to have it provided—the utility they earn from having it supplied is greater than the cost associated with its provision. When this set of conditions occurs, a market failure is said to exist. Fulton and Ketilson (1992) provide a number of examples from communi-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ties in rural Saskatchewan where this market failure has been addressed through local community-owned cooperatives that provide retail (e.g. groceries and farm supplies) and financial services to the members of the community. The formation of the rural electrical and telephone cooperatives in many parts of the USA during the 1940s is also an example of an association of rural residents attaining a good that would otherwise not have been provided.

As with oligopolistic pricing, the source of the informational asymmetry market failure lies in the fact that the conditions for a perfectly competitive market do not always exist. An important condition for a perfectly competitive economy is that all participants in the market have the same information. In practice, however, some parties will have information that other parties do not—in short, informational asymmetries are said to exist. As Akerlof (1970) showed in his markets for lemons paper, an asymmetry in the information held by the buyer and the seller can lead to a lack of trade between these two parties, even when trade would be beneficial to both.

Numerous examples exist in agriculture of informational asymmetries between producers and the firms with which they deal. Producers, for instance, will know whether they are a good credit risk or whether the quality of their output is high. The firms with which these producers deal may not have this information, however, particularly if the cost of obtaining it is large. Faced with this lack of information—or a high cost of obtaining it—firms may simply decide not to participate in particular markets. For instance, if processing firms are uncertain as to the quality of the product supplied by producers, they will be reluctant to make an investment in a market where product quality is critical. Similarly, faced with a lack of knowledge of the credit worthiness of rural residents, financial institutions may simply decide not to provide credit to rural residents. The result is a market failure—even though trade would be potentially beneficial, it does not take place.

Producer associations provide a potential solution to this market failure. As a collective organisation made up of producers, a producer association may be able to obtain the information more cheaply than can for-profit firms. For instance, members of the association may have knowledge of other members' credit worthiness, knowledge that outside financial firms would not have. Or a producer association may be more effective at providing guarantees of product quality—perhaps because its costs of ensuring compliance are lower. If the producer association is able to reduce these informational asymmetries, it may be able to allow trade to occur when it otherwise would not.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Many examples exist of producer associations that have been formed to address problems of information asymmetry. Among the most common examples are alternative organisations for the provision of rural credit. [For a history of credit unions in Saskatchewan, Canada, see Clements (1965).] Credit unions that provide loans and take deposits can be found in virtually every part of the world; micro-credit schemes that rely on small groups to decide upon loans and to monitor repayment are also increasingly popular in developing countries. One of the keys to the formation and success of these credit organisations has been their ability to efficiently determine an individual's credit worthiness and create incentives for loan repayment.

In addition to fostering price competition, a number of agricultural cooperatives and bargaining associations may have been formed as a way of dealing with informational asymmetries. Hueth and Marcoul (2003) suggest that one of the reasons for the formation of bargaining associations in the US is that they have been able to share production information with processors that would otherwise be costly to obtain, while Hendrikse and Bijman (2005) argue that bargaining associations have developed recently in the Dutch fruit and vegetable industry as a way of more efficiently negotiating contract terms. Henriksen and Hviid (2003) outline how dairy co-ops emerged as the dominant organisational form in the Danish dairy industry in the late 1880s because of their ability to effectively monitor the quality of the milk delivered to the dairy processing plant.

Government failure

Governments are an extremely important part of a market economy. In addition to providing the basic legal and judicial framework (e.g. property rights, court system) for a market economy, governments provide a host of regulations, as well as many goods and services, to their citizens. Governments, however, do not always supply these regulations and goods/services effectively, in large part because of the complexity of the economy and because the required information is unavailable or costly to obtain. Complexity and informational problems result in inefficient policies and programs, myopic regulations, institutional rigidities, political constraints, incorrect objectives and corruption (Lipsey et al. 1988).

Producer associations can often address these government failures, in large part for the same reasons that they are able to address the market failures described above. For instance, by taking on the provision of certain services that might otherwise

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

have been provided by government, producer associations may be less likely to be influenced by other objectives and thus more likely to provide the service effectively. Similarly, producer associations may have informational advantages that governments do not have, with the result that services can be provided more efficiently.

Examples of producer associations that were formed in response to government failures can be found in a number of different areas. Producer-funded research programs (e.g. pulse and canola research in Canada) have in part been formed because the producer associations that operate them have been able to more quickly respond to the changing needs of the industry than have government research agencies. These research associations were also formed because producers of these commodities believed that government was unwilling to fund research to the extent that they believed was desirable.

Producer rural-resident associations have been formed to provide local services and infrastructure that are often provided by one of more levels of government. In the US, rural electrical and telephone co-ops were formed during the 1940s to supply electricity and telephone to rural areas (as discussed above, the formation of these co-ops was in response to a market failure—for-profit firms were generally unwilling to supply these services because they could earn a greater rate of return in the more-populated urban areas). In more recent years, local associations have been formed to provide education, health and social services, and waste-disposal services to rural areas in many parts of the US—see Sanderson and Fulton (2003) for examples. These cooperatives and associations can typically provide services that are tailored to the needs of their members, and thus represent a mechanism to deal with the informational asymmetries that often make government provision costly.

Nature of goods and services

The manner in which goods and services are provided can be linked to their characteristics. For instance, it is argued that the government most effectively supplies public goods, while for-profit firms most effectively supply private goods, and groups or associations most effectively supply what are known as common-pool goods. To understand the role played by producer associations in supplying common-pool goods, it is necessary to examine how goods and services can be characterised and how this characterisation influences the manner in which they are most effectively supplied.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Goods and services have been characterised along three dimensions: rivalry; excludability; and voice. A good or service is said to be rival if its use by one person means that others cannot use it, while a non-rival good is one that can be used by everyone. Shoes and haircuts are examples of rival goods, while scientific ideas, the music and lyrics to a song, and national defence are non-rival goods. Excludability refers to the degree to which one person can exclude others, either technically or legally, from using a good. Goods that can be stored or locked away have a high degree of excludability, while goods or services available in the public sphere (e.g. clean air) are non-excludable. Voice refers to the degree to which the good supplied depends on the specific needs of the people consuming the good and the degree to which these needs are difficult or costly to determine.

Governments are generally the most effective at providing public goods and services—those that are non-rival and non-excludable and have low voice. The classic examples of public goods include national defence and basic scientific research. The non-excludability of these goods and services means that for-profit firms will have difficulty appropriating the benefits that consumers receive from their consumption, while the non-rival nature of the goods means that it is most efficient if they are supplied by only one economic player. The low degree of voice associated with these goods means that informational asymmetries are unlikely to substantially affect the nature of the good or service that is provided. As a consequence, public goods are most effectively supplied by public agencies.

Private goods and services—those with a high degree of rivalry and excludability and a low degree of voice—are generally most effectively supplied by for-profit businesses. The rivalry and excludability of these goods and services mean that for-profit firms are able to capture a portion of the consumer benefit, while the low degree of voice means that specific knowledge of particular groups—which may be difficult or costly for a firm to acquire—is not required to supply the good or service.

The third category of goods and services—common-pool goods—is characterised by a high degree of voice, and some degree of non-rivalry and non-excludability. The presence of some degree of non-rivalry and non-excludability means that for-profit firms often find it difficult to profitably supply these goods; the high degree of voice and the associated informational asymmetries also often makes these goods costly

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

to provide. While governments could supply these goods, this provision may not be effective because of informational asymmetries. An association of the people that consume this common-pool good, however, is often able to supply it.

To effectively supply this good, the group must meet a number of challenges associated with the good's common-pool nature. The group must, at least partially, overcome the free-rider problems associated with limited excludability and rivalry. These free-rider problems include the challenge of raising capital to provide the good and the need for mechanisms to limit those individuals that have access to the good or service. The group must also find a way of tailoring the good or service to the specific needs of the membership, as well as finding rules and regulations that ensure the costs and benefits of the association are distributed in such a manner that the members continue to see a benefit from participating in the association.

A number of the examples of producer associations listed above can be viewed as instances where a group of agricultural producers or rural residents joined together to provide common-pool goods. Rural infrastructure (e.g. electricity and telephone networks) and agricultural research can be considered common-pool goods. They have some degree of non-rivalry, since their use by one person does not generally preclude their use by others. As a consequence, it is more efficient if these goods are supplied only once, since doing so ensures their least-cost provision. While rural infrastructure is largely excludable and could be easily provided by for-profit firms, the incentive for them to provide this good and the associated services may not exist (thus giving rise to a market failure). While governments can supply this good, they too may not have the incentive to provide it at the most desirable level. An association of rural residents, however, often does have the appropriate incentives to supply the good.

In the case of agricultural research, the lack of excludability that is often associated with new seed varieties, for instance, may make it difficult for for-profit firms to profitably undertake the research. While government could undertake the research—and indeed often has—see Alston et al. (1995) for details on the role of government in funding agricultural R&D—it may not have the incentives or the information to undertake the appropriate amount and type of research. In particular, producers of a specific commodity may find it advantageous to be able to fund and to direct research on their crop, particularly if government funds for agricultural research are limited and if producers possess specific knowledge of where the research should be going (i.e. the degree of voice is high).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Of course, the producer association still faces the problem that the research is non-rival and that free-rider problems will emerge in getting producers to fund the research. In Canada, this problem has been overcome by providing the producer association with legislative power to levy a check-off on sales of the commodity in question. This levy power, however, is granted to associations only if they can demonstrate that a significant portion of the producers (e.g. more than two-thirds) support a check-off.

Social factors

Market economies also give rise to social conditions/factors that can lead to the formation of producer associations. The economic and political forces at work in a market economy rarely provide similar benefits and opportunities to everyone. For instance, certain geographic regions often find themselves disadvantaged relative to other regions; in many cases, the hardship suffered by a region is linked to its reliance on economic sectors that decline as a market economy develops. Agriculture is a good case in point. Agricultural products typically have both low price and income elasticities. As a consequence, productivity increases—which result from a substitution of capital for labour and which have been particularly prevalent in agriculture—result in falling agricultural prices and lower employment over time. For regions that are highly dependent upon agriculture, the fall in labour demand resulting from productivity increases has typically been greater than the increase in aggregate output in the region. Thus, high agricultural productivity has had a negative impact on employment opportunities in agriculture-dependent areas.

Historically, agricultural producers have also believed they lacked economic and political power. This perception stems in part from the outcome of the forces described above, in part from producers' need to deal with oligopolistic businesses when they purchase their inputs and sell their outputs, and in part from the geographic isolation often associated with agriculture. The perceived isolation and hardship not only gave agricultural producers something to react to and protest against, but also provided them with a sense of identity.

Numerous examples exist of producers forming associations to reduce the economic hardships associated with agriculture and the geographic region where they are located. In a number of instances, the formation of producer associations was

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

associated with social and/or political movements that sprang up to deal with the perceived lack of economic and political power enjoyed by a region or sector. The formation of producer associations was often aided by the sense of identity that had been created among producers.

The overall role of producer associations

As an alternative form of organisational structure to government and for-profit firms, producer associations have been formed to overcome failures in either the government or the market to provide the entire range of goods and services demanded by agricultural producers. As well, producer associations are much better suited than either private firms or government to providing common-pool goods. Thus, producer associations have to be seen as an important and integral component of a well-functioning market economy.

Further in this vein, producer associations can also play an important check-valve function in market economies. As outlined above, they are a mechanism by which greater competition can be introduced into oligopolistic or monopolistic markets. As well, in the instances when they were formed to redress a perceived lack of economic and political power, producer associations have usually been important in better integrating their members into the economy, often by rebalancing power or in removing the sense of isolation that initially led to their formation.

THE FORMATION OF PRODUCER ASSOCIATIONS

As discussed in the previous section, producer associations emerge because a group sees a benefit from acting together; producer associations are thus a form of collective action. As a form of collective action, however, producer associations suffer from collective-action problems—see Olson (1971) for a discussion of such problems. Because the benefits accrue to everyone, free-rider problems emerge—while each individual sees a benefit from having the good or service supplied, each individual would prefer that the others incur the cost of providing the good or service. The free-rider problem is particularly important at the time of formation of associations. If the free-rider problem is not solved, the good or service may not be provided or supplied.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Associations face other problems at the time of their formation. While the potential members of an association may understand that a problem exists, they may not understand the options available in terms of dealing with the problem. Even after the formation of an association is identified as the preferred method of dealing with the problem, a clear understanding of precisely what the association will do may not be present. As well, membership in the association is often diverse, with the result that compromises need to be worked out, and policies and rules developed that allow the different members to benefit from the association. Finally, trust and commitment may be lacking among the membership, and these are elements that are critical for the formation of effective associations (Ostrom 1990; Ostrom et al. 1993).

As a consequence of these problems, associations are rarely formed solely on their own accord. While associations clearly form from the initiative of what is usually a core group of initial members, the actions of this group are frequently not enough. In addition, the association often requires development assistance from what are known as external development agents (Stefanson 1999). The next section outlines the nature of the development assistance that is typically provided to associations. [For more detail on the ideas presented in the section, see Harris et al. (1998).]

Development assistance

Much of the organisational assistance that has been provided to producer associations is in the form of support for external agents—individuals who assist with the formation of an association but are not directly associated with it (for instance, as a member). At the most basic level, external agents help to offset the organisational problems outlined above. Recall that these problems are often peculiar to associations; e.g. the cost of organising meetings, of getting agreement on the idea of forming the association, and of deciding on the activities that the association might undertake. External agents can reduce these costs by identifying commonalities among the members and by assisting members to understand the interdependencies that exist between them. They often assist in legitimising the use of an association to meet the problem the members are facing, they facilitate discussion among the members, and they push the members to understand the economic situation they are facing. Legitimisation is important because often the association model does not fit with what people have learned in school, from the media, and from their dealings with others. Understanding member commonalities and the economic environment

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

is important because the better the members comprehend the benefits that might result from collective ownership of an investment, the more likely they will be to make the investment.

Once a common purpose is defined, external agents also identify appropriate leaders for the group, assist in the identification of potential members, locate resources for business plans and industry analyses, and help to ensure that the association proceeds only if the outlook is reasonably favourable. To that end, external agents can improve communication among participants, collect and disseminate information, evaluate existing resources, and contribute skills and experience about alternative institutional arrangements and in developing governance structures. While the external agents must have a good understanding of the emerging association, they must remain outside it. Unless the external agents are able to remain outside, they run the risk of imposing their ideas and beliefs on the association and depriving the members of control. Both of these are serious problems for an association. A clear sense of ownership is one of the ways of ensuring member commitment, and the imposition of ideas and beliefs by outsiders usually results in the association not responding appropriately to the problems it is facing.

An important role of the external agent is to build trust and cooperation among the members of an association in an incremental and sequential manner (Ostrom 1990). Rather than occurring within a single step, the process of forming associations often involves a series of small steps—with low initial costs—that progressively build upon one another.

As discussed above, the provision of common-pool goods requires that producer associations develop mechanisms by which the costs and benefits are distributed in a fashion that maintains member commitment to the organisation. External agents can assist and encourage groups to develop rules that are well-tailored to local conditions by providing a low-cost mechanism for modifying these rules and by clearing up inevitable ambiguities about their application. In addition, a system of monitoring behaviour and enforcing graduated penalties is often needed to ensure that collective-action commitments are kept in the long run. External agents can act as monitors and enforcers of rules. However, it is important to stress that, as such, external agents must remain answerable to the members for the process to remain self-governed—while the agents can assist in enforcing the rules and penalties, these must be defined by the members themselves (Ostrom 1990).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Examples of development assistance

Many examples exist where development assistance was critical in the formation of producer associations. The development agents that participated in the formation of these associations come from a wide variety of backgrounds and include people from other associations, university extension agents, government extension personnel, and local business and religious leaders. The cases provided below are linked to examples outlined in the previous section.

In Saskatchewan, retail cooperatives and credit unions were created during the 1930s and 1940s with the assistance of Saskatchewan Wheat Pool field agents. These agents not only helped organise the co-ops, but also often provided the initial office space for the new organisations. Before this, the Saskatchewan Wheat Pool was itself a result of the efforts of outside individuals, including Aaron Sapiro, the California lawyer who was closely connected with the formation of many of the marketing co-ops in various parts of the US and particularly California. The wheat pools were also promoted by farm leaders, pre-existing farm organisations and politicians (Fairbairn 1984).

The importance of cooperative development assistance can also be seen in examples from the US. In the 1930s and 1940s, the United States Department of Agriculture provided considerable support to develop rural electric and telephone co-ops. This active support for co-op development continues today; rural utility cooperatives and associations of existing cooperatives in North Dakota and Minnesota, for instance, played and, continue to play, a very important role in developing 'new generation co-ops' (NGCs). [Stefanson (1999) examines the role of development agents in the formation of NGCs.]

Other factors in association formation and success

There are a number of additional factors that affect the likelihood of association formation and success. Generally speaking, the more homogeneous are the members of the association, the more likely is the association to form. The greater is member heterogeneity in characteristics such as size of operation or type of production activity undertaken, the more difficult it is to find policies and pricing rules that allow all members to benefit. At the same time, complete homogeneity of membership is not advantageous. To be successful, producer associations require a diversity of perspectives and approaches in order to be able to effectively understand and deal with the challenges and issues that they will face. This diversity will not be forthcoming if all members are similar.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

While diversity of views is important, it is also critical that a significant portion of the membership has a common identity or world view. Successful producer associations often build on existing identities and/or encourage the development of new identities. [Akerlof and Kranton (2000) examine the role of identity in economics.] For instance, a number of producer associations have been built on the idea that agricultural producers lack economic power; this was the case in the formation of the large agricultural marketing co-ops—see Torgerson et al. (1998). In other cases, associations have been built on the notion that the members of the association are dynamic, forward-looking and leaders in their agricultural sector. This was the case with the producer associations in Canada that fund research and development, and with the NGCs in the US (Harris et al. 1996; Fulton 2000).

As discussed above, healthy producer associations require well-defined benefit structures, as well as effective monitoring of the actions of the members and the management. These elements are critical for associations because they determine the incentives that the members and management face, which in turn affects the stability of the organisation and its ability to meet its members' needs. Members must be provided with the incentive not only to participate in their association, but also to participate in the appropriate fashion. For instance, members of a marketing association must have the incentive to use their association to market their products and to produce the type and quality of product required for the market that their association is serving. The policy and rules that are chosen for the organisation, the pricing schemes that are implemented, and the monitoring and enforcement that are undertaken will create the incentives for the membership to behave appropriately. As was noted above, it is critical that the membership determines and selects the benefit structure and oversees the monitoring in the association. Member commitment and trust can be developed and maintained only if members feel that they have ownership of their organisation.

The need for members to have ownership and control of their organisation is a critical requirement for successful producer associations and is closely linked to whether the association has been created and is operated on the basis of a bottom-up approach or a top-down approach. In the bottom-up approach, the members have ownership and control—they finance the organisation, select the managers, and determine the benefit and monitoring structure. Although they are often assisted in these activities by external agents (see discussion above), the members make the critical policy decisions, including whether there is in fact a need for the organisation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

An important part of this ownership and control is that the members are responsible if the organisation should fail—they are the ones who will be faced with a loss of equity and/or the loss of service provision.

Under a top-down approach, the association is effectively owned and controlled by some other party or parties. Often this other party is the government (local, provincial/state or national), although it could be another association or a for-profit firm. In addition to reducing member commitment, the top-down approach may result in a lack of information about local needs and may be unable to develop a suitable membership identity.

Evidence strongly suggests that producer associations formed with a top-down approach tend to be unsuccessful. In North America and northern Europe, virtually all producer associations are formed on the basis of a bottom-up approach; elsewhere in the world, however, the top-down approach has often been used. For instance, most of the agricultural co-ops formed in Africa and India during the 1960s and 1970s were formed using a top-down approach. While the governments of the day understood that co-ops could be an effective element in their development strategy for the reasons cited in the previous section, they were unwilling to let the co-ops be formed by the producers on the basis of their needs and requirements. Although governments have invested millions of dollars in these enterprises, they have not been successful.

While producer ownership and control are critical for producer associations, government support may also be required. As will be discussed below, a formal legal framework for producer associations is one type of support that government can provide. In addition, some types of producer associations will require specific legislation in order for them to operate effectively. For instance, producer-funded and directed research organisations must be able to raise their research money through something like a producer check-off. As was discussed earlier, this power should be granted to an association only if it can demonstrate that a substantial majority of its members are supportive of such power being granted. As well, once the check-off is in place, it is critical that the association be allowed to make the research-funding decisions, since it is the members' funds that are being spent.

The external environment in which producer associations are formed is also important to their success. The presence of a legal framework that allows for the establishment of producer associations is critical. This framework is important for

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

a number of reasons. First, a formal legal structure provides the associations with the ability to enter into contracts and to borrow money. This formal legal status is critical if producer associations are to carry out the functions described earlier in the paper.

Second, by determining the basic organisational features of producer associations (e.g. the composition of the board of directors, the types of benefit structures that are allowed and not allowed), the legal framework can ensure that agricultural producers are provided with ownership and control. Whether or not the members then use these basic organisational features effectively is their decision.

Third, the presence of a legal framework also provides legitimacy to producer associations as bona-fide organisations. One of the fundamental institutions in an economy and a society is the legal system. The legal system typically reacts to and reflects the changing needs and values of society, rather than acting as an architect of these values. As a result, the law serves a function similar to that of an engineer or plumber. Once a plan or policy objective is identified, the legal system assists in putting the plan into place. Thus, the presence of a legal framework for producer associations is a sign that a country has understood the need for producers to work together to address problems they are facing and is willing to provide them with a mechanism and a structure for them to work together.

Although producer associations may be provided with a basic level of legitimacy by a national or provincial government, numerous groups may still oppose their formation and operation. As was outlined in the previous section, producer associations are often formed because of market and government failures. As a consequence, the formation of producer associations may often be viewed as a threat. For-profit firms or government personnel/agencies may not wish to see additional competition or to see economic power shift in favour of producers. As a result, the power and incentive structure in the larger community may impose roadblocks and additional costs on the formation of producer associations.

Different power and incentive structures in different communities are one reason why producer associations that are successful in one community may not be successful in others. Many other reasons exist for this lack of success, since organisations depend on a complex set of economic and social factors—e.g. the social and economic background of the membership, the world view of the membership, and the presence and/or nature of an external development agent. While many

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

examples do exist of organisational models being successfully transplanted from one community or country to another, there are also many examples where the transplant has not been successful.

The question is often raised as to whether producer associations should be formed from scratch or whether existing organisations should be restructured and reformed. The reform of existing organisations may provide access to existing infrastructure and employees, thus reducing the cost of forming the association. However, the reform of existing organisations does not come without costs. Vested interests and existing mindsets can often make the reform very difficult; moreover, reform may not engender the required sense of ownership and control among the membership that is needed to create a successful organisation. As a result, the creation of a new organisation may often be a less costly way of forming an association. The creation of new organisations may also be important in another respect. If successful, new organisations are often used as models by producers in other locations who are looking for a way of overcoming similar problems.

CHALLENGES FOR PRODUCER ASSOCIATIONS

Once established, producer associations face a range of challenges. Most of these have to do with the benefit and monitoring structure that is in place in the association. In short, associations face a number of what can be termed internal property-right issues: the free-rider problem; the horizon problem; and control and agency problems—for a discussion of these property-rights problems, see Vitaliano (1983), Cook (1985), Bonin and Jones (1993) and Hansmann (1996).

The free-rider problem exists because of the collective nature of the association and was described earlier in the paper. As a result of free-rider problems, associations may have trouble raising capital. They may also have trouble with members overusing facilities or making/requesting deliveries at inopportune times. The horizon problem emerges because the benefits that the members can obtain from the organisation are limited to the time that producers are actually members. As a consequence, producers near retirement may be unwilling to make any major long-term investment in their association, since they will not see the benefits of this investment (Cook 1995; Rey and Tirole 2001).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Control and agency problems arise because of the manner in which producer associations are governed. A widely dispersed ownership, especially in large associations, provides individual members with limited incentives to monitor the performance of the managers of their association. The result is the well-known agency problem—managers may have the ability to direct the association into activities that are beneficial to them rather than the members. This ability is enhanced because managers also have access to information that the members lack, which gives them additional power (Cook 1995).

The latitude that managers have to direct the activities of the association can lead to attempts by members to steer the association to positions that will benefit them personally. The ability and likelihood of this sort of rent-seeking activity is likely to be greater, the greater is the heterogeneity of the association (Banerjee et al. 2001). The need to ensure member-support means managers must constantly work to build consensus, an activity that is often costly—particularly when members have highly diverse interests. Capital constraints and the horizon problem also make management more difficult (Cook 1994).

These property-rights problems are likely to become more severe over time (Cook 1995). At the time of their formation, association membership is typically reasonably homogenous, in large part because it is likely that groups with a highly heterogeneous membership will be unsuccessful at forming associations. In addition, there is likely to be a fairly strong sense of identity among the members; most will have a similar world view as to the problems they are facing and how the association can be used to address those problems.

Over time the membership of an association changes. New members replace old members as retirements occur; also, existing members make changes to their own operations and to their world view. As a consequence, member heterogeneity increases, and makes it more difficult to keep all the members satisfied that the association is providing them with a benefit. The shift in membership also makes the existing set of policies, pricing schemes and monitoring systems less than ideal at producing the most desirable behaviour from the members; in addition, since the association is no longer as effective and may be operating on the basis of what is perceived to be a different world view, member commitment is reduced.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

This change in the membership is typically accompanied by changes in the structure and activities of the association. As associations grow and develop, they usually rely more and more on hired management for their administration; in addition, the scope of the activities of the association often increases. As a consequence, there is a greater likelihood of agency and control problems emerging. As well, increased member heterogeneity results in greater opportunity for rent-seeking that can lead to loss of efficiency and reduced member commitment.

The external environment in which the association is operating is also subject to change. While some form of consensus among the members may have existed when the association was first formed, this consensus may be difficult to maintain when the association is faced with adapting itself to a new economic environment. In addition, the structure of the association may have to be changed in order for it to operate effectively in the new environment. [Fulton (2000) discusses how the contract structure of NGCs better fits agriculture's new economic environment.] The result is that, over time, associations typically become more difficult to manage. Property-rights problems become more acute, and it becomes more difficult to find policies and programs that will appeal to all members. Member commitment to the organisation may also diminish. Nevertheless, many producer associations are long-lived and have successfully adapted themselves to their changing internal and external environments. A good example is the cooperative retailing system in western Canada, which has shown substantial growth and increased profitability for much of the past 20 years (Fairbairn 2004).

Part of the reason for the success of associations over the years can be linked to the efforts made to constantly educate the elected and corporate officials. For instance, compulsory board training is a feature of most large cooperatives in Canada and the United States. This training is carried out both in-house and through the expertise of the various educational and training centres that have been developed over the years. Some of the training and education is carried out in universities and in associations or federations of cooperatives; many of the large commercial cooperatives also conduct their own in-house training (Hammond Ketilson and Fairbairn 1994).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CONCLUDING REMARKS

Producer associations are an important part of agriculture in a market economy. Since neither the market nor the government is capable of effectively and efficiently providing all the goods and services desired by agricultural producers and rural residents, producer associations—which, when properly structured have strengths that for-profit firms and governments do not have—have often been formed to provide goods and services. Producer associations are also an important means by which the market economy regulates itself and adaptation occurs. They help correct the inefficiencies, excesses and rigidities that often occur and they can assist in rebalancing power in the economy.

The successful formation of producer associations requires a formal legal structure, independence—associations must be allowed to fail and to succeed, assistance by third-party agents that allow the members to take effective ownership and control of their organisation, and clearly established property rights and rules for sharing benefits. Over time, associations succeed or fail based on their ability to solve internal property-rights problems and to successfully adapt to changing conditions in the external environment. The ability of associations to react to these challenges is linked to the governance and management structures they have in place and to the efforts they make to constantly educate their members and staff.

REFERENCES

Akerlof, G.A. 1970. The market for 'lemons': quality uncertainty and the market mechanism. Quarterly Journal of Economics, 84, 488–500.

Akerlof, G.A. and Kranton, R.E. 2000. Economics and identity. Quarterly Journal of Economics, CXV, 715–753.

Alston, J.M., Norton, G.W. and Pardey, P.G. 1995. Science under scarcity: principles and practice of agricultural research evaluation and priority setting. Ithaca, NY, Cornell University Press.

Banerjee, A., Mookherjee, D. et al. 2001. Inequality, control rights, and rent seeking: sugar cooperatives in Maharashtra. Journal of Political Economy, 109, 138–190.

Bonin, J.P., Jones, D.C. et al. 1993. Theoretical and empirical studies of producer cooperatives: will ever the twain meet? Journal of Economic Literature, 31, 1290–1320.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Clements, M. 1965. By their bootstraps: a history of the credit union movement in Saskatchewan. Toronto, Clarke, Irwin and Company Limited.

Cook, M. 1994. The role of management behavior in agricultural cooperatives. Journal of Agricultural Cooperation, 9, 42–58.

— 1995. The future of U.S. agricultural cooperatives: a neo-institutional approach. American Journal of Agricultural Economics, 77, 1153–1159.

Cotterill, R.W. 1984. The competitive yardstick school of cooperative thought. American cooperation. Washington, DC, American Institute of Cooperation, 41–54.

Fairbairn, B. 2004. Living the dream: membership and marketing in the co-operative retailing system. Saskatoon, Centre for the Study of Co-operatives.

Fairbairn, G.L. 1984. From prairie roots: the remarkable story of Saskatchewan wheat pool. Saskatoon, Western Producer Prairie Books.

Fulton, M. 2000. Traditional versus new generation cooperatives. In: Walzer, N. and Merrett, C., ed., A cooperative approach to local economic development. Greenwood Publishing Group.

Fulton, M.E. and Hammond Ketilson, L. 1992. The role of cooperatives in communities: examples from Saskatchewan. Journal of Agricultural Cooperation, 7, 15–42.

Hammond Ketilson, L. and Fairbairn, B. 1994. Education and training in North America, co-operative. In: Dülfer, E., ed., International handbook of cooperative organizations. Gottigen, Vandenhoeck and Ruprecht.

Hansmann, H. 1996. The ownership of enterprise. Cambridge, Mass., Harvard University Press.

Harris, A., Fulton, M.E., Stefanson, B. and Lysyshyn, D. 1998. Working together: the role of external agents in the development of agriculture-based industries. University of Saskatchewan, Saskatoon, Centre for the Study of Co-operatives and the Department of Agricultural Economics.

Harris, A., Stefanson, B. and Fulton, M.E. 1996. New generation cooperatives and cooperative theory. Journal of Co-operatives, 11, 15–28.

Hendrikse, G. and Bijman, J. 2005. On the emergence of new growers' associations; self-selection versus countervailing power. European Review of Agricultural Economics, Special Issue: Contracting in Agriculture, in press.

Henriksen, I. and Hviid, M. 2003. Governance in a contractual perspective. A historical case. Paper presented at the European Research Conference (EURESCO) on vertical markets and cooperative hierarchies: the role of cooperatives in the international agri-food industry. Bad Herrenalb, Germany, 12–16 June 2003; <http://www.flec.kvl.dk/kok/coop03/>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Hueth, B. and Marcoul, P. 2003. An essay on cooperative bargaining in U.S. agricultural markets. Journal of Agricultural & Food Industrial Organization, 1(1), Article 10.

Lipsey, R.G., Purvis, D.D. and Steiner, P.O. 1988. Economics, 6th ed. Harper and Row.

Olson, M. 1971. The logic of collective action: public goods and the theory of groups. Cambridge, Harvard University Press, Harvard Economic Studies.

Ostrom, E. 1990. Governing the commons: the evolution of institutions for collective action. New York, Cambridge University Press.

Ostrom, E., Schroeder, L., and Wynne, S. 1993. Institutional incentives and sustainable development: infrastructure policies in perspective. Colorado, Westview Press, Inc.

Rey, P. and Tirole, J. 2001. Financing and access in cooperatives. Working Paper. L'Institut d'Economie Industrielle, University of Toulouse, Toulouse, France. <http://www.idei.asso.fr/Commun/Articles/Tirole/Financing-Access.pdf>.

Sanderson, K. and Fulton, M. 2003. Producer adaptation to the new agriculture: application of the co-operative model to changes in market specifications, regulation and service access. Report prepared for the Canadian Co-operative Association and Le Conseil Canadien de la Coopération, February. University of Saskatchewan, Centre for the Study of Co-operatives.

Stefanson, B. 1999. Adult educators in co-operative development: agents of change. Unpublished MSc thesis, University of Saskatchewan.

Torgerson, R.E., Reynolds, B. and Gray, T.W. 1998. Evolution of cooperative thought, theory and purpose. Journal of Cooperatives, 13, 1–20.

Vitaliano, P. 1983. Cooperative enterprise: alternative conceptual basis for analysing a complex institution. American Journal of Agricultural Economics, 65, 1078–1083.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

4.3 FARMER PROFESSIONAL ASSOCIATIONS IN RURAL CHINA:

STATE DOMINATED OR NEW STATE–SOCIETY PARTNERSHIPS?

Minggao Shen
Center for Chinese Economic Research, Peking University, Beijing, People's Republic of China

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

Linxiu Zhang
Centre for Chinese Agricultural Policy, Institute for Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

Two decades of economic reform have changed the economic landscape of China. Per-capita grain output has reached developed-country levels; many farmers have shifted into higher-value crops, making decisions increasingly on market-oriented principles; the research system has helped push up productivity by almost double the rate of population growth; and the nation has by far the most sophisticated agricultural biotechnology program in the developing world—indeed many of its breakthroughs are of global importance (Huang et al. 2002). Rising food exports demonstrate that China's farmers are now able to compete in international markets. More than 40% of rural residents have off-farm employment; and about 100 million of them have moved to urban areas for employment (de Brauw et al. 2002). Rural incomes have risen

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

dramatically and hundreds of millions of people have escaped poverty during this time (World Bank 2001). Growth in agriculture, non-farm employment and rural industry, and the transformation of domestic and international markets, have changed the face of rural China and are playing key roles in the nation's modernisation.

While the new landscape should fill leaders with optimism, there are still great challenges ahead. With the transition from planning in the rural economy mostly complete, China's main challenge has shifted to one of development (Nyberg and Rozelle 1999). In China's new environment, the main measure of success will be the extent to which the rural economy can become an integral part of the nation's push towards modernisation. For China to successfully modernise, the nation's economy will have to experience a fundamental transformation—from rural to urban and from agriculture to industry and services. Also, the government needs to play a role when markets fail (Mo 1995).

To effect such a transformation, one of the main challenges is a shift in the role of the state and development of new partnerships with citizen groups to carry out efficient and equitable growth (World Bank 2003). Although the government has moved out of the direct provision of many goods and services, it needs to redirect efforts to providing public goods, overcoming market failure and providing useful services that the private sector is unlikely to find profitable. To achieve these changes, the main task of leaders is to comprehensively redefine the role of government and make explicit to various levels of governments, bureaus and individual leaders what they should and should not be doing. Also, as the government gets out of direct production, it will be in a better position to create, implement and coordinate policies that involve conflicting goals. Mistakes have been made in this area in the past, such as poverty-alleviation projects to raise livestock (goats, sheep) in unsuitable areas that have resulted in serious environmental damage. Some sub-national governments have taken drastic but effective measures to manage natural resources while still helping the poor, but others need better guidance.

In a modern society that is dominated by markets and where assets and information are mostly in the hands of private individuals and enterprises, the government needs partners to carry out its tasks (Trewin 2003). It is important at this point of its development for China to encourage truly independent non-state organisations, including organisations that will act as information networks, business-support groups, marketing systems and credit cooperatives. Drawing on the experience of

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Japan, Korea and Taiwan, the rural economy in China is in need of active and strong farmer professional associations (FPAs) to help the rural population carry out a number of production and consumption-oriented activities needed for rapid growth.

Although the role of FPAs is beginning to be discussed again in academic and policy-making circles, such institutions are still relatively low profile and little is known about them. It has been stated that there are more than 100,000 farmer associations in China (World Bank 2003). The Ministry of Agriculture (MOA) claims that the current associations include 4–5% of all farmers (Zhou 2003). The validity of these numbers, however, is unclear, and they need to be treated with caution, since the structure of most associations is still ill-defined and there are no standards on which reports from FPAs are based.

To overcome the dearth of information on so important a part of China's future development process, this paper reports the results of a survey designed to provide a picture of the current status of FPAs in China. As our first objective, we establish a baseline of the size of the FPA movement in China, its rate of growth and the scope of the activities. Second, we identify when, where and what FPAs are emerging, examining our data by province, by income category and by several other indicators. Finally, we seek to find what factors are inducing the emergence of FPAs.

DATA

At the heart of our analysis is our data-set. We use a unique set of data on the institutions and development investments in rural China that we collected in 2003. The authors and several Chinese and foreign collaborators designed the sampling procedure and final survey instrument, with the village as the unit of analysis. The field-work team, made up of the authors and 30 graduate students and research fellows from Chinese and North American educational institutions, chose the sample and implemented the survey in 6 provinces and 36 counties in an almost nationally representative sample. The sample provinces were each randomly selected from China's major agro-ecological zones.[1]

The sample villages were selected by a process that the survey teams implemented uniformly in each of the sample provinces. Six counties were selected from each province, two from each tercile of a list of counties arranged in descending order of gross value of industrial output (GVIO). GVIO was used on the basis of the conclusion

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of Rozelle (1996) that it is one of the best predictors of standard of living and development potential and is often more reliable than net rural per capita income. Within each county, we also chose six townships, following the same procedure as the county selection. When our enumerator teams visited each of the 216 townships (6 provinces by 6 counties by 6 townships) officials asked each village to send two representatives (typically the village leader and accountant) to a meeting in the township. On average, enumerators surveyed 11 villages in each township. The number of villages per township ranged from 2 to 29.[2]

After answering questions about the economic, political and demographic conditions of their villages in 1997 and 2003, the respondents answered a set of 25 questions about the activities of FPAs that were operating in or around their villages. The questionnaire was designed to elicit information about the size of the association, its coverage, its main functions, its charter, registration rules and internal organisation. The survey also included a section that attempted to understand how the actions of government agencies affected the start-up of the associations.

---

1 The sample villages come from six representative provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanghai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighbouring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognise that we have deviated from the standard definition of China's agro-ecological zones, the realities of survey work justified our compromises. Pretests in Guangdong demonstrated that data collection was extraordinarily expensive and the attrition rate high. One of our funding agencies demanded that we choose at least two provinces in the northwest. Our budget did not allow us to add another central province (e.g. Hunan or Hubei) to the sample.

2 On average, the attrition rate was only 6%. In no case, did we leave a township until at least 80% of the villages had been enumerated. In order to examine if the villages that were not enumerated (due to attrition) were systematically different from those that participated, we collected a set of variables about no-show villages from the township and ran a probit regression with the dependent variable represented as an indicator variable where the variable equalled one if the village did not come and zero otherwise. There were no variables that were significant. If a township had more than 25 villages, we randomly selected 25 of them. This affected fewer than five townships.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

FARMER PROFESSIONAL ASSOCIATIONS IN CHINA

To meet our first objective, we examine the number of villages that report any sort of FPA, regardless of its characteristics. We then use this information to identify those FPAs that have met a number of criteria (e.g. having a certification or being officially chartered) that are thought to typically define a *formal association*. We also identify those FPAs that have characteristics (e.g. they are not registered as a commercial entity at the Market Administration Bureau, or they are associations in which government officials do not have decision-making authority) that make them appear to be a *functional association*. In most of the report, we will examine the nature of FPAs according to these definitions.

When leaders from the 2459 sample villages were asked the *unqualified* question, 'Are any farmers in your village currently participating in an FPA?' only a small fraction of the respondents responded affirmatively. According to our data, 251 villages reported that their farmers participated in some form of FPA. Since some villages had farmers in more than one FPA (2 villages reported activity in 4 FPAs; 3 villages reported activity in 3 FPAs; 23 villages reported activity in 2 FPAs), our surveyors enumerated 290 FPAs in the sample villages.

Although the sample size was relatively small (only 0.35% of China's villages), with a number of assumptions, the randomness of our sample allows us to make an estimate of total FPA activity in China. If it is assumed that all villages have equal probability of being observed and are of equal size, our survey finds that 10.21% (250/2459) of China's sample villages have FPAs (not shown in Table 4.1). When we account for the probability of observing each of our villages according to their population proportion (that is weighting our descriptive statistics by the sizes of the population of township, county and region of each observation), our survey finds that 10.21% of China's villages have FPAs (Table 4.1, column 1, row 1). Using the weighted statistics (*as we do in the rest of the report*) and extrapolating from our sample to the rest of China, we estimate that about 75,000 villages at least nominally have FPAs (row 2). Moreover, on average, 28.5% of the households in each village are part of the village's FPA. Hence, our data suggest that about 2.91% of China's farm households, or about 6.93 million households, nominally have an association with a FPA (Table 4.1, column 1, rows 3 and 4). These numbers of unqualified FPAs are surprisingly close to the figures of the Ministry of Agriculture, which has reported

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 4.1 National point estimates of villages and farm households that participate in farmer professional associations (FPAs) in China, 2003

		Total FPAs[a]	Formal FPAs[a]	Functional FPAs[a]
National point estimates of number of villages with FPAs[b]	%	10.21	7.49	7.50
	Number of villages (thousands)[c]	75	55	55
National point estimates of number of farm households that participate in FPAs[b]	%	2.91	1.76	2.08
	Number of households (millions)[d]	6.93	4.19	4.95

[a] Total FPAs includes all reported FPAs, without any qualifications. Formal FPAs is a term that designates FPAs in villages that meet three of the four criteria, including being registered, being chartered, having formal membership requirements and/or charging annual fees. Functional FPAs is a term that designates FPAs in villages that meet three criteria, including *not* being registered as a commercial entity in the Marketing Administration Bureau, *not* being mainly set up to run a commercial business and *not* being dominated by a government official in the making of major decisions.

[b] Regional weights are calculated for six regions in China that are estimated on the basis of estimates from the six sample provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanghai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighbouring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognise that we have deviated from the standard definition of China's ago-ecological zones, the realities of survey work justified our compromises. The regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region

[c] Number of villages estimated by multiplying the estimated proportion of villages with FPAs (row 1) times the number of villages in rural China (737,000—China National Statistical Bureau (2001)).

[d] Number of households estimated by multiplying the estimated proportion of households that participate in FPAs (row 3) times the number of households in rural China (238.1 million—China National Statistical Bureau (2001)).

Source: authors' survey

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

that about 100,000 villages had FPAs, and include 4–5% of China's households. In short, although only a small fraction of China's villages have FPAs, the absolute number of FPAs in China is large.

When more carefully categorising the reported FPAs—into those that follow more *formal* rules (without regard to how they function), those that *function* according to standard definitions of associations (as opposed to commercial units or government programs), and those that are only nominally FPAs (or those that are merely FPAs in name)—we produce what we believe are more-informative estimates of FPA activity in China. In the survey, we included two sets of questions designed to understand how FPAs operate. The first set measured the formality of FPAs. Specifically, we asked: (a) if the FPA was formally registered (and where); (b) if the FPA had a written charter; (c) if there was a process by which individuals established their formal membership; and (d) if participants were required to pay dues or an annual membership fee. Although somewhat ad hoc, we decided to designate those associations that had two or more of these characteristics as *formal FPAs*.

Using our information on FPA formality, we find that most, but not all, FPAs follow internationally established procedures and can be counted as formal FPAs (Table 4.2). For example, 74% of FPAs formally register with one of several government bureaus (Table 4.2, row 1). Slightly more (82%) have written charters, which typically are documents that specify the rules and regulations governing FPA activities (Table 4.2, row 3). Just under three-quarters (72%—although not exactly the same FPAs) have procedures in which they admit formal members (Table 4.2, row 2). In these villages, members must fill-out an application, and membership is not automatically conveyed on them merely because they are in the village. Finally, some FPAs, though a much lower proportion (14%), have annual membership-fee requirements that oblige active members to pay dues to the FPA. By examining the presence or absence of the formality characteristics in the sample FPAs, we find that 2% have none of the four formality characteristics and 15% of reported FPAs have only one or none (Table 4.2, rows 5 and 6). The rest, or 84% of FPAs (33 + 41 + 10), meet at least two of the formality criteria and are counted as formal FPAs.[3] According to the formality criteria, in total there were 233 FPAs, which would imply that 7.49%

[3] Note that, throughout the paper, rounding means that percentages in many cases do not add up to 100.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PART TWO

INVESTING IN AGRICULTURAL AND RURAL RESOURCES

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 5

PREPARING FOR LABOUR MIGRATION

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

5.1 PREPARING FOR MIGRATION OFF THE FARM

CCICED ARD Task Force members

All modern nations in the world—in Europe, North America and Asia—are urban, with robust industrial and service economies. There are no high-income countries in the world that have more than 7% of their populations reliant on agriculture, or have more than 10% of their people living in rural areas. None of these nations, however, started out with this structure. At some time in the past they were all similar to China's society in the early 1980s, when most of the population was living in rural areas and engaged in farming. From international experience, one of the most defining characteristics of successful development is transformation from rural to urban societies based on industry rather than agriculture. The development of labour markets and access to off-farm jobs is the conduit through which the shift of population from rural to urban and agriculture to industry occurs.

CHINA'S LABOUR SHIFTS

Off-farm work has emerged as the main source of income growth for rural households. By 2003, half of the members of China's rural labour force earned at least part of their income from off-farm jobs; more than 85% of households had at least one person working off the farm. Internal migration has become the most common way for rural labourers to get a job off the farm. More than 100 million migrants now live and work outside of their home villages. More than 75% of 16–20-year-olds work off the farm in cities far away from their homes. A veritable flood of young and relatively well-educated workers has been flowing towards China's cities and into industrial and service sector jobs in recent years. Self-employment opportuni-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ties in the rural economy have also risen rapidly during the past two decades, and the quality of these micro-enterprises has steadily improved. The firms, although household-based and extremely labour intensive, provide employment for more than 80 million rural residents in more than 50 million households.

OFF-FARM EMPLOYMENT AND PRODUCTIVITY, INCOME, POVERTY AND INEQUALITY

The shift of the rural population off the farm into wage-earning jobs and self-employment has generated large increases in productivity and is responsible for most of the increase in rural incomes since the mid 1980s. Large increases in productivity are generated by moving low-productivity workers from farms to more-productive manufacturing and service-sector jobs. For example, during the 20th century, more than 60% of the rise in productivity in the fast-growing Asian economies is attributed to the shift of the labour force from rural to urban areas. Research shows that about 50% of the rise in productivity in China has come from moving rural workers into off-farm jobs.

The role of off-farm work in raising rural incomes is significant. Between 1980 and 2000, rural household income per capita rose by 4% per year, almost all of it from the off-farm sector. The importance of off-farm employment is even more significant when viewed from the household's perspective. When households are able to place a member into an off-farm job, household income rises, on average, by 56%.

Off-farm employment is the primary engine of poverty reduction and in recent years has begun to aid in the reduction of rural income inequality. Economic growth and access to off-farm employment were by far the greatest sources of poverty reduction during the 1980s and 1990s. The increase in participation of young men and women from poor, rural areas demonstrates the pervasiveness of the penetration of labour markets into poor areas. For example, the participation rates of 16–25-year-old men and women from poor areas in wage-earning activities rose from about 15% in 1990 to nearly 70% in 2000.

Although off-farm income was increasing inequality during the late 1980s and early 1990s, since 1995, as more and more households have found jobs off the farm, wage-earning activities, especially the earnings of migrants, have begun to reduce inequality. Access to off-farm employment was by far the most important source of

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the reduction in inequality. In the same way that other East Asian countries, during their periods of rapid development, experienced 'growth with equity', China's income disparities have moderated, and this has been almost exclusively due to the rapid rise in more-equally distributed wage-earning jobs. China's rural Gini coefficient fell from 0.42 to 0.38 between 1995 and 2002.

ENABLING FACTORS

Rapid economic growth has been responsible for the strong expansion of off-farm employment for rural workers. China's continued rural transformation will depend on the demand for labour generated by the industrial and service sectors. Importantly, the key industries in job creation are mostly in the market-oriented, private sector.

As China's economy has developed and the incentives that drive employment and other business decisions have become more focused on profits, labour markets have emerged and have gradually begun to function well. Research supports this assertion, especially work on the off-farm sector's *returns to education*—the relationship between investment in education and earnings. Returns to education in China increased during the 1990s. For example, the return to education for those 30 years of age reached more than 10% by 2000; the return to education in the migrant labour force is more than 13%. As these returns have increased, the importance to households of investing in education has risen, since higher wages and access to off-farm jobs depend inherently on access to education.

While the rising demand for rural workers was the key to increasing off-farm employment, a number of other factors also allowed rural residents to find off-farm jobs. Despite the persistence of China's household registration system and the artificial barriers that it raised during the planning era, restrictions on movement around China and into cities for rural residents were gradually relaxed throughout the 1980s and 1990s. In the countryside, the initial worries about land-tenure insecurity proved unfounded and, as land rights improved and rental markets emerged, individuals and families have been increasingly willing to leave their rural homes. Rules and regulations for self-employment are minimal and the ease of entry into many sectors, such as construction, transportation, trading, retail and small-scale manufacturing, has encouraged those with capital and entrepreneurship to become self-employed in search of higher returns. Today, China's markets for wage-earning workers and for the self-employed are among the fastest growing and most competitive of all markets.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REMAINING CONSTRAINTS

Not enough jobs and lack of education (poor human capital) are the main constraints to future growth of off-farm employment. While much progress has been made in the management of China's industrial structure, many policies of the past and present distort the relative demand for labour and capital. For example, an inordinate proportion of loans from the nation's banking system are targeted for capital-intensive industries that provide relatively little employment, while many medium and small enterprises are unable to obtain enough financing.

While the dual urban–rural household registration system does not act directly as a barrier, the lack of basic services for rural migrants is undoubtedly slowing China's transformation. Migrants still face discrimination in entering urban school systems, despite recent changes in regulations. Private health clinics that are affordable for rural migrants are heavily regulated, frequently to the point to which they are driven underground. Housing policies in the cities have not promoted the emergence of a low-cost housing sector—either for sale or rent. There is little private housing available to migrants—especially in the larger, faster-growing municipalities. Health insurance, unemployment insurance and social security are still unavailable to rural workers. Above all, rural China's weak education system—especially in poor areas—and its poorly developed system of skills-training pose the largest threats to the long-run growth of the economy. Even with the government's recent efforts to improve education, the weakness of rural education is evident in many dimensions. For every 100 yuan spent by the government on an urban primary student, only 20 yuan are spent on rural students. The difference is even greater for middle school.

The quality of rural education is poor. There is almost no country in the world in which primary education is not free. Other countries support primary and secondary education for the simple reason that it makes economic sense to do so—the social return is far above the private return. And while private returns are high and most rural families are willing to invest heavily in the education of their children, the current system often puts a burden on rural households. China's rural households, especially in poor areas, spend an amount that is equivalent to up to half of per-capita income on elementary school fees and even more (an amount that is equivalent to a level that exceeds per-capita income) on middle-school fees. In many cases, they are unable to afford high school and college, in the rare cases that students are able to gain entry. The main problem, of course, is lack of funding. Part

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of this problem is structural. In China, local governments still bear an unusually large part of the burden for financing primary and secondary-school education. In most modern nations, senior levels of government provide a large part of all basic educational services. With the rise of migration in China, local governments not only will have fewer resources to finance local education, but also will have increasingly less incentive to provide high-quality education, since those that get educated will almost certainly leave the local economy. Moreover, it has been shown that when the cost of education is lower (because of full or mostly full subsidies from the government), girls are more likely to attend school (since some families will be less willing to spend scarce household resources on their daughters).

The low level of funding and poor quality of rural education manifests in many ways. Although attendance rates in primary schools have risen in recent years, drop-outs, repetition of grades and poor grades still plague many schools, especially those in poor, remote and minority regions. Research has shown that young girls in some areas are especially vulnerable. The greatest discrepancies occur in secondary school. Despite rules on mandatory nine-year education, the drop-out rate of rural children is more than 10–20 times that of urban children. And, while upper-middle-school education is becoming nearly universal for students in many cities, it is still unusual for households in many rural areas. Entrance to college is rare and almost unheard of in most villages. Hence, in a society that is endowed with labour, access to those services that enhance human capital and raise the returns to labour are extremely unequal. If not rectified soon, this will almost certainly become a bottleneck for development.

POLICY OPTIONS

Unfortunately, there are few, new policy ideas for reducing barriers to the continued expansion of off-farm employment. Most fundamentally, increased off-farm employment depends on *new jobs and enhancing human capital*.

On the side of demand for labour, rapid economic growth is the only true engine of employment growth, especially in an economy like that of China, in which labour-markets function reasonably well and where many industries are relatively unregulated. Policies that promote labour-intensive manufacturing and service provision are needed, and policies to minimise investment into, and loans for, capital-intensive

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

industries should be based on profitability and not on other criteria. Any measure that eliminates distortions in investment into, and lending for, state-owned enterprises and capital-intensive firms and directs investment to the private sector and labour-intensive firms will be pro-employment.

On the supply side, the experience of developing countries around the world, but especially those of Asia, demonstrates that rural education underpins development. China needs to commit itself to providing free primary and lower-middle-school education. Additional funding to make upper-middle-school and college education attainable for rural students should be implemented. Needs-based scholarship programs are desperately required. In short, the gap in funding between rural and urban education should be eliminated and China should make it a goal to allow all children, regardless of their socioeconomic status, equal access to education. School funding, at least for poor areas, but ideally for all of rural China, should come from the national government. The curriculum for rural residents should be flexible, especially at the middle-school level, to allow both academic and skills-training options. If anything, teacher salaries in rural areas should be raised above those in urban areas to encourage high-quality teaching. Equally ambitious efforts should be focused on providing better health services and health insurance. Above all, even more effort should be made to provide education and health services to those in remote, minority regions.

New and innovative programs are also needed for those who are still young and mobile and have completed their basic education program. Adult training programs that give potential migrants the skills that employers demand will improve the nation's productivity. Experiments with adult education in rural source communities and in urban migrant destinations should begin and be given priority funding.

In the cities, the policy goal should be to offer those of rural origin equal access to housing, education, health and other services. In the long run, there is no good reason for China to maintain a two-tier system of citizenship. Efforts should be made to encourage the construction of low-cost housing that is affordable for rural migrants to buy or rent. The government should consider policies similar to those promoted in other nations. There need to be rules requiring low-cost, affordable housing to be built in some proportion to higher-cost development. Preferential, needs-based mortgage programs will promote home ownership by the poor. At the same time, policies to promote, small, inexpensive private clinics are also needed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

A variety of education institutions should be fostered. Migrant schools, although informal, should be allowed to help rural residents to bring their children and families with them to the city. The recent changes in rules about opening urban elementary and middle schools to migrants should be continued and their implementation encouraged. It should be a matter of national policy to progressively promote a legal and social environment that will encourage rural workers to move from the countryside to the city and welcome them when they arrive.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

5.2 SELF-EMPLOYMENT, ENTREPRENEURSHIP AND GROWTH IN RURAL CHINA

Linxiu Zhang
Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

Jian Zhang and Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

Since China initiated its economic reforms in the late 1970s, off-farm employment in rural areas has grown rapidly (de Brauw et al. 2002). The expansion of off-farm employment has increased rural welfare by raising incomes and productivity (Parish et al. 1995; Rozelle 1996). For China to be transformed successfully from an agricultural economy to an industrial one, however, the economy needs more than an emerging off-farm sector; it must also rely on strong and sustained investment and entrepreneurship. One of the key tenets of economic development is the profound restructuring that occurs through those that innovate, bringing capital and new ideas together (Schumpeter 1936).

Given the importance of the entrepreneurial sector, it is somewhat surprising that relatively little attention has been directed at the rise of the self-employment sector in rural China.[1] In fact, the sector was the fastest-growing part of the off-farm

[1] In this paper, self-employment refers to those individuals who are engaged in running non-agricultural enterprises. Although farmers and small-scale livestock operators are also self-employed, we separate them out as the agricultural sector.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

employment sector between 1988 and 1995 (Rozelle et al. 1999). The number of self-employed people in rural China increased from 25 to 52 million, representing almost 40% of all new off-farm jobs created during that period. After 1995, the self-employment sector continued growing at a high rate, although its growth slowed somewhat, relative to migration. In other countries with a much smaller self-employed sector—for example, the United States and Great Britain—there has been much more extensive coverage of self-employment (Evans and Leighton 1989; Evans and Jovanovic 1989; Blanchflower and Oswald 1998).

In another sense, however, the lack of attention might be understandable. In other developing countries, self-employment is not always looked upon as a leading sector of the economy. In fact, some researchers believe that self-employment is primarily a refuge for people who are excluded from formal labour markets (Tokman 1992; Gong et al. 2000). Sceptics frequently raise questions such as how much a person standing at a street corner selling toilet-paper or cigarettes can contribute to economic growth. If most of the self-employment in an economy is of this type, it is easy to see how it could be seen as a sign of a deteriorating economy rather than as a growth pole. Hence, despite the dramatic rise in the number of self-employed, the absence of attention to the sector in the China literature may reflect the same ambivalence.

Recent findings, however, provide strong evidence that shows China's self-employment sector is not a refuge of the rejected and laid off, but rather is becoming increasingly sophisticated and entrepreneurial. By disaggregating the growth in self-employment by occupation and factor intensity, Mohapatra (2004) shows that rural China's self-employment sector is becoming more capital-intensive and participating in ever more complex economic activities. Indeed, based on this evidence, the work concludes that self-employment in rural China should be considered a source of growth of rural China and not a sign of economic distress.

Although some of the recent research on self-employment is convincing, there is little in-depth work trying to understand how entrepreneurs start their enterprises and operate them. If self-employment is growing so fast and becoming more complex, scholars will want to better understand the sector and policy makers need to understand the dynamics of the sector so they can formulate policies to promote its growth. Hence, both economists and policy makers would like to be able to answer a number of outstanding questions. How do individuals start up their enterprises? How are the operations of the firms organised? What is the nature of

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the business environment within which they operate? How well do firms perform in terms of the standard measures from their income statements and balance sheets? Answers to these questions, taken together, will help answer another more fundamental question: are these firms appearing in the rapidly growing, dynamic regions and sectors of China or in the more backward ones and are they worth supporting? In our review of the literature, we found that there has been little or no effort to systematically answer these questions. The overall goal of our paper is to answer some of these questions by painting a picture of self-employment in rural China, centring our attention on analysing a rich set of primary data.

DATA

The data-set was collected from a randomly selected, almost nationally representative sample of 60 villages in 6 provinces of rural China (henceforth called the China National Rural Survey or CNRS). To reflect accurately varying income distributions within each province, one county was selected randomly from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were selected randomly within each county. The survey teams used village rosters and their own counts to choose 20 households at random, including both those with their residency permits (*hukou*) in the village and those without. A total of 1199 households was surveyed.

The survey form was designed to collect data on all aspects of the income-earning activities of rural households as well as the determinants of the income sources. The CNRS project team also gathered detailed information on household demographics, wealth, agricultural production and investment. The form includes a detailed section on labour allocation, which records the number of hours and other information about all of the wage-earning and non-wage-earning jobs that each individual in the household performed during 2000.

A major block of the survey, consisting of three subsections, was designed to learn about self-employment in rural China. The first subsection asks the household for detailed information on firm start-up. In particular, this subsection gathers information on the type of business the household was engaged in, the amount of the initial investment, the sources of the initial investment funds, the relationship with the village and its leaders, and the formal ownership structure of the self-employed enterprises at the time of the firm starting up.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The second part asks firms about the way they organise their operations. Specifically, this part of the survey form solicits information on who within the family operates the firm, and collects information that can be used to describe the firm's use of labour, especially its use of family and hired labour. Finally, we also gather information on the use of capital, its growth rate over time and level of capitalisation.

The final part of the self-employment block gathers information about the firm's financial performance. Enumerators recorded information on all of the firm's revenues and expenses. We use a cash-accounting basis to calculate net income. The survey form also records detailed information on all assets and liabilities, including capital equipment, investment in buildings and land, inventories, accounts receivable, and accounts payable and other debts owed by the firm to banks and private individuals.

GETTING STARTED

One of the most difficult parts of the process facing individuals or groups of individuals that engage in business is the start-up process. During the process, the entrepreneur needs to make many decisions such as the type of business to start up, the ownership structure and the level of initial investment. Using our data on the history of 473 firms, this section centres on understanding how firms launch their businesses. To do so, we first describe the occupational diversification in rural China and show the occupations from which the self-employed came. Next, we examine how people start up self-employed enterprises, especially focusing on the ownership structure of the firm, who it was that initially launched the firm, and the size and sources of the initial investment. Finally, we examine the role of the collective in the start up of the firm.

Occupational diversification and transition into self-employment

Before the economic reforms in the late 1970s, almost all of the people in rural China were exclusively engaged in farming, but policies since then have allowed people to shift out of the sector. A number of policies, especially the household-registration system (or *hukou* system) initiated in 1955, tied rural people to rural areas. Even after de-collectivisation in the late 1970s, however, almost every household was engaged in farming. Land was distributed to each household and, with poorly developed commodity, credit and insurance markets, almost all house-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

holds depended heavily on farming. As the economic reforms unfolded in the 1980s and 1990s, however, leaders relaxed the constraints on the movement of rural labour into the off-farm sector in order to provide labour for the emerging manufacturing and service sectors. Leaders also allowed farmers to pursue non-agricultural activities. By the late 1980s and early 1990s, the passive nature of policy became proactive and leaders began actively promoting an economy that encouraged rural individuals to work for a wage off the farm or to start their own businesses.

With relaxation of the restriction on labour movements, the transition into off-farm occupations has steadily progressed. The labour force participating in off-farm occupations grew from about 15% of the total rural labour force in 1981 to about 43% in 2000 (de Brauw et al. 2002). Specifically, the labour force participating in wage-earning occupations increased from 11% to about 27% ; off-farm self-employed people increased up to 16%.

Despite the shift into off-farm work, households in China are still heavily involved in farming according to our data (Table 5.1). Although about 79% of rural households pursue off-farm occupations, most of them (94%) still participate in farming (Table 5.1, row 2). In particular, of the households that run self-employed businesses, 90% are still involved in farming; of the households pursuing wage-earning occupations, 96% are still involved in farming (Table 5.1, column 3).

While the occupational patterns of individuals are less tied to farming than households, most individuals are still engaged in farming (Table 5.2). According to our data, 19% of individuals in China were working as entrepreneurs in the self-employed sector. However, only a small minority (5%) were doing so full time (Table 5.2, row 3).

Table 5.1 Diversification of occupational choice by households in rural China

Occupation	Frequency	Percentage	Percentage of households also		
			farming	wage-earning	self-employed
Farming only	250	21.1	100.0	0	0
Off-farm jobs	934	78.9	93.5	63.8	42.5
Wage-earning	704	59.5	95.7	100.0	24.7
Self-employment	404	34.1	90.0	43.1	100.0

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.2 Diversification of occupational choice by individuals in rural China

Occupation	Frequency	Percentage	Cumulative
Farming only	1593	49.98	49.98
Wage-earning only	481	15.09	65.08
Self-employment only	147	4.61	69.69
Farming + wage-earning	525	16.47	86.16
Farming + self-employment	397	12.46	98.62
Wage earning + self	8	0.25	98.87
Farming + wage + self	36	1.13	100.00
Total	3187	100.00	100.00

In addition, there were some that worked an off-farm job and were engaged in self-employment. However, despite the fact that a few focus solely on their self-employed businesses, most are still in farming at the same time. Of all of the individuals who are self-employed, 74% are also in farming or are engaged in farming and work for a wage (Figure 5.1).

The emergence of the self-employed, while beginning during the early 1980s, did not really take off until the late 1980s (Figure 5.2). Before 1989, the entry rate into the self-employed sector is not systematically higher than the exit rate, indicating that during this period the number in the self-employment sector increased little, if at all. After 1989, the entry rate became systematically higher than the exit rate, and self-employment began increasing.

The diversified set of occupations for households and individuals mostly reflects the fact that the move into the self-employed sector has come relatively recently and that today's entrepreneurs actually started in other sectors (Table 5.3). For example, about 19% of the self-employed in China had worked in off-farm labour as wage-earning workers before becoming self-employed (Table 5.3, row 2). On average, these workers-turned-entrepreneurs had worked for an average of eight years before starting their enterprise. About 50% of the currently self-employed people had farmed before switching to self-employment (Table 5.3, row 1). Only about 31% chose self-employment when they initially entered the labour market (Table 5.3, row 3).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

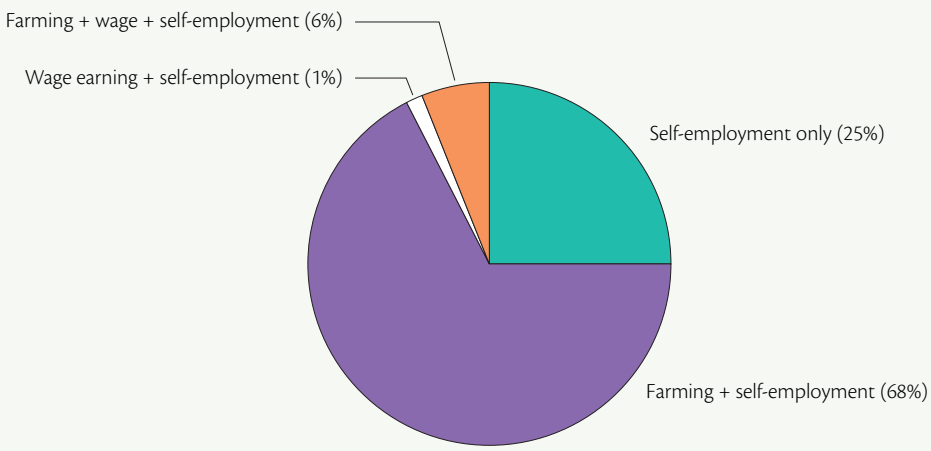

Figure 5.1 Occupation diversification conditional on self-employment

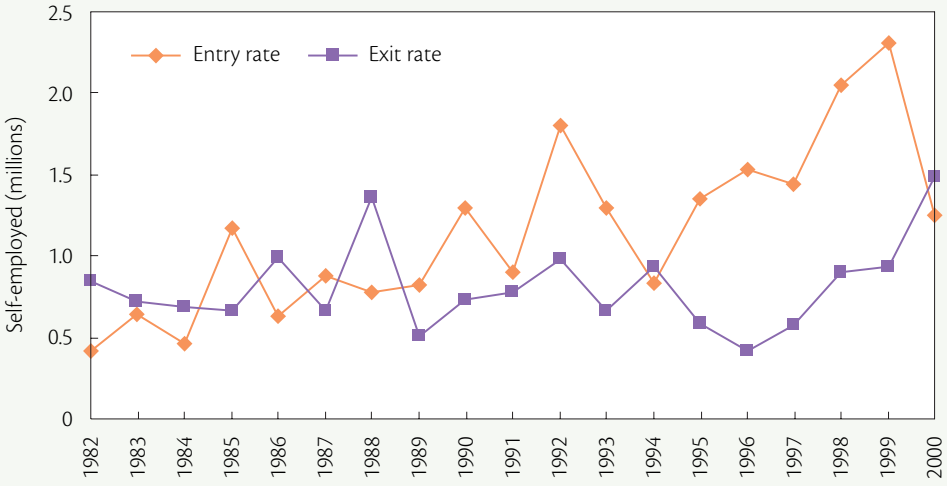

Figure 5.2 Self-employment entry and exit, 1981–2000

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.3 Transition into self-employment in rural China

Occupation immediately before self-employment	Number	Percentage
Farming	182	50.00
Wage-earning	70	19.23
Self-employment	11	30.77
Total	364	100.00

The people and sources of the funds

Despite the diverse occupational background of individuals before they shifted into self-employment, when individuals launch new firms there are well-established patterns of business operation. Most of the self-employed choose to run their own firms by themselves and do not enter into partnerships (Table 5.4). Indeed, only 7% of self-employed enterprises began as partnerships (Table 5.4, column 2). Instead, an overwhelming majority (93%) of rural self-employed firms are initiated as sole proprietorships.

Those who start up enterprises also share a number of general characteristics, especially when compared with those engaged primarily in wage-earning and farming (Table 5.5). On one hand, the self-employed are more likely to be married and they are older; their marriage status and age are closer to those of farm than wage workers. However, in terms of gender (being male), education level and access to special training, the self-employed are more like wage-earners than farmers. The profile of the self-employed, interestingly, is consistent with the findings of Parish et al. (1995) and de Brauw et al. (2002), who also sought to characterise the off-farm sector using econometric analysis.

Table 5.4 Initial ownership structure and change in ownership in self-employed firms in rural China

	Initial ownership		Current ownership	
	Number	Percentage	Number	Percentage
Sole Proprietorship	427	92.8	430	93.5
Partnership	33	7.2	30	6.5
Total	460	100.0	460	100.0

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Although China's self-employed have a distinct set of characteristics across the nation, they appear to differ fundamentally from the self-employed in other developing countries. For example, in rural Honduras most of the self-employed are young women, in many cases with low levels of education (Ruben and Van Den Berg 2001). In Africa, the majority of micro-enterprises are also owned and operated by women (Mead and Liedholm 1998). Grosh and Somolekae (1996) find that rural micro-enterprise owners in Botswana typically have low levels of education; almost all of them have at most a primary education. China's self-employed also appear to differ from the self-employed in other countries in the amount of experience that they have had before starting up their business. In rural Indonesia, around 50% of the self-employed in the cotton industry are female and are limited to young mothers, widows and the elderly, categories of individuals that probably mean they had little experience in the workforce before they began to be self-employed (Chernichovski and Meesook 1984; Weijland 1999). Clearly, when compared to the self-employed in other developing nations, there appears to be a new class of 'self-employed with Chinese characteristics'.

Perhaps because of the dominance of the sole-proprietorship structure, and given that those in rural China are still relatively poor, with poorly developed capital markets, rural firms in China start off as extremely small and relatively undercapitalised firms (Table 5.6). More than 70% of firms have an initial investment of less than 5000

Table 5.5 Occupational choice: averages and standard deviations of individual characteristics for three occupations—self-employment, farming and wage-earning—in rural China in 2000

	Sample average (overall)	Subsample		
		Self-employment	Farming	Wage-earning
Sex (male)	54% (0.5)	70% (0.5)	44% (0.5)	65% (0.5)
Age	38.0 (13.7)	37.4 (11.0)	42.3 (13.3)	29.7 (11.7)
Marriage (married)	78% (0.4)	86% (0.3)	88% (0.3)	52% (0.5)
Education	6.0 (3.5)	6.7 (3.0)	5.0 (3.5)	7.8 (3.0)
Whether receiving training before	20% (0.4)	40% (0.5)	10% (0.3)	30% (0.5)
Sample probability	100%	15%	56%	29%
Observations	3187	486	1792	909

Note: Standard deviations of the averages are in brackets.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

yuan (about US$610 dollars at official exchange rates) which amounts to only about 40% of the household's annual income (Table 5.6, row 2). In contrast, only about 9% of the self-employed enterprises invest more than 30,000 yuan (Table 5.6, row 4). In fact, so low a level of capitalisation is not surprising in an economy with such labour-intensive enterprises. For example, the average farm in China only has about 1274 yuan of equipment (de Brauw 2002). Clearly, the low level of capitalisation in the self-employed sector is consistent with a farming sector (the other self-employed sector) that also depends on few capital assets.

The size of the initial investment also undoubtedly affects the way that most entrepreneurs raise their initial funding (Table 5.6). Most of the self-employed (64%) are completely self-financed, using only their household's own funds (Table 5.6, row 1). Even for the 35% of the self-employed that rely on borrowed funds, in most cases these funds are supplementary. For the self-employed firms launched in 2000, about 81% of the initial start-up funds come from the family. Consistent with the under-development of credit markets in rural China (Findlay et al. 2003), only a small proportion of the self-employed (26%) obtain any funds from banks. For firms launched in 2000, we find only about 7% of the start-up funds come from banks.

While funding from formal and informal sources of credit is low, given the prevalence of the underdevelopment of credit markets in the developing world, the reliance of self-employed enterprises in other developing countries on bank credit appears to be even lower. For example, 78% of the firms in Kenya are financed by personal savings, while only 2% are funded from banks (Fafchamps et

Table 5.6 Size and sources of initial investment in self-employment firms in rural China

Initial investment (yuan)	Number of firms	Sources of initial investment (percentages)						
		Own only	Banks only	Others[a]	Own & banks	Banks & others	Own & others	Own & banks & others
Total	473	64	4	8	4	15	2	3
0–5,000	335	77	3	7	1	11	0.4	0.6
5,000–30,000	98	37	6	9	10	23	5	9
Above 30,000	40	30	5	10	15	23	8	10

[a] Includes friends, relatives and other people who loaned funds to the self-employed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

al. 1994, 1995). Similarly, 90% of the firms in Zimbabwe are financed by personal savings while only 3% are funded from banks. In Honduras, start-up funds for self-employed enterprises also rarely came from formal credit sources (Ruben et al. 2001).

The role of collectives

One of the most interesting findings from this study of China, a communist country with a history of heavy government involvement with economic activities, is the almost complete absence of the local state in the start-up of self-employed firms. Independence from the state is a characteristic that makes these firms strikingly different from rural firms that arose in the 1980s and early 1990s. During the 1980s, the relationship between rural firms and the local state was one of close, interlinked ties (Whiting 2001). Most firms—'township and village enterprises' (TVEs)—were owned by the township or village government (Oi 1999). When private firms did emerge, they typically were highly reliant on the collective. Due to the lack of institutionalised property rights and the exclusion of private firms from the state's planned distribution channels, private firms needed the local state's protection and help to access input and output markets. Hence, during the 1980s, most firms were at least somewhat tied to the local state.

Self-employed firms, in contrast, have almost no relationship with the collective when they launch their business (Table 5.7). In our survey, we asked the entrepreneur about a number of different ways that the collective could have provided aid to the firm. Did the village provide land and/or buildings? Were the village leaders co-investors? Does the self-employed firm have a contracting relationship with the local TVE? Despite the long list of questions, 92% of self-employed enterprises stated that they were not related to the collective in any way (Table 5.7, row 1).

In summary, our data show that there is a standard way that the self-employed initiate their businesses in rural China. Most firms are started by individuals as sole proprietorships and only a small number of the self-employed are engaged in partnerships. Most of the self-employed people are males and married; compared with farming people, they are more highly educated. They initially invest little capital; most of the start-up funds come from the family itself while formal credit markets play only a limited role in financing the start-up. Few have any ties with the local state.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.7 Relationship between enterprises and collectives in rural China

Relationship with collectives	Percentage of firms
No relationship	92.4
Buy from collective	0.9
Contract from collective	4.0
Rent land from collective	0.6
Rent building from collective	0.4
Cooperate with collective	1.1
Others	0.6

NATURE OF THE ORGANISATION OF SELF-EMPLOYED ENTERPRISES

Once businesses have started up, the self-employed pursue a diverse set of businesses (Figure 5.3). About 25% of the firms in our sample are engaged in wholesaling, retailing and trading activities. These trading firms handle a wide variety of commodities, including household goods, food items, construction materials and electrical equipment. Some firms are simple; the corner family stores that are run out of the first floor of the owner's home, and commodity traders that buy up the output of other farmers in the village and surrounding villages during the harvest season, reselling them in the local seasonal market. Others are complex; such as one household that owned several canal- and river-going barges and bought, sold and delivered bricks and roofing tiles all over the Yangtze River Delta. Moreover, perhaps reflecting the fact that China's service sector is underdeveloped in general (World Bank 2002), 21% of self-employed individuals are running businesses that provide a wide variety of services, such as barber shops, tailor shops and photo finishing. In the beginning, most of the service firms operated in the household's own village; increasingly it is observed (and our data concur) that households are moving to the cities to operate their service-oriented firms (de Brauw 2002). Finally, as might be expected in the rural sector, a significant proportion (14%) is engaged in a farming-related business.

In some sense, the participation of rural households in trade and service provision is similar to the rest of the world. Unlike households in most other nations, however, the rural self-employed in China are involved in a number of less-traditional sectors.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

About 15% of the self-employed run transport and communication businesses and 14% run manufacturing and construction firms. In some villages, there are even some individuals running businesses that require fairly high levels of professional expertise; for example, health-care providers, banking and technological services. For example, there are 12 households in our sample that are engaged in health-care services or have set up clinics in a village. Of these, five households have invested more than 2000 yuan, implying they might have put funds into a building and medical equipment.

Firm structure, family roles and hired labour

In the same way that most self-employed firms began their business activity with the effort of a single member of the family, the ownership structure of the self-employed enterprises in our sample demonstrates a pattern of organisation that mostly relies on a single individual. Interestingly, this approach is different from

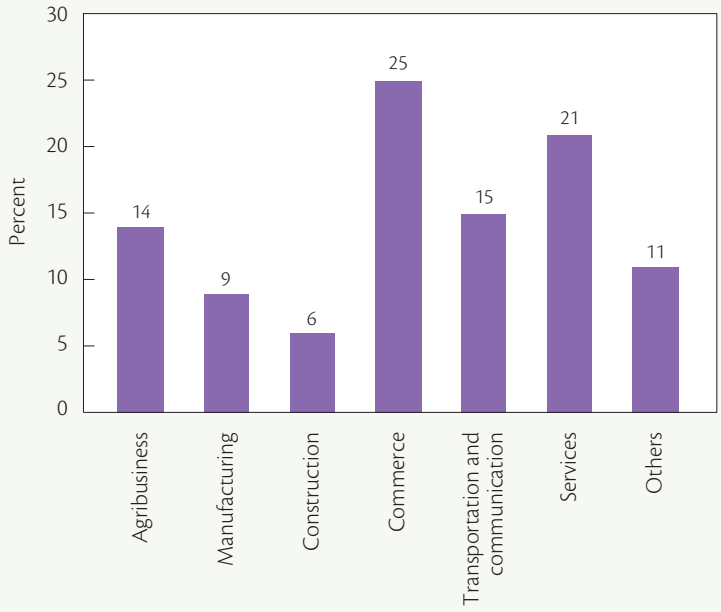

Figure 5.3 Distribution of self-employment across industries in rural China

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the pattern described by Unger (2002). In his book, Unger observed in Xiqiao, a prosperous township in Guangdong Province, that almost all of the self-employed had initially formed partnerships with relatives, friends or neighbours in order to amass sufficient capital and diversify their risk. Unger observed, however, that once the enterprise grew to a certain size, the partnerships usually splintered into smaller, individually run family firms. In contrast, a large majority of the enterprises in our sample began as sole proprietorships and most continued to operate over the life of the firm without changing ownership structure (Table 5.4). According to our data, about 92.8% of the firms were sole proprietorship when they started up (Table 5.4, column 2). By 2000, the percentage being operated as sole proprietorships is almost unchanged at 93.5% (Table 5.4, column 4). It is unclear why the households in our sample differ from those in Unger's study. Given that more than 70% of the enterprises had an initial investment of less than 5000 yuan, it seems plausible that most firms in our sample did not face capital constraints as did those in the Unger sample, which was drawn from the local Textile Chamber of Commerce and contained individuals who were trying to run larger manufacturing firms.

Although self-employed enterprises are family-based, there are many possible combinations of roles different family members could take on. There are fairly strong patterns in rural China (Table 5.8). More than half of China's self-employed firms (53%) are operated solely by the male, household head (Table 5.8, row 1). In these households, although the other family members do not directly participate, they do so indirectly, by shouldering more of the work on the farm. In about 52% of the households with husband-only firms, the head's spouse takes over most of the work on the farm with other family members, while in only 38% of the households with no off-farm occupations is the wife the primary on-farm worker.

There are forms other than husband-only firms. About 25% of the enterprises are operated as intra-family partnerships—mostly jointly run by husband and wife (Table 5.8, row 3). Although our data do not include information on the precise roles of husbands and wives in these jointly run enterprises, Unger (2002) observes that, in Xiqiao, wives often oversee production of family firms while their husbands take care of sales. If so, these firms would be similar to those found in Taiwan, where there is a fairly well-defined division of labour, with the wife overseeing production and the husband doing sales (Greenhalgh 1988). Interestingly, for the firms where husbands and wives share responsibilities, the husband, on average, takes on a greater share of the farm work (53%) than that for the husband-only firms (46%).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Given the small size of the initial investment, it is not surprising that the number of workers (including the proprietor) in most of the self-employed enterprises is also small (Table 5.9). According to our data, the average number of workers per enterprise in our sample is only 2.3, although there is considerable variation among firms. For example, our data show that about 60% of the enterprises are operated by only one person, the proprietor, working on his or her own (Table 5.9, row 1). In contrast, there are a few enterprises employing a large number of workers; four enterprises in our sample employ more than 40 workers.

Since firms are generally small with only limited employment, most of the firm's labour force comes from the family rather than labour markets (Table 5.10). About 94% of workers in all of the sample enterprises are members of the entrepreneur's

Table 5.8 Composition of family members pursuing rural enterprises in China

Type	Number	Percentage	Cumulative
Husband	252	53.3	53.3
Wife	50	10.1	63.4
Husband and wife	120	25.4	88.8
Child only	30	6.3	95.1
Other	23	4.9	100.0
Total	473	100.0	

Table 5.9 Employment distribution in self-employed enterprises in rural China

Number of employees	Number of enterprises	Percentage	Cumulative
1	283	59.83	59.83
2	126	26.64	86.47
3	31	6.55	93.02
4	11	2.33	95.35
5	6	1.27	96.62
>5	4	3.38	100.00
Total	473	100.00	

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

immediate family (Table 5.10, row 1 and column 2). Of the family members, only 1% were reported to have drawn a wage. Some 6% of the workers were non-family members, all of them hired for a wage (Table 5.10, row 1 and column 4).

Like other characteristics of the sample firms, the scale of the enterprise affects hiring decisions. As the size of the firm increases, so does its use of paid labour. For example, the enterprises with fixed assets in the range 60,000–70,000 yuan, on average, hire 43% of their labour force while 57% come from the family (Table 5.10, row 9). Only 28 of the 393 firms that have fixed assets below 10,000 yuan hire workers for a wage.

While the average self-employed enterprise is small, in the aggregate they contribute a significant amount to national employment. In 2000, there were 499 million people in China's rural labour force (China Statistical Press 2001). Our data show about 15% of the rural labour force is self-employed. If our sample is representative and can be used to estimate employment across the nation, we estimate almost 80 million people were involved in self-employed enterprises in 2000. Under these assumptions, given the 712 million people in China's overall labour force (China Statistical Press 2001), this means about 11% of national employment is created by the rural self-employed.

Table 5.10 Employment composition of rural enterprises in China, grouped according to size of fixed asset

Fixed asset (yuan)	Number of enterprises	Percentage of firms hiring labour from labour markets	Percentage of labour from labour market	Percentage of labour from family
Overall	473	9.3	6.0	94.0
0– 5,000	335	6.6	4.1	95.9
5,000–10,000	58	10.3	6.8	93.2
10,000–20,000	29	10.3	5.9	94.1
20,000–30,000	11	9.1	6.1	93.9
30,000–40,000	7	42.9	31.9	68.1
40,000–50,000	9	22.2	11.1	88.9
50,000–60,000	4	0.0	0.0	100.0
60,000–70,000	3	66.7	43.1	56.9
70,000–80,000	1	0.0	0.0	100.0
Above 80,000	16	31.3	24.4	75.6

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Capital growth and investment

Given the shortage of capital in rural China, most self-employed enterprises use only relatively small amounts of capital, although there are exceptions (Table 5.11). On average, China's self-employed enterprises own only about 36,000 yuan of fixed assets, meaning that firms are quite small, and much lower than the fixed assets of the average TVE (Oi 1999; Table 5.11, row 2). The average capitalisation of a TVE in 1995 was 607,000 yuan. Moreover, not only is the average level of fixed assets relatively small, their distribution across enterprises is skewed. Of all enterprises in our sample, 50% have fixed assets of less than 4400 yuan; 80% have fixed assets of less than 20,000 yuan. Despite this, there are a few enterprises with fixed assets more than 50,000 yuan (11%). The largest enterprise in our sample, a manufacturing firm that hires more than 40 people, has assets of more than 1.8 million yuan.

Although self-employed enterprises are small, they have been growing moderately rapidly in terms of their rate of capital accumulation (Table 5.12). Our data show that the fixed-asset holdings of rural self-employed firms increased, on average, about 15% per year (Table 5.12, row 1). If conditioned on the enterprises that made at least one additional investment in their firm's fixed-asset base after their initial start-up investment, the annual rate of increase is about 34%. Perhaps because of the limited ability of the self-employed firms to raise funds and lack of help from the state in facilitating access to formal financial markets, the growth rate of capital in self-employed firms, although fast, is lower than that of TVEs, which was 27% over the period from 1985 to 1995 (Oi 1999).

Table 5.11 Structure of total assets (yuan) of rural enterprises in China in 2000

	Number	Mean	Median	Standard deviation	Minimum	Maximum
Total asset	343	45,454.46	6,661.65	195,753.20	0	2464,997
Fixed asset	353	35,820.30	4,441.96	175,201.00	0	2,164,997
Account receivable and credit	353	9,634.16	400	33,117.08	0	300,000
Liability	353	6,854.75	0	26,552.55	0	330,000
Net equity	353	38,599.71	5,316.67	185,356.20	−138,242.8	2,314,997

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.12 Fixed asset growth and investment in self-employment firms in rural China

Initial investment (yuan)	Average annual compound growth rate
Overall	15.2
0–5,000	20.4
5,000–10,000	9.8
10,000–15,000	5.9
15,000–20,000	2.4
20,000–25,000	8.1
25,000–30,000	0
Above 30,000	10.5

Despite the relatively modest growth rates, it is still of interest to understand the distribution of growth across firms. Somewhat unexpectedly, the overall growth of the self-employed firms is mainly driven by the small firms. Firms with initial investments of less than 5000 yuan actually grew at a rate that was higher than the overall growth rate of the larger self-employed firms (20% —Table 5.12, row 2). In fact, the growth rate of these small firms is double or even higher than that of the rest of firms. Moreover, consistent with the different growth rates across firm size, there are quite different investment patterns between the small firms and the large ones. After the start-up, the small firms make more frequent investments than the larger firms (Table 5.13 and Figure 5.4). Perhaps because they are more flexible and change technologies or lines of business more rapidly, for the firms with initial investments of less than 5000 yuan, the owners make investments in nearly every subsequent year (Figure 5.4, top and left panel). In contrast, in the firms with an initial investment between 10,000 and 15,000, investments occurred in only 4 of the first 10 years (bottom and left panel). However, it should be noted that although the subsequent investments by small firms are more frequent, those by the larger firms are larger on average (Table 5.13). For example, conditional on the fact that a firm invested, the average investment for the firms with the initial investments between 20,000 and 25,000 is about 9300 yuan (row 5). The average investment size for firms with the initial investment less than 5000 is only about 5500 yuan (row 1).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.13 Investment pattern after start-up of self-employment firms in rural China

Initial investment (yuan)	Overall average investment	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
0–5,000	5,476.9	3,316.5 (10.1)	6,262.7 (6.3)	7,292.3 (5.8)	2,691.4 (4.3)	4,532.5 (3.8)	3,811.3 (4.8)	4,372.0 (2.4)	6,400 (1.0)	20,945.5 (1.4)
5,000–10,000	7,022.9	6,976.5 (8.2)	0.0 (0.0)	1,700.0 (2.0)	3,800.0 (4.1)	10,570.2 (2.0)	0.0 (0.0)	18,717.8 (2.0)	6,925.7 (4.1)	0.0 (0.0)
10,000–15,000	8,710.5	6,059.1 (12.5)	9100 (4.2)	0.0 (0.0)	0.0 (0.0)	6,403.5 (4.2)	6,976.5 (8.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
15,000–20,000	10,307.7	5,000 (11.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
20,000–25,000	9,248.8	0.0 (0.0)	1,951.0 (11.1)	0.0 (0.0)	0.0 (0.0)	2,000 (11.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
25,000–30,000	0.0	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

Note: values in brackets are the percentages of firms that invest.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

With lower levels of assets, the accumulation of debt in China's self-employed firms generally is relatively small. In China, in general, firms have built up huge debt relative to their equity. For example, in 1998 the average debt–equity ratios for the state-owned enterprises and the collective enterprises were 320% and 199%, respectively (Naughton and Yang 2004). In contrast, debt is not an important part of the way that assets are financed for self-employed firms and most have low liability (Table 5.14). About 83% of enterprises have liability less than 5000 yuan (Table 5.14, row 3 and column 1). Despite this, only 49% of enterprises have total assets of less than 5000 yuan (Table 5.14, row 1 and column 4).

Table 5.14 Joint distribution of total asset and liability in self-employment firms in rural China

		Liability (yuan)		Total	
		≤5000	>5000	Percentage	Number
Total asset (yuan)	≤5000	47.1%	1.4%	48.5%	207
	>5000	36.1%	15.5%	51.6%	220
Total	Percentage	83.2%	16.9%	100%	
	Number	355	72		427

The joint distribution of assets and liabilities indicates that, overall, the enterprises are financially healthy. Liabilities are only 12% of total assets, which shows the low degree to which enterprise assets are financed through debt. Perhaps this is because the self-employed enterprises are rationed out of the formal credit markets and/or due to the nature of the small initial investments required for labour-intensive, self-employed enterprises. It is possible that both forces are at work. This pattern is the case outside China, and in this way shows China is not unique. Fafchamps et al. (1994, 1995) show that in Kenya and Zimbabwe a considerable percentage of enterprises are rationed out of credit markets; while at the same time a significant percentage of enterprises say that they do not need a loan from banks.

THE BUSINESS ENVIRONMENT

If self-employed enterprises significantly contribute to poverty alleviation and economic growth, then it is important to know what part of the business

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

environment is conducive to such enterprises. Several attributes of the business environment have been shown to be important to entrepreneurial activities. For example, communication infrastructure can expand the range of information on technology and markets to help inform entrepreneurial activities (Schmit 1989). Siting businesses close to cities and with access to convenient transportation services are also conducive to business growth because they can lead to lower transaction costs and make it easier for entrepreneurs to gain access to markets (Perkins 2003). An environment with weak credit markets limits the financing ability and thus constrains people from entrepreneurial activities (Eswaran and Kotwal 1986).

Our data[3] show that, like in other countries, these attributes are important in rural China. Households located in villages close to the township seat, are well-off and have good communication facilities and are more likely to have more firms in the self-employment sector (Table 5.15). For example, 40% of surveyed households located in villages close to the township seat participated in the self-employment sector while it was only 26% for other villages (Table 5.15, rows 1 and 2, and column 1). Moreover, households in richer villages are more likely to participate in the self-employment sector than those in poorer villages (Table 5.15, rows 7 and 8, and column 1). If the level of previous income is a good approximation of the degree of financial constraint, it may be that financial constraints are an obstacle to entrepreneurship in rural China. As it does in rural China, financial constraint also impedes entrepreneurship in other countries (Holtz-Eakin et al. 1994; Blanchflower and Oswald 1998; Burke et al. 2000; Dunn and Holtz-Eakin 2000; Paulson and Townsend 2001). Villages with better communication facilities are associated with a higher proportion of self-employed households (Table 5.15).

[3] To understand the business environment in which the firms are operating, the survey team also executed a community-level survey. The survey instrument collects information on the location of the village, the availability of electricity, telephones, radios and televisions, and the number of roads and buses going through the village. We also asked leaders about the general characteristics of the community, its income level, the importance of agriculture and the extent of the non-agricultural industrial development. With the information, we can create a profile of the infrastructure that exists in each village that can support or constrain self-employment. The data are available for two years, 1990 and 2000.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.15 Business environment and self-employment in rural China

Business environment in 1990		Percentage of households in self-employment in 2000	Growth between 1990 and 2000 (%)
Distance from the township	Near	40	4.8
	Far	26	4.5
Distance between nearest paved roads and villages	Near	35	4.8
	Far	33	5.2
Number of households having phones	Few	32	5.4
	Many	43	3.3
Level of income	Low	30	5.3
	High	38	4.3
Gross industrial output value	Low	39	7.0
	High	37	2.4

PERFORMANCE OF SELF-EMPLOYED FIRMS

We focus on two important aspects of financial performance: profitability of the self-employed and the financial risk of the enterprises run by them. We first examine their profitability, assessing the performance of self-employed firms by comparing self-employment earnings with wage earnings. We also compare the return on assets of self-employed firms with those of state-owned enterprises (SOEs) and township and village enterprises (TVEs). Finally, we examine the financial risk of the self-employed enterprises, by making comparisons with those of SOEs and TVEs, and the heterogeneity of the financial performance within the self-employment sector.

Profitability

Compared with workers with wage-earning jobs, those that are self-employed in rural China earn more per hour but also assume higher risks (Table 5.16). The self-employed in rural China earn, on average, about 7.8 yuan per hour in 2000 while wage earners earn only about 2 yuan per hour (Table 5.16, column 1). Note, however, that the standard deviation for the earnings of the self-employed is nine times as high as that of wage earners (Table 5.16, column 3).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 5.16 Hourly earning for self-employment and wage jobs in rural China

	Mean	Median	Standard deviation	Minimum	Maximum
Wage-earning	2.0	1.4	3.9	0	109.7
Self-employment	7.8	2.4	36.8	−40.5	500

There are several possible reasons for the relatively higher earnings of self-employment workers. Since many self-employment activities are riskier than wage-earning occupations, part of the self-employment earnings could be thought of as a risk premium. Alternatively, self-employment often requires the use of capital. We have seen that credit is limited. Hence, it is possible that the capital requirement of starting a firm could be imposing a barrier to entry, preventing people from entering the self-employed sector and keeping self-employment earnings at a level higher than wages. Finally, it could be that self-employment earnings contain a return to entrepreneurial ability, a scarce input and one that is not required for wage-earning occupations.

Although self-employment earnings in rural China are higher than wage earnings, this relationship is not typical of many countries. For example, in Kenya only about one quarter of the self-employed enterprises make above the minimum wage of the modern sector, while only 10% earn more than the average wage, indicating that in many cases self-employment is not sufficient by itself to move a household out of poverty (Daniels and Mead 1998; Daniels 1999). In the United States, wage jobs have higher initial earnings and growth of earnings is greater than those of the self-employed (Hamilton 2000).

Self-employment earnings are higher than wage earnings in China, and are higher than the wage that the self-employed could have earned if they had chosen to be a wage earner (Table 5.17). To show this we need to first account for the difference between the characteristics of the self-employed and wage earners. A standard way to show this is to use a wage equation estimated from the same sample, and then create a predicted wage for the self-employed, by forecasting the wage, given the characteristics of the self-employed. Based on the selection and wage equations estimated by using our data-set—and reported in de Brauw (2002)—we can show that, if the self-employed were wage earners, the self-employed would have earned,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

on average, 2.7 yuan per hour, which is higher than the earnings of wage earners but substantially lower than the self-employment earnings, even after we remove the capital income part from the self-employment earnings (Table 5.17, row 1). These findings could indicate two things. First, self-employed are more able in labour markets and earn more. Second, even with the high ability they are more likely to voluntarily choose to be in the sector rather than being forced into the sector.

Not only do the self-employed earn more than the wage earners, the enterprises run by them also have return on assets that are higher than those from other types of enterprises such as SOEs and TVEs (Table 5.18). Return on assets, which is calculated as net profits divided by total assets, is one of the key ratios used to measure the profitability of firms. However, there is one problem with calculating the ratio for the self-employed enterprises. The profit for the enterprises includes a labour component, since most of the self-employed also are functioning as unpaid workers in the enterprises. In calculating the return on asset ratio we thus remove the labour component from the profit by subtracting the predicted wage for the self-employed from the profit. Even after doing this, the ratio of return on assets for self-employed enterprises is 0.98, meaning that, given one dollar of an asset, the self-employed firm will on average generate 0.98 dollar of profits (Table 5.18, row 1 and column 1). The ratio is much higher than those of SOEs and TVEs (0.03 and 0.07, respectively; Table 5.18, rows 2 and 3, and column 1), indicating that assets of self-employed enterprises have returned well according to this measure.

Table 5.17 Predicted wage earnings and capital interest income for the self-employed in rural China, grouped by asset size

	Mean	Wage	Capital income per hour	Difference
Overall	7.8	2.7	0.77	4.33
Bottom 10%	3.9	2.6	0.005	1.3
Low middle	2.4	2.8	0.04	–0.44
High middle	8.8	2.7	0.28	5.8
Top 10%	31.7	3.0	1.32	27.4

Note: The capital income part is calculated as the interest income that the self-employed would have earned if they put funds in banks, instead of investing in self-employed firms. The interest rate used for calculating the interest income is the annual interest rate (2.25%) of deposit (China Statistical Press 2001).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Compared with SOEs and TVEs, self-employed enterprises can also be said to be financially much less risky.[5] The debt-to-asset ratio for the self-employed enterprises is 0.21, meaning that, on average, 21% of the total assets of the self-employed enterprise is financed through debt (Table 5.18, row 1 and column 2). However, the debt-to-asset ratios for SOEs and TVEs are three times as high (Table 5.18, rows 2 and 3 and column 2), because SOEs and TVEs have been heavily reliant on bank loans to fund their investments. Given the low profitability of SOEs and TVEs, it is possible that they may not always be able to repay debts, including interest payments and principal. Hence, from a financial analyst's point of view, SOEs and TVEs are a greater financial risk.

The heterogeneity of financial performance

While the average self-employed enterprise is more profitable but less financially risky than SOEs and TVEs, their financial performance varies considerably. For example, according to our data, the highest hourly earnings of the self-employed are about 500 yuan per hour (about 65 dollars per hour) while the lowest earnings are negative (–40.5 yuan). In addition, while most of the self-employed enterprises have zero debt, several enterprises have a debt-to-asset ratio higher than 0.80.

Table 5.18 Debt-to-asset ratio of different types of enterprises in rural China

	Return on asset	Debt-to-asset ratio
Self-employed enterprises	0.98	0.21
State-owned enterprises[a]	0.03	0.60
Township and village enterprises[b]	0.07	0.60

[a] China Statistical Press (2001)

[b] China Statistical Press (1999)

[5] We evaluate the financial risk of the self-employed enterprise in terms of how much of the assets are financed through debt. If the enterprise is sufficiently levered, interest expenses may be so high that, under adverse economic conditions, the enterprise may not be capable of paying back. That means financial risk is directly proportional to leverage. We use the total debt to total assets ratio, which is one of the important leverage ratios and is often used by financial analysts, to assess the financial risk of the self-employed enterprises.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Despite the variations, clear patterns of financial performance exist in the self-employment sector. The self-employed with a higher level of total assets have higher hourly earnings (Table 5.19). For example, the self-employed with asset holdings in the bottom 10% of asset distribution earn only 3.9 yuan per hour. In contrast, those in the top 10% earn about 32 yuan per hour (column 1). In fact, those in the bottom 50% do not earn significantly higher hourly earnings than the corresponding wage earners while the upper 50% earn substantially more.

While returns are higher for the firms with high levels of assets, so is the risk (Table 5.19). Enterprises with high levels of assets have high debt-to-asset ratios. For example, the self-employed enterprises in the bottom 10% of the asset distribution have virtually no debt, while the debt-to-asset ratio of the firms in the top 10% is 0.24 (Table 5.19, column 5). The standard deviation is also higher for firms with higher returns. Perhaps this is because the self-employed with higher assets need to find alternative ways to fund their investments besides using their own savings.

Table 5.19 Financial performance of self-employed enterprises in rural China, grouped by size

	Hourly earnings		Return on asset		Debt-to-asset ratio	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Bottom 10%	3.9	8.1	10.8	40.8	0	0
Low middle	2.4	5.8	–0.03	3.1	0.13	0.4
High middle	8.8	38.1	0.19	0.62	0.23	0.4
Top 10%	31.7	87.8	0.26	0.26	0.24	0.5

CONCLUSIONS

In this paper, we provided a picture of the self-employment sector in rural China, especially focusing on the start-up, operation and financial performance of self-employed enterprises and the business environment within which they operate. Above all, this paper shows that there is a standard way that the self-employed initiate their businesses in rural China and a new class of 'self-employed with Chinese characteristics' appears to be emerging. Our paper shows that, although the self-employed

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

firms, on average, employ fewer than three persons, self-employment in the aggregate contributes a significant share of national employment. Self-employed firms have also been growing rapidly in terms of their rate of capital accumulation. Finally, we show that the self-employed earn more than wage earners and that the self-employed firms in a number of senses have performed better than SOEs and TVEs. In sum, this paper provides evidence that, although the self-employed enterprises are small, they have grown rapidly, are in complex businesses and perform well financially.

There is one question about the self-employment sector we have not answered yet: is the expansion of self-employment a component of the healthy and dynamic development process of rural China or just a phenomenon occurring in poor areas? We have been observing firms in the aggregate, but it is possible that most of the expansion is in poor areas and that, as poor areas develop, the importance of self-employment will diminish. In other words, it is possible that self-employment is just a transient institution.

In order to understand in greater depth the nature of the self-employment sector, we also used our data to examine regional differences in self-employment. We find that the self-employment sector has been expanding rapidly in both the richer and poorer regions. In all areas, firms that use complex technologies and more capital are growing over time. In both richer and poorer areas, handicraft or custom labour providers are becoming less dominant. In addition, self-employment earnings are higher than wage earnings in both richer and poorer regions and the self-employed are relatively better educated and share similar human capital.

Given this result, we believe that the findings indicate three things. First, the expansion of self-employment in rural China is not unique to poorer regions. Second, in both the richer and poorer regions, the quality of the self-employment sector has been improving over time. Third, in both regions, self-employment activities are pursued by people with relatively high human capital who are attracted to the sector by profitable opportunities. Hence, we believe that the rise of self-employment in rural China is part of the dynamic development process, not a sign of economic failure. In contrast, Daniels (1999) finds that in Kenya the self-employed firms are in fact survival activities that reflect a lack of opportunities in the modern sector.

If self-employment in rural China is judged to be a source of growth of rural China and not a sign of economic distress, it deserves more attention and may be a source of continued output and employment growth. Policy makers should overcome their biases against self-employment. Instead, they should formulate supportive policies

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

for the sector. Those policies that help small entrepreneurs gain access to credit and provide technological support would boost self-employment activities. In the meantime, development economists also need to rethink the role of self-employment in the development process and modify their own intellectual biases about self-employment, at least in the case of China.

REFERENCES

Blanchflower, G.D. and Oswald, A.J. 1998. What makes an entrepreneur? Journal of Labour Economics, 16, 26–60.

Burke, E.A., FitzRoy, F.R. and Nolan, M.A. 2000. When less is more: distinguishing between entrepreneurial choice and performance. Oxford Bulletin of Economics and Statistics, 62, 565–587.

Chernichovski, D. and Meesook, O. 1984. Poverty in Indonesia: a profile. World Bank, Washington, DC, World Bank Staff WP 761.

Daniels, L. 1999. The role of small enterprises in the household and national economy in Kenya: a significant contribution or a last resort. World Development, 27, 55–65.

Daniels, L. and Mead, D. 1998. The contribution of small enterprises to household and national income in Kenya. Economic Development and Cultural Change, 47, 45–71.

de Brauw, A. 2002. Unpublished PhD dissertation. Davis, CA, Department of Agricultural and Resource Economics, University of California.

de Brauw, A., Jikun Huang, Rozelle, S., Linxiu Zhang and Yigang Zhang 2002. The evolution of China's rural labour markets during the reforms. Journal of Comparative Economics, 30, 329–353.

Dunn, T. and Holt-Eakin, D. 2000. Financial capital, human capital, and the transition of self-employment: evidence from intergenerational links. Journal of Labour Economics, 18, 282–305.

Eswaran, M. and Kotwal, S. 1986. Access to capital and agrarian production organization. Economic Journal, 96, 482–498.

Evans, S.D. and Jovanovic, B. 1989. An estimated model of entrepreneurial choice under liquidity constraints. Journal of Political Economy, 97, 808–827.

Evans, S.D. and Leighton, L.S. 1989. Some empirical aspects of entrepreneurship. American Economic Review, 79, 519–535.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Fafchamps, M., Pender, J. and Robinson, E. 1995. Enterprises finance in Zimbabwe. Washington, DC, World Bank.

Fafchamps, M., Srivastava, Biggs, T. and Conning, J. 1994. Enterprise finance in Kenya. Washington, DC, World Bank.

Findlay, C., Watson, A., Enjiang Cheng and Zhu Gang, ed. 2003. Rural financial markets in China. Canberra, Australia, Asia Pacific Press.

Greenhalgh, S. 1988. Families and networks in Taiwan's economic development. In: Winckler. E.A. and Greenhalgh, S., ed., Contending approaches to the political economy of Taiwan. Armonk, M.E. Sharpe.

Grosh, B. and Somolekae, G. 1996. Mighty oaks from little acorns: can microenterprise serve as the seedbed of industrialization? World Development, 24, 1879–1890.

Hamilton, B. 2000. Does entrepreneurship pay? An empirical analysis of the return to self-employment. Journal of Political Economy, 108, 604–631.

Holtz-Eakin, D., Joulfaian, D. and Rosen, H.S. 1994. Entrepreneurial decisions and liquidity constraints. RAND Journal of Economics, 25, 334–347.

Mead, D. and Liedholm, C. 1998. The dynamics of micro and small enterprises in developing countries. World Development, 26, 61–74.

Mohapatra, S. 2004. The rise of self-employment in rural China: distress or development? Unpublished PhD dissertation, Davis, CA, Department of Agricultural and Resource Economics, University of California.

Naughton, B. and Dali Yang 2004. Holding China together: diversity and national integration in the post-Deng era. New York, Cambridge University Press.

Oi, J. 1999. Rural China takes off. Berkeley, University of California Press.

Parish, L.W., Xiaoye Zhe and Fang Li 1995. Nonfarm work and marketization of the Chinese countryside. China Quarterly, 143, 697–730.

Paulson, L.A. and Townsend, R. 2001. Entrepreneurship and financial constraints in Thailand. Working paper, University of Chicago.

Perkins, T. 2003. Entrepreneurial fiends and honest farmers: explaining intravillage inequality in a rural Chinese township. Economic Development and Cultural Change, 51, 719–752.

Rozelle, S. 1996. Stagnation without equity: patterns of growth and inequality in China's rural economy. China Journal, 35, 63–96.

Rozelle, S., Guo Li, Mingao Shen, Hughart, A. and Giles, J. 1999. Leaving China's farms: survey results of new paths and remaining hurdles to rural migration. China Quarterly, 158, 367–393.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Ruben, R. and Van Den Berg, M. 2001. Nonfarm employment and poverty alleviation of rural farm households in Honduras. World Development, 29, 549–560.

Schmit, J.A., Jr. 1989. Imitation, entrepreneurship and long-run growth. Journal of Political Economy, 97, 721–739.

Schumpeter, J.A. 1936. The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle. Cambridge, Mass., Harvard University Press.

Tokman, V., ed. 1992. Beyond regulation: the informal economy in Latin America. Boulder, Lynne Rignner.

Unger, J. 2002. The transformation of rural China. M.E. Sharpe, Inc.

Weijland, H. 1999. Microenterprise clusters in rural Indonesia: industrial seedbed and policy target. World Development, 27, 1515–1530.

Whiting, S. 2001. Power and wealth in rural China. Cambridge University Press.

World Bank 2002. Understanding services and measuring the size of China's services sector. Beijing

China Statistical Press 2001. China statistical yearbook. [Zhongguo Tongji Nianjian] Beijing.

China Statistical Press 1999. China rural statistical yearbook [Zhongguo Nongcun Tongji Nianjian] Beijing.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 6

RAISING PRODUCTIVITY ON THE FARM

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

6.1 AGRICULTURAL RESEARCH, EXTENSION AND WATER MANAGEMENT TO RAISE FARM PRODUCTIVITY

CCICED ARD Task Force members

AGRICULTURAL RESEARCH

China has traditionally had a strong agricultural research system that has generated technologies adopted by millions of farmers to meet the increasing demand for food and fibre in the most-populous country in the world. Publicly funded agricultural research and a network of extension agents were the keys to the nation's performance. There is concern, however, that China is not currently investing enough in agricultural research. Agricultural research investment intensity (ARII—agricultural research expenditures divided by agricultural gross domestic product) declined from the mid 1980s to the late 1990s. Although increasing since 2000, total ARII is still only 0.5%, less than half of the minimum level of investment recommended by the United Nations. If we examine only government budgetary allocations for agricultural research (that is, if we exclude earnings of the commercial subsidiaries of China's research institutes), the percentage of budgetary ARII is 0.25%, only about one-tenth of the average for developed countries (2.37%) and about one-third of the average intensity for developing nations (0.65%).

At the same time, substantial changes are under way in the agricultural research system. Research institutes are overstaffed and burdened with the duty to care for retirees and house the staff. Recent changes in the funding mechanisms for

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

research institutes have transferred responsibility for raising funds to the institutes themselves. While these changes have the potential to make some of the research institutes more efficient and more responsive to the demands of the market, not all agricultural research can or should be commercialised. With rising concern about research being needed to overcome problems in raising yields for conventional varieties (that is, for crops in which the private sector has no interest), poverty reduction and environmental sustainability, the government needs to remain actively involved in funding. Since the benefits from basic research rarely accrue to the party that is engaged in such research, commercial interests will never do the optimal amount of basic research. Most scholars believe the agricultural research system needs to be fundamentally reformed to be able to serve the nation as its modernisation proceeds.

EXTENSION

There is even more concern about China's extension system. The task force concludes that it is a great challenge for the agricultural extension system to provide new and appropriate technologies for 240 million small farm households. Unfortunately, during the 1990s, one of the largest and most-effective extension systems in the world nearly collapsed. According to a recent survey of the nation's 1 million extension staff, only a small fraction is engaged full-time in extension work. Many extension stations at the township level exist in name only. Extension agents often pursue agendas that are not in the interests of farmers.

While poor training and antiquated equipment and methods are problems, by far the greatest weakness is that the government's budgetary commitment to agricultural extension is inadequate. Since the late 1980s, many local extension stations have not been able to pay their technicians a full salary. Instead, upper-level officials encourage their field agents to shift part of their efforts to commercial activities in order to supplement their income. Extension agents are supposed to do business, such as selling pesticides, for part of their time and use the earnings to subsidise their extension work. They cannot effectively serve two masters, but even when agents are willing to perform their extension tasks they do not have access to any resources to do so. A recent survey shows that extension agents spend only a small fraction of their time, if any, doing extension work. More than three-quarters of local extension stations do not have any extension projects. Finally, there are many

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

reported cases where extension agents are not promoting appropriate technologies, at least in part because of conflicts of interest between their commercial activities and their extension work. In some areas, extension agents tried to slow down Bt cotton adoption since it would reduce the demand for agricultural chemicals. Without reforming the extension system, it will remain an overstaffed bureaucracy with unqualified technicians who have little incentive to work on appropriate extension activities.

Despite the problems facing China's agricultural research and extension systems, it is more important than ever to build-up the institutions that can create and deliver new agricultural technologies. The country is still land-short and faces an emerging water crisis. The new pressures of urbanisation, changing preferences, rising wages and emerging markets will put a great deal of pressure on the research and extension system to create and deliver agricultural innovations that can raise agricultural profitability in the future.

FACING THE CHALLENGES OF WATER MANAGEMENT

Water shortages pose a serious barrier to growth. They are limiting efforts to alleviate poverty and are becoming a major source of environmental problems. So far, no option has proven very successful in combating the problem of increasing water shortages. Unfortunately, traditional policies either no longer work (e.g. investing in increasing the supply of water—most of the water in northern China is already being used) or do not lead to real water savings (e.g. the promotion of technologies such as sprinklers). Such strategies are unlikely to solve China's water shortages since they do not lead to real water savings. Even with south-to-north transfer, there will still not be enough water to solve the crisis. Since traditional engineering approaches are not feasible, there is a need to turn to more ambitious water policies. While complicated, we summarise here the steps that the government must take in order to begin to manage north China's water resources.

- *First*, water savings in irrigated agriculture need to focus on reducing the water consumed per unit of crop production. This requires an integrated approach of improvements in irrigation technology (including water-conveyance systems and drainage), agronomic practices, and farm-water management.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- *Second*, water-management agencies need more authority to implement the difficult allocation measures that are needed.
- *Third*, to achieve true water savings while avoiding inequitable outcomes, a system of water rights for *both* surface and groundwater is needed, with rights extending to individuals who live in specific areas and the total amount of the rights limited to water availability after taking into account the environment and other needs.
- *Fourth*, after water rights are established, China needs to begin the investments and management shifts that will allow for volumetric pricing and regulation of water.
- *Finally*, with the institutions and facilities in place to implement a system of water rights and volumetric charges for water, the nation can begin to move toward improved water management.

The efforts on the conservation side must be matched on the pollution-abatement side in order to stop the mounting, and often irreversible, damage to China's water resources. Water scarcity is more critical when limited water resources become unusable because of water-quality deterioration. In sum, it is not going to be easy to make the fundamental shifts, but of all the areas of resource management, getting water policy right may be the most important.

MAJOR ISSUES

Reformers of China's agricultural research and extension system face three major issues:

Antiquated institutional setting

- Lack of coordination and unproductive duplication: China's agricultural research system is the most highly decentralised system in the world. Over 95% of research institutes and more than 85% of China's research staff are in provincial and prefecture institutes. There is little coordination between central and sub-national institutions. Without coordination, research programs in many parts of the country are duplicative. While competition among research centres is healthy, redundancy and duplication waste resources and lead to few new breakthroughs. Also, a gap has emerged between research and extension.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Overstaffing with unqualified personnel: China's R&D staffing levels are too high. Overstaffing plagues almost all institutes. Most institutes are burdened with many unqualified staff. There are more than 130,000 approved staff positions. Although many positions are unfilled, there are 70,000 active research personnel, a level that is three times that of the US and the former Soviet Union. There are more than 1 million extension workers. Only 10% of China's extension staff have BS degrees; only 0.1% have MS or PhD degrees. There are no systematic ongoing training programs for extension agents; the lack of ties between research institutes and agricultural universities makes continuous learning difficult.
- The drag of retirement: In addition to all other duties, the research and extension system must provide social welfare services for its retired staff. It is estimated that the ratio of working staff to retired staff increased from 4:1 in the 1980s to about 2:1 in the late 1990s. Because core funding has not increased as retirement costs have risen, an increasing share of the research and extension budget is being allocated to retirees.

Public and private partnership

- All public; no private: The creation and extension of China's agricultural technologies are overwhelmingly financed and undertaken by the public sector. While the public research system comprises over 1600 research institutes, there are no more than a handful of private agricultural research institutes. Also, investment in R&D is mostly from the public sector; less than 2% of research expenditures are by the private sector. In contrast, the role of the private sector is rising in many other nations. China's already overburdened public sector is taking on tasks that are privately funded elsewhere in the world. The presence of the government often suppresses private-sector activity.
- Need for bold reforms: Although China has been trying to reform its agricultural research and extension system, the results of reforms have been mixed. Few of the reforms have reached the goals of creating a modern and efficient agricultural technology sector. In the same way that the bold reforms in other parts of the research system outside of agriculture were executed and succeeded (e.g. those in the Chinese Academy of Sciences), wide-reaching commercialisation of selected institutes and the concentration of greater levels of funding on the best research teams are needed in agriculture. These changes will not be easy; and will not be painless. China must make them to modernise its R&D system.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Financing

- More funding; improved R&D climate: While China has been increasing investment in agricultural research since the late 1990s, its investment is still low. Insufficient budgets are severely limiting the effectiveness of the agricultural research and extension system and reducing the incentive of staff.
- More funding; higher-quality research staff: insufficient funding is limiting the ability of China's agricultural research and extension system to attract quality staff. In today's world, the system must be able to compete for the best and most-creative minds.

POLICY RECOMMENDATIONS

Deepening agricultural research and extension reforms

- China's leaders should take steps to further reforms in agricultural R&D. High levels of future funding should be promised to those institutes and academies that take significant moves to upgrade their research capacity and eliminate marginal research staff.
- China may consider establishing a new series of regional agricultural academies of sciences by merging several provincial agricultural academies of sciences that are in the same eco-region. A similar approach can be applied to the merger of prefectural agricultural research institutes into larger ones. National level academies and institutes should be strengthened and there should be clear divisions of responsibilities between them and regional institutes. The national government must take far greater responsibility for funding and coordinating research at the new academies since coordination and joint-funding arrangements are difficult to arrange. Regional research projects funded by the central government, as is done in the US and Canada, are also needed.
- China needs to completely reform its agricultural extension system. It may even be worth creating an entirely new public extension system; the current system is so weak and ineffectual that reform may be impractical. The reformed system should draw no more than 20–30% of the most qualified extension technicians from the current system. New personnel with more training are needed. The

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

new staff need to be well-supported with adequate salaries and program funds. They should not be allowed to engage in commercial activities. Ongoing training needs to be systematised.

- Modern and effective institutional arrangements should be established in the new agricultural research and extension system. For example, extension programs that are put out for competitive bid may help better match skills to extension needs. Competitive grants in the research program will improve incentives and guide the direction of research. However, not all funding can be by project. Basic salaries and program costs must be met from government budgets.

Create the environment for a better relationship between public and private sectors

- China needs to clearly delineate the roles to be played by the public and private sectors in agricultural research and extension. Public research and extension should concentrate on the provision of public goods; other activities should be spun off to the private sector. New and effective institutions are needed to facilitate public–private partnerships. For example, private seed companies should be encouraged.
- To increase the financing and effectiveness of applied research and extension, the government might consider industry groups such as the agricultural industry groups in Australia or the agricultural commodity organisations in the US and Canada. These organisations tax those who could benefit from research—for example, the beef industry—and, in return, the industry has a say in what research and extension are financed.
- The reforms should recognise also that not all agricultural research institutes and technologies can be commercialised. Research institutes should not be encouraged to go into business. Commercial businesses require competitive and efficient institutional and management systems. Rules and institutions that encourage public institutes to license and sell their technological products to the private sector are needed.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Substantially increase investment in agricultural research and extension

- China needs to substantially increase its investment in agricultural research and extension. Commercialising part of its current agricultural research and extension systems does not imply a reduction in the government's role in financing agricultural research and extension. Agricultural research driven by commercial interests would naturally be directed towards the most commercially viable products and technologies. Once the market-driven research system starts to fund and execute research of certain commercial commodities and activities, the public research system can focus on activities that will lead to poverty reduction and environmental sustainability.
- The current needs for agricultural research and extension indicate that public funding from the central government should be the primary source of agricultural research and extension in the decade ahead, with continuing aid from provincial and prefecture governments. Difficulties in implementing and enforcing a strong intellectual property rights (IPR) system also imply the importance of the government's continuing support for agricultural research and extension.
- We recommend that public agricultural research investment should be increased from the current level of less than 0.3% to at least 1% of total agricultural GDP. Although China will still be far behind other countries, it is a goal that is attainable in the short term. Similar levels of public investment in agricultural extension are needed.
- Remove restrictions on foreign investment in R&D in biotechnology and the seed industry.

Improving the environment for intellectual property rights enforcement

- If the private sector is to play a larger role in conducting and financing agricultural research, IPRs on inventions in the private sector must be strengthened. The main problem of IPRs in China has been enforcement of trademarks, patents, and plant-variety protection rather than the laws themselves. The trademark,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

patent, and plant-variety protection laws are similar to laws in developed and more-advanced developing countries. One limitation of the laws is that some crops—such as cotton—are still not covered by plant-variety protection.

- Reduce government subsidies to provincial, prefecture and county seed and input companies so that the subsidies support the provision of public goods.
- Ensure that regulations on technology, quality, environmental safety, and food safety are science-based and are enforced by officials who are adequately paid by the government and do not earn money from the regulated industries. For example, seed-quality regulations are handled by government seed stations that are also in the seed business.

Improving water management

- Implement several policies:
  - Raise water prices (although higher prices may need to be matched by increased investment).
  - Promote new, water-saving technologies (ones that will lead to true water savings, such as reduced-irrigation cultivation practices for wheat). Increases in investment in research and development on water-saving technologies are needed; as are investments in new extension efforts and training.
  - Reform management institutions in order to achieve cropping intensity levels and cropping patterns, as well as municipal and industrial use levels that will be sustainable.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

6.2 CHINA'S AGRICULTURAL RESEARCH AND DEVELOPMENT:

REFORMS AND CHALLENGES

Jikun Huang and Ruifa Hu
Center for Chinese Agricultural Policy, Institute for Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, People's Republic of China

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

INTRODUCTION

The rapid and steady increase in output of major food and agricultural products in China ranks as one of the nation's great achievements. Publicly funded agricultural research has had a key role in this impressive performance (Huang et al. 2003). Expenditures grew rapidly from the early 1960s to the mid 1980s and the number of agricultural researchers increased throughout (Fan and Pardey 1992).

The rising research investment resulted in a steady stream of productivity-increasing technology. China was the first nation to extend semi-dwarf rice varieties and drought and pest-resistant wheat cultivars in the 1950s (Stone 1988). Its scientists also developed hybrid rice in the early 1970s and a number of successful varieties in the 1970s and 1980s. Several studies conducted by the Chinese Academy of Agricultural Sciences (CAAS) show that technology contributed more than 40% of agricultural growth (Zhu 1997). Recent studies on agricultural total factor productivity (TFP) further confirm that agricultural-productivity growth has come mainly from technology changes,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

including the expansion of high-yielding varieties (HYVs), other embodied input technology and improvement in farming systems (Fan and Pardey 1997; Huang et al. 2000; Jin et al. 2002). The major output of agricultural research—improved varieties and farming system management—has come from national, provincial and prefectural institutes as well as from agricultural universities (Huang et al. 2003).

There is concern, however, that the research system might have been weakened after the late 1980s. The overall funding for agricultural research stagnated during 1985–1995 (Huang and Hu 2000). Long lag times between agricultural research expenditures and benefits mean that adverse effects of shortfalls in expenditures will not become evident until 5–10 years later, which may partially explain the lower growth rates of crop, particularly grain, yields in recent years.

On the other hand, the future demands on agricultural research in China will be sizable. The country has less than 10% of the world's arable land and 25% of world per-capita water availability, but already feeds more than 20% of the world's population. To keep pace with increased demands from projected population increases, food production in China will have to increase continually (Huang et al. 1999; World Bank 1997). Given the limitations on arable land, productivity increases will have to be the primary source of increases in output (Nyberg and Rozelle 1999).

In order to maintain a high food-self-sufficiency level, policy makers tried to raise funding for agricultural research, shifted funding from institutional support to competitive grants and moved more funds from basic research to research aimed at solving problems of economic development, and encouraged research institutes to be self-sufficient by selling their technology (Rozelle et al. 1997). However, several questions are raised. Can China's public agricultural research financing maintain a strong agricultural R&D system? How can China manage commercialisation of its agricultural research? What is the role of the private sector in generating and providing agricultural technologies for farmers? What kinds of reforms are necessary to improve the efficiency of agricultural research?

Answers to these questions are critical to policy makers, producers and agricultural industry in China. This study is designed to gain a better understanding of the questions above. The paper is organised as follows. In the next section, the existing structure of the agricultural research system is reviewed. The third section examines the trends and structure of agricultural research financing and revenues. The current reforms and policies are discussed in the fourth section. The final section draws conclusions and makes policy recommendations.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

AGRICULTURAL RESEARCH INSTITUTIONS

An overview

A public-sector dominated research system

Agricultural research in China is overwhelmingly financed and undertaken by the public sector; private-commercial agricultural research is minor. The public research system comprised over 1600 research institutes and more than 130,000 staff in 1999 (Table 6.1), plus about 55,000 retirees who are dependent on research institute budgets for their pensions. Public agricultural research is conducted in the agricultural research institutes (mainstream agricultural research system, MARS), universities and non-agricultural research institutes. Among all staff, MARS accounted for 83% in 1999, and the rest is about equally distributed between the universities and the research systems under other ministries. It is estimated that the number of research staff from the private sector engaged in agricultural research is no more than 500 (Pray 1998). Research expenditure of the private sector is only about 1.7% of the nation's total agricultural research budget.

Table 6.1 The numbers of institutes and staff in public agricultural research in China in 1999

	Total	University[a]	Others[b]	Mainstream agricultural research system (MARS)			
				Sub-total	National	Provincial	Prefecture
Number of institutes	1,635	312	104	1,219	56	451	712
Number of total staff	131,439	10,200	12,457	108,782	10,706	51,609	46,467
Staff per institute	80	33	120	89	191	114	65
Staff shares (%)	100	8	9	83 (100)[c]	8 (10)	39 (47)	35 (43)

[a] Under universities, agricultural research staff are those professors or lecturers who have research projects in agriculture-related fields, whereas staff numbers in other columns are the total staff, including all professional, support and other staff working in and supported by the institutes.

[b] Others include those under other than MARS and universities (i.e. Chinese Academy of Sciences).

[c] The numbers in parentheses are the staff shares (%) within MARS.

Source: authors' survey and database from the Ministry of Science and Technology.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

A highly decentralised research system

Some 95% of the research centres and more than 85% of research staff are found at sub-national levels. Provincial and prefectural agricultural research institutes number 451 and 712, respectively (Table 6.1). Within MARS, the national level research institutes accounted for only 10% (or 8% of China's total staff) in 1999. Each province has its own provincial academy of agricultural sciences, at least one agricultural university and several other agriculturally related colleges at provincial and prefectural levels. Most prefectures have their own agricultural research institute. All core budgets of research institutes at provincial and prefectural levels are from the corresponding local governments. The research projects conducted at the provincial and prefectural institutes are financed mainly by local governments. In terms of budget allocation, national level institutes within MARS account for only 12% of China's agricultural research budget (Table 6.2). Provincial and prefectural institutes account for 51% and 34%, respectively (Table 6.2). As the size of institutes measured by staff numbers differs among the institutes at various levels, the budget per staff at the national research institutes (77,000 yuan/staff, Table 6.2) is much higher than those at the provincial (54,000 yuan/staff) and prefecture levels (40,000 yuan/staff).

Table 6.2 Total revenue of public agricultural research in China in 1999

	Total	University	Others[a]	Mainstream agricultural research system (MARS)			
				Sub-total	National	Provincial	Prefectural
Total revenue (million yuan)	6846	478	889	5479	827	2772	1880
Revenue per institute ('000 yuan)	4187	1532	8548	4495	14,768	6146	2640
Revenue per staff ('000 yuan)	52	47	71	50	77	54	40
Revenue shares (%)	100	7	13	80 (100)[b]	12 (15)	40 (51)	27 (34)

[a] Others include agricultural research institutes under other than MARS and universities (i.e. Chinese Academy of Sciences).

[b] The numbers in parentheses are the revenue shares (%) within MARS.

Source: authors' survey and database from the Ministry of Science and Technology.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

A research-institute dominated system

Agricultural research in China is primarily built around the research institutes of the Chinese Academy of Agriculture Sciences (CAAS),[1] a series of provincial and prefecture academies, and to a lesser extent, the agricultural university research system. Researchers in the universities account for only 8% of the total agricultural research staff and 7% of budget share (Table 6.2). Over-staffing in agricultural research institutes and an under-funded agricultural research system may partially explain under-use of human resources in universities.

A crop-oriented research system

Food security has been one of the central goals of China's national policy since the 1950s. The priority of research programs has been in basic, staple foodstuffs, particularly grains in the 1960s–1970s. Rising incomes have resulted in changes in diet and increasing demand for non-staple foods since the 1980s. Concomitant with these changes, the structure of agriculture has also been gradually moving to non-staple crops, livestock and other agricultural products. However, even with these changes in agricultural production structure, based on our surveys of over 1200 agricultural research institutes under MARS, about 68% of the research budget was allocated to crops, 18% for livestock and 14% for all others (Huang et al. 2003). These proportions have been nearly constant over the past two decades. Since a large part of the income of the poor is from crop production, in this consideration, the crop-oriented public research system ('pro-poor' system) contributes to both food security and poverty-alleviation objectives.

[1] There are five major agricultural academies at national level. They are CAAS, Chinese Academy of Fishery (CAFi), and South China's Academy of Tropical Plants (CATP) under the MOA, Chinese Academy of Forestry (CAFo) under State Forest Bureau, and Chinese Academy of Agricultural Mechanization (CAAM) under both State Machinery Bureau and the MOA. However, CAAS is the largest in terms of staff and budget. In this paper, our discussions will focus mainly on CAAS, but policies and issues raised here are equally applicable to the rest of the national agricultural research system.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Challenges

Lack of coordination

A decentralised research system has potential merits as it could easily prioritise research programs to meet local farmers' needs and develop appropriate technologies for locally specific environments. However, there are also several disadvantages associated with this system. Limited coordination among institutes can lead to duplication of research between regions, which may lower overall efficiency of research investment for the country as a whole. When the constraints of agricultural research finance are considered, as evidenced in many less-developed areas in China, the decentralised system could have significant implications for agricultural technology changes and farmers' income growth in the poor areas. Inefficient resource allocation could easily be created from management conflicts and similarity of the research priority settings between the central and local governments, among various ministries (at central government) or bureaus (at local government) at the same jurisdiction, and among local research institutes in similar regions.

Over-staffing

Large numbers of unqualified researchers and lack of research funding are quandaries that China's agricultural research system is facing. Among 130,000 staff, about 70,000 are claimed to be 'active research' staff. In the absence of a national pension system, China's agricultural research system also supports more than 55,000 retirees through the institutes' budgets. The number of active research staff is three times that of the USA and the former Soviet Union (Table 6.3). It is worth noting that this comparison is not to measure research capacity, but rather to point out one of the fundamental problems in China's research system: over-staffing and a large number of unqualified researchers. Considering the size of the country's agriculture, Table 6.3 also shows that China's number of agricultural researchers per million US dollars of agricultural GDP is higher than all the other countries except the former East Germany. Such a resource distribution pattern reflects the features of a socialist economy, where the strategy in resource allocation is to replace scarce capital by human resources with suppressed salaries. With the transition from a planned to a more market-oriented economy, the salary levels lag far behind the expectations of agricultural researchers. Consequently, agricultural researchers started to move to other sectors and their number has declined recently.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 6.3 International comparisons on numbers of agricultural scientists

	Number of active researchers				Number of agricultural researchers per million US dollars of agricultural GDP
	Public agricultural research institutes	Universities	Private sector	Total number	
China (1999)	59,058	10,200	500	69,758	0.40 (0.69)[a]
India (1987)	4,052	5,800	600	10,452	0.16
Brazil (1995)	2,097	965	266	3,328	0.05
Argentina (1995)	1,051	61	110	1,222	0.07
Columbia (1995)	524	17	318	859	0.08
Mexico (1995)	1,365	464	901	2,370	0.14
Chile (1995)	189	50	13	252	0.05
USSR (1991)	23,144	0	0	23,144	0.46
East Germany (1989)	6,200	1,350	0	7,550	0.72
East Germany (1995)					(0.12)
West Germany (1989)	1,300	2,410	404	4,114	0.16
West Germany (1995)					(0.15)
Japan (1986)	11,154	3,605	8,850	23,609	0.13
USA (1991)	3,687	7,525	14,188	25,400	0.14

[a] Refers to total staff, rather than active research staff (0.40).

Sources: Pray and Umali (1998); Huang et al. (2003); and authors' survey.

Retirees

The research institutes have a large proportion of retired staff. It is estimated that the ratio of working staff to retired staff has changed from 4:1 in the early 1980s to about 2:1 in 1999. For 1219 agricultural research institutes under MARS, the retirees were 49% of the existing staff. Because core funding from the government has not been raised as much as the requirements for salary and pension systems, an increasing portion of research institute budgets is allocated to payments for retired staff. For example, in CAAS, on average 20% of the academy's budget or 32% of the academy core funding is spent on about 4600 retirees (58% of working staff). In several research institutes, such as the Institute of Crop Breeding and Cultivation and the Institute of Vegetable Crops and Flowers, payments for retirees account for almost all of the institutes' core funding.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

AGRICULTURAL RESEARCH FINANCING

Agricultural research financing has undergone fundamental changes since 1989. Before the research reforms initiated in the mid 1980s, the government provided all of the funding for research. Planners allocated most funds through five-year plans with supplementary funding for special issues arising during the planning period. The former State Science and Technology Commission (SSTC) and, since 1998, the Ministry of Science and Technology (MOST), together with the Ministry of Agriculture and other ministries, wrote the research component of the plans with the assistance of special committees made up primarily of senior scientists from the various disciplines. Most of the funds were then allocated on a formula basis to the research institutes mostly at the national level. A similar funding mechanism was followed at provincial and prefectural levels. The formula-based financing has been gradually shifted to competitive grants. Lack of funding to maintain operations has pushed agricultural research institutes to generate their revenue from commercial activities that accounted for 41% of the total budget in 1999 (Huang et al. 2003).[2] By the late 1990s, the government fiscal budget accounted for only about 50% of the total budget of the institutes (Table 6.4).

Agricultural research investment: amounts and trends

China's agricultural research system expanded in most periods over the past five decades. The rapid growth of the agricultural research system has benefited from unremitting commitment by the government to agricultural research. Expenditure for agricultural research in real terms grew by 13.5% annually between 1976 and 1985 (Huang et al. 1999). Between the mid 1980s and mid 1990s, however, the government fiscal investment in agricultural research did not increase and even declined in many years (Table 6.4). This raised concerns about China's future ability to meet the growing demand for agricultural products resulting from rapid growth of the economy. Realising the slow growth, and even decline, in agricultural research expenditure, China increased public investment in agricultural research after the mid 1990s.

[2] Our surveys show that there is only about 5–15% of commercial income invested in research projects, the rest going to salaries and bonuses for employees, mostly those working on commercial activities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Slow growth of total agricultural research investment

Total investment (including government fiscal expenditure and research institutes' commercial income) in agricultural research[3] grew from 1355 million yuan in 1985 to 6368 million yuan (current prices) in 1999, representing a more than four-fold increase (Table 6.4). However, measured at the real value (deflated by the general price index), the annual growth rate was only 3.6% over 1985–1995 or 4.0% over 1985–99, below the growth rate of agricultural GDP (more than 4%) in the corresponding period.

Table 6.4 China's agricultural research investment in the public research system, 1985–1999

Year	At current prices (million yuan)			At 1998 prices (million yuan)		
	Total	Fiscal	Commercial	Total	Fiscal	Commercial
1985	1355	1015	203	3923	2939	588
1986	1346	958	200	3676	2617	546
1987	1403	948	269	3572	2413	685
1988	1782	1189	366	3827	2554	786
1989	2095	1400	402	3820	2553	733
1990	2050	1243	499	3661	2220	891
1991	2381	1283	655	4133	2227	1137
1992	2761	1442	840	4548	2375	1384
1993	3273	1558	1077	4763	2267	1567
1994	4409	2072	1322	5272	2478	1581
1995	4856	2441	1541	5058	2543	1605
1996	5238	2754	1580	5143	2704	1551
1997	5377	2789	1588	5237	2717	1547
1998	5847	3060	1687	5847	3060	1687
1999	6368	3358	1810	6565	3462	1866
Annual growth rate (%)						
1985–95	13.3	8.4	21.8	3.6	–1.3	12.1
1996–99	6.5	7.4	3.9	6.5	7.4	3.9
1985–99	12.5	9.6	17.6	4.0	1.1	9.1

Source: Ministry of Science and Technology.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Government investment re-started growth after the mid 1990s

Among total agricultural research institute revenues, Table 6.4 shows that the government fiscal expenditure for agricultural research in real terms declined in 1985–1995; annual growth rate was negative (–1.3%). It re-started growth at a rate of 7.4% annually in 1996–1999 (Table 6.4). Our recent interviews with officials from the Ministry of Finance revealed that the annual growth rate of agricultural research expenditure has exceeded 10% in 2000–2003.

Rising commercial income with declining growth rate

Non-government fiscal investment, or income generated by research institutes from commercial activities, was a major component of research institutes' revenue in 1985–93, but experienced slower growth after 1993 (Table 6.4). The annual growth rate reached 12.1% in 1985–95, but declined to 3.9% in 1996–99.

Intensity of agricultural research investment

Internationally, investment intensity (that is, the percentage of agricultural research investment relative to agricultural GDP) is usually used to measure the level of investment in agricultural research. Table 6.5 shows that investment intensity in China's agricultural research declined during the period of 1985–1996 and resumed growth only recently.

Based on government budgetary allocations for agricultural research (excluding income generated by research institutes through commercial activities), the percentage fell from 0.40% in 1985 to 0.20–0.23% in the late 1990s. If the income generated by research institutes and the investment in agricultural research by foreign companies and private enterprises are included, the intensity of investment in agricultural research reached 0.44% in 1999 (Table 6.5). This is still one of the lowest in the world (Table 6.6).

Investment in agricultural biotechnology research

China considers use of agricultural biotechnology to be one of the primary measures to improve its national food security, raise agricultural productivity and give it a competitive position in international agricultural markets. In order to achieve these goals, China has made great efforts to improve its innovation capacity in national

[3] Including agriculture, forestry, animal husbandry, water conservancy, and agricultural services.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

biotechnology programs since the early 1980s. In contrast to the stagnating, or even declining, trends in public agricultural research staffing and expenditure in 1985–95, the number of plant-biotechnology researchers more than tripled in the past two decades.[4] We estimate that there were about 2700 researchers (including support staff) dedicated to plant biotechnology in 2003 (Table 6.7). If we include the animal sector, the number of agricultural biotechnology researchers may be more than 4000, which probably is one of the largest in the world.

Table 6.5 Intensity (%) of investment in agricultural research and technical extension services in China, 1985–99.

Year	Agricultural research			Agricultural technical extension
	Government fiscal expenditure	Commercial income and others	Total	
1985	0.40	0.13	0.53	n.a.
1986	0.35	0.14	0.49	0.41
1987	0.30	0.14	0.44	0.40
1988	0.31	0.15	0.47	0.37
1989	0.33	0.16	0.50	0.36
1990	0.25	0.16	0.41	0.33
1991	0.24	0.21	0.45	0.34
1992	0.25	0.23	0.48	0.34
1993	0.23	0.25	0.48	0.32
1994	0.22	0.25	0.47	0.30
1995	0.20	0.20	0.40	0.27
1996	0.20	0.18	0.38	0.29
1997	0.20	0.18	0.38	0.31
1998	0.21	0.19	0.40	0.42
1999	0.23	0.21	0.44	0.46

Sources: Ministry of Finance, and Agricultural Policy Research Center of the Chinese Academy of Agricultural Sciences.

[4] This is based on our survey of 29 research institutes in the plant biotechnology area in 2000, interviews with the ministries and research institutes in 2002, and our most recent research institute survey in 2004.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 6.6 Intensity of agricultural research investment in the mid 1990s

Region	Investment intensity (%)			Share (%)	
	Government	Non-government	Total	Government	Non-government
China (1999)	0.23	0.01+0.21[a] =0.22	0.45	51.1	48.9
Taiwan	4.65	n.a.	n.a.	n.a.	n.a.
Other Asian countries					
India	0.37	0.06	0.43	86.0	14.0
Malaysia	0.58	0.15	0.73	79.5	20.5
Thailand	0.69	0.10	0.79	87.3	12.7
Indonesia	0.24	0.02	0.25	96.8	7.2
Pakistan	0.47	0.02	0.49	95.9	4.1
Latin America					
Argentina	0.82	0.05	0.88	94.3	5.7
Brazil	0.83	0.12	0.95	87.4	12.6
Chile	0.64	0.05	0.69	92.8	7.2
Columbia	0.26	0.15	0.41	63.4	33.6
Mexico	0.36	0.28	0.64	56.3	43.7
Peru	0.76	0.14	0.91	83.5	16.5
Venezuela	0.82	0.08	0.90	91.1	8.9
Developed countries					
Japan	2.1	2.22	4.32	48.6	51.4
Australia	3.54	1.54	5.08	69.7	30.3
UK	2.29	3.80	6.09	37.8	62.2
France	2.24	2.52	4.76	47.1	52.9
Germany	1.88	2.66	4.54	41.4	58.6
US	2.02	2.34	4.36	46.3	53.7
16 high-income countries[b]	2.37	1.86	4.23	56	44

[a] The figures are for private (0.01) and income generated from development activities (0.21) by research institutes.

b. The figures for 16 high-income countries are the figures of late 1980s.

Sources: Pray and Umali (1998); S. Rozelle, Jikin Huang and C. Pray, unpublished data.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 6.7 Estimated research staff and annual expenditure on plant biotechnology research in China, 1986–2003

Year	Staff	Research expenditure		
		Million RMB at current price	Million RMB at 2000 price	Million US$
1986	740	14	38	4.2
1990	1067	40	68	8.3
1995	1447	88	87	10.5
2000	2128	322	322	38.9
2003	2690	462	463	55.9

Note: expenditures include both project grants and costs related to equipment and buildings.

Source: Huang et al. (2004).

The growth in research investment in agricultural biotechnology in the public sector has been substantial. The estimated investment in plant-biotechnology research was only US$4.2 million in 1986 (Table 6.7) when China formally started its '863 Plan'. The investment grew to US$8.3 million in 1990, US$10.5 million in 1995, and US$38.9 million in 2000, the increase over 1995–2000 representing an annual growth rate of about 30%. The investment in plant-biotechnology research continued to grow in the first few years of the 21st century, reaching US$55.9 million in 2003, about 44% higher than that in 2000 (Table 6.7). Nearly all investment in biotechnology in China is from government sources (Huang et al. 2002).

Bt cotton is one of the most-often cited examples of the progress of agricultural biotechnology in China. In addition, other transgenic plants with resistance to insects, disease or herbicides, or plants with improved quality, have been approved for field release and some of them are nearly ready for commercialisation. These include: transgenic cotton lines resistant to fungal disease; rice resistant to rice-stem borer or bacterial blight, diseases and herbicide; wheat resistant to barley-yellow-dwarf virus; maize resistant to insects and with improved quality; poplar trees resistant to gypsy moth; soybeans resistant to herbicides; transgenic potato resistant to bacterial diseases or Colorado beetle (Huang et al. 2004). From 1997–2003, the National Agricultural Bio-safety Committee received a total of 1044 applications for field trials, environmental release, pre-production, and commercialisation of genetically modified organisms (GMOs), of which 821 were GM plants. Of these, 777 (585

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

plants) were approved. Eighteen transgenic cotton varieties generated by Chinese institutions and five varieties from Monsanto with resistance to bollworm were approved for commercialisation in China in 1997–2002. While several GM varieties of tomato, sweet pepper, chilli pepper and petunia have also been approved for commercialisation since 1997, the areas under these four crops are very small.

Challenges ahead

While there has been increasing investment in agricultural research since the mid 1990s, China's agricultural research is still much under-invested. Insufficient research budget could severely affect the stability of the agricultural research system and the enthusiasm of researchers. Based on our interviews, the time spent on research activities by agricultural researchers dropped from 74% in 1985 to about 50% in the late 1990s.

Improvement of research capacity is another challenge that China's agricultural research is facing. For the country as a whole, for every 100 agricultural research workers in 1999, there were only 0.57 researchers with a PhD (Table 6.8). The percentage of researchers with PhDs differs widely between research institutes. It was 2.84% in national research institutes and 0.58% in provincial research institutes. Although prefectural research institutes employed more than 46,000 staff, only 12 researchers held PhD degrees (0.03% of total staff) in 1999. A similar pattern was evident for researchers with Masters degrees (Table 6.8).

The challenge is also raised for the less-developed regions under China's highly decentralised research system. While the decentralised system has its own merits, it may also present some disadvantages for agricultural productivity growth, food security and poverty alleviation in the poor areas, as local ability to invest in agricultural research depends on local income and financial capacity. Table 6.9 presents agricultural research investment intensities (ARII) by region, and shows that there is a negative correlation between ARII and economic development or income.

Western China is the least developed region with average per-capita income of 1502 yuan in 1999 (Table 6.10). Nearly half of China's rural poverty population is located in the region. Western China's poverty incidence (7.3%) was nearly six times as high as that in eastern China (1.3%, Table 6.10). However, it had the lowest value of ARII (0.26%), followed by central (0.30%) and eastern (0.36%) China (Table 6.10). The difference in ARIIs between western and eastern China is even larger when we include investment in national institutes located in the regions (Table 6.10).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 6.8 Agricultural research staff by education and position for national and local research institutes under the mainstream agricultural research system in China in 1999

Total	Total staff	PhD	Masters degree	Bachelors degree	Professor + associate professor	Senior research assistant
Total	108,782	615	2,871	22,323	11,816	19,747
National	10,706	304	754	2,805	1,763	2,244
Provincial	51,609	299	1,836	11,374	6,572	9,426
Prefectural	46,467	12	281	8,144	3,481	8,077
As percentage of total staff (%)						
Total		0.57	2.6	21	11	18
National		2.84	7.0	26	16	21
Provincial		0.58	3.6	22	13	18
Prefectural		0.03	0.6	18	7	17

Source: Ministry of Science and Technology.

NATIONAL STRATEGY TO REFORM THE AGRICULTURAL RESEARCH SYSTEM

The reforms in the agricultural research sector vividly illustrate the propensity of the leadership to implement deep reforms in the most tradition-bound sectors (Maddox and Swinbanks 1995; Rozelle et al. 1997). As part of China's general move to distance itself from the rigid, closed planning system, reformers gradually implemented a series of science and technology policies that were designed to fundamentally alter the behaviour and output of research institutes. In addition to opening to the outside world, the agricultural research reforms of the 1980s and 1990s targeted two main areas: changes in the basis of the distribution of research funds to a more-competitive system, focusing resources on the most productive scholars and institutes; and policies encouraging research institutes to commercialise the products of their research, allowing them to retain profits and re-invest as a major source of revenue for their research work. Since the late 1990s, a new reform aimed at modernising the agricultural research system has been initiated.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 6.9 Regional agricultural research investment intensity (%) under the mainstream agricultural research system in China in 1999

Region	Excluding national institutes in the region	Including national institutes in the region
Total or average	0.32	0.37
Southwest	0.20	0.21
North	0.26	0.35
East	0.29	0.33
Central	0.34	0.35
Northwest	0.39	0.51
South	0.41	0.46
Northeast	0.49	0.56
Western	0.26	0.30
Central	0.30	0.33
Eastern	0.36	0.43

Note: Eastern China includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan; Central China includes Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Hunan, Hubei, and Henan; Western China includes Sichuan, Chongqing, Yunnan, Guizhou, Tibet, Shaanxi, Gansu, Ningxia, Qinghai and Xingjiang.

Table 6.10 Regional income and poverty in rural China, 1999

	Average per-capita income (yuan)	Population under poverty (million)	Percentage of poverty in nation's total (%)	Poverty incidence (%)
Western	1502	16.44	48	7.3
Central	2003	12.67	37	3.9
Eastern	2929	5.01	15	1.3
China	2210	34.12	100	3.7

Sources: MOA (2000); NSBC (2000).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Reforms before 1999

Competitive grants and focused research programs

Beginning in the early 1980s, national research policy gradually increased the proportion of funding allocated competitively, by encouraging funding agencies to make grants and fellowships to researchers putting forth the best proposals. Before that time, directors of research institutes and their department heads allocated the fund provided by the State Science and Technology Commission (SSTC) to projects, laboratories and individual scientists. Currently, most research funds from national sources can be accessed only through competitive research-funding programs. National leaders also competitively allocate funds for priority research areas, such as biotechnology, through programs like the 863 Program and the Special Foundation for Transgenic Plants. Most of the national and provincial Science and Technology Committees have expert committees made up primarily of scientists who rate proposals on the basis of the expected contribution to farmers, the proposed methodology, originality etc.

While the gradual trend towards competitive grants dominated the funding of agricultural research projects in the 1990s, all institutes still get 'administrative fees' (*shiyefei* or core funding) on a formula (non-competitive) basis from the Ministry of Agriculture (MOA) or their local budgetary authorities for base salaries, pensions and other operating costs. For the most part, administrative fees are used for the research staff's basic salaries and funds for benefits, such as housing subsidies and medical payment. One of the biggest uses of administrative fees has been for supporting retired personnel. Frequently, when administrative funding from a unit is insufficient to support its welfare needs, an institute's director will divert research grants by raising overhead rates or allowing project members to have the right to withdraw a portion of grants (normally in the range 5–15%) as a 'bonus' for their project staff to meet the fiscal needs.

Shifting research grants from a formula base to a more-competitive base is expected to have significant impacts on research productivity and prioritised areas that government intends to focus on. The research productivity may increase with the reform, as larger research budgets can be allocated to more-productive research institutes and individual scientists. Government objectives in areas of social and environmental concern such as food security, poverty alleviation and environmental protection can also be incorporated into competitive research programs.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Commercialisation reforms

Policy makers began encouraging research institutes to earn their own income through commercial activities in the mid 1980s. In 1987, the SSTC chairman announced a plan to push scientists to think like entrepreneurs. MOA officials soon copied the SSTC moves, encouraging agricultural research institutes to earn money (Liu 1991). Researchers in our interviews recall that they initially gave little credence to the new directive, since seed prices were heavily subsidised and there was little prospect of making a commercially viable product except for seed.

As budgets became increasingly tight and the need to reform grew, the nature of commercialisation evolved. Reformers originally had designed the policy changes as a way to encourage institutes to capitalise on breakthroughs in research. It soon became an accepted practice, however, to make money in any way possible. Income generated by commercial activities increased rapidly in the late 1980s and early 1990s (Table 6.4). In the early reform period, commercial activities ranged from selling products produced by the institutes (e.g. plant-breeding institutes selling new plant varieties) to activities that were far from the unit's traditional discipline, such as running hotels and restaurants or selling industrial products. Recently, more income has been generated from technologies closely associated with the agency's area of expertise.

Unfortunately, weak IPR makes licensing technological breakthroughs with manufacturing enterprises or technology development firms not a credible option. Licences and technology contracts typically are not honoured for very long. For an economy with hundreds of millions of small farmers, the cost of enforcement or strict implementation of a strong IPR system, could be so high as to be not feasible. The way that a research establishment often partially capitalises on a breakthrough is to manufacture and distribute the product itself.

The impact of the reforms

Rozelle et al. (1997) found that China's agriculture reforms were only partially successful. Although the real income from commercial enterprises increased rapidly from 1985 to 1994, only a small amount of that income was used to fund research. The funds generated from commercial activities were insufficient to offset the reduction in government support for research. Moreover, the growth of income generated from commercial activities slowed after the early 1990s.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

On the other hand, while competitive grant funds may have focused resources on the better scientists, funding for agricultural-research projects in real terms did not increase for all types of research institutes. Since staff members in commercial enterprises did not move off the rolls, funds per scientist did not go up as officials hoped.

While there are signs of an increase in technology transfer because of the commercialisation process, the change has not been significant. In fact, many of the commercial activities in the early reform period by public agricultural-research institutes had little relationship to the technology they are responsible for developing. Intellectual property rights and contractual law in China apparently are too weak for technology to be profitably and successfully licensed. For a variety of reasons, then, by the late 1990s, the common perception was that the reforms, though perhaps successful in beginning to change the structure of China's research institutes, had only partially reached the goals or targets reformers had set.

A new push for reform

Strategy and plan

Lack of impact of the earlier reforms in terms of their provision of new technologies to producers, and failure to reduce over-staffing and duplication of research among institutes, have created a new impetus to launch another round of research reforms. In addition, the new needs created by China's move to a more market-oriented economy and the challenges of research in the new, high-technology fields reinforce the need to reform the agricultural research system. In this new round, the challenge that officials have set themselves is very high: to create a modern, responsive, internationally competitive and fiscally sustainable agricultural-research system (State Council 2000). The goals to better commercialise its products and increase funding per scientist are seen as necessary for keeping the best people engaged in agricultural research.

To meet the above goals, government policy to modernise the agricultural-research system contains several measures. The reforms attempt to separate the types of activities that are being performed by the current research staff into those that can be commercialised (most are applied research) and those that should be maintained in the public 'research innovation base' (most are applied-basic and basic research as well as research of a public-goods nature). For that left in the non-commercial sector, an effort then is made to separate the outstanding research staff and those with potential from those without the same potential. Those who are identified as the high-quality scientists have received higher salaries and large increases in per-capita support.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Based on the above principles, in the late 1990s, MOST officials sketched a '1/3–1/3–1/3 plan' for agricultural-research reform. Reformers believe that, through fully commercialising some agricultural research institutes and commercialising some specific research programs or activities in each research institute, one-third of institute staff could be separated from the research system. During the transition phase of reforms for those institutes or programs/activities to be commercialised, the core funding would be gradually reduced, until the revenues of the institute-cum-enterprises become fully dependent on sales. Institutes and programs that to some extent also provide public goods (named as non-profit public institutes that are also believed to account for about one-third of total staff), receive public funding to cover part of their expenses. The rest of the agricultural research system is maintained, and placed into an innovation base and is to be given an increase in both core funding (particularly the researchers' salaries) and research budgets.

In the end, China's research reformers want to have a modern, state-of-the-art, internationally competitive, agricultural-research system. With such high competition, they will be able to attract better scientists. Higher levels of funding for the better researchers will keep them from diverting their attention from research into other activities such as consulting or commercial activities. MOST predicted that another benefit of such a system (which would also give the research institute's director more discretion over salaries and hiring) would be that more scholars would be attracted back from overseas.

Challenges of recent reforms

Our recent study shows that institutes face several challenges during the reforms—even with considerable additional investment (Huang et al. 2003). First, support for the retired staff has been a serious problem. For example, on average in CAAS institutes, pension and medical payments to retirees took up 32% of the core funding in 1999. The average ratio of retired staff to currently active staff was 0.6:1 in 1999, ranging from 0:1 (in newer or growing research institutes such as the Biotechnology Research Institutes) to nearly 1 to 1 (in older research institutes such as cropping-oriented research institutes). In the traditional institutes, which have been around for many years and have an ageing staff and many retirees, more than half of core funding is allocated to pensions and health care. Active scientists in these research institutes rely mostly on project funding or consulting for their salaries.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

National research directors also pointed out that, without a firm commitment to increased funding, the national research system might not follow the path directed by MOST. Some institutes in the rich regions that initiated commercialisation reform in the late 1990s have gradually returned to the government for support. In the less-developed provinces, where local government financial revenue generation is weak and investment in agricultural research is not viable, leaders used research reform as a mechanism to cut the budget. Quickly, however, reformers in the less-developed provinces and even in the more-developed coastal provinces found that few agricultural-research institutes could succeed commercially. Those that struggled included institutes that were originally thought to be engaged in 'applied' research. The main question is whether or not these institutes can survive after they are commercialised under their current management in China's current institutional and legal system.

Management problems also often occur because academics are seldom good businessmen, and managers are rarely given any real authority to restructure the firm. According to our interviews, managers are almost always prohibited from laying-off workers. In the minds of institute managers, commercialised enterprises must continue to take care of their retirees and other employees, otherwise they will become the burden of the institute.

Another difficult problem is that the business environment in the agriculture sector is not conducive to earning profits. Poor intellectual property rights, fragmented technology markets (e.g. for seed) and other factors keep agricultural technologies from prospering. Low profit rates, high transaction costs for servicing small customers, and other costs of doing business limit the commercial potential of many firms.

Lessons and new policies

In facing the above problems and challenges of reform, leaders realised that, while the reforms are needed, increasing financial support is an essential condition for successful reform. Even with successful commercialisation, large increases in budgets are needed to fund the elite scientists at levels needed to modernise the research sector and attract the best minds in the country. Recently, commodities and technologies that have strong public-goods features and social implications have been strengthened within the public research system. Other commodities and technologies with high potential for private-sector entry have been commercialised gradually with support from the public sector.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Policy makers have also recognised that although commercialisation of many of the institutes can succeed and contribute to budgetary savings, the process might take time. A longer period and more support are needed to allow for a redirection of effort and restructuring of the firm. Recently, options have been opened to allow managers in some institutes to lay off workers, provide a better incentive system for the enterprises, and begin to make money.

CONCLUDING REMARKS

China has been highly acclaimed for its ability to feed its growing population within the constraint of extremely limited natural resources. Over the last four decades, per-capita availability of food, household food security and nutrition have all improved significantly. Increased domestic production is almost solely responsible for increased per-capita food availability and significantly contributes to poverty alleviation and farmers' income.

China's past experience shows that technological change in the developing countries is the main engine of agricultural growth, farming income increase and poverty alleviation. Publicly funded agricultural research has played critical roles in generating the technologies needed by hundreds of millions of farmers. However, the success of research-led technology changes in the past does not imply that agricultural research will be necessary to effectively generate the farmers' demand for agricultural technology in the future. Many things are changing.

This paper shows how China has been trying to reform its over-burdened, public dominated and decentralised research system in order to establish a modern, responsive, efficient, and internationally competitive agricultural-research system. Our study shows that commercialising agricultural research does not imply weakening government's role in financing agricultural research. Agricultural research driven by commercial interests would naturally be directed towards the most commercially viable products and technologies. Market-driven research systems will leave research directed to food security, poverty alleviation and environmental sustainability under-funded. The roles of agricultural research imply that public funding should be its primary source of support in the decade to come. Difficulty in implementing and high cost of enforcing a strong IPR system also imply the importance of a viable public financial support system for agricultural research.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There are a few other lessons and experiences that resulted from China's agricultural research investment and reforms. These include: the commercial component of research reforms may not be successful if other reforms (such as output, input and technology market reforms) do not occur in the rest of the economy; not all agricultural research institutes and technologies can be commercialised; the commercial businesses of research institutes require a market-oriented institutional and management system; human capacity of academics in financial and business management is far behind the need for successful enterprise development; and the importance of public and local research on biotechnology. The fact that Bt cotton was developed by government researchers in parallel with its development by international companies clearly made it more palatable to the government and ensured that there was informed support for the technology.

Funding through various non-government sources is expected to increase in the future. This requires thorough reform of the existing public agricultural-research system and implementation of other policies and reforms, particularly those related to relaxing the barriers for private participation in research and technology transfer. To increase the ability for income generation by commercialised research institutes and to attract private investment in agricultural research, reforms should be continued to liberalise agricultural input and output markets, more resources and efforts should be invested in implementation and enforcement of policies related to IPR and ownership, the barriers to market access for private participants in the research and technology sector should be reduced, and government should provide greater incubator funding to assist local firms in the initial stages of private development.

The research capacity and technology gaps between rich and poor regions, and their implications for income distribution, have not been given much attention in the current research system in China. Since most of the research budgets of local research institutes come from the corresponding local government's fiscal revenue, it is expected that an increasing technology gap between the rich and poor regions would be enlarged given the current decentralised research system with its lack of coordination with national and inter-regional institutes. In this situation, regional research-investment priority is not likely to be given much attention by policy makers.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REFERENCES

Fan, S. and Pardey, P.G. 1992. Agricultural research in China: its institutional development and impact. The Hague, International Service for National Agricultural Research.

Hu, R., Huang, J., Jin, S. and Rozelle, S. 2000. Assessing the contribution of research system and CG genetic materials to the total factor productivity of rice in China. Journal of Rural Development, 23, 33, 70.

Huang, J. and Hu, R. 2000. Agricultural R&D investment system and pattern: current situation and international comparison. Management World, No. 3 (2000), 170–179.

Huang, J., Hu, R., Pray, C. and Rozelle, S. 2004. Plant biotechnology in China: public investments and impacts on farmers. Paper presented at the 4th International Crop Science Congress, 26 September–1 October 2004, Brisbane, Queensland, Australia.

Huang, J., Hu, R. and Rozelle, S. 2003. Agricultural research investment in China: challenges and prospects. Beijing, Chinese Fiscal and Economic Press.

Huang, J., Hu, R., Zhang, L. and Rozelle, S. 2000. Economy of China's agricultural research investment. Beijing, China's Agricultural Press.

Huang, J., Rozelle, S., Pray, C. and Wang, Q. 2002. Plant biotechnology in China. Science, 295, 33–70.

Huang, J, Rozelle, S. and Rosegrant, M. 1999. China's food economy to the 21st century: supply, demand and trade. Economic Development and Cultural Change, 47, 737–766.

Jin, S., Huang, J., Hu, R. and Rozelle, S. 2002. The creation and spread of technology and total factor productivity in China. American Journal of Agricultural Economics, 84, 916–930.

Liu, J. 1991. Quanguo Nongcun Jingji Fazhan: Shinian Guihua he Dibage Wunian Jihua [The nation's rural economic development: the 10-year plan and the eighth 5-year plan]. Beijing, China Economic Press.

Maddox, J. and Swinbanks, D. 1995. China still hopeful ten years on. Nature, 378, 537–552.

MOA (Ministry of Agriculture) 1999. Department of Science, Technology and Education, Ministry of Agriculture, ed., The fifty years of China's agricultural science and technology. Beijing, China's Agricultural Press.

— 1980–2000. China's agricultural yearbook. Beijing, China's Agricultural Press.

NSBC (National Statistical Bureau of China). 1980–2000. *Statistical Yearbook of China*. China's Statistical Press, Beijing.

Nyberg, A. and Rozelle, S. 1999. Accelerating China's rural transformation. Washington, DC, The World Bank.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Pray, C. 1998. Private investment in China. Rutgers University, Working Paper.

Pray, C. and Umali, D. 1998. Private agricultural research: will it fill the gap? World Development, 26, 1127–1148.

Rozelle, S., Pray, C.E. and Huang, J. 1997. Agricultural research policy in China: testing the limits of commercialization-led reform. Comparative Economic Studies, 39, 37–71.

Stone, B. 1988. Developments in agricultural technology. China Quarterly, 116 (December).

State Council 2000. The Tenth Five-year Plan: Draft. Beijing, State Council.

World Bank 1997. At China's table: food security options. Washington, DC, The World Bank.

Zhu, X. 1997. The contribution of R&D to agricultural growth in China: methodologies and applications. Beijing, China's Agricultural Press.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

6.3 SOME CANADIAN EXPERIENCES IN STRENGTHENING AGRICULTURAL RESEARCH AND EXTENSION USING PUBLIC–PRIVATE PARTNERSHIPS

D. Gordon Dorrell
Formerly Assistant Deputy Minister, Research Branch, Agriculture and Agri-food Canada, Ottawa, Ontario, Canada

The responsibility for providing agricultural research and development (R&D) and extension services in Canada has shifted from the public sector being completely responsible to a variety of models that involve the private sector. This has come about due to changes in government policies; a reduction in public funding for agricultural R&D; an increased need to bring knowledge from non-agricultural disciplines to solve more complex problems; and the emergence of a stronger private-sector R&D capacity. This paper will discuss three examples of partnerships used in conducting R&D and in transferring technology to the Canadian agriculture sector. Specifically, these are: the partnership of federal and provincial departments of agriculture (Alberta–Canada Research Agreement); the federal department of agriculture and the private sector (Agriculture and Agri-Food Canada Matching Investment Initiative); and a consortium of the federal government, provincial governments, universities, industries and research institutes focusing on genomics (Genome Canada).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

EVOLUTION OF MODELS

In the late 1940s a number of events changed the way agricultural R&D and technology-transfer programs would be conducted in Canada. Mechanisation became more commonly used on farms, Canadians expected, and could afford, a broader array of food products, prices fell relative to personal income and more technology was available and used in the production and processing of food. Also, new government funding tended to be allocated to health, social programs and the development of new sectors, rather than to agriculture. At that time, companies tended to import rather than develop the technologies they required. By the early 1970s it was clear that the public sector would not be able to fund all the R&D necessary for Canadian agriculture to take advantage of accelerated innovation, emerging production and quality issues, environmental concerns etc. By this time, the private sector was using classical extension techniques to assist in the marketing of pesticides, fertilisers and seed. Specifically, they demonstrated their products using farm-based trials and provided up-to-date information on new farming practices. The public sector began to redefine its role and examine new ways to share responsibilities.

Some of the first formal partnerships were borne out of financial necessity, others were created to strengthen research teams by adding new skills, while others involved the recipient of the technology co-funding its development and transfer. By the early 1980s, departments of agriculture in larger provinces were funding and conducting R&D in support of their changing agriculture sectors. This led farmers to demand more co-operation and co-ordination between the two levels. One outcome was the innovative Alberta–Canada Research Agreement.

The Province of Alberta had an aggressive funding program, 'Farming for the Future', but limited infrastructure. The federal department, on the other hand, had excess research facilities in Alberta but constrained budgets. This new agreement enabled a provincial department to transfer funds to federal facilities to conduct research on its behalf. This set the stage for jointly funded research. The principles were relatively simple: there would be agreed priorities; at selected federal research centres, Alberta would fund projects that were consistent with its innovation strategy; and there would be joint transfer of technology.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There were, of course, difficulties. For example:

- legal and accounting processes had to be negotiated
- research centres had limited experience in meeting contractual obligations associated with research
- no mechanisms were in place to deal with the ownership and exploitation of intellectual property.

After these issues had been addressed, it became obvious that both levels of government were more effectively setting priorities and were serving mutual clients in a more-productive and timely manner. Much of this was due to the inclusion of producers and processors on project selection boards. The agreement remains active and continues to provide valuable technology to agriculture in Alberta *and* in western Canada.

By the mid 1990s, the private sector was developing and transferring technology to many parts of the food-production and processing chain. In the case of greenhouse and field vegetable production destined for processing, poultry meat and eggs, and the dairy industry, farmers tended to purchase 'packages' of genetics, feed or fertiliser and marketing directly from companies. Consequently, many provincial governments reduced or eliminated their traditional production-focused, technology-transfer services and concentrated on marketing information for specialty crops (e.g. herbs) and animals (e.g. deer), environmental regulations and special income-support programs.

During this period, Agriculture and Agri-Food Canada (AAFC) faced a 25% reduction in research funding. In response, the department phased-out all research that was in direct competition with the private sector. This included, for example, poultry genetics, machinery research, food-product development, and the release of maize hybrids. It shifted focus to those areas where the market could not yet support private technology (public good) and to basic research. There were, however, gaps that needed to be bridged. Policies were put in place to encourage the private sector to comment on AAFC's strategic research directions, to participate in government research through co-funding and to directly transfer federal technologies to end-users.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The enabling mechanism was the Agriculture and Agri-Food Canada Matching Investment Initiative. In this program, AAFC contributed some $30 million per year to be matched by the private sector (broadly defined as entities that were not publicly funded). Again the principles were relatively simple and based upon experience gained from the Alberta–Canada Research Agreement. Specifically:

- the program was open and competitive
- projects were restricted to areas where AAFC had a science mandate and expertise
- selections were made considering the quality and relevance of the project and its potential contribution to the economy of Canada
- contributions would be cash or in-kind (staff, technology, facilities etc.)—in-kind contributions enabled some small companies and organisations to participate
- results were published but companies could request a delay in publishing for up to a year for commercial reasons
- intellectual property generated by the project would be owned by AAFC but the partner company was granted the 'first right of refusal' to practise the technology. Royalty payments were made to AAFC but used at the research centre where the technology was developed.

This initiative was successful:

- research output was greater than before the budget reduction
- interaction with the private sector was greatly expanded
- there was a good balance of large and small companies and farm organisations participating
- the relevance and quality of AAFC research was verified with positive feed-back on the value of the technology and by repeat customers
- technology was transferred to and taken-up by customers more rapidly as the company participated in development of the technology at a early stage and had a better idea of its utility

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- by partnering with specific companies, AAFC gained access to background technologies whose unavailability would block progress in certain areas of biotechnology
- some scientists developed entrepreneurial and legal skills.

But there were difficulties that had to be addressed:

- the government had no simple mechanisms to accept and account for contributions from companies or individuals
- some scientists worked in areas of research that were more suited to the program than others, creating a feeling of inequity among scientists
- scientists had to become familiar with contractual and legal agreements and devote significant time to the management of multi-party agreements, especially where companies brought background and foreground technology to the joint project
- there was some political concern about a public agency working closely with multi-national companies.

The program has been modified as required and continues today.

As part of Canada's new millennium celebration the federal government made special investments in Canada's scientific research capacity. This involved university chairs, infrastructure and foundations. An example of a foundation is Genome Canada which received a $375 million contribution to develop, implement and partially fund a national strategy in genomic and proteomics research. The objective was to bring together industry, governments, universities and research institutes in support of this national objective. Federal funding had to be matched by the other partners. Approved funding was to be allocated to large-scale genomics projects, capacity building and infrastructure at five genomics centres. This approach was borne out of necessity, as fragmented and competitive research activities do not lend themselves to large science initiatives. Further, enabling intellectual property (including research tools and genes) was frequently owned by the private sector and was blocking related development in the public sector. On the other hand, companies were finding development, protection and marketing of new agricultural biotechnology to be expensive and risky. Thus, some form of consortium or partnership was a solution for both the public and private sectors.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Genome Canada projects involve the development of research tools, platform technologies, databases and potential products that demand appropriate strategies to deal with patents, licences, material handling agreements and publication. It was agreed that where intellectual property (IP) is created within a Centre it will belong to the researcher and/or their institution. If the IP is derived from work performed at the Centre for industrial clients on a contractual basis, the IP will be owned by the client. An agricultural example of this program is Genome Prairie, which focuses on issues such as functional genomics of abiotic stress. This project involves scientists from nine universities, three AAFC research centres, two other federal departments, numerous international collaborators and industry participation by Advanta, Adventis and Pioneer.

This initiative has enjoyed early success:

- an array of expensive but excellent research projects is under way that would not have been funded by any one group or agency
- new and extensive cooperation and sharing among researchers has been established
- research is more strategic, and focused on an interesting combination of discovery and commercial products.

There is more to do:

- the need to find partners to match the federal funding is difficult in some areas of research
- in complex partnerships considerable effort must be undertaken to identify and resolve differences in legal policies and expectations relating to IP, and to manage the outcomes.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

IS THE CANADIAN EXPERIENCE WITH PUBLIC–PRIVATE PARTNERSHIPS RELEVANT TO CHINA?

This paper considered three examples from an array of evolving public–private partnerships that are being employed to facilitate the development and delivery of technology for the Canadian agriculture and food sector and discussed some of the attendant problems and opportunities. Our experience suggests that any country contemplating public–private cooperation or partnerships should consider the following approaches as essential:

- the various levels of government continue to adequately fund basic research with strong emphasis on 'public good' research such as protection of species, preservation of germplasm, conservation of the environment etc.
- policies and laws should be in place to regulate the ownership of IP and technology and partnerships
- politicians and senior government officials must be in agreement about the objectives of partnerships and visibly support them.

Once a decision has been made to adopt a particular public–private model(s) it takes considerable effort, and some risk, to identify appropriate partners and develop agreements and their attendant operating rules. Where companies have had little experience working with public institutions they will be concerned about ownership, confidentiality, focus and timeliness. Some companies will try to use political influence and to control the outcomes of the project while making relatively little investment. A partnership must not be seen as the public subsidising R&D that would normally been undertaken by the company. Rather, it is the sharing of costs and risks of doing research that is in the best interest of the country and profitable for the company.

Again, based upon our experience, one should, at a minimum:

- experiment with a sector that understands the value of R&D and needs specific technology to be more competitive
- select partners after considering commercial, scientific and political realities
- establish mutually understood and agreed-upon objectives

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- use rules that are consistent, transparent and not seen to benefit one company or organisation over another
- establish if exclusive or non-exclusive use of the technology is appropriate
- use a governance structure that is not overly complex
- expect to adapt and accommodate throughout the agreement
- ensure there is a termination clause that is fair.

What type of organisation will make a good initial partner? Our experience was that farmer-led organisations tended to work well with the public sector as they had relatively positive experiences with extension agents, public scientists and public technology (plant varieties, pest control and production techniques). The agreements can be straightforward and focus on more narrowly defined problems in specific geographic regions. This tends to increase the chances of producing useful results in a relatively short time. In turn, it establishes a positive reputation.

The private sector, whether domestic or international, will likely be working with farm organisations and individual farmers by conducting on-farm trials to demonstrate their products. They may have working arrangements with universities but are likely to be importing technology. They probably will not move beyond this stage unless there are clear national policies relating to IP, taxation, control of imported technology versus in-country development, direct competition from state-owned facilities etc. If the business climate is positive, the private sector will select areas of activities and markets where they can provide a needed service or product with the expectation of making a reasonable return on investment in relation to other domestic or international opportunities. There will be activities that are less attractive but are important to the country and have the potential for commercial return. These are the areas most likely to produce productive public–private partnerships.

In conclusion, Canadian producers and processors have benefited from public–private partnerships in that new technologies have been developed and dispersed faster than under a public-only R&D and technology-transfer system. Some of these experiences might be useful as China engages in debate about food security, integrated food-production groups and rationalisation of public sector R&D in the new market economy.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 7

LAND SECURITY AND MARKETS

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

7.1 ENCOURAGING SECURITY AND RENTAL MARKETS FOR CULTIVATED LAND

CCICED ARD Task Force members

Secure property rights and well-functioning land markets are considered important catalysts for economic growth, as they make investment worthwhile and facilitate transfers of land to the most-efficient users. The efforts of the government over the past decade and the new Rural Land Contracting Law, where fully implemented, have solved most of China's land-tenure security problems. Poor security of tenure seems to have only minor effects on agricultural investment. In a recent survey, only 6 of 1200 households in 60 agricultural villages across China reported that they had had a fixed investment taken away from them over the previous 20 years. In four of these six cases, the household had received compensation.

SECURITY OF LAND RIGHTS: ISSUES AND RECOMMENDATIONS

Land security has benefits beyond promoting investments in agriculture, thus it is important that central and sub-national governments continue to make a strong and sustained effort to implement and enforce the new regulations. Land can serve as a mechanism through which farm households can gain access to credit. For example, household access to credit significantly increased in Vietnam when households received formal title to their land, since the title was used as collateral to secure bank loans. Income from renting-out land can also add to family income when families

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

are engaged in off-farm activities or when they are older. Access to land by rural families has been shown to be a source of employment during times of recession in the cities and serves as a form of unemployment insurance.

Although China has made progress in promoting land security, many villages still do not provide completely secure tenure. The new contracting law tries to promote secure access to land that should further all of these functions (that is, increase access to credit, allow families to rent-out their land with little fear of expropriation and provide employment during times of economic downturn). Surveys by the China National Statistical Bureau, however, have found numerous violations over the past two years and discovered that almost half of local leaders and most farmers do not fully understand the new law.

Secure tenure is needed to ensure also that households are provided with appropriate compensation when their land is appropriated for development projects. Currently, one of the most egregious violations of the rights of rural households occurs when farmers have their land taken from them and receive only minimal levels of compensation. (In China it is not legal for villages to sell development rights directly to developers. Land must be sold to the government which resells the land to developers.) In the past five years, there were still about 25% of villages in which no compensation was paid for land that was taken away from them. The average payment for those who did receive compensation, amounted to only 12,000 yuan per mu, only a fraction of the land's true value. In most cases, the price paid to villages by the government was far below the value of the land. While it is true that in other countries too, the original land-owner rarely gets its full value when it is sold for development (in fact, internationally, the developer usually gets the larger share), the share that has gone to villages in China is only a fraction of what is typically paid to the original property owners in other countries. And when the share of the compensation that goes to villages is small, the share that goes to the individual households that own the small parcels of land is even less. While there are many reasons for this circumstance, the lack of clear ownership and land titling make compensation issues less clear.

RENTAL MARKETS FOR CULTIVATED LAND

In addition to implementing the new contracting law to promote secure tenure, additional effort is needed to promote well-functioning land-rental markets. In an economy with scarce land, off-farm employment is becoming the main source

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of future income for *most* farmers. The future of China's development will rely on the growth of off-farm income and the movement of the rural population to urban areas. In order to achieve efficiency and equity, households with opportunities off the farm need to be able to rent-out their land, and those who are left in the village need to be able to rent-in land so that they can raise their incomes from farming. Increases in farming income for those left in rural areas are important for stability as well as for providing the resources that will let them invest for the benefit of future generations that can continue to push China's modernisation.

Over the past decade, the record on rental markets for cultivated land is clear: while still not completely developed, their emergence is well under way. According to data from national surveys, rental markets for cultivated land in China began to emerge in the late 1980s. At that time, however, only 1% of land was rented. By 1995, around 3% of cultivated land was rented. According to China's 2003 national household survey, more than 10% of households nationwide rented-in land. In some provinces, such as Zhejiang, up to 20% of the cultivated land is rented.

There are many indications that the growth of cultivated land markets is improving efficiency. Rental markets have been shown to shift land from those who have relatively large quantities of land to those with lower quantities. Across China, land rental occurs more frequently in regions that have high levels of migration. For example, while the average rental rate in China was 10% in 2000, it was 15% in China's central provinces (provinces with high migration rates), such as Hubei and Anhui. When examining household data, it is clear that migrant households are more inclined to rent-out land, while households that have few or none of their members working off the farm, rent-in land. Rental markets in China are increasingly moving land away from those who are less efficient at farming to those who are more efficient.

Survey data indicate that land rental markets assist in poverty reduction. Households renting-in have less than half the level of assets of those that rent-out. The households that rent-in also have lower endowments of land. And perhaps most importantly, the per-capita income of those renting-in is significantly lower than those who rent-out. Interestingly, this result is quite unintuitive, and, as such, important. There are many who probably believe rental markets benefit mainly the rich, as such markets did in the period before the 1950s. According to a number of data sources, however, this is no longer true.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Land rental markets promote efficiency and equity. And since they raise the income of those engaged in agriculture, they will lead to higher output. Finally, because rental markets provide land to families in villages that have high rates of migration, they also contribute to poverty reduction.

GOVERNMENT POLICY AND LAND

Despite the recent improvement in tenure security and the emergence of rental markets, policy makers still have an important role to play. In order to ensure even better security, the central government needs to make repeated efforts to publicise, through various channels, the salient clauses that affect farmer rights. Strong directives through both the government and party hierarchy need to convey the importance of the new Rural Land Contracting Law.

New regulations are also needed to protect the rights of farmers when their land is being bought for development. For example, clear property rights and regulations that allow land sales transactions directly between developers/city-users and villagers are needed to protect the interests of villagers. Titling will also help.

Although rental transactions should occur between households that are seeking to improve their welfare, there is an important role for government in promoting the mobility of land among users. The experience in other countries indicates that formal land registration can lead to increased rental market activity and lay a foundation for banks to begin to use land as collateral for loans. In general, registration gives additional protection to farmers by improving transparency in land transactions. Moreover, if it is administered at a high enough level, farmers across large regions can be provided uniform certificates of registration that will broaden the market and make registration more valuable. For these reasons, a provincial-level pilot trial of land use rights registration is suggested. It has been shown in other countries that land registration is one of the most productive and useful loan/grant packages (in terms of its impact on raising the productivity of the agricultural economy). It can be done with a minimum burden to the government. Land registration loans are largely self-financing, since registration fees paid by farmers are usually sufficient to pay back the entire amount of the loan. Land titling, however, can succeed only if the titles are given the utmost authority in a legal sense (that is, the titles give the holder controlling rights over the land).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

7.2 RURAL LAND AND LABOUR MARKETS IN THE PROCESS OF ECONOMIC DEVELOPMENT:

EVIDENCE FROM CHINA

Klaus Deininger and Songqing Jin
Rural Development Group, Development Economics, World Bank, Washington, DC, USA

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

INTRODUCTION

The 'East Asian miracle' is generally regarded as one of the most successful development paradigms in the 20th century. Following this pattern, Japan, Korea and Taiwan experienced rapid transformation from a rural towards an urban society based on industry rather than agriculture as the main source of income. During the 'takeoff periods' large fractions of the rural population moved off the farm into urban manufacturing jobs, fuelling sharp rises in productivity and incomes. Almost as important, during industrialisation and urbanisation phases, leaders were able to reduce poverty among those left in rural areas and maintain a healthy agricultural sector, thereby attenuating trends toward increased inequality (Johnston and Mellor 1961; World Bank 1993).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In many ways, China's path of development during the past two decades has been similar to that followed by Japan, Korea and Taiwan. Starting with a largely rural population engaged in farming, many rural residents have reoriented their livelihood strategies. Off-farm work has emerged as a main source of income growth for many rural households (Lohmar 1999; Kung 2002). Up to 100 million migrants live away from their home villages. Family-owned businesses and privately run factories provide increasing levels of employment in rural areas. To an extent never experienced before, young and better-educated workers moved to cities, while their remittances or the assets they brought back upon their return contributed to rising rural incomes (de Brauw et al. 2002).

Despite the historical similarities, China now confronts challenges which in many ways exceed in complexity those that were faced and overcome by Japan, Korea and Taiwan (OECD 2002). Those countries aggressively used trade barriers and other pricing measures to raise the returns to farming and increase the value of the assets of rural residents.[1] Even though there is little doubt that they did so at a (unnecessarily) high cost to society, such pricing policies have helped to keep rural incomes and asset values high, thus contributing to the reduction in poverty and rise in rural incomes without radically changing either the farm size structure or existing production patterns. China, by contrast, is going through the early stages of development in an environment where reliance on either input provision by parastatal institutions or output price subsidies as a means to ensure a minimum standard of living for rural areas is no longer an option. Instead, it will have to grow in an environment where producers and consumers, including those who work and live in poor rural areas, will need to gain access to factors of production mainly through markets, and base their economic decisions on the price signals these markets generate.

Even though such a market-based strategy, especially if combined with provision of productivity-enhancing public goods, can contribute to a rapid transformation of the productive structure in rural areas, its feasibility depends critically on the presence of an institutional framework in which markets will be able to function. For example, the definition of property rights is not costless, and even where such rights are well-defined, indivisibilities and informational imperfections can create barriers to participation that will make it difficult for markets to contribute to greater

[1] Even today the domestic prices of rice and other key agricultural commodities in Japan, Korea and Taiwan are several times higher than international ones.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

efficiency and equity (Deininger 2003). Such concerns are particularly relevant for land markets, for two reasons. On the one hand, land has many characteristics that tend to limit the scope for operation of markets. Also, China has made the transition towards private land-use rights only in the 1980s, with many restrictions remaining that make land rights differ significantly from ideal property rights. In view of this, it would not be surprising to find imperfections in the way in which land markets operate that could lead to serious questions concerning the sustainability of China's development paradigm. As the heated recent debate on rising inequality in China demonstrates, this could have far-reaching implications for policy.

The goal of this paper is to contribute to this debate by characterising in more detail the operation of land markets and links between labour and land markets in rural China. Based on this characterisation, we make inferences about the likely impact of these markets on economic efficiency and equity. To do so, we pose two questions.

First, we ask if the functioning of labour markets is consistent with the objective of better development of the agricultural economy or if migrant labour contributes to draining rural areas of their best potential in terms of human capital. This question has been intensely debated in the literature on the nature and impact of labour markets in China (de Brauw et al. 2002). We add to this literature by including a measure of the household's agricultural ability to assess whether migration and the emergence of a local non-farm economy is indeed a zero-sum game that lures away the best and brightest from rural areas or whether, by providing scope for productivity gains through more-efficient allocation of scarce resources, the process actually contributes to broader economic development.

Second, we explore whether or not the functioning of labour markets in rural China generates benefits that extend beyond those who participate directly. In an environment where property rights are well defined, information is readily available and other markets function well, one would indeed expect such synergies. Indeed, more-active labour markets can establish the preconditions for the operation of land markets that would not only enhance productivity by transferring land to better users but also, by allowing those who stay behind to expand their holdings and thus their base of sustenance, contribute to greater equity. In the case of China, scholars differ widely in their assessments of the efficacy of land markets (Benjamin and Brandt 2002). Hence, the direction of the efficiency and equity effects on the rise of land and labour markets is by no means a foregone conclusion and rigorous empirical assessment is warranted.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Compared with other studies of the rural sector in China, our analysis offers two advantages. First, by using a data-set that is representative of the rural sector, we are able to capture the significant variability across China's regions. Second, by analysing land and labour markets together rather than looking at each of them separately, we are able to demonstrate the links between the two markets, as well as the fact that greater activity in labour markets improves the functioning of land markets as well. Results suggest that increasing reliance on market forces provides, in a context of rapid globalisation, an avenue for China to increase rural productivity while at the same time helping to safeguard basic equity concerns.

The paper is organised as follows. Section two reviews the challenges to which the rural sector in China has to respond, outlines the conceptual model and discusses the data, econometric issues and estimation strategy. Section three presents a number of descriptive statistics on the functioning of rural factor markets. Section four provides econometric evidence on household participation in off-farm labour markets (migration and local non-farm labour markets) and land markets and the links between the two. Section five concludes by discussing the policy implications and raising a number of issues for future research.

CONCEPTUAL MODEL, DATA AND ESTIMATION STRATEGY

To put the issues at hand in perspective, and illustrate the benefits from analysing land and labour markets in a more integrated way, we first review the evidence on a number of challenges confronting China's rural areas and discuss the contribution that rural markets can potentially make to help meet these challenges. We use this as a basis for a simple model of rural diversification and the emergence of markets in rural areas, point out the strategy for econometric estimation, and describe the data to be used for doing so. Traditionally, rural factor markets, especially those for labour and land, have often been analysed in isolation from each other. As background to considering them jointly, we use this part of the paper to review some of the key development challenges facing China and the role which such markets might have to play in formulating a policy response.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Key challenges for China's rural economy

Accelerated migration

China experienced a rapid increase in the importance of inter-regional migration during the 1990s. Survey data show that the share of migrants in the labour force increased from 5% in 1988 to more than 10% in 1995 (Rozelle et al. 1999a) and that, after further acceleration in the late 1990s, in 2000 there were more than 80 million migrants, comprising about 17% of the labour force (Taylor et al. 2003). A number of sources show that migrants are covering increasingly large distances and, in general, are moving towards large coastal cities (Rozelle et al. 1999a; Solinger 2002). Researchers also agree that participation in migration is particularly high among the poor (Parish et al. 1995; de Brauw et al. 2002) and that migration can help to reduce poverty, e.g. through remittances (Zhang et al. 2003). Some urban firms have become less discriminatory in their hiring of people without an urban residential permit (*hukou*) (Knight and Song 2003). Evidence on the contribution of migration to local economic development in rural China (Zhao 2002), together with experience from other countries, suggests that, through remittances and returning migration, migration can provide important backward linkages that in turn facilitate asset accumulation and economic development in backward areas. The literature has also pointed out that land-tenure arrangements and mandatory marketing delivery quotas could increase the cost of out-migration, thus posing barriers to the ability of workers to take advantage of such opportunities (Yang and Zhou 1996; Hein 2000; Fleisher and Yang 2003). This suggests that land and labour markets are likely to be closely linked and should ideally be viewed and analysed jointly.

Rising inequalities

Although China has, over the past two decades, experienced some of the highest growth rates in the world, the increase of Gini coefficients for per-capita expenditure, which nearly doubled in the 1980–2000 period, suggests that the opportunities created by such growth were not equally accessible to all (Khan and Riskin 1998). In particular, urban incomes have risen faster than rural ones for almost the entire period, leading to widening imbalances between rural and urban sectors (Fleisher and Yang 2003). Part of this can be attributed to gaps across regions and sectors that remained from socialist times (World Bank 1997). However, ill-functioning markets for land, labour and credit have also frequently been cited as a reason why China's prosperity has bypassed large parts of the rural population (Benjamin et al. 2003; Kanbur and Zhang 1999).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The challenge of WTO accession

The restrictions imposed by China's integration into the international trading system are likely to exacerbate the consequences of regionally unequal growth. China's World Trade Organization (WTO) entry is likely to reduce prices for many crops widely grown in rural China, putting a premium on more capital- and knowledge-intensive commodities.[2] While average effects on the farming sector may be small, poorer producers of staple grains and fibres in central China will be disadvantaged by the first-round effects of such reforms (Huang et al. 2003). The longer-term effect, however, will depend on the extent to which households can respond by moving into sectors where China has a comparative advantage, including horticulture, livestock and off-farm activities (Huang and Chen 1999). The ability to shift towards such activities will, in turn, depend on well-functioning markets for output as well as labour and land. WTO agreements limit the type of interventions that Chinese policy makers can use to address regional imbalances largely to non-distorting infrastructure and productivity-enhancing investments (Fan et al. 2000). While such investments are considered to be the most-efficient way to improve productivity and sectoral efficiency, well-functioning markets are needed to ensure that farmers will be able to benefit from such investments.

Increasing importance of self-employment in local off-farm labour markets

The rise of off-farm self-employment whereby rural residents obtain a large part of their income as traders, merchants and small and medium-scale individual- and household-run businesses (Entwistle et al. 1995), is one of the most-significant recent employment trends in rural China. Between 1988 and 1995, the number of households in rural off-farm self-employment is estimated to have increased by up to 30 million, making off-farm self-employment the fastest-growing sector in rural China (Rozelle et al. 1999b). During this period, almost 40% of new, rural off-farm jobs were contributed by small and medium entrepreneurs who also experienced a significant increase in their human capital endowments (Cook 1999; Zhang et al. 2002). Even though numbers of migrants grew faster than those of the self-employed in the late 1990s, small businesses also matured, often changing from labour-intensive handicraft producers and providers of labour-intensive services

[2] For example, prices for wheat, maize and cotton are expected to fall by 10–20%, while those for livestock products and horticulture are expected to rise by 5–15% (Huang et al. 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

into more-capital-intensive, complex businesses engaged in transportation, trading and manufacturing (Mohapatra et al. 2004). While there is scope for more in-depth analysis of this phenomenon, increased earnings from off-farm self-employment made a major contribution to increasing China's rural incomes in the late 1980s and 1990s (Parish et al. 1995).

Expansion of land rental and legal changes in property rights

A number of contributions to the literature point towards a significant increase in land-market activity over time. In 1988 and 1995, farmers rented-in less than 1 and 3%, respectively, of cultivated area (Benjamin and Brandt 2002), while in 2000, 7% of China's arable land was rented-in (Zhang et al. 2002). Retrospective information also indicates that, in three of China's most-backward provinces, land-rental markets had been virtually non-existent five years ago but were, in 2002, used by almost 10% of households (Deininger et al. 2003a). One reason for limited rural land rental was that, until very recently, imbalances in households' land access were to be rectified through periodic administrative reallocation by village leaders (Kung 1995).[3] This weakened property rights to land, thereby limiting the scope for decentralised markets to operate and, to the extent that there is a high correlation between migration and land-rental activity, may also have reduced incentives for migration and involvement in non-farm labour markets (Kung 2002).

Model and hypotheses

To provide a basis for understanding the links between the operation of land and labour markets, we use a simple model from which we can deduce empirically testable hypotheses. Let rural households, indexed by i, be endowed with land T_i, labour L_i and capital assets K_i as well as a given level of agricultural ability A_i and formal education E_i. Households can choose to use their labour endowment either in farming, local off-farm employment or migration. Farming (Ag) follows a Cobb-Douglas production function, $f(T, l_{ag}, K)$, that obeys standard regularity conditions (i.e. $f' > 0; f'' < 0$). Migration (M_i) pays a wage w per unit of labour spent and is independent of the level of education and ability but, because it involves physical movement from the place of residence, is incompatible with agricultural

[3] In fact, in a 1998 survey, most villagers still viewed administrative reallocation as the only mechanism to allow equalisation of operated area across households (Kung 2002).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

or self-employment activity. The local, off-farm labour market consists of the self-employed *(Se)* whose returns per labour unit l_{Se} follow a function *n(E, K; Q)*. In line with the literature, to start-up self-employment, a minimum level of capital, $\bar{K}$ is needed. Under these conditions, allocation of the available labour endowment between agricultural activity, self-employment, and migration by the representative household with the goal of maximising income leads to labour-supply functions li^* *(T, K, E, A)* with $i = Ag, Se, M_i$. Comparative statistics on these yield the following testable hypotheses:

Hypothesis 1

Households with limited endowments of land and physical and human capital, and low agricultural ability, will choose migration as a potential pathway out of poverty. In areas where demand for local services is limited, households which have only a limited amount of land and few agricultural skills will tend to migrate out. By contrast, in areas in which there is higher labour demand from manufacturing and service enterprises, the household's propensity to allocate labour to the off-farm labour market is expected to be higher.[4] This also will help improve equity, because by drawing on migration income, migrants or their families will be able to accumulate capital that can, in the long term, help them to cross the threshold to self-employment. As a corollary, and a direct consequence of the higher (human or physical) capital requirement of local non-farm employment, we would expect that participation in this activity will be more pronounced among those with higher levels of wealth or education. The same reasoning would be expected to hold not only for household heads but also for their offspring. Given that most household heads made choices about their sector of employment a long time ago, and the international evidence suggesting that, in many cases, the shift from agriculture to non-agriculture is associated with generational transition (Ahituv and Kimhi 2002), one would expect to see the impact of the labour market and other factors more clearly in the case of offspring.

[4] This is in line with evidence from the literature, according to which those with higher levels of financial and human capital will choose to become self-employed (Taylor et al. 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Hypothesis 2

Higher levels of migration and, to a lesser extent, participation in the local non-farm labour force, will help activate land-rental markets, thereby providing additional benefits to the migrants as well as those who stay back. Migrants will benefit because renting-out will allow them to gain access to rental income during their absence without having to give up the option of resuming own-cultivation in subsequent seasons, for example if they lose their migration job. Those staying back will benefit because access to additional land resources will allow them to make better use of their non-tradable endowments (agricultural assets and agricultural ability) and increase their income beyond what would have been possible in autarky. Thus, migration and the associated higher level of land rental activity together would be expected to be mutually reinforcing in setting in motion a process that will increase the household's well-being and contribute to at least a narrowing of pre-existing income gaps. Even though the literature has made this point at a conceptual level, illustrated with descriptive evidence (Kung 2002), no rigorous demonstration for a larger sample is available.

Hypothesis 3

In addition to their positive equity effect, more-active land-rental markets will help to increase overall productivity in rural areas by transferring land from producers with low ability to those with higher levels of ability. Use of panel data allows us to make inferences on this variable that can be used to test for the extent to which land-rental markets will contribute to greater allocative efficiency by transferring land to better producers. Moreover, to the extent that the presence of land markets allows producers to make a conscious choice, we would expect that it will be those with low agricultural ability who engage in migration or participate in the non-farm labour force, thereby increasing the productivity benefits to be obtained in the process of structural change in rural areas. In the long term, market-based land transfers of land groups can also contribute to consolidation that will allow more-able households to increase their cultivated area in a way that is preferable to administrative solutions (Lin et al. 1997; Wan and Cheng 2001).

The hypotheses identified above can be translated into econometric equations to assess determinants of the household's participation in migrant and non-agricultural labour markets, and of supply and demand for land rental. The interaction of labour and land markets will increase productivity if one can show that: (i) it is those with

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

lower agricultural ability who use labour markets to exit this sector; (ii) greater labour-market activity in any given location will help to activate land-rental markets; and (iii) land-rental markets provide an opportunity for those with high agricultural ability to gain access to additional land. Having information on the initial asset endowment of those participating will allow us to make inferences on the equity impact of land and labour markets.

Data sources, estimation strategy and econometric issues

To test these predictions empirically, we estimate equations for household participation in migration, self-employment and land rental (both renting-in and renting-out). We first discuss data issues. We then provide more detail for each of the estimating equations as well as the predicted coefficients.

Data for the regressions are from a 30% sample from China's rural Household Income and Expenditure Survey (HIES), a nationally representative, continuing survey of more than 50,000 rural households by China's National Bureau of Statistics (CNBS).[5] The survey collects data on household consumption through diaries that are checked by survey staff twice a month. As a result of the intensive data-collection effort and close interactions between monitors and respondents, the quality of expenditure data is judged to be very high (Jalan and Ravallion 1999). Additional information on the allocation of labour time by all household members, the nature of activities performed and income obtained, details on endowments with land and other assets, as well as agricultural production, are collected through supplementary surveys. The 2001 survey was the first to include information on household participation (on the supply or demand side) in land-rental markets, including the area of the land transacted.[6]

[5] In our study, we use the traditional/formal definition of 'rural', which includes all households that have been assigned rural residential permits (*hukou*). The sample comprises 29 provinces and uses a two-stage sampling procedure.

[6] Note that, to the extent that the survey selects households which are able to fill out the expenditure module on a continuing basis, it may be biased against those most likely to supply land to the rental market. Therefore, the estimates on this topic are likely to constitute a lower bound of the true value.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Participation in migrant labour markets

To identify the determinants of participation in migrant labour markets by both the household head and their children, we estimate probit or tobit equations of the form

$$M_i = \alpha' + \beta'\alpha_i + \delta_j'Z_{ij} + \omega_i \quad (1)$$

where M_i is either a dummy variable that takes the value of 1 if there was participation in migration in 2002 and 0 otherwise, or a continuous variable measuring the number of months spent migrating. In line with our model, explanatory variables are α_i, the household's level of agricultural ability, and Z_{ij} a vector of household and village characteristics. Household characteristics include the household's endowments of human capital, labour and other productive assets including land (per capita). To control for the availability of economic opportunities at the village level, we include mean village per-capita expenditure as another right-hand-side variable.

Based on our model, we expect that households with higher levels of agricultural ability will be less likely to participate in off-farm migration (i.e. $\beta < 0$). Similarly, we expect higher per-capita endowments of land and agricultural assets, as well as higher levels of education and non-farm assets at the household level, to reduce the propensity to migrate. The latter is due to potential threshold requirements to set up non-farm enterprises which normally offer higher returns to education and assets than off-farm migration while at the same time avoiding some of the transaction costs that migrants have to incur (Zhao 1999).

Since we have data on household heads and their dependants, we estimate equation (1) separately for both groups. One reason for doing so is that this allows us to capture the dynamics of the diversification of households out of the agricultural sector which is often linked to generational transition (Kimhi and Bollman 1999). The regression for migration by children is similar to the one estimated for the household head, with the exception that we do not have an estimate of agricultural ability for the children and, in addition, we must use their own human capital endowments (that is, their own educational level and age) rather than those of the household head.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Participation in the local off-farm labour market

To identify the determinants of participation as a self-employed entrepreneur by either the household head or their children, we estimate a probit (tobit) equation of the form:

$$S_i = \alpha' + \beta'\alpha_i + \delta_j'Z_{ij} + \omega_i \qquad (2)$$

where, similar to equation (1), S_i is either a dummy variable for participation or denotes the number of months spent in local off-farm employment by the household head or their offspring during 2002. Right-hand-side variables are identical to those in equation (1). To the extent that starting a self-employed enterprise is contingent on a certain threshold of wealth, we expect the coefficient on non-agricultural assets to be positive.

Land-market participation

To identify the determinants of land-market participation, we specify a reduced form regression for renting-in (-out) cultivated land through land-rental markets. Formally, we estimate:

$$R_i(O_i) = \alpha + \beta\alpha_i + \delta_j Z_{ij} + \varepsilon_i \qquad (3)$$

where $R_i(O_i)$ is a dummy variable that is equal to one for renting-in (-out). Alternatively, we can use a tobit model to estimate equation (3) when the dependent variable is equal to the actual quantity of land area (in mu) that is rented-in (-out) by the *i*th household. As in equations (1) and (2), α_i is the household's agricultural ability and Z_{ij}, is a vector of j other household- and village-level factors that affect land-market participation and ε_i is an *iid* error term. Most of the right-hand-side variables are identical to those used in the earlier equations.

Given that land cannot be transferred across villages, the hypotheses discussed earlier imply that the level of migration at the village level will be an important trigger for the emergence of land-rental markets. To capture this, we include the share of households in the village who have sent out migrants and the share of households who shifted into local off-farm employment. We predict that both variables will have a positive impact on supply of land for rental and thus lead to greater observed land-rental market activity. To establish a link between labour and land markets at the household level, we include an indicator variable for the household's involvement

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in migration or the local off-farm labour market in the land-rental equation as well. Because farmers' labour-market participation might be determined simultaneously with their other economic choices, inclusion of this variable could lead to simultaneity bias. To avoid this problem, we include the household's past participation in off-farm labour markets and report results both with and without this variable.

DESCRIPTIVE EVIDENCE

Contrary to most contributions to the literature, which are often based on small and non-representative samples, the ability to draw on a data-set that is representative of China's rural sector allows us to obtain a better picture of regional differences in the level of diversification of economic activity and household incomes. Linking these indicators to levels of activity in rural land and labour markets allows us to give a descriptive account of some of the underlying relationships that can subsequently be subjected to testing by more-rigorous econometric techniques.

Income composition and household characteristics

Table 7.1 has information on income and its composition (panel 1), participation in labour and land markets (panels 2 and 3) and a number of other household attributes (panel 4), for all of China (column 1) and broken down for different regions (columns 2–5). The ability to draw on the full CNBS sample implies that the descriptive statistics obtained are almost identical to those reported in official publications.

Levels and composition of income

Survey data on levels and sources of income confirm the relatively high levels of diversification of income sources, as well as inter-regional differences in income levels. With a national average per-capita income of 2681 yuan, per-capita income in coastal provinces (3894 yuan) is more than double that attained in the country's southwest (1794 yuan). Similarly, while agriculture still makes the largest contribution to overall rural household income (37%, followed by income from local off-farm wage and self-employment with 25% and 29%, respectively, and migration remittances with 9%) at the national level, this is no longer the case in all of the regions. For example, in the coast region, local self- and wage-employment together contribute 62% of average income, with agriculture's share having declined to 28%. At the same time, with 41% of income, agriculture is still the main source of income in the country's central region and in the southwest.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.1 Key indicators of labour and land market activity in China's main regions, 2001[a]

	All China	North & northwest	Coast	Central	South-west
Income level and composition					
Mean per-capita income (yuan)	2,681.3	2,646.1	3,894.0	2,390.9	1,794.1
Agricultural production (%)	36.8	38.2	27.9	40.5	40.5
Local off-farm wage employment (%)	25.1	27.7	32.1	21.2	19.1
Local off-farm self-employment (%)	29.1	28.2	30.6	25.4	32.3
Remittances from migration (%)	8.9	6.0	10.5	12.6	8.0
Participation in economic activities					
Households engaging in local off-farm self-employment	10.5	7.3	14.4	11.1	9.2
Households with migrants	37.1	24.6	34.8	47.3	37.1
Months spent in local off-farm employment	10.0	8.3	13.7	9.2	7.6
Months spent in migration	4.1	2.4	4.4	5.4	3.6
Agricultural endowments					
Per-capita land endowment (mu)	1.6	2.1	1.0	1.3	1.4
Share of households renting-in	8.9	7.1	9.4	10.4	7.5
Share of households renting-out	6.2	4.9	8.8	5.1	5.7
Rented to own land ratio[b]	0.5	0.5	0.59	0.50	0.4
Number of sample households	54,590	12,390	14,680	14,860	12,660
Other household characteristics					
Household size	4.2	4.0	4.1	4.3	4.4
Age of household head	45.0	44.9	46.4	44.9	43.5
Head's education (years)	8.5	9.0	8.6	8.4	7.9
Children above 14 years of age	1.2	1.1	1.3	1.3	1.2
Observations in 'reduced' sample	15,873	3,312	4,700	4,219	3,612

Source: Computation from China National Bureau of Statistics 2001 Household Income and Expenditure Survey.

[a] The north and northwest region includes the provinces of Hebei, Shanxi, Liaoning and Henan; the coastal region includes Jiangsu, Zhejiang, Fujian, Shandong and Guangdong; the central region includes Anhui, Jiangxi, Hubei, Hunan and Guangxi; and the southwest region includes Sichuan, Guizhou, Yunnan, Shaanxi and Gansu.

[b] Only for households who are renting-in.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Migration

Although neither the sample nor the survey instrument have precise measurement of migration income as their primary goal, the survey used can provide interesting evidence on participation in non-farm and migrant-labour markets. The data suggest that China's labour markets have been emerging rapidly and that the share of households which obtain at least some benefits from migration (37%) is much larger than the contribution of migrant remittances to household income (9%). This is consistent with the literature, which suggests that, even in cases where migrant remittances constitute only a small part of household income, their importance as an insurance substitute, a means to smoothing consumption, and to overcome credit market imperfections may be very significant. In line with this reasoning, migration is particularly large in the poorer regions: while only 25% of households have at least one migrant member in the north/northwest, this share is almost double (47%) in the central part of the country and, at 37%, still fairly high in the southwest.

We also note that, in 2001, 11% of households managed their own enterprises and 37% had at least one member participate in the migrant labour force. With the average migration spells lasting for 4 months, the mean household in China supplied 14 person-months to the non-farm labour force. At a regional level, more than 14% of households in the coastal region have invested in self-employed businesses, but only 7–9% of households in the poorer north/northwest and southwest regions have. Households in wealthier areas are more likely to become self-employed (e.g. in response to higher demand for services) and are more able to get a wage-earning job in the local off-farm labour market. Poor areas rely more on agriculture and migration.

Other household characteristics

Use of our 30% sample allows us to provide information on a number of other household characteristics. Doing so suggests that, at least at first glance, the large differences in per-capita incomes are not substantiated by equally large differences in household endowments. On the contrary, the mean household sizes vary between 4.0 and 4.4, with between 1.1 and 1.3 dependants above 14 years old and a fairly high level of average education of household head that varies between 7.9 and 9.0 years with the highest values obtained in the north rather than on the coast.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Land-market participation

Based on information from the 2001 survey, which for the first time included a module on land-rental-market activity, we find that 9% of households nationwide rented-in land while 6% rented-out land (panel 3 of Table 7.1).[7] Comparison with historical data suggests that, after almost complete elimination of land-rental markets during the 1980s, the level of land rental in China may once again be approaching levels that are closer to those observed before the socialist era. Although there are some regional differences, all of the regions are characterised by comparatively high levels of land-rental-market activity.[8] We also observe a positive correlation between activity in land and labour markets as a first indication of synergies whereby land and labour markets would mutually reinforce each other, e.g. because higher levels of migration and off-farm activity result in greater availability of land that can then be allocated through market mechanisms at the local level. While household survey data are not well-suited to provide estimates for village-wide levels of activity in land rental or migration, village-level data for the 1105 villages from which the households included in our sample originate indicate simple correlations between the share of households with at least one member migrating and the share of households who rented-in/out land of 0.20 and 0.13, respectively, both significant at the 1% level of confidence. Table 7.A1 in Appendix 1 illustrates this relationship at the provincial level: in poorer provinces, rental markets are more active in provinces with higher levels of out-migration (Jiangxi, Henan, Hubei, Hunan and Anhui), while at higher levels of income (e.g. in Zheijiang, Shandong, Guangdong), local off-farm employment tends to increase land-rental-market activity.

To go one step further in exploring the characteristics of land-market participants, Table 7.2 compares a number of attributes that should, according to our model, be associated with higher levels of land-rental-market activity between those who are renting-in or renting-out land and the mean for the remainder. The results provide strong evidence in favour of the redistributive nature of land-rental markets. As Table 7.2 illustrates, households with lower per-capita land endowments, significantly lower per-capita income and non-farm asset endowments (though insignifi-

7 This is not surprising given that some of those renting-out may not be present in the survey.

8 Not surprisingly, the spatial variations widen when we disaggregate regions (Appendix Table 7.A1). For example, 20% of households in Zhejiang Province rented-in land. During the same year, only 2.9% of households in Gansu did so.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

cantly different agricultural assets), and lower participation in off-farm employment and remittances, rely disproportionately on renting-in land as a strategy to increase their operational area and income. By contrast, those renting-out are shown to have significantly higher levels of wealth, land and participation in the non-farm economy. This suggests that land-rental markets provide an opportunity for the poor in rural areas who are not well-positioned to participate in migration or other non-farm economic activities. To test these predictions econometrically, we need to obtain a measure for the household's agricultural ability, α_i. We also make use of the fact that all of the 15,873 households in our 'econometric' sub-sample were interviewed in both 2000 and 2001.[9] This allows us to estimate a crop-production function to derive both household- and village-level fixed effects and to obtain each household's agricultural ability (α_i – net of any unobservable village-specific factors) by subtracting the household fixed-effects from the village fixed-effects. The creation of the agricultural ability variable is discussed in more detail in Appendix 2.

ECONOMETRIC RESULTS

Consistent with the descriptive findings, results from econometric analysis provide strong support of our hypotheses that it is those with relatively low skills who will join the migrant or non-farm labour force. The results also show that those with relatively inferior agricultural skills will tend to supply land to the rental market, whereas those with superior skills will tend to rent-in additional land. In addition, we are able to demonstrate quantitatively that higher levels of labour-market activity (either migration or non-farm employment) indeed make a significant and positive contribution to the level of activity observed in land-rental markets. Together with the fact that there is no evidence to suggest a negative equity impact of land-rental markets, this leads us to conclude that the combined activity of land and labour markets contributes to economically desirable outcomes. While the descriptive statistics reported earlier are derived from the full sample, the econometric analysis uses data from a subset of almost 16,000 households for 19 of 30 provinces included in the CNBS sample.

[9] For the econometric analysis we use a 30% sub-sample of the households included in the CNBS master sample for the provinces of Hebei, Shanxi, Liaoning, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Hubei, Hunan, Guangdong, Guangxi, Sichuan, Guizhou, Yunnan, Shaanxi and Gansu which, together, contain more than 80% of China's total population. The sample is stratified by overall levels of rental market participation.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Participation in migration and local non-farm employment

Probit and tobit regressions for the household head's participation in migration (Table 7.3, columns 1 and 3) and local off-farm employment (columns 2 and 4) support the efficiency- and equity-enhancing nature of migration, as predicted in our hypothesis. The negative coefficients on agricultural skills in both regressions support the hypothesis that migration or joining the off-farm labour force are avenues that will be most attractive to those with limited agricultural skills. To illustrate the magnitudes

Table 7.2 Asset holdings and economic activities of households renting-in and renting-out land in 2001

	All China	By households' rental market participation		
		Rent-in[a]	Rent-out	Autarkic
Owned land per capita (mu)	1.4	1.4**	1.7**	1.4
Operated land per capita (mu)	1.5	2.0**	1.1**	1.4
Original value of agricultural assets (yuan)	775.5	811.5	739.9	771.8
Original value of non-farm assets (yuan)	420.0	236.8**	556.7**	450.2
Household's own draft animal (%)	31.5	37.7**	26.0**	30.7
Per-capita income (yuan)	2686.0	2582.9**	3024.3**	2636.2
Agricultural income share (%)	38	52**	31**	40
Local off-farm wage income share (%)	33	27**	35**	31
Local off-farm self-employment income share (%)	17	12**	21**	18
Remittance income share (%)	11	9*	13**	11
Months spent in migration	3.7	3.6*	4.7**	4.0
… of which head (%)	18.0	12.8**	19.1	17.5
Months in local off-farm employment (wage-earning and self-employment)	10.0	8.7**	12.2**	9.9
… of which head (%)	33.3	31.0**	36.2*	34.0
Number of observations	15873	3332	2590	9951

Source: Computation from China National Bureau of Statistics 2001 Household Income and Expenditure Survey.

[a] Stars indicate that the value for the respective sub-group is statistically different from the mean: * significant at 5%; ** significant at 1%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

involved, note that the least-skilled producers in the sample are about 10% more likely to join the migrant labour force but about 40% more likely to take up local non-farm employment. To the extent that those who rent-in land through rental markets have higher-than-average ability, this would suggest an overall increase in economic efficiency, something we will come back to later.

The negative coefficients on the household's asset endowment in the migration equations suggest that joining the migrant labour force can provide poor households with an opportunity to improve their economic well-being. This is supported by the fact that it is those in the sample with levels of education significantly below the mean who are most likely to participate in migration. The impact of education on the propensity to migrate has the shape of an inverted U that reaches its maximum at about 5 years of education, implying that a minimum level of human capital is required in order to participate in migration. At the same time, presumably because returns to human capital in temporary long-distance migration are quite low, the propensity to migrate-out decreases beyond an educational attainment of 5 years. The village mean of expenditure is negative, indicating that there may be a push factor that causes residents from marginal locations to migrate-out. Both the head's age and the household's labour endowment, measured by the number of children at working age, have a very significant and strong positive impact on the propensity to migrate. At the same time, the fact that the coefficient on owned land is negative though insignificant would suggest that lack of access to land is not one of the main motivations for households to join the migrant labour force, contrary to what is observed in many other developing countries, such as India, where access to land is more unequal than in China.

Comparing these results with determinants of the head's participation in local off-farm employment is instructive: heads going into off-farm employment have higher levels of non-farm assets and education, but also significantly lower endowments of land. The importance of education as a determinant of joining the local non-farm labour force is particularly remarkable: according to the probit regression, every additional year of education above the sample mean (of 8 years) will increase the probability of participating in local non-farm employment by at least 2%. The result that individuals with more non-agricultural wealth are more likely to join the local non-farm labour force is consistent with a minimum capital requirement for establishing an own enterprise, e.g. because of ill-functioning capital markets (Kanbur and Zhang 1999). In addition, even though local-income

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.3 Probit and tobit regression coefficients of determinants of household head's participation in migration and local off-farm employment

	Probit models		Tobit models	
	Participation in migration	Participation in local off-farm employment	Months of migration	Months of local off-farm employment
Agricultural ability	−0.057*** (7.70)	−0.205*** (12.30)	−3.668*** (7.73)	−2.883*** (18.22)
Owned land per capita	−0.001 (1.46)	−0.005** (2.11)	−0.098*** (3.05)	−0.099*** (9.47)
Value of agricultural assets (log)	−0.003** (2.36)	−0.013*** (7.21)	−0.198*** (3.25)	−0.160*** (7.71)
Value of non-agricultural assets (log)	−0.004*** (3.94)	0.018*** (4.75)	−0.242*** (4.93)	0.230*** (14.77)
Years of education obtained by head	0.007** (2.48)	−0.006 (0.91)	0.394** (1.98)	−0.123** (2.01)
Head's education squared	−0.001*** (2.96)	0.001*** (3.16)	−0.027** (2.26)	0.021*** (5.66)
Head's age	0.009*** (3.89)	0.019*** (5.27)	0.530*** (4.44)	0.193*** (5.51)
Head's age squared	−0.0002*** (6.75)	−0.0003*** (8.48)	−0.010*** (7.36)	−0.003*** (9.19)
Household expenditure at village mean	−0.001 (1.24)	0.001 (0.59)	−0.031 (1.14)	0.038*** (4.58)
Number of children at working age	−0.010** (2.20)	−0.010 (1.52)	−0.499*** (3.13)	−0.030 (0.60)
Constant			−15.477*** (5.59)	0.282 (0.33)
Observations	13598	13598	13598	13598
Pseudo R-squared	0.12	0.09	0.07	0.04
Log likelihood	−4296.65	−8538.31	−8494.70	−26,805.94

Notes: Robust z statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

levels do not appear to have a significant impact on off-farm labour-market participation, they are estimated to be a significant determinant of the amount of time spent in such activities, suggesting that, in wealthier communities, it will be easier to sustain such enterprises.

As the opportunities open to the offspring of the household heads are likely to be quite different from those available to their parents, looking at their employment choices will help to explain some of the underlying determinants of off-farm employment more clearly, even though this comes at the cost of not being able to observe agricultural ability of the individuals concerned. Results of doing so, as reported in Table 7.4, provide a number of additional insights and have greater predictive power (as illustrated by higher R^2 values) than the ones obtained for household heads.

First, we find that migration provides opportunities for the poor, as evidenced by the fact that most children who migrate come from households with low land and asset endowments. The fact that the propensity to migrate peaks at an age of about 30 is consistent with the hypothesis of an inter-generational phenomenon. A second finding of interest is that, in line with our hypothesis, a minimum level of non-agricultural assets appears to be needed in order to participate in local non-farm employment but not for migration; in fact, it is clearly those with lower levels of non-agricultural assets who tend to migrate, everything else being constant. Third, minimum educational qualifications for joining the non-farm sector and for migration are higher for the dependants of each head than for the heads themselves. Consistent with a significant expansion of education during the past few decades, even migration now seems to require some minimum amount of human capital. At the same time, the different signs of village-level income suggest that migrants are more likely to come from poor villages, whereas participation in non-farm activity is supported by a minimum level of economic development and wealth at the local level. Finally, the positive coefficient on the number of siblings at working age illustrates that households with larger labour endowment are more likely to engage in migration as well as off-farm activities. This could be due to greater pressure to explore alternative sources of income in large households, greater flexibility and the associated possibility to share risk within the household, or the ability to draw on migration networks in an effort to increase the success probability of such a step.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.4 Probit and tobit regression coefficients of determinants of children's participation in migration and local non-farm employment

	Probit models		Tobit models	
	Participation in migration	Participation in local off-farm employment	Months of migration	Months working in local off-farm labour market
Owned land per capita	−0.004*** (3.84)	−0.006*** (4.42)	−0.152*** (4.18)	−0.170*** (7.38)
Value of agricultural assets (log)	0.009*** (4.25)	−0.006** (2.29)	0.249*** (3.63)	−0.175*** (4.10)
Value of non-agricultural assets (log)	−0.007*** (4.01)	0.004** (1.99)	−0.260*** (4.99)	0.058* (1.72)
Education obtained by children older than 13	0.118*** (23.16)	0.144*** (29.93)	4.128*** (21.68)	3.158*** (27.13)
Children's education squared	−0.006*** (19.58)	−0.008*** (23.67)	−0.218*** (18.49)	−0.153*** (21.01)
Average age of children older than 13	0.065*** (3.74)	0.115*** (8.10)	2.549*** (10.97)	2.455*** (16.75)
Children's age squared	−0.001*** (3.36)	−0.002*** (6.12)	−0.047*** (10.33)	−0.039*** (13.71)
Education obtained by head	−0.001 (0.19)	−0.019** (2.44)	0.060 (0.34)	−0.285** (2.43)
Head's education squared	−0.000 (1.07)	0.000 (0.65)	−0.018 (1.54)	0.006 (0.78)
Head's age	0.022*** (2.91)	0.033*** (4.52)	0.759*** (4.75)	0.673*** (6.55)
Head's age squared	−0.0002*** (2.82)	−0.0003*** (4.65)	−0.007*** (4.88)	−0.007*** (7.33)
Household expenditure at village mean	−0.003*** (3.81)	−0.000 (0.45)	−0.092*** (3.55)	0.034** (2.05)
Number of children at working age	0.099*** (15.38)	0.151*** (17.33)	4.858*** (25.82)	5.162*** (40.35)
Constant			−81.525*** (18.91)	−66.985*** (24.31)
Observations	10,416	10,416	10,416	10,416
Pseudo R-squared	0.24	0.35	0.10	0.13
Log likelihood	−5214.36	−4606.38	−18,000.26	−23,639.81

Notes: Robust z statistics in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Land-market participation

Tables 7.5 and 7.6 report results from equations for renting-in land and supplying land to the rental market. The most remarkable result, which adds significantly to the existing literature, is that higher levels of migration at the village level lead to an increase in the activity of the land-rental market, on both supply and demand sides. Non-farm employment, while having less impact on the propensity to rent-in land, has a significant impact on the household's propensity to rent-out and on the area that was rented out. In addition, we empirically confirm that land-rental markets make a significant contribution towards higher levels of productivity and transfer land to land-poor, younger producers. We discuss results separately for renting-in and renting-out.

Renting-in

Our results support the hypothesis that rental markets shift land towards those with higher levels of farming skills, irrespective of the specification chosen. To give an illustration of the order of magnitude, we note that, based on the coefficients in Table 7.5, the most-able farm producers in the sample are about 32% more likely to rent-in land than the least-able ones. This is consistent with earlier findings from China (Deininger and Jin 2002) and other countries (Deininger et al. 2003b). In a separate set of regressions (not reported), we added the interaction terms of farming ability and provincial dummies and dropped the linear farming ability term. Results show that the efficiency-enhancing effect of rental markets is robust across provinces, as the interaction term is positive and significant at 1% for 18 of the 19 provinces, the sole exception being Gansu.

While this might suggest that emergence of efficiency-enhancing markets could still be wealth biased and thus possibly hurt poor households, we do not find evidence of this. Neither non-agricultural wealth nor the level of education attained by the head has a significant role in enabling households to gain access to land. Hence, with the possible exception of access to agricultural assets, land-rental markets do not have any inherent wealth bias. On the contrary, our results suggest that land-rental markets improve access to land by the land-poor and can thus be understood as contributing to greater equity. The only exception is that, according to our results, rural households with draft animals and agricultural assets are more likely to rent land-in, suggesting that indeed a minimum level of agricultural equipment will be needed. Land markets thus appear to provide a means for smallholders to increase their holdings, and, with the passage

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.5 Probit and tobit regression coefficients of determinants of participation in renting-in and area rented-in

	Probit (participation)		Tobit (area rented in)	
	Base model	Expanded model	Base model	Extended model
Agricultural ability	0.160*** (11.41)	0.157*** (9.55)	3.294*** (13.73)	3.225*** (13.43)
Owned land per capita	−0.011*** (9.28)	−0.011*** (5.10)	−0.085*** (5.38)	−0.085*** (5.41)
Own draft animal	0.057*** (6.41)	0.058*** (3.77)	1.028*** (6.41)	1.048*** (6.54)
Value of agricultural assets (log)	0.007*** (3.54)	0.006 (1.62)	0.098*** (2.92)	0.095*** (2.83)
Value of non-agricultural assets (log)	0.000 (0.27)	0.001 (0.32)	0.012 (0.51)	0.018 (0.75)
Education attained by head	−0.000 (0.05)	−0.000 (0.04)	−0.005 (0.06)	−0.005 (0.05)
Education attained by head squared	−0.000 (0.39)	−0.000 (0.34)	−0.001 (0.10)	−0.001 (0.12)
Head's age	0.012*** (4.12)	0.013*** (4.50)	0.141*** (2.88)	0.167*** (3.37)
Head's age squared	−0.0002*** (4.83)	−0.0002*** (5.07)	−0.002*** (3.74)	−0.002*** (4.11)
Share of households migrating in the village	0.039*** (2.66)	0.060*** (3.04)	0.389 (1.40)	0.823*** (2.78)
Share of households working in the local off-farm labour market in the village	−0.003 (0.26)	0.006 (0.23)	−0.259 (1.23)	−0.089 (0.39)
Household expenditure at village mean	−0.001** (2.04)	−0.001 (1.31)	−0.021* (1.67)	−0.018 (1.43)
Months out-migrating during the previous year		−0.003*** (3.67)		−0.056*** (4.65)
Months working in the local off-farm labour market during the previous year		−0.001 (1.22)		−0.027** (2.35)
Constant			−4.965*** (4.07)	−5.655*** (4.58)
Observations	13,598	13,598	13,598	13,598
Pseudo R-squared	0.05	0.05	0.02	0.02
Log likelihood	−7211.71	−7201.00	−14,558.61	−14,545.85

Notes: Robust z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.6 Probit and tobit regression coefficients of determinants of supplying land to the rental market and area rented-out

	Probit (participation)		Tobit (area rented-out)	
	Base model	Expanded model	Base model	Extended model
Agricultural ability	−0.029*** (2.75)	−0.026** (2.46)	−0.761*** (3.71)	−0.696*** (3.39)
Owned land per capita	0.008*** (11.47)	0.008*** (11.59)	0.279*** (23.99)	0.280*** (24.11)
Own draft animal	−0.015** (2.16)	−0.016** (2.21)	−0.498*** (3.25)	−0.504*** (3.29)
Value of agricultural assets (log)	−0.000 (0.15)	−0.000 (0.02)	−0.013 (0.45)	−0.010 (0.33)
Value of non-agricultural assets (log)	0.001 (1.06)	0.001 (0.57)	0.026 (1.20)	0.015 (0.70)
Education attained by head	0.002 (0.46)	0.002 (0.54)	0.035 (0.44)	0.043 (0.53)
Education attained by head squared	−0.000 (0.04)	−0.000 (0.16)	−0.000 (0.01)	−0.001 (0.14)
Head's age	−0.004** (2.22)	−0.005*** (2.71)	−0.081** (1.98)	−0.097** (2.40)
Head's age squared	0.00004*** (2.86)	0.00002*** (3.25)	0.001** (2.50)	0.001*** (2.83)
Share of households migrating in the village	0.025** (2.12)	0.017 (1.37)	0.611** (2.36)	0.482* (1.74)
Share of households working in the local off-farm labour market in the village	0.065*** (7.23)	0.052*** (5.46)	1.435*** (7.17)	1.152*** (5.43)
Household expenditure at village mean	0.001* (1.87)	0.001 (1.54)	0.027** (2.46)	0.024** (2.19)
Months out migrating during the previous year		0.001*** (2.82)		0.026** (2.48)
Months working in the local off-farm labour market during the previous year		0.002*** (4.12)		0.041*** (4.08)
Constant			−7.209*** (6.78)	−6.811*** (6.41)
Observations	13,598	13,598	13,598	13,598
Pseudo R-squared	0.05	0.05	0.05	0.05
Log likelihood	−5281.50	−5270.62	−8862.98	−8852.68

Notes: Robust z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of time, possibly help to undertake initial investments or to gradually consolidate holdings. We also note that, by shifting land from older to younger producers, rental markets may contribute to the process of structural change. A key contribution of this paper is the ability to link participation in land markets to labour-market participation. Using information from the set of sample households in each village (and excluding the household under concern) we find that a higher share of out-migration does indeed allow those remaining to gain access to land through rental markets. No such effect can be discerned for local non-farm employment, in line with the hypothesis that such activity will still allow those engaging in a job off the farm in the local labour market to cultivate their agricultural land. Even though the variable may be subject to endogeneity concerns, adding past participation in migration and local non-farm employment at the household level leads to a similar result: households that participated in migrant labour markets in the past are less likely to rent-in land, whereas past participation in local off-farm labour is not seen to have any impact on land-rental participation but decreases the amount of area demanded.

Supply of land to the rental market

In many respects, and consistent with our hypotheses, the regressions for renting-out are nearly mirror images of those for renting-in. We note in particular that those with higher levels of agricultural skills are less likely to rent-out, although the magnitude of the coefficient is much smaller than in the case of renting-in. Higher levels of land ownership are predicted to increase the propensity of supplying land to rental markets, confirming the redistributive character of land rental. With the exception of a dummy for ownership of draft animals, which is negative, none of the other indicators for endowments of physical and human capital emerge as significant determinants of supplying land to the rental market.

Again, and similar to what emerged for renting-in, levels of migration and off-farm labour-market participation at the village level emerge as highly significant determinants of supplying land to the rental market. This supports the view that, as the rural non-farm economy gathers strength, well-functioning land-rental markets will be essential to not only bringing scarce factors of production to their best use but also to helping expand the economic opportunities of those who, for various reasons, choose not to join the non-farm labour force. The link between activity in labour and land-rental markets found here is likely to be of policy relevance beyond China, especially for countries such as India or Ethiopia that have historically imposed restrictions on

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the functioning of land-rental markets, thereby increasing the cost of migration for those who own land. This may imply that it is no longer those with the low agricultural ability who move out, thereby reducing or even counteracting the potentially positive impact of migration on the source economy, either reducing the scope for start-up of non-farm enterprise (Deininger et al. 2003a) or leading to migration as a coping strategy by those lacking land access (de Haan 2002; Rogally 2002).

CONCLUSION AND POLICY IMPLICATIONS

In view of its rapid recent pace of economic growth, China provides an excellent example to study the implications of a large-scale transition of the labour force from the agricultural to the non-agricultural sector. Exploring determinants of the household's decision to participate in labour markets allows us to demonstrate not only that those with lower endowments of human capital and physical assets will be forced to join the migrant labour force while those who have some assets or live in wealthier provinces can establish non-farm businesses or obtain local wage employment, but also to show that it is indeed those with lower agricultural ability who are most likely to join the non-agricultural labour force. This implies that operation of land markets can, by transferring land no longer used by households who have taken up non-agricultural employment, provide gains not only in efficiency but also in equity. Our empirical analysis allows us to substantiate this claim by showing that it is indeed the more-productive and land-poor producers who gain access to land through rental markets. We also demonstrate that higher levels of migration and local non-farm employment are important factors that help to activate land-rental markets. The emergence of land markets, then, can set in motion a process of greater agricultural productivity which, especially if complemented with productivity-enhancing public investment, can help to narrow the income gaps within and across provinces that have recently become the subject of much concern by policy makers.

While the empirical evidence allows us to identify a number of promising signals, it also points towards two topics which cannot be resolved within the context of this study but which could provide valuable insights for both research and policy. First, throughout our analysis, we have treated property rights to land as exogenously given and essentially constant over time. Given that, since the adoption of the household responsibility system in the late 1970s and early 1980s, there has been a continuing, though regionally uneven, process towards better definition of property

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

rights that has culminated in the passage of the 2003 Rural Land Contracting Law, this assumption clearly involves a gross simplification. Although there is agreement that more-secure property will encourage land-related investment and productivity-enhancing land transfers, we know of no recent empirical studies that explore the extent to which measures that enhance tenure security are adopted in response to such economic opportunities. In fact, the views of experts on the topic differ markedly. At the one extreme, it is assumed that measures to increase security of property rights will more or less automatically emerge once conditions are right, and all that is required from policy makers is to help establish an environment where the obstacles to such an organic evolution are minimised (Platteau 2000). On the other hand, there is a more 'interventionist' school that departs from the assumption that exogenous interventions to increase the security of property rights in a more discontinuous fashion can make an independent contribution to jump-start investment and the emergence of land as well as possibly financial markets.

Given the fundamental role of property rights in any society, the potentially high cost of interventions (such as cadastres and registries) to improve the security and transferability of such rights, this is obviously an issue of high policy relevance. Although it clearly transcends the scope of this study, using variation in institutional arrangements on security of land rights and functioning of land and labour markets, before and after the passage of the Rural Land Contracting Law, could well help to provide insights into this phenomenon that would be of great interest to students of institutional change.

A second area where further research may be rewarding relates to the extent to which markets can set in motion a dynamic of their own, rather than just leading to an efficiency-enhancing redistribution of endowments within the economy. In international comparison, it would be of considerable interest to explore to what extent the beneficial equity and efficiency effects associated with the operation of land markets come about because of the relatively equal distribution of cultivated land among China's rural households. In the context of China, while our results highlight that markets work in the 'right' direction, they do not indicate to what extent better functioning of labour and land markets can help to increase rural incomes sufficiently to narrow what is perceived as an ever-widening gap between rural and urban areas in terms of household welfare. To arrive at an answer to this question, further information on the nature and direction of technical change in rural areas and of economic growth in urban areas will be required. Given the obvious relevance for policy, more in-depth study of this issue may well be of interest, especially in the context of China's

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

WTO accession. The results of such study are likely to provide important insights on policies to improve rural productivity and the functioning of land and labour markets, and to reinforce the importance of such markets.

ACKNOWLEDGMENTS

We thank the China National Statistical Bureau for its cooperation in providing the data. Financial support for the work done in this paper was provided by the Knowledge for Change Trust Fund and the Norwegian ESSD Trust Fund. Rozelle is a member of the Giannini Foundation.

REFERENCES

Ahituv, A. and Kimhi, A. 2002. Off-farm work and capital accumulation decisions of farmers over the life-cycle: the role of heterogeneity and state dependence. Journal of Development Economics, 68, 329–353.

Benjamin, D. and Brandt, L. 2002. Property rights, labour markets, and efficiency in a transition economy: the case of rural China. Canadian Journal of Economics, 35, 689–716.

Benjamin, D., Brandt, L. and Giles, J. 2003. The evolution of income inequality in Rural China. Toronto, University of Toronto, Department of Economics Working Paper.

Cook, S. 1999. Surplus labour and productivity in Chinese agriculture: evidence from household survey data. Journal of Development Studies, 35(3), 16–44.

de Brauw, A., Huang, J., Rozelle, S., Zhang, L. and Zhang, Y. 2002. The evolution of China's rural labor markets during the reforms. Journal of Comparative Economics, 30, 329–353.

de Haan, A. 2002. Migration and livelihoods in historical perspective: a case study of Bihar, India. Journal of Development Studies, 38(5), 115–42.

Deininger, K. 2003. Land policies for growth and poverty reduction. World Bank Policy Research Report Series. Washington, DC, World Bank; Oxford and New York, Oxford University Press.

Deininger, K. and Jin, S. 2002. Land rental markets as an alternative to government reallocation? Equity and efficiency considerations in the Chinese land tenure system. Washington, DC, World Bank Policy Research Working Paper 2930.

Deininger, K., Jin, S., Adenew, B., Gebre-Selassie, S. and Demeke, M. 2003a. Market and non-market transfers of land in Ethiopia: implications for efficiency, equity, and non-farm development. Washington, DC, World Bank Policy Research Paper 2992.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Deininger, K., Jin, S., Adenew, B., Gebre-Selassie, S. and Nega, B. 2003b. Tenure security and land-related investment: evidence from Ethiopia. Washington, DC, World Bank Policy Research Paper 2991.

Entwistle, B., Henderson, G.E., Short, S., Bouma, J. and Zhai, F. 1995. Gender and family business in rural China. American Sociological Review, 60, 36–57.

Fan, S., Hazell, P. and Thorat, S. 2000. Government spending, growth and poverty in rural India. American Journal of Agricultural Economics, 82, 1038–1051.

Fleisher, B.M. and Yang, D.T. 2003. Labor laws and regulations in China. China Economic Review, 14, 426–433.

Hein, M. 2000. Agricultural labour and rural population mobility: some observations. In: West, L.A. and Zhao, Y., ed., Rural labor flows in China. Berkeley, University of California Press.

Huang, J. and Chen, C. 1999. Effect of trade liberalisation on agriculture in China: institutional and structural aspects. CGPRT Working Paper Series No. 42.

Huang, J., Li, N. and Rozelle, S. 2003. Trade reform, household effects, and poverty in rural China. American Journal of Agricultural Economics, 85, 1292–1298.

Jalan, J. and Ravallion, M. 1999. Are the poor less well insured? Evidence on vulnerability to income risk in rural China. Journal of Development Economics 58, 61–81.

Johnston, B.F. and Mellor, J.W. 1961. The role of agriculture in economic development. American Economic Review, 51, 566–93.

Kanbur, R. and Zhang, X. 1999. Which regional inequality? The evolution of rural–urban and inland–coastal inequality in China from 1983 to 1995. Journal of Comparative Economics, 27, 686–701.

Khan, A.R. and Riskin, C. 1998. Income and inequality in China: composition, distribution and growth of household income, 1988 to 1995. China Quarterly (154), 221–253.

Kimhi, A. and Bollman, R. 1999. Family farm dynamics in Canada and Israel: the case of farm exits. Agricultural Economics, 21, 69–79.

Knight, J. and Song, L. 2003. Chinese peasant choices: migration, rural industry or farming. Oxford Development Studies, 31, 123–147.

Kung, J.K. 1995. Equal entitlement versus tenure security under a regime of collective property rights: peasants' preference for institutions in post-reform Chinese agriculture. Journal of Comparative Economics, 21, 82–111.

Kung, J.K.-S. 2002. Off-farm labor markets and the emergence of land rental markets in rural China. Journal of Comparative Economics, 30, 395–414.

Lin, J., Cai, F. and Li, Z. 1997. The China miracle: development strategy and economic reform. Asia–Pacific Development Journal, 4, 165–169.

Lohmar, B. 1999. The role of institutions in rural labor flow in China. Davis, California, University of California, Department of Agricultural and Resource Economics.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Mohapatra, S., Goodhue, R. and Rozelle, S. 2004. The emergence of self employment in rural China. Davis, California, University of California, Department of Agricultural and Resource Economics, Working Paper.

OECD (Organization for Economic Cooperation and Development) 2002. Agricultural policies in OECD countries: a positive reform agenda. Paris, France, OECD Trade and Agricultural Division, Working Paper.

Parish, W.L., Zhe, X. and Li, F. 1995. Nonfarm work and marketization of the Chinese countryside. China Quarterly, (143), 697–730.

Platteau, J.P. 2000. Institutions, social norms, and economic development. Fundamentals of development economics, vol. 1. Reading, UK, Harwood Academic.

Rogally, B. 2002. Seasonal migration and welfare/illfare in Eastern India: a social analysis. Journal of Development Studies, 38(5), 89–114.

Rozelle, S., Li, G., Shen, M., Hughart, A. and Giles, J. 1999a. Leaving China's farms: survey results of new paths and remaining hurdles to rural migration. China Quarterly, (158), 367–393.

Rozelle, S., Taylor, J.E. and de Brauw, A. 1999b. Migration, remittances, and agricultural productivity in China. American Economic Review, 89, 287–291.

Solinger, D.J. 2002. Labour market reform and the plight of the laid-off proletariat. China Quarterly, (170), 304–326.

Taylor, J.E., Rozelle, S. and de Brauw, A. 2003. Migration and incomes in source communities: a new economics of migration perspective from China. Economic Development and Cultural Change, 52, 75–102.

Wan, G.H. and Cheng, E. 2001. Effects of land fragmentation and returns to scale in the Chinese farming sector. Applied Economics, 33, 183–194.

World Bank 1993. The East Asian miracle: economic growth and public policy. Oxford and New York, World Bank and Oxford University Press.

— 1997. Sharing rising incomes. Washington, DC, World Bank.

Yang, D.T. and Zhou, H. 1996. Rural–urban disparity and sectoral labor allocation in China. Durham, North Carolina, Duke University, Research Papers in Asian Pacific Studies.

Zhang, L., Huang, J. and Rozelle, S. 2002. Employment, emerging labor markets, and the role of education in rural China. China Economic Review, 13, 313–328.

— 2003. China's war on poverty: assessing targeting and the growth impacts of poverty programs. Journal of Chinese Economic and Business Studies, 1, 301–317.

Zhao, Y. 1999. Labor migration and earnings differences: the case of rural China. Economic Development and Cultural Change, 47, 767–782.

— 2002. Causes and consequences of return migration: recent evidence from China. Journal of Comparative Economics, 30, 376–394.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

APPENDIX 1

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 7.A1 Key differences in migration and rental market activity across provinces

	Share of households		Percentage of income from			Households		Months				
	Renting-in (%)	Renting-out (%)	Agricultural production (%)	Wages (%)	Self-employment (%)	Self- employed (%)	Migrating (%)	Months migrated (number)	Months off-farm (number)	Land endowment (Mu/per cap.)	Rental ratio[a]	No. of households
North & northwest	**7.1**	**4.9**	**38.2**	**33.7**	**28.1**	**7.3**	**25.4**	**2.3**	**8.3**	**2.14**	**0.48**	**12390**
Hebei	6.4	3.5	37.7	35.5	26.8	9.0	23.1	2.3	10.3	1.78	0.48	4200
Shanxi	5.0	4.8	33.7	35.8	30.5	5.0	13.1	1.1	6.8	2.23	0.43	2100
Liaoning	12.0	7.0	42.8	27.7	29.5	6.0	19.6	1.7	7.4	2.95	0.51	1890
Henan	7.5	3.5	48.1	26.3	25.6	9.0	37.9	3.5	8.1	1.51	0.43	4200
Coastal region	**9.4**	**8.8**	**27.9**	**41.5**	**30.6**	**14.4**	**35.4**	**4.5**	**13.7**	**1**	**0.59**	**14680**
Jiangsu	3.8	6.2	26.5	49.6	23.9	14.0	32.5	3.3	12.9	1.14	0.54	3400
Zhejiang	13.7	16.6	17.8	43.0	39.2	20.0	27.3	3.4	16.2	0.80	0.85	2700
Fujian	13.4	10.5	25.1	33.7	41.2	14.0	37.4	4.7	15.3	0.62	0.81	1820
Shandong	6.8	4.7	42.1	28.9	29.0	14.0	27.5	2.6	9.0	1.44	0.35	4200
Guangdong	13.4	8.8	25.3	49.5	25.2	10.0	56.5	8.8	14.5	0.73	0.56	2560

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

	Share of households		Percentage of income from			Households		Months			
	Renting-in (%)	Renting-out (%)	Agricultural production (%)	Wages (%)	Self-employment (%)	Self- employed (%)	Migrating (%)	Months migrated (number)	Months off-farm (number)	Land endowment (Mu/per cap.)	Rental ratio[a]	No. of households
Central region	**10.4**	**5.1**	**40.5**	**34.1**	**25.4**	**11.1**	**47.0**	**5.4**	**9.2**	**1.31**	**0.50**	**14860**
Anhui	9.4	3.8	43.8	35.4	20.8	8.0	51.5	5.7	10.1	1.42	0.42	3100
Jiangxi	18.7	6.9	38.6	47.0	14.4	11.0	56.5	6.7	11.3	1.19	0.53	2450
Hubei	7.3	4.2	45.8	29.0	25.2	12.0	43.1	5.8	9.5	1.38	0.66	3300
Hunan	11.8	7.4	29.4	39.1	31.5	15.0	45.7	4.7	8.4	1.06	0.47	3700
Guangxi	11.6	6.9	36.1	30.8	33.1	12.0	37.8	4.5	6.8	1.23	0.53	2310
Southwest and northwest	**7.5**	**5.7**	**40.5**	**27.2**	**32.3**	**9.2**	**37.5**	**3.6**	**7.6**	**1.37**	**0.44**	**12660**
Sichuan	7.4	6.9	33.2	33.9	32.9	8.0	50.8	5.7	9.3	0.99	0.39	4000
Guizhou	8.0	3.5	42.2	21.9	35.9	13.0	29.3	3.5	6.4	1.06	0.51	2240
Yunnan	7.5	3.3	47.1	14.5	38.4	8.0	19.9	1.5	5.0	1.39	0.39	2400
Shaanxi	11.7	11.3	41.6	32.6	25.8	9.0	41.9	3.5	8.6	1.61	0.53	2220
Gansu	2.9	2.3	47.1	26.8	26.1	9.0	39.2	2.8	8.2	2.12	0.24	1800

Source: Computation from China National Bureau of Statistics 2001 Household Income and Expenditure Survey.

[a] The rental ratio is defined as the share of the land rented in over owned land. It is reported here only for households which are renting-in.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

APPENDIX 2 — DERIVATION OF THE MEASURE OF HOUSEHOLDS' ABILITY

We assume the crop-production function is Cobb-Douglas:

$$Y_{ijt} = \exp(\alpha_i + \alpha_j) A_{ijt}^{\delta_1} L_{ijt}^{\delta_2} K_{ijt}^{\delta_3} \quad \text{(A1)}$$

where Y_{ijt} is total crop output produced by household i in village j in year t; A_{ijt}, L_{ijt} and K_{ijt} are the land, labour and capital used to produce this output Y_{ijt}, and δ_1, δ_2, and δ_3 are technical coefficients. The term $\exp(\alpha_i + \alpha_j)$ is our efficiency parameter which consists of household- and village-specific elements. While we do not know exactly what is embodied in the efficiency parameter, it likely reflects such factors as differential access (of farm households and groups of farm households in their villages) to infrastructure and markets, soil quality and climate. Taking logs of both sides of equation (1) and adding a time trend and an *iid* error term, and letting $\alpha_{ij} = \alpha_i + \alpha_j$, we obtain an estimable equation for the relationship between inputs and outputs of the production relations of household i in village j at time t:

$$y_{ijt} = \alpha_{ij} + \delta_1 a_{ijt} + \delta_2 l_{ijt} + \delta_3 k_{ijt} + \phi t + \varepsilon_{ijt} \quad \text{(A2)}$$

where the lower-case letters refer to the logarithm of the quantities referred to above. The availability of two observations per household in our panel for our sample households allows us to estimate equation (2) using household fixed effects,

$$y_{ijt} - \bar{q}_{ij} = \alpha_{ij} - \bar{\alpha}_{ij} + \delta(Z_{ijt} - \bar{Z}_{ij}) + \phi(t - \bar{t}) + \varepsilon_{ijt} - \bar{\varepsilon}_{ij} \quad \text{(A3)}$$

where Z_{ijt} is a vector consisting of a, l and k and δ is a vector of coefficients. In addition to land and household labour use in agricultural production, Z_{ijt} also includes the aggregate value of material inputs, such as chemical fertiliser, pesticides and seeds. Fixed capital is the value of all assets that are used by the household for crop production. Since the survey did not report values for draft animals, we include a dummy indicating whether or not the household owned a draft animal. After estimating equation (3), we can recover the composite efficiency parameter α_{ij}, which includes both household and village effects. Since we ultimately want to get a measure that includes only household effect, we apply a similar procedure at the village level to obtain α_j which measures just village-specific effects. Our estimate of the pure, household-specific idiosyncratic effect, α_i, for each can be obtained by subtracting the estimated village effect, α_j, from the estimate of joint village-household effect, α_{ij}.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 8

FINANCE FOR RURAL DEVELOPMENT

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

8.1 EXPANDING FINANCE OPTIONS FOR RURAL DEVELOPMENT

CCICED ARD Task Force members

THE PLACE OF FINANCE IN RURAL DEVELOPMENT

Availability of credit facilitates development; it is not a determinant of development. Development is an outcome of entrepreneurs, in business and in farming, who exploit opportunities to employ new resources, combine resources with emerging technology to produce new products, or combine resources to build new markets for existing or new goods and services. To make these changes, entrepreneurs in business and farming require access to sources of finance. The availability of credit can facilitate such entrepreneurial initiatives.

A common characteristic of successful development is a transition from a rural, agriculture-based economy to a more urban, industry-based economy. The development of labour markets and access to off-farm jobs are means to achieving this transition. Therefore, addressing credit constraints to agricultural development needs to include finance for the creation of off-farm employment in villages and towns as well as finance for on-farm activities. When families move from the countryside to the city, they also need access to financial resources to do so. Given China's enormous challenge of creating hundreds of millions of jobs over the coming years, China needs to develop a solid rural-financial system.

For farm households it is important also to recognise that immediate, short-term credit needs may well arise from family emergencies or spending expected for important life-cycle events—birth, marriage and death—within a family. In typical

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

small-farm households there often exists a need for credit to meet both the family's consumption and production needs. It is credit sought under the latter that will lead to productive investments with some probability of success. Income transfers obtained from kin, especially to address 'surviving economy' needs, are typically not seen as credit, but they are important. In many successful developing countries, there are many sources of rural finance, formal and informal.

Likewise, the rural financial system also plays in important role in providing rural households a safe place to make deposits. In many rural settings and for many households, even in prosperous areas, there are not necessarily always good projects with high returns. In such cases, farmers value access to a rural credit system that will allow them to invest some of their funds safely at a positive interest rate. A good rural financial system will lend such funds to those with good projects and in need of funding.

LIMITATIONS OF THE CURRENT RURAL FINANCIAL SYSTEM IN CHINA

In China there are three formal rural credit sources: Rural Credit Cooperatives (RCCs), the Agricultural Bank of China (ABC), and the Agricultural Development Bank of China (ADBC). As of 2001, loans extended in China were 11,200 billion yuan, of which agricultural loans accounted for 570 billion, or 5%. Loans to township and village enterprises (TVEs) were 640 billion yuan, an additional 6%. Even if loans by the ADBC for the procurement of agricultural products are added, the support for agriculture and rural industrial development accounts for only 17% of loans nationwide.

The role of the ABC in rural finance is declining. Before the mid 1980s, 98% of its loan portfolio was located in the countryside. From the mid 1980s to the early 1990s it adjusted the structure of credit, using 60% of its 'agricultural' credit to support the purchase of agricultural by-products and to develop TVEs. After the mid 1990s, as progress in commercialisation reform of the ABC quickened, the allocation of its financial resources was no longer limited to agriculture and the countryside as its support for rural power grids, transport and communications increased. After the 1990s, its institutional network gradually withdrew from the countryside, the rate of growth of agricultural loans eased, the ratio of take-up began to fall and business

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

was sought increasingly in cities and with industry. Currently, agricultural loans account for only 10% of ABC's loan portfolio. One of the main problems faced by ABC management in making loans in rural areas is that loans are small and interest rates heavily regulated. Furthermore, many policy measures make it difficult for rural customers to come up with collateral for loans.

With this substantial cutback by the ABC in rural finance, the RCCs have become the main source for agricultural loans. Although RCCs are formal financial institutions that directly cover a vast area of the countryside with an extensive network, their provision of loans to small-farm households is limited. Only 25% of smallholders nationwide have obtained a RCC loan. Further, the proportion of RCC loans for agriculture has declined from 46% in 1990 to 34% in 2000—although in recent years new government programs have increased the flow of funds to rural areas. As major commercial banks, one by one, withdraw from the countryside, dependence solely on the strength of credit available from the RCCs will by no means be adequate to resolve difficulties in obtaining loans by farmers and small-business entrepreneurs in towns and villages. An additional concern is the high proportion of bad debts (estimated at 37%) held by Chinese rural-finance institutions. As they lack an equivalent capital base to cover these bad debts, their commercial viability is not assured.

Informal credit is widespread in rural areas. The main channel through which farm households borrow is private loans. It is estimated that between 50 and 60% of farm households have obtained informal loans accounting for at least 70% of total funds borrowed. This is commensurate with TVEs that seek high-interest financing through popular channels. The existence of informal credit also suggests several other characteristics of the rural financial system. First, there is unmet demand by the formal credit system. Second, although being unregulated may enhance access to credit in some cases, if it is possible to allow for informal lenders to become more formal without impeding their ability to lend (or if it is possible to allow the entry of more formal lenders that will service the part of the economy being serviced by the informal sector), the overall rural financial system might be strengthened.

It is fair to say that, even though for more than a decade reformers have tried to reform the banking sector in rural China, the nation still faces most of the common problems faced by other developing countries. The rural economy faces poor financial intermediation. There are large flows of funds out of the region. Recent

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

studies show China extracted a total value of about 1289 billion yuan (in 2000 prices) of capital from the agricultural sector for use in the nation's industrialisation between 1980 and 2000. Nearly twice as much, about 2297 billion yuan, flowed from the rural sector to the urban economy during the same period.

REMAINING CONSTRAINTS AND ENABLING FACTORS

In 1998, the National People's Congress identified financial-system reform, including decentralisation and commercialisation, as one of five priorities. This process is now well under way, although the reach into rural areas, especially in western China, is still limited. Current initiatives include decentralising RCCs to the provincial level. In addition, the People's Bank of China initiated a program in 2001 to encourage RCCs to develop micro-finance options. There is some evidence of pay-off from this initiative in that RCC loans to small-farm households more than doubled during 2002.

Another encouraging development is experiments with both unofficial and informal approaches to credit delivery. With administrative supervision from the Ministry of Agriculture, Rural Cooperative Funds have emerged at the township level. As they cannot accept deposits, they facilitate borrowing by farmers and TVEs, by drawing on funds obtained from share capital. Local governments, non-governmental organisations and a number of international donors are experimenting with various approaches to micro-finance.

Nonetheless, significant barriers to financial market reform remain in rural areas:

- Interest rates remain regulated, which rations credit and limits access by small borrowers and depositors. Given the high administrative costs of maintaining a large portfolio of small loans, the band of interest rates allowed by the People's Bank of China is still too low to permit earnings that provide competitive returns on a rural lending institution's assets and equity. Commercial sustainability therefore remains problematic. The regulated interest rates also distort resource allocation, inviting misallocation and rent-seeking, and—because real interest rates are negative in years where significant inflation occurs—they

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

reduce incentives to hold savings in a financial form. The effect of this has been limited expansion of financial services to meet demand from emerging entrepreneurs in small businesses and on farms.

- With limited opportunities to deposit savings in many rural areas, households primarily hold their wealth—an estimated 83%—outside the banking system. Savings are held in the form of housing, cash, grain and fixed assets. For pastoralists it is livestock. They view their herds of animals as their 'bank'. The animals are a form of saving that can be turned into cash when needed. They also represent various forms of insurance to meet emergency needs for cash in times of illness, accident, unemployment or death. While rural households will always keep some of their wealth in these real assets even though many are unproductive (e.g. holding grain stocks that exceed one year's consumption), from a national development point of view, there is scope for increasing savings rates.
- Subsidised credit has been used extensively as an approach to poverty reduction. As this micro-credit is offered with the intent that the poor households will graduate to an income level where they will be served by existing financial institutions, the programs make no attempt to build institutions and sustainable micro-finance programs. As a result, alternative approaches to delivering rural finance based on market interest rates have difficulty competing with this welfare delivery program. The net effect is stunted development of financial services in rural areas, especially in poverty-designated counties.
- Formal lending practices are typically based on collateral. Farmers find it difficult to meet these collateral conditions as they do not own their land and markets for land-use rights are only just beginning to emerge. In Vietnam, land-use rights titles are used to secure loans; after titling, lending to farmers increased sharply. Alternative lending practices need to be considered: informal appraisal of borrowers and investments, access to repeat and larger loans based on repayment performance, and collateral substitutes such as group liability, compulsory savings or some form of guarantee.

While all of the above problems pose a challenge to reformers, many observers believe that by far the biggest problems in the rural financial system are in the ownership and lack of competition in the sector. Until managers, boards of directors or other players are directly responsible for (and are rewarded by) the growth in bank assets, lending will always be more political than economic. Today no one is interested in building healthy portfolios because there is little incentive to do so. Frequently, rules

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

are set up so rigidly that entrepreneurship and creative credit policies are dampened. In addition, without free entry of banks, competition is lacking. Research by China's economists has demonstrated that, in almost every case where there is competition, the quality of the portfolio and the profitability of the lender rises.

POLICY OPTIONS FOR REFORMING THE EXISTING FINANCIAL SYSTEM

Rural financial reforms have not kept pace with growing demands for banking services to facilitate a continued economic transition in rural areas. A fundamental resolution of current problems in Chinese rural finance cannot be confined to minor repairs and adjustments to the existing rural financial system. It is necessary to have the system as a whole in mind and again perform functional reorientation and adjustment of the ABC, the ADBC and the RCCs with an aim of establishing a more-complete and vigorous rural financial system.

Reforming Rural Credit Cooperatives

First, a solution should be found to common problems in RCCs: unclear proprietary rights, incomplete legal administration, comparatively low levels of management, and a lack of effective inspirational mechanisms and control of insiders.

Current demands put forward by central government in a call for reform of the RCCs include: property rights relationships should be clear, the mechanisms of restraint should be reinforced, service functions should be strengthened, and there should be appropriate state support; but local governments should be responsible. As a result of the differences between places throughout the country, it would obviously be inappropriate to compel RCCs to reform in line with a centralised model.

There are two schools of thought about this reform. One option is to reorganise each RCC branch into a joint-stock company. If business is reasonably good in developed areas it is appropriate to commercialise the running of credit unions in this manner. This structure localises proprietary rights with autonomous, independent management as its basis. No specialised legislation is required as joint-stock companies form part of the national banking legislation. Existing regulations and laws covering joint-stock companies would apply and would govern management and operation of such financial institutions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The second option is to reorganise RCCs in a stratified form. Drawing lessons from the successful experience with the development of cooperative banking abroad, branches of the RCC can be changed into truly cooperative financial organisations. These cooperative banks would be owned by those residents of a community who chose to become members. The intent is a non-profit association that operates as a commercial enterprise without interference from local government officials. Alternatively, current RCC branches within a province could be changed into a grass-roots network of the ADBC with policy-related loans as their main business. This variation of the second option is mainly suitable for areas where the level of economic development is rather low, and whose residents lack the knowledge and skills needed of risk management and other financial operations.

Whichever type of organisational form is adopted, it is essential that problems of unclear proprietary rights and poor legal administration be resolved. Only in this way can there be a solution to the problem of governments carrying final, overall responsibility for the bad debts of RCCs. In other words, although the long-term solutions are complex and must be implemented gradually, there is still scope for beginning by focusing on more immediate, less-comprehensive reforms. We believe China can and should begin to experiment with issues of how to raise the short-run supply of credit locally in order to attempt to increase farmer incomes and promote production activities and that this may help gain experience in solving some of the longer-term problems (such as the property rights of banks, the emergence of small and medium private banks and managerial and governance reforms of the state-owned commercial banks).

In conducting experiments, we believe China may want to take a regional approach. Because the demand for credit varies among regions, and because the institutional capacity of the banking system is so different in each part of the country, banking officials should be able to conduct experiments in coastal, central and western areas. The most important reforms invariably will happen in the coastal areas, since China's drive to establish a modern banking system must start in the most-advanced areas. The overall goals should be to abolish policy constraints and foster competitive rural financial markets. In the near future, private banks should be allowed to emerge in some areas and their effect on the financial system should be assessed carefully.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

More flexibility with interest rates

A second issue that needs to be addressed is the problem of controls on interest rates. The negative effects brought about by these controls are not only a distortion to the price of using funds and irrationality in the allocation of financial resources, the level of earnings by commercialised financial institutions in the rural financial market is also affected. Strict enforcement of official interest rate restrictions will prevent the development of micro-finance programs and the RCC system. The floating of interest rates on a large scale should be realised on the basis of market demand, with interest rate controls gradually relaxed so that the demand for commercialised financial institutions to carry on financial activities in the rural financial market can be met. Because financial markets are so interlinked, it is not going to be possible to liberalise deposit rates until deposits in the whole system are liberalised but, in the future, this also should be a goal. In other Asian countries, raising deposit rates induced massive savings and helped the poor more than did the extension of new loans.

Improving supervision

A third issue is the lack of an effective supervisory framework. Successful operation of all financial institutions requires public confidence. An environment that builds public confidence includes: (a) well-defined laws and procedures that govern the accounting, auditing and reporting requirements for all financial institutions; and (b) a stable, growing economy that enables small entrepreneurs to undertake new ventures and to sustain the profits required for loan repayment and the provision of local employment while producing the goods and services in demand in the community. To create such an environment, there is a need to establish an effective supervisory framework that will enhance ideas about supervision, improve supervisory technology and raise the quality and efficiency of supervision. This framework will include means to inspect and to enforce relevant regulations and laws.

EXPANDING RURAL FINANCIAL OPTIONS

One of the most effective strategies used by reformers in their management of China's transition to a 'socialised market' is a focus on competition within the market. This addresses the problems associated with state-owned enterprise through growth of a non-state sector, reducing the role of the former and assuring competition within the

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

market. Extending this approach to a market transition to rural finance calls for a policy shift that allows locally owned alternatives to emerge as competition for a reorganised RCC, ADB and ADBC system. Competition will extend the reach of these existing financial institutions and will spawn innovation in the delivery of financial services.

There are many options. RCCs can be privatised and allowed to set up branches in other counties. Private banks can be allowed to emerge. Foreign banks should be encouraged to participate in rural areas. In addition, a Rural Savings and Credit Association, patterned somewhat on credit unions in other countries, is also recommended as a model. This model can provide a legal basis for the unofficial and informal credit institutions and programs evident in rural China. A starting point for a Rural Savings and Credit Association will be either an existing affinity group or the creation of affinity groups to meet the condition of offering financial services to members only. In most cases, the organisation would be based locally and would be focused on servicing the needs of those within the community. Ideally, each affinity group would constitute a local informal network that can facilitate assessment of the suitability of clients who have applied for loans.

As low-income households typically cannot offer full collateral, knowledge of the client serves as the basis for initiating a ladder approach to developing a credit history—initial small, short-term loans for consumption, moving up to larger loans for investment purposes. Co-insurance of loans may be considered in the form of group lending, which draws in members of an extended family. A Rural Savings and Credit Association option will require regulatory and legal changes that will enable micro-finance programs to operate on a financially sustainable basis. To make such changes, the China Banking Regulatory Commission will need to clarify definitions of property rights relationships and, where necessary, advance legislative changes to assure the transparency and accountability required for the development of sound savings–credit institutions. If successful, this would likely displace part of the informal sector and would allow for more regulation and control over this part of the rural financial system.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ENCOURAGING MICRO-FINANCE

In the final analysis, even if the rural financial reforms were successful and a more functional, wider-ranging rural financial system were operating, in an economy such as China's there will still be those who will not be serviced by the more liberalised sector. In most cases, those excluded will include the poor, members of minority groups and those who live in deep and isolated regions of China. These people, despite their poverty and remoteness, have demand for credit and deposit services. To serve these needs, we strongly urge that China continues to allow experimentation with micro-credit programs. International and domestic groups should be encouraged to set up peer-monitoring and other innovative programs that target the poor. Local government micro-credit schemes have been less successful and though their efforts should continue to be encouraged, the role of non-government organisations should also be recognised and efforts made to reduce local governments and financial organisations regulating and interfering with them.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

8.2 RURAL FINANCE OPTIONS TO PROMOTE SUSTAINABLE AGRICULTURE DEVELOPMENT AND ALLEVIATE RURAL POVERTY IN CHINA

Henry Rempel, Yue Hongchen and Hu Wanjing
Department of Economics, University of Manitoba, Winnipeg, Manitoba, Canada

RURAL FINANCE AND RURAL DEVELOPMENT

The development of rural China will require significant injections of financial resources. Addressing the many important issues involved is larger than the scope of this paper. Rather, the purpose of the paper is to address that sub-set of rural finance issues that can affect low-income households—farmers and small businesses—located primarily in the provinces covered by China's Western Economic Strategy. The goal is to advance sustainable agriculture and promote rural development in these regions in a manner that will alleviate poverty and promote a more equitable distribution of income within China.

The approach of the paper is to describe briefly the existing formal financial system serving rural areas and to identify the limitations of this system as a provider of deposit and lending services for lower-income households. The proposed solutions include reforming the existing formal financial system plus facilitating and promoting the evolution of new institutions. The generic alternative presented is intended to increase access of lower-income rural households to financial services and to increase competition in rural areas in the delivery of a range of formal financial services.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

It is a premise of this paper that the success of the proposed rural-finance development will depend on a simultaneous evolution of other complementary activities as presented in this monograph:

- appropriate advances in agricultural research and extension and innovations in grain storage and marketing to affect changes in farming practices, technology utilised and commodities produced (Chapter 2 and Chapter 6)
- re-definition of property rights for land in a manner that promotes more efficient use of land by providing increased incentives for farmers to make longer-term investment decisions and to enhance access to credit from existing institutions within the rural financial system (Chapter 7)
- fiscal reform to reduce the fees and taxes paid by farmers and to change the extent and nature of public goods and services provided for farmers (Chapter 1)
- full exploitation of the green and amber box provisions for agriculture within China's World Trade Organization commitments to advance the opportunities for and capabilities of small farmers (Chapter 3)—as Han (2003) indicates, China has room within its World Trade Organization green and amber box provisions to expand expenditures to develop agriculture
- expansion of off-farm employment opportunities to provide greater access to scarce land resources for households that remain in farming, to expand demand for agricultural production, and to increase financial resources for investment in households that receive remittances from migrants (Chapter 5).
- development of new approaches for farmers to organise and cooperate to increase access to technology, extension and farm inputs, to expand processing, storage and marketing of farm output, and to access credit (Chapter 4).

RURAL FINANCE WITHIN CHINA'S FINANCIAL SYSTEM

The role of a financial system

Stiglitz (1998) describes a country's financial system as the 'brain' of an economy. Institutions that make up a financial system have two primary functions: first, to collect and hold savings from individuals, households and business firms who have

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

an excess of resources at a stage in their life or operation; and second, to channel these savings as loans to entrepreneurs, including farmers, who can make productive use of these financial resources. The 'brain' element of the financial system is the process of selecting the most-productive entrepreneurs for the limited resources available, monitoring the use of the funds to ensure they continue to be used productively, minimising risk involved for savers and borrowers alike, and transmitting the information needed for all these transactions to occur expeditiously. A financial system that fails to carry out some or all of these functions limits the development of the economy.

Financial reform in contemporary China

In a press conference at the conclusion of the National People's Congress, Premier Wen Jiabao identified banking reform as an important economic issue that China must implement successfully (Gao 2004).

Rural financial reform is only one part of a much larger process of reform occurring as China's financial system evolves. While there has been something of a rural economic revolution—a rapid increase in agricultural production, growth of Township and Village Enterprises, and associated changes in the structure of the rural economy—'…rural financial reforms have not kept pace with actual and required further economic transition in rural areas' (Scott and Druschel 2003).

Primary institutions shaping rural finance

A powerful voice in shaping the evolution of China's financial system is the central bank, the People's Bank of China. Its approach to rural finance has been built around three existing institutions.

Rural credit cooperatives

At the official level, rural credit cooperatives (RCCs) are the primary providers of credit for farmers. In 2001, there were approximately 40,000 branch offices (sometimes also called credit unions), spread throughout China. According to He Guangwen (2003), this represents a considerable decline from approximately 55,000 RCCs in 1981. It is estimated the RCCs account for 12% of all deposits held in China (Zhang Hongyu 2003). Of its 1200 billion yuan loan portfolio, 37% was directed to agriculture, accounting for an estimated 78% of total agricultural loans from

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's formal financial system (Han 2003). Entering this millennium, the People's Bank of China identified RCCs as the means to develop rural areas. The focus was a provision of credit, in the traditional sense, for farmers and small businesses. Extending financial services to low-income households in rural areas, until recently, has not been a priority development issue. The People's Bank of China initiated a program in 2001 to encourage RCCs to develop micro-finance options. Some 32,000 co-operatives report having established such a program, but micro-finance coverage in the rural areas remains low (Han 2003). There is some evidence that this initiative has expanded the credit available to peasant households. It is not a use of the financial system as a means to social engineering, such as empowering women, as articulated so well by the All China Women's Federation. Recent reforms include establishing RCC unions at the county and provincial levels and conversion of RCCs into provincial-level commercial banks (Scott and Druschel 2003). The need for reform remains strong, with 37% of the RCCs loan portfolio designated as bad debts in 2002 (Han 2003). In April 2003, the monitoring role of the People's Bank of China for RCCs was shifted to the China Banking Regulatory Commission.

Agricultural Bank of China

The Agricultural Bank of China (ABC) operates like a commercial bank, providing credit in rural areas. Of its 2001 loan portfolio of 1604 billion yuan, 54% was agriculture related (Han 2003; Zhang Hongyu 2003). Park and Changqing Ren (2001), in contrast, report only 14% of the ABC's lending was for agriculture. After the mid 1990s, with a move toward commercialisation of the ABC's operations, it now also finances rural infrastructure: power grids, transport and communications. Within China's financial system, government-based micro-finance is lodged primarily within the ABC. The government entrusted the ABC with responsibility for the micro-credit that forms a major part of the poverty-alleviation funds delivered as a form of welfare to poverty households. No collateral is required for these loans and interest rates are set at 2.88%. In government-designated poverty counties, poverty households are eligible for this form of credit. It is assumed—an assumption not formally tested or demonstrated in practice—that such credit must be subsidised to make it accessible to poor people. As welfare delivery is generally deemed to be a temporary program, there is no recognised need to create delivery institutions or worry about program sustainability. The poverty-alleviation loan funds channelled as a form of welfare through the ABC increased dramatically during the 1990s to 8.5 billion Yuan in 1997 (Park and Changqing Ren 2001). These funds served to

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

reduce the number of families living in poverty, in part because timely repayment of these low-interest loans was approximately 50%. Given a pervasive presence of this form of micro-credit in poverty counties, alternative approaches to delivering rural finance, based on market interest rates, have difficulty competing with this welfare-delivery program. Also, the magnitude of poverty-alleviation funds involved has caused this approach to micro-credit to dominate the rural finance development agenda in lower-income regions of China. Micro-credit is offered in poverty-reduction programs with an intent that the poor will graduate to an income level where they will be served by existing financial institutions. There is evidence that some county governments now recognise that this assumption is not valid (Park and Changqing Ren 2001). As a result, some poverty-alleviation loan funds are being used to establish micro-finance programs to expand the range of financial services available in these rural areas in a manner that presents new opportunities for households designated as being in poverty.

Agricultural Development Bank of China

The Agricultural Development Bank of China (ADBC) primarily carries out a government mandate to finance the purchase of important agricultural commodities. It relies mainly on the People's Bank of China for its loan funds. More than 90% of ADBC's loans serve to finance government purchases of strategic commodities such as grain, cotton and oil (Han 2003).

It does not lend directly to small farmers.

The financial system's failure to serve low-income rural households

Experience shows that lower-income groups in many parts of China are not served well within China's current formal financial system:

- Existing banks and other formal sources of credit focus on the more-developed parts of the country and are not as accessible in the poor counties and remote areas in northern and western China. The World Bank and the Asian Development Bank observe that existing formal-sector banks are unwilling to include low-income households because transaction costs involved are too high. More profits can be made lending the available deposits to larger firms and farmers (Sterner 2002).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- In general, formal sources of credit require collateral as security for a loan. This practice prevents low-income borrowers from obtaining credit for new business or farming ventures.
- Savings mobilisation is achievable and essential for sustainable rural financial intermediation. Experience with organising micro-credit in rural areas suggests loan funds for an association need to grow to a minimum of one million yuan if it is to generate adequate revenue to cover operational costs (Branch et al. 2003). However, savings mobilisation is still the forgotten half of rural finance within the existing financial system. As a result, institutional loan funds available in rural areas generally cannot meet demand. There is a need to design saving services that serve lower-income rural households. Mixing voluntary saving for members with compulsory savings can encourage savings behaviour.
- Studies have demonstrated that loan-repayment rates will decline if borrowers and savers do not believe they will benefit from the long-term survival of the institution, and they lack a sense of ownership of the program involved. Public confidence built on transparency and community control of the financial institution is important for rural financial development.

According to Scott and Druschel (2003), overcoming these shortcomings, by extending the rural financial system, can promote rural development:

> There is no contradiction between the objective of fostering a commercially sustainable rural financial system and promoting rural income expansion and welfare. Most firms and households that have profitable business opportunities value timely, reliable and convenient *access* to financial services (especially loans, savings and insurance products) and generally are willing and able to pay a market price for them.

They go on to challenge the myth that subsidised credit programs are required for small, low-income firms and households. As in other countries, subsidised credit is in finite supply, with the subsidies captured primarily by borrowers who are 'well connected', which need not be the potential borrowers with the highest expected-return business opportunities.

> By offering credit in a convenient and flexible manner according to commercial principles and the expressed needs of their customers, commercially sustainable rural financial institutions can substantially improve the efficiency of the allocation of credit in rural markets. By pursuing business strategies oriented toward meeting the need of clients, they similarly can substantially improve rates of savings mobilization' (Scott and Druschel 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

THE PLACE OF CREDIT IN AGRICULTURE AND RURAL DEVELOPMENT

Credit facilitates development; it is not a determinant of development. Credit enters when entrepreneurs, including farmers, are willing to exploit opportunities to employ new resources and/or combine existing resources to exploit new markets for existing or new products. To make these changes, entrepreneurs require access to finance. The availability of credit can facilitate such entrepreneurial activity.

Women involved in selected rural-poverty-alleviation projects have demonstrated an ability to take a small loan and transform it into a stream of income that covers the forced saving and the interest charges plus provides a reasonable return on investment. This shows that there is latent entrepreneurial talent, even in low-income households in counties designated as being in poverty. The development observed goes beyond an increase in income for the borrower (Park and Changqing Ren 2001). It also takes the form of increased self-confidence of the women, improved social status of these women in their community, improved health of household members, and freeing of time from labour-intensive household chores to invest it in remunerative activities.

For peasant households it is important to recognise that immediate, short-term credit needs may well arise from family emergencies or spending expected for important life-cycle events—birth, marriage and death—within the family. Zhang Jie (2003) distinguishes a 'surviving economy' mentality and a 'rational small farmer' mentality evident simultaneously in typical peasant households. It is credit sought under the latter that leads to productive investments with some probability of success. Income transfers obtained from kin, especially to address 'surviving economy' needs, are a form of mutual aid, and typically are not seen as credit (Ma Zhongfu 2003). It is reasonable to expect such transfers will remain unreported in surveys of credit activity. Relying on moneylenders as a source of finance is usually a last resort as their interest rates are 2–10 times those of official rates (Ma Zhongfu 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

FINANCE OPTIONS FOR LOW-INCOME FARMERS AND PASTORALISTS

Formal credit institutions

In general, the proportion of loans provided by formal credit institutions to peasant households is limited. The People's Bank of China sought to address this by initiating in 2001 a program to encourage RCCs to develop micro-finance options but, as reported above, coverage in the rural areas remains low. There is some evidence, though, of pay-off to this new initiative in that RCC loans to peasant households more than doubled during 2002 to 75 billion yuan (Zhang Hongyu 2003). Nonetheless, it is Han's (2003) assessment that:

> After all major commercial banks one by one withdrew from the countryside, dependence solely on the strength of credit in the rural credit union system will by no means be capable of resolving the difficulties of the peasants in obtaining loans.

Informal credit: extended family and money lenders

The primary source of credit for small, low-income rural households is the extended family and moneylenders. A survey of 365 households in 21 counties in 5 provinces reports 61% of borrowing transactions are from informal, non-bank sources. The RCCs account for 31% and the Agriculture Bank 4% (He Guangwen 1999). On the deposit side, RCCs provided 62% of total transactions and the Agriculture Bank 20%. Of the total number of loan transactions, only one-third were for investing in productive assets. Average interest paid was 0.95% per month, with rates as high as 3% per month. Similarly, in a survey of 472 peasant households in one county in Sichuan Province, Chen Fan (2003) reports only 5% of the households had loans from a RCC; 82% borrowed from relatives. Some 71% of the households reported they would be willing to borrow from a RCC, but only 40% thought they could obtain such a formal loan.

Micro-finance organisations

Micro-finance is a growing option, although it meets the credit needs of only a small portion of China's many small farmers. [For a survey of China's micro-finance experience see Du (2003) and Cheng (2003). Park and Changqing Ren (2001, Table 1) provide a list of internationally funded micro-finance projects in China.] The ability

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of micro-finance to address their credit needs is currently constrained by regulations that prevent associations and institutions from taking deposits and limit interest rates from being set at market clearing levels (Park and Changqing Ren 2001). Where the emergence of a range of micro-finance initiatives shows promise for the future, the sustainability of such programs is still not assured (Han and Cheng 2005). In all cases, initiating the programs has been subsidised. This includes loan capital provided by donors, use of poverty-alleviation loans at subsidised interest rates as another source of loan capital, extensive training and advice provided by such institutions as the Chinese Academy of Social Sciences and by donors, and the use of government employees to manage and deliver credit programs (Du 2003). Of specific concern is the future of government-run micro-finance programs, which are, in general, performing poorly (Park and Changqing Ren 2001).

The place of small-farm households within the formal financial system

Within China's financial system, loans provided by RCCs, the ABC and the ADBC account for 17% of total lending (Han 2003). Han concurs with others—e.g. Zhang Jie (2003) and He Guangwen (1999)—that the extended family and moneylenders are the primary sources of credit for small farmers. Han (2003) reports:

> Informal credit is quite widespread. Considering sources of borrowing, the main channel through which peasant households borrow is popular private loans. It is estimated that between 50% and 60% of peasant households have obtained informal loans while the ratio of their popular borrowing exceeds 70%. This is commensurate with a part of town and township enterprises which seeks high interest financing through popular channels. However, informal credit has no legal position.

Rural household savings on deposit have grown at an annual compound rate of 20% since 1990 to 1382 billion Yuan in 2001 (Scott and Druschel 2003). Nonetheless, small households in lower-income regions are not served well, as micro-finance organisations are generally prohibited from accepting deposits. Based on a survey of emerging Asian markets, Dickie (2003) concludes:

> …the experience from emerging Asia is that it is difficult for an existing financial institution to sponsor or create effective microfinance programs. While such approaches can be encouraged and may well be beneficial, they are likely to represent a diversion for the concerned bank and be limited in scope.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

This conclusion applies also to China. Given the high administrative costs of maintaining a large portfolio of small loans in rural areas, the band of interest rates allowed by the People's Bank of China is still too low to permit earnings that provide competitive returns on the lending institutions' assets and equity and hence assure commercial sustainability (Scott and Druschel 2003; Han and Cheng 2005).

DOES CREDIT AVAILABILITY CONSTRAIN RURAL DEVELOPMENT?

The limited evidence on credit availability and lack of credit as a constraint to rural development is mixed. Park and Changqing Ren (2001) cite a 1997 survey in six poor counties in several provinces, which '…found that nearly two-thirds of households either had an outstanding formal loan (mainly from RCCs) or felt they could get one if they wanted (the amount, however, is constrained)'. But total borrowing increased where additional sources of credit became available. Again, Park and Changqing Ren (2001) cite results from a Chinese Academy of Social Sciences survey which found that 25% of the respondents would not have undertaken the scale of their current projects if micro-finance had not been available.

Of specific concern is that poor households are still largely excluded from the existing formal financial system operating in China. The people are assumed to be too poor to be able to save. As a result, they are not encouraged to hold their savings in a financial form. Second, low-income borrowers tend to be excluded from formal financial programs because they lack the collateral needed for a loan. Also, existing institutions are often not located conveniently to serve the needs of poor households. Third, even where loan funds available might be adequate, the interest rate ceilings limit the ability of RCCs to generate the revenue required to employ adequate staff to administer a portfolio of small loans spread over a large number of small farmers. One expression of a lack of financial options to save and borrow is pastoralists, who view their herds of animals as their 'bank'. The animals are a form of saving that can be turned into cash when needed. They also represent various forms of insurance to meet emergency needs for cash in times of illness, accident, unemployment or death. It can be demonstrated that, if these pastoralists viewed their animals as an investment, to be used to maximise household income, male animals other than for breeding or draft purposes would be sold as calves or within four years and non-productive females would be similarly sold off. Provided there is a market for

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

milk, hides, wool and meat, herd size would be considerably smaller and household income would increase. Such a transformation to a higher-income, more sustainable form of animal husbandry becomes an option only if there are alternative, preferably financial, means for saving, borrowing and insurance (Sterner 2002).

A case can be made that there are significant cash-flow constraints at the small-farm level, especially in western and northern China. Even if a well-functioning rural financial system—as defined by Stiglitz (1998)—emerges, it does not follow that such a system will channel credit to small farmers. For donors intent on investing in poverty alleviation, a question to ask is whether devoting a set of funds to establishing a sound micro-finance program will advance household income and well-being more than some alternative use within the community of that set of funds. Finally, a hypothesis that needs to be tested is whether the location of available credit in investments that provide rural, non-agricultural employment will have greater development impact on small-farm households than locating such funds as some form of farm credit. This is an important hypothesis because of an estimate made in 2000 that 30–40% of farmers need to move out of agriculture to enable the agriculture sector to move forward in a manner that generates farm-household income-streams comparable to the non-farm incomes available (Rempel 2002).

POTENTIAL MODELS FOR RURAL FINANCE REFORM

Extending China's financial system to draw in lower-income peasant farmers, both as savers and borrowers, is basic for agriculture and rural development to serve as a means to reduce rural–urban and regional income disparities and to alleviate rural poverty. How can this best be done?

Relevant experience in China

Successful extensions of financial systems to incorporate small farmers, especially those located away from an economy's centre, typically build on farmers forming associations to overcome their own problems. Some examples drawn from other low- and middle-income economies include the Grameen Bank of Bangladesh, the Bangladesh Rural Advancement Committee (BRAC), Bank Rakyat Indonesia (BRI) and BancoSol in Bolivia. In China, there is now extensive experience with various approaches to micro-finance that can serve as models for reforming existing financial institutions and facilitating the emergence of new, rural financial institu-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

tions. For the purpose of this discussion, micro-finance is defined as 'a program of action within a community that builds institutions to encourage and facilitate savings, to extend small loans and to offer financial and social services in a manner that addresses the causes of poverty in the community' (He Bing and Rempel 1999). What distinguishes micro-finance from commercial lending or bringing aid to the poor is that 'low and middle income groups are the designated target customers… provided with financial product services' (Du 2003).

For example, in 1994 the Chinese Academy of Social Sciences, with the cooperation of the Yixian County government in Hebei Province, introduced a Grameen Bank model in a micro-finance project. Financial and technical support was provided by the Ford Foundation, the Grameen Trust and the Canada Fund. Given the success of this project in Yixian, it has spread to Yucheng and Nanzhao in Henan Province.

Given the experience in the other provinces, Yucheng created its own model, which has reduced poverty in that county. The county helps low-income farm households to organise. It also uses weekly meetings and relies on group liability to assure repayment. The company distributes loans to groups and offers technical help. The core element of the program is connecting scattered household management with domestic and world markets. This facilitates specialisation in production, unified operation, business management and social services to transform traditional agriculture into a market-based agriculture.

In addition, major donors have funded and operated micro-finance activities: World Food Programme (WFP), International Fund for Agricultural Development (IFAD), United Nation's Development Programme (UNDP), United Nation's International Children's Fund (UNICEF), and the United Nation's Population Fund (UNFPA) plus several non-government organisations (NGOs). In his summary of China's experience with micro-finance, Du (2003) notes that China's continuous reform of political and economic systems has provided a policy environment for implementing sustainable micro-finance to assist people living in poverty that has generated micro-finance initiatives with unique features:

> …China's experiments in micro-finance, when compared with large-scale micro-finance institutions and projects including those in parts of neighbouring South and Southeast Asia, is different with regard to time, scale, design thinking, operational entities and the policy environment for implementing micro-finance.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

> Assessing this micro-finance experience, the World Bank (1999) concludes: Despite its sensitivity, particularly in terms of interest rates, microfinance experiments are currently being successfully carried out by a range of government, semi-government and development agencies. While the results are invariably promising, the broader policy environment of directed and subsidized credit continues to raise major obstacles to large-scale expansion. On the interest rate question, all agencies are constrained by the low interest rate ceilings that form the credit basis of the Government's 8/7 and other poverty reduction programs and constitute an important element of the Government's *socialized market* approach. Apart from the question of achieving financial viability given the minimal interest margin available, other problems include the non availability of microfinance institutions and the inability of non-banks to collect savings.

Canada's experience with credit unions as a source of rural finance

In Canada, farmers, especially in Quebec and on the Western Prairies, formed effective co-operative ventures to address their problems. For example, organising provincial-level grain-marketing co-operatives was their response to a few firms dominating the purchase of grain from farmers. Similarly, credit unions were formed to encourage rural people to save and to ensure that these savings were channelled back into the community in the form of loans for local enterprises and farmers.

The first successful credit union, Caisse Populaire, was formed in the Province of Quebec in 1900. The Antigonish Movement initiated credit unions in eastern Canada during the Great Depression of the 1930s. The concept spread quickly to western Canada. The evolution of a financial system that advanced Canada's development may have some relevance in identifying the main factors to be considered in extending the formal financial system in China:

A provincial base for a system of rural savings and credit associations

The credit unions are governed by laws of the province in which they are located and are not subject to the regulation exercised by the Bank of Canada over Canada's commercial bank. Credit unions in each province have joined together to form 'credit union centrals' at the provincial level. The credit unions, as members of the central, must hold a portion of the value of their deposits (8% in Manitoba) with the credit union central. In return, the central serves as a lender of last resort where credit unions may borrow up to 10% of the value of their deposits if they encounter a temporary liquidity shortage.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Subsequently, provincial governments have created credit union deposit guarantee corporations, which guarantee the deposits of members within each credit union. In the event a credit union declares bankruptcy, this deposit guarantee corporation pays members the value of their deposits in that credit union. In some provinces, the guarantee is for the full value of deposits; in others there are maximums set for each deposit account that will be guaranteed in case of credit union failure. Credit unions pay annual fees to cover the cost of operating this deposit guarantee provision. Along with the credit union central, a provincial deposit guarantee corporation has a regulatory role: for example, it sets a percentage of the value of deposits that has to be held in cash or as deposits in their credit union central. Initially, the deposit guarantee corporations provided full audit services for credit unions. This is now limited to periodic audits of loan portfolios. If such an audit indicates a credit union may be encountering difficulties, a deposit guarantee corporation can implement a 'watch', where special assessments are carried out of loans made by the credit union. If there is evidence of fraud, it can be granted supervisory power to temporarily take over the management of a credit union.

A role for a national apex body

The provincial credit union centrals jointly formed a national apex body, the Canadian Cooperative Credit Society in 1953. It serves as a lobbying group and provides certain services at the national level, such as cheque clearing for cheques written in other provinces and providing national switches for the automated teller machine (ATM) systems.

Provision for accepting deposits to build institutional sustainability

From the outset, credit unions were able to accept deposits, which provided members with an option to mobilise savings in a financial form and served as a means for credit unions to grow. In some cases, members held deposits as an act of charity to assure funds were available for lending to families in need. Some credit unions also used forced savings—a deposit equal to a small percentage of the loan—to build a loan fund and as a form of collateral. A need for a larger loan fund, to facilitate community development was recognised early on, and voluntary savings were induced with the payment of interest on deposits. Over time, credit unions expanded their range of financial services, including cheque accounts.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Approaches to minimising the risk of loan defaults

In some provinces, the initial legislation required each credit union to be based within an affinity group—residents of a particular community, employees of government or of a specific firm, or members of a religious group—and financial services could be offered to members only. This restriction facilitated the vetting of loans, reducing risk as clients were known. Also, it served to develop the trust required to attract deposits. Establishing credit committees, which included board members as well as staff, to decide who would receive a loan also served to reduce risk and to assure transparency and accountability for the loan portfolio. Credit committees now are typically staff and, in many cases, only loans above a certain size need to be vetted.

Increased competition for existing financial institutions

Credit unions were able to compete with commercial banks because they had low administration costs, were located within the community and had convenient hours of operation, and they could assure that savings deposited would be used for mortgages and investment loans within the community. In many cases they have become effective competition for banks and have contributed significantly to the development of rural communities in parts of Canada. Factors that contributed to the success of credit unions in Canada include:

- involvement of community leaders was important to gain local acceptance
- defined membership where members were known by credit union staff and/or board members
- management and operation of credit unions was located with credit union members with direct involvement of government excluded
- financial services were offered to business firms in towns as well as to farmers, creating a more diverse loan portfolio that reduced risk somewhat
- creation of the credit union deposit guarantee corporations significantly increased member confidence in credit unions as a place to locate savings
- the operation of credit union centrals increased overall stability through regulation, through services to members and as a lender of last resort
- operations were kept simple, with a primary focus on meeting the financial needs and demands of their respective members.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

EXTENDING FINANCIAL SERVICES IN RURAL AREAS

Potential options for reform of existing rural financial institutions

A failure to define property-rights relationships creates a regulatory nightmare for the China Banking Regulatory Commission. In setting-out options for rural financial reform it is important to avoid creating a multitude of small nightmares throughout the country. Specifically, the regulators will be concerned that: '…property right relationships should be clear, the mechanisms of restraint should be reinforced, service functions should be strengthened' (Han 2003; Han and Cheng 2005).

The following several options for an orderly financial system meet these conditions:

Option 1: Reorganise RCCs as joint-stock companies

Under this option, each local RCC branch would be reorganised as a locally owned joint-stock company (Han 2003). No specialised legislation is required, as joint-stock companies form part of the national banking legislation. The appropriate regulations and laws would apply and would govern management and operation of such financial institutions.

Option 2: Reorganise RCCs as cooperative banks (credit unions)

Alternatively, the ownership of each local RCC could be reorganised as a thrift-and-credit co-operative, owned by those residents of the community who chose to take out a membership. The intent would be a non-profit association that operates as a commercial enterprise without interference from local government officials (Scott and Druschel 2003).

Option 3: Experiments with options 1 and 2

The State Council of the People's Republic of China, as of August 2003, initiated a pilot project in eight provinces—ZheJiang, ShanDong, JiangShu, JiLin, JiangXi, GuiZhou, ChongQing and Shanxi—to further the development of RCCs. The intent appears to be to transform RCCs within each province into a provincial bank. This could be a one- or two-tier bank. A two-tier bank would have a lower tier of either option 1 or 2 above and an apex tier at the provincial level. In either case, overall management of these transformed RCCs would then shift from the People's Bank

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of China to provincial governments or to a combination of local owners and their provincial government. Central-government support for this initiative includes: special loans from the People's Bank of China, a fiscal subsidy, a reduction in selected taxes, and greater flexibility in setting interest-rate policy.

Promoting the development of rural savings and credit associations

To extend accessibility of lower-income rural households to formal financial services, additional financial institutions need to evolve. This would provide an additional benefit of increased competition in the delivery of financial services in the rural areas.

The People's Bank of China has initiated a study to determine the desirability and feasibility of allowing associations to be recognised as non-bank credit institutions. Financial services offered would be limited to members only and such institutions would operate on a non-profit basis. If implemented, this would provide opportunity for obtaining a legal basis for associations and institutions created as part of China's emerging micro-finance program. It represents a significant, commendable change in that additional financial institutions will emerge in rural areas, opening up the possibility of more-effective competition for both depositors and borrowers. Competition will extend the reach of such financial institutions and will spawn innovation in the delivery of financial services.

China's unique experience with micro-finance and other forms of non-formal credit institutions can serve as a base to build new, formal financial institutions that meet the savings and borrowing needs of low-income households—both farming households and small business owners (Watson 2003; Cheng Enjiang et al. 2003). A rural savings and credit association, patterned somewhat on credit unions (e.g. as in Canada), is recommended as a model.

Such associations will require regulatory and legal changes that will enable micro-finance programs to mature into financially sustainable institutions. To make such changes, the China Banking Regulatory Commission will need to clarify definitions of property-rights relationships and, where necessary, advance legislative changes to assure the transparency and accountability required for the development of sound savings–credit institutions. In addition, options for mobilising savings, including

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

payment of interest for savings, will need to evolve. Sustainable operation will require interest-rate liberalisation, to allow a premium between what is paid for savings and what is charged for loans that is adequate to cover operating costs (Onyang 2003).

A starting point for a rural savings and credit association will be either an existing affinity group or the creation of affinity groups to meet the condition of offering financial services to members only. Ideally, each affinity group would constitute a local informal network that can facilitate assessment of the suitability of clients who have applied for loans. As low-income households typically cannot offer full collateral, knowledge of the client serves as the basis for initiating a ladder approach to developing a credit history—initially small, short-term loans for consumption, moving up to larger loans for investment purposes. Co-insurance of loans may be considered in the form of group lending, which draws in members of an extended family.

Zhou (2004) argues that there is a psychological barrier, based on negative past experience, to the concept of the cooperative. Currently, 'company and rural household' is the alternative model popular among farmers. This model cannot form the basis for building an association as it entails contracts between individual farmers and a company. Effective farmers' professional associations exist in some villages and could serve as affinity groups to start rural savings and credit associations. Other models for forming affinity groups will need to be pursued to enable low-income households in rural areas—farmers and small businesses alike—to cooperate in addressing their local needs for basic financial services.

In the spirit of micro-finance, and consistent with expected legal changes, savings-and-credit associations will start by providing non-bank credit services. The collection of voluntary savings from members, which are then deposited in existing banks, e.g. RCCs or area branches of the ADB, can be one approach to building savings mobilisation. It may be possible to leverage the delivery of such deposits for a percentage of an RCC's or ADB's deposits as a loan fund to be administered by the rural savings and credit associations. Similarly, it may be possible to leverage poverty-alleviation funds available to counties as low-interest credit as the basis for extending an association's loan fund.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Primary elements of an extended rural finance system

Extending the current financial system in rural areas, using models such as those outlined above, can serve as a program of action within a community that builds institutions to encourage and facilitate savings, to extend small loans and to offer financial and social services in a manner that seeks to overcome the causes of poverty in the community. Such a program can be an effective tool for economic and social development if it is designed to provide financial services—for savers and for borrowers—to low-income households.

A typical program offers small loans, through informal appraisal of borrowers and investments, with access to repeat and larger loans based on repayment performance. As low-income households typically cannot meet collateral requirements of formal credit institutions, collateral substitutes, such as group liability, compulsory savings or some form of guarantee are required (Ledgerwood 1999). Other than basic financial services (e.g. insurance), some institutions also provide social services such as group formation, development of self-confidence and training in management capabilities.

The successful operation of all financial institutions requires public confidence. A sound macro-economic environment can serve to build and maintain such public confidence. Such an environment has two important elements:

- well-defined laws and procedures that govern the accounting, auditing and reporting requirements for all financial institutions
- a stable, growing economy that enables small entrepreneurs to undertake new ventures and to sustain the profits over the time required for loan repayment and provide local employment while producing the goods and services in demand in the community.

Even the best-designed and most-efficient rural finance programs may fail in the absence of such a sound macro-economic environment.

Other specific policies that serve to extend a financial system in rural areas include the following:

- Interest rates for loans and deposits that cover the rate of inflation and the cost of offering financial services must be enabled. Park and Changqing Ren (2001) provide substantial evidence of the ability of small farmers to bear market-clearing interest rates. Indeed, they argue that the opportunity cost of the time

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

involved travelling to and from meetings and attending micro-finance project meetings is likely a more significant deterrent than interest rates up to 3% per month. Dickie (2003) also makes the case for deregulating interest rates and allowing institutions to vary interest rates dependent on the credit risk of the prospective borrower.

- The self-reliance of rural finance institutions can be improved through increased mobilisation of savings in the form of deposits.
- Decentralised institution development at the village level will help to ensure poor people have access to savings and lending services.
- Sound accounting and auditing practices will ensure sustainability through professional management of costs and risks.

Given an expanding education base among the rural population, and a dynamic, growing economy, it is realistic to expect Chinese farmers and small businesses can develop new financial institutions that serve their needs. Within an appropriate regulatory environment that facilitates associations of farmers and small businesses, they have the same sorts of capabilities as those of the Bolivians who developed BancoSol, the Bangladeshis who developed BRAC, and the Indonesians who developed BRI. The examples of financial institutions developed in Hebei and Henan Provinces cited earlier are good indicators of what is possible in China.

Nonetheless, micro-finance development in China is a relatively new phenomenon. Training is needed to strengthen management, to improve staff quality, and to enable members to exercise ownership (Du 2003). Levels of government with a goal of promoting micro-finance to mature into formal financial institutions could assist this process through the support of such training ventures (Dickie 2003).

Experience in China and elsewhere has demonstrated that interest rates at levels that enable credit programs to flourish can serve as an effective poverty-reduction strategy. Examples of such programs are provided in He Bing and Rempel (1999) and Park and Changqing Ren (2001). This experience has demonstrated that poor people can and want to save, they can pay commercial interest rates, and access to non-subsidised financial services is a primary means to growth and poverty reduction. The inclusion of such innovative approaches in a rural financial system opens the door to financial services for poor people who are currently being turned down by the existing formal financial institutions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

An important cost factor in any credit program is loan defaults. Training for borrowers, plus regular monitoring of loan use and repayment can serve to minimise this cost. Where borrowers gain a sense of ownership of the funds on loan, loan defaults tend to decline significantly. An ability to accept deposits and then to link, in the minds of members, the loans and the deposits, serves to create this sense of ownership. A weaker, intermediate position is to establish a clear link between repayment of a current loan and access to future loans. Given that non-bank institutions are currently prohibited from accepting voluntary deposits, this latter approach is the primary method in place in China.

Information about potential borrowers can serve, in addition, as an important means to managing risk associated with loan defaults. The RCCs have initiated a credit rating system (Scott and Druschel 2003). With computer technology there is an option of extending the range of rural customers included within the rating system by drawing on the loan experience of all credit institutions and, in turn, making the database accessible to these credit institutions.

The role of government

The role of government in defining the requisite legal framework, complete with relevant regulations, for a comprehensive, competitive rural financial system is clear (Sterner 2002). Another important role is to inspect and to enforce relevant regulations and laws.

Where debate remains is whether governments at any level should be directly involved with any of the financial institutions. Traditionally, governments had an exclusive or primary role. Looking to the future, some argue government involvement is part of the problem and needs to be removed from ownership and management of emerging rural financial institutions (Du 2003; Zhang Jie 2003; Funding the Poor Cooperative in Yucheng County and Henan Province, as cited in Park and Changqing Ren (2001)). Others note county and local government officials tend to play a vital role in development initiatives involving associations or groups of farmers (Park and Changqing Ren 2001).

Agencies funding and promoting development have, in a number of cases, drawn on labour paid for as local government officials to subsidise their initial micro-finance initiatives. Some examples are: CIDA-funded Canadian Co-operative Association project in Xinjiang Province; CIDA-funded Integrated Rural Development Poverty

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Reduction Project; several NGO–government and government micro-finance projects in Shaanxi Province (Park and Changqing Ren 2001); and the Women's Credit Co-op in Mancheng (Chen Lanyan 1999). Relying on local governments in this manner, to cover some of the initial operating costs, may prove beneficial, provided ownership and management of rural savings and credit associations remain with their respective members. This management control would include a credit committee to assess loan applications.

REFERENCES

Branch, P, Du, X. and Luo, H. 2003. Canada–China Women's Income Generating Project in Xinjiang: evaluation final report. Gatineau, Canadian International Development Agency.

Chen Fan 2003. Analysis of the supply of and demand for credit funds for peasant households. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Chen Lanyan 1999. Expanding women's co-operatives in China through institutional linkages. Development and Change, 30, 715–738.

Cheng, E. 2003. Microfinance in rural China. In: Findlay, C., Watson, A., Cheng Enjiang and Zhu Gang, ed., Rural financial markets in China. Canberra, Asia Pacific Press, 120–133.

Cheng, E., Findlay, C. and Watson, A. 2003. Institution innovation without regulation: the collapse of rural credit foundations and lessons for further financial reforms. In: Findlay, C., Watson, A., Cheng Enjiang and Zhu Gang, ed., Rural financial markets in China. Canberra, Asia Pacific Press, 89–104.

Dickie, P.M. 2003. Rural banking in emerging Asian markets: lessons for China. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Du, X. 2003. Attempts to implement micro-finance in China. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Gao, N. 2004. Win: sustain balanced growth. China Daily, March 15, 1 and 2.

Han, J. 2003. The creation of a favourable environment for investment in rural China: current situation and future prospects. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Han, J. and Cheng, Y. 2005. Promoting institutional innovation of rural finance in China. In: Sonntag, B.H., Huang, J., Rozelle, S. and Skerritt, J.H., ed., China's agricultural and rural development in the early 21st century: challenges, opportunities and policy options. Canberra, ACIAR Monograph No. 116, 388–412.

He Bing and Rempel, H. 1999. Microfinance in China: background paper for discussion of issues. Microfinance Roundtable, Beijing, 28 October 1999.

He Guangwen 1999. From rural farmer's financial borrowing and lending behavior see rural financial restraint and financial deepening. China's Rural Economy, 10.

— 2003. Economic and financial transformation of rural China and diversification of rural financial institutions. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Ledgerwood, J. 1999. Microfinance handbook: an institutional and financial perspective. Washington, DC, World Bank.

Ma Xiaohe 2003. The difficulties and policy reform in China's rural finance. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Ma Zhongfu 2003. Rural informal finance In: Findlay, C., Watson, A., Cheng Enjiang and Zhu Gang, ed., Rural financial markets in China. Canberra, Asia Pacific Press, 105–119.

Onyang, H. 2003. The liberalisation of interest rates and raising the income of Chinese peasants. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Park, A. and Changqing Ren 2001. Microfinance with Chinese characteristics. World Development, 29, 39–62.

Rempel, H. 2002. Rural China adapting to a world market. Canadian Journal of Development Studies, 23, 543–569.

Scott, D. and Druschel, K. 2003. Institutional issues and prerequisites for efficient savings mobilization and allocation in rural and lesser developed regions in China. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Sterner, T. 2002. Policy instruments for environmental and natural resource management. Washington, DC, Resources for the Future and the World Bank; Stockholm, Swedish International Development Cooperation Agency.

Stiglitz, J. 1998. More instruments and broader goals: moving towards the post-Washington consensus. Helsinki, Finland, 1998 WIDER Annual Lecture.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Watson, A. 2003. Financing farmers: the reform of rural credit cooperatives and provision of financial services to farmers. In: Findlay, C., Watson, A., Cheng Enjiang and Zhu Gang, ed., Rural financial markets in China. Canberra, Asia Pacific Press, 63–88.

World Bank 1999. Consultations on poverty reduction strategies. Beijing, People's Republic of China.

Zhang Hongyu 2003. The system of Chinese rural financial organizations: achievements, shortcomings and institutional renewal. Paper presented at the workshop on rural finance and credit infrastructure in China, Paris, 13–14 October 2003.

Zhang Jie 2003. China's rural credit system: a long run angle of view. From: http://www.unirule.org.cn/symposium/c243.htm

Zhou, Z.-Y. 2004. China's experience with agricultural cooperatives in the era of economic reform. In: Trewin, R., ed., Cooperatives: issues and trends in developing countries. Canberra, ACIAR Technical Report No. 53.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

8.3 PROMOTING INSTITUTIONAL INNOVATION OF RURAL FINANCE IN CHINA

Han Jun
Department of Rural Economy, Development Research Center, State Council of the People's Republic of China, Beijing, People's Republic of China

Cheng Yu
Renmin University of China, Beijing, People's Republic of China

AN OVERVIEW OF THE CURRENT RURAL FINANCIAL SYSTEM

The Government of China has given high priority to urban and industry development on the long road to industrialisation. Under this development strategy, the financial sector implemented a policy of favouring urban over rural finance, extracting rural funds to support the development of industry in urban areas. Though there have been some recent changes in this policy orientation, especially during the 1990s, the problem of financial institutions providing insufficient rural loans remains. The insurance industry, for its part, also focuses on the cities. In the absence of subsidies and support for agricultural insurance, insurance companies are unenthusiastic about underwriting agricultural activities.

Formal financial institutions

Formal rural-credit channels fall mainly into three categories: rural credit cooperatives (RCCs), the Agricultural Bank of China (ABC), and the Agricultural Development Bank of China (ADBC). These institutions issued loans totalling 11,200 billion yuan in 2001:

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

agricultural loans were about 570 billion, accounting for 5% of the total, and township–village enterprise (TVE) loans were 640 billion yuan, 6% of the total. Even when loans for agricultural-product procurement provided by the ADBC are included, loans for agriculture and rural industry accounted for only 17% of the total loan portfolio.

Agricultural Bank of China

The ABC is becoming less active in the rural financial system. Before the mid 1980s, 98% of loans issued by the ABC were directed to rural areas. From the mid 1980s to early 1990s, the ABC adjusted its credit policies and 60% of agricultural loans were used to support agricultural-product procurement and the development of TVEs. After the mid 1990s, with rapid commercialisation, the ABC issued more loans for rural electricity, transportation and communication projects. As agricultural loans fell, the ABC's deposits from rural areas began to decline with the gradual transfer of its main business to cities and industry. The ABC's agricultural loans now account for only 10% of its total lending.

The ABC is now withdrawing its branches from rural areas, and poverty-alleviation funds have not attained set objectives. The state-owned banks of the ABC—the China Construction Bank (CCB), the Industrial and Commercial Bank of China and the Bank of China—have removed 31,000 branches at or below county level since 1998, leading to a dearth of financial organisations in rural areas and an increasingly uncompetitive financial market, with the formerly dominant status of the ABC in rural finance greatly weakened.

Rural credit cooperatives

With the ABC's gradual withdrawal from the rural financial system, rural credit cooperatives (RCCs) have become the main channel for formal agricultural loans. As of 2002, there were 37,000 independent RCCs, including 2460 county-level rural credit cooperative unions (RCCUs). From 1996 to 2001, RCCs issued agricultural loans of 1655 billion yuan, with an average annual value of 276 billion yuan. By the end of November 2003, RCCs held deposits of 2360 billion yuan, which is 12% of the total for all financial institutions in China; the loan portfolio was 1745 billion yuan, 11% of the total. The value of agricultural loans was 736 billion yuan, accounting for 85% of the total of such loans by all financial institutions. Some 587 billion yuan (80%) of these loans went to rural households. The loans extended to TVEs were 590 billion yuan, which amounted to 76% of the total loans to TVEs by all financial institutions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Though the RCC network covers almost all rural areas, only 25% of total rural households have taken RCC loans. New government projects have promoted the flow of funds into rural areas in the past few years, but the value of agricultural loans relative to total loans issued by RCCs has fallen from 46% in 1990 to 34% in 2000. With the withdrawal of the main commercial banks from rural areas, RCCs by themselves cannot be relied on to solve the capital shortage faced by rural households and small TVEs.

While RCCs are promoting rural-household micro-credit and group guarantee lending, which improves access of rural households to credit and alleviates some of the borrowing difficulties, several problems continue to restrict their ability to provide rural credit needs. These include management limitations, failure to adopt good business principles, and insufficient deposits. Furthermore, property rights and governance structure are not clearly defined. RCC members have only nominal property rights in the RCC in which they invest; the real rights are controlled by the state. An extension of this is that RCCs expect government to take the final responsibility for all non-performing loans. The governance structure of RCCs is fragmentary, with serious problems of concentration of decision-making in individuals and insider control. These problems contribute to a high proportion of non-performing assets.

Agricultural Development Bank of China

The ADBC focuses mainly on financial policy operation in agriculture for the central government, in particular to facilitate the movement of grains, cotton and edible oils. At the end of November 2002, the balance of loans of the ADBC was 724 billion yuan, with loans for grain and oil procurement accounting for 98% of this. More recently, with the development of the market economy and a deepening of reform of the grain circulation system, ADBC's business has shrunk. By the end of October 2003, its loan portfolio had dropped to 689 billion yuan.

The ADBC has limited capacity for rural institutional finance. First, its fund sources are unstable, depending mainly on Central Bank re-loans. Second, the efficiency of fund management is low. Third, its business scope is narrow as it plays only an institutional finance role in agricultural products procurement; it is, in essence, no more than a 'grain bank'.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Post Office Savings

Although some of the funds deposited in the PBOC can be returned to rural areas to support agriculture, in practice such amounts are rather small. Post Office Savings has thus become the largest sink for rural funds. In addition, Post Office Savings has, in the past, depended on interest income from the Central Bank for its survival. On 1 August 2003, the PBOC reduced the interest rate on savings in Post Office Savings from 4.1% to 1.9%, equivalent to the interest rate of deposit reserve funds. Post Office Savings is thus faced with great challenges to sustain its operations.

Agricultural insurance

China's agricultural insurance system is inadequate. Each year in China, some 30 million hectares (25% of the total cropping area) are affected by natural disasters,. At present, the response to disaster relies on governmental agricultural disaster relief implemented by civil affairs administrations, and commercial agricultural insurance provided by the state-owned People's Insurance Company of China (PICC). In practice, neither of these agencies provides satisfactory results. A resistance in rural households to buying insurance, and other factors, mean that the risk of financial loss still resides in financial institutions.

Since 1996 agricultural insurance has been run mostly by the PICC. At the beginning of the 1990s, agricultural insurance made great strides, income from the business reaching 830 million yuan in 1993. However, with the transformation of the PICC from a policy insurance company to a commercial insurance company, it could not afford the frequent deficits from agricultural insurance. From 1982 to 2001, the cumulative income from agricultural insurance was 7 billion yuan and the insurance indemnity 6.2 billion yuan. When costs are taken into account, the cumulative deficit in agricultural insurance would be about 600 million yuan. Since 1994, PICC's income from agricultural insurance has declined relative to value-added in agriculture. It accounted for just 0.03% of added value in 2000. Income from agricultural insurance was 330 million yuan in 2002, accounting for just 0.6% of the total income from all types of insurance. This was 20% lower than in 2003, representing the largest decline in 20 years. Furthermore, the categories of agricultural insurance have dropped from more than 60 to less than 30.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Government supports agricultural insurance primarily by waiving sales tax. It is estimated that—at a unified sales tax rate of 8%—the value of this exemption is 560 million yuan. Currently, there are no other economic supports for agricultural insurance. There appear to be two choices available: one is to set up a policy-oriented insurance company dealing exclusively with policy-related business; the other is for commercial insurance institutions to undertake government-subsidised agricultural insurance. In 2004, it was proposed in the No. 1 document of the central government that the establishment of a policy-oriented, agricultural-insurance system be accelerated. It would focus on selected products and regions for pilot schemes, and offer subsidies in insurance fees to crop and breeding industry farmers who buy insurance.

Domestic and international experience indicates that agricultural insurance has quasi-public goods characteristics. Therefore, its conduct as a fully commercial operation would likely result in market failure. Given its complexity and the high cost of supervision, agricultural insurance is extremely expensive and has limited profit potential. A policy-oriented agricultural insurance system implemented by government may be the better choice to support and protect agricultural development. If government and the market were to combine, government could determine the direction and quantities of the insurance supply and formulate a unified institutional framework within which various authorised organisations and institutions could operate agricultural insurance and re-insurance. At the same time, it could offer certain public financial or other kinds of support to agricultural insurance products.

In summary, China has made great efforts to reform the rural banking system during the past 10 years, but many of the problems prevalent in developing countries remain. There are still insufficient financial intermediaries in the rural economy, and funds are being channelled from rural areas to the urban sector. Another worrying issue is a massive bad debt (approximately 37% of loans are non-performing) within the rural financial system. Given limited capital and business activity to offset these bad debts, the survival and development of rural financial services are threatened. Insurance for agricultural activities must be improved, and this will likely require government intervention.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Informal finance

Informal credit

Financial activities that are not conducted through formal financial institutions include free credit, credit middlemen (*yinbei*) and private money shops, revolving savings and credit associations (RSCA), informal fundraising, pawn credit and informal commercial credit. Compared with the formal financial system in rural areas, informal finance is disproportionately active, implying that the formal rural financial system fails to satisfy the demand for financial services in rural areas. The main channel for rural family loans is private credit. It is estimated that 70% of loans for 50–60% of families come from informal channels. This number is commensurate with that of usurious loans obtained by TVEs through social channels. Although informal credit is comparatively prevalent in rural areas of China, the government is unable to regulate the activity because informal credit organisations operate largely underground.

Micro-credit

Micro-credit, a system first introduced in Bangladesh, refers to services to low-income groups (including poor households). Its essence is to finance those low-income groups able and willing to undertake economic activity, but which cannot obtain loans from traditional formal financial institutions. It assists households to rise above poverty through their own efforts.

Micro-credit pilot projects in China are greatly influenced by the Bangladesh model. Small-scale, micro-credit pilot projects were initiated in rural areas of China at the beginning of the 1990s by non-government and public organisations using foreign funds. In the mid 1990s, the Chinese Government launched micro-credit projects for anti-poverty objectives and by August 1998, these projects had been extended to 605 counties in 22 provinces, with more than a billion yuan in total funds. According to statistics of the ABC, governmental micro-credit projects had issued 25 billion yuan in cumulative total loans, with a balance of 24 billion yuan, supporting over 17 million poor rural households as of the end of 2001. However, since this kind of micro-credit cannot accept deposits and depends completely on external financial support, its coverage and growth potential are limited. Also, the kinds of projects supported are not sustainable, because most of them depend on subsidies.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

By 2002, the RCCs had launched extensive micro-credit projects, issuing loans of 9.7 billion yuan to rural households, with balance of loans of 76 billion yuan at the end of the year. They also issued 47 billion yuan group guarantee loans to rural households, with a value of 25 billion yuan at the end of the year. This micro-credit has now been incorporated into the formal financial system, acquiring a new organisational form and institutional basis and achieving wider development.

ANALYSIS OF THE DEMAND FOR RURAL CREDIT IN CHINA

Rural household demand for credit

Rural household demand for credit is generally for small loans. The scale of family business determines the scale of credit funds needed for family living and production. Because of a relatively developed economy in eastern areas, rural private enterprises and individual businesses in rural areas are generally more affluent, and thus invest more in the non-agricultural areas such as industry, commerce, construction and transportation. The demand for capital is thus relatively high and loans are bigger (typically up to 10,000 yuan) than those taken out in central and western regions. In the less-developed western areas, rural households have little opportunity to engage in non-agricultural businesses, so their loan size per household is small (typically 100 to a few thousand yuan). In central areas, economic activity and living standards are intermediate between western and eastern areas, as are the sizes of loans taken out.

Loans can be used for consumption, working credit and/or abnormal credit. In most areas, the consumption credit of rural households exceeds their working credit. There has been some increase in abnormal credit use. The main purpose of household consumption credit is to supplement insufficient income and savings, so as to meet the needs of living expenses such as house building, marriage and medical costs. Working credit can be directed to agricultural and/or non-agricultural production. Working capital loans for the latter are the main part of rural household loans in recent years. In agricultural production, inputs for planting can usually be satisfied by the rural household's own funds. Working credit is often used in animal husbandry, aquatic industry and non-agricultural production.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

After the rural reform, most rural household credit was used in production and business activities. In recent years, the demand for consumption credit has exceeded the demand for working credit, mainly because farmers' incomes have grown slowly or have even fallen since 1995. Poor rural households borrow money to survive, particularly in the less-developed parts of the country.

Rural households that can obtain loans from formal financial institutions are mainly the richer ones with higher social capital; most low-income households can obtain loans only through informal channels. Strong demand for consumption loans is satisfied mainly by informal finance (Ye Jingzhong et al. 2004). As the income level of a rural household increases, so does the tendency to borrow for production rise and the tendency to borrow for consumption fall. On average, rural households in which the borrower is in the 31–40-year-old age range are inclined to borrow working credit, while other age groups seek consumption credit (Shi Qinghua 2002).

Although rural household income levels have increased greatly in the past 20 years, assets that can be used as collateral are still limited. The most valuable asset, or the most significant asset to mortgage, is the house. At present, since a house is a rural household's basic living guarantee, the value of taking a house as collateral is limited. Taking a deposit receipt as collateral for a rural household's loan can reduce credit risk, but most rural households do not have bank accounts. Some rural households borrow another person's deposit receipt as collateral, which turns formal loans into informal loans. The best way to satisfy rural-household demand for loans is to finance them with little or no collateral, but this violates current principles of the formal financial sector.

It is difficult for rural households to deal with complicated loan procedures, because they generally do not fully understand them. In addition, rural-household loan needs often require rapid approval. Tedious loan procedures may delay approval until after the time when credit was needed.

Most rural households would like to get loans with a term of a year or longer and with low interest rates. This is not only an economically rational choice, but is also driven by weak economic competency, especially in underdeveloped areas. In addition, rural households want financial services that are close by and convenient.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There are many studies indicating that it is difficult for most rural households to obtain loans from formal financial institutions. Compared with the 1980s, the proportion of loans that rural households obtained from formal financial institutions has declined greatly. Before 1985, most loans were from the ABC and RCCs. This fell to some extent after 1990, but these agencies still accounted for about 40% of loans, whereas from 1995 to 1999, the proportion dropped below 25%.

Rural informal credit has the following characteristics. First, the proportion of loans with no interest is low and high rates are common. The understanding and usage of credit by rural households have undergone remarkable changes, with more and more farmers accepting loans with higher interest rates. Second, large loans are becoming more common. The proportion of small-scale credit for emergencies is on the decline, while the incidence of larger loans is steadily increasing. But all larger loans incur higher interest rates and often result in lawsuits. Third, credit instruments often do not follow accepted norms and frequently need only oral agreements. Even though there is a receipt for a loan, the content is very simple. Fourth, there are many delinquent loans, given the use of non-standard credit forms and a lack of effective regulation of rural informal credit. These loan defaults often cause disputes and are becoming an important factor influencing the stability of rural society. Finally, rural households in areas with a weak economic base have difficulty accessing credit given their poor credit status and the RCCs' low-quality credit services, weak financial capacity, and inadequate funds to support agriculture.

Township and village enterprise demand for credit

After reform, China's TVEs witnessed rapid development, with large increases in total economic volume. By the end of 2000, the gross domestic product (GDP) of TVEs accounted for 30% of the national GDP and 64% of the national rural social added value.

TVEs make various demands for financial services, with credit the main one. The sector features a high liability–asset ratio and a high proportion of informal direct financing to liability (Ma Zhongfu 2001). At present, formal financial institutions in rural China, such as the ABC and RCCs, can satisfy deposit demand of small and medium-size enterprises. For transaction services, banks such as the ABC have an advantage over the RCCs which, because of their management system, have a problem of slow transactions. On the matter of capital stock, the development process

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

of TVEs means that their capital sources are diverse, including cumulative inputs of rural government, fiscal investment, government fund-raising, employees' stock, individual accumulation, formal credit, informal credit and foreign capital investment.

Before the 1990s, TVEs faced soft credit constraints. This led to abnormal credit expansion and high debt-to-asset ratios. Investment behaviour of TVEs often reflected strong impulses for expansion, which increased further their large demand for capital. The start-up, investment and operation of TVEs were not based on their own capital but depended on full use of various credit relationships. TVE financing and capital growth relied strongly on banks and RCCs, with commercial credit, governmental credit and intra-enterprise credit also playing a role. Since the early 1990s, TVEs have faced a relatively severe macro-environment and market structure. Along with the acceleration of property reform and the rapid development of direct financing, it has become more difficult for TVEs to realise indirect financing because of a decline in their asset value and loan quality. Small-scale TVEs especially were often discriminated against in their development and financing.

At present, there are still some contradictions in the assets and financing structures of TVEs. First, the proportion of fixed assets is large while that of liquid assets is quite small, which means that TVEs face severe shortages of working capital for daily operations. Second, stock and receivable accounts are large and increasing, which exacerbates the shortage of working capital. Third, the assets and financing structures are seriously misallocated, with low quality of assets, resulting in high financial risk and weak ability to repay short-term debts. If the macro-economic environment becomes severe, the ability of TVEs to use market opportunities may be squashed by the enormous pressure of repayment, which will destabilise their operations. Fourth, extreme, long-term dependence on debt hinders the growth of capital and has an increasingly serious negative influence.

In the future, rural financial institutions will remain a main channel for indirect financing of TVEs, though it is a fact that TVEs have difficulties in obtaining loans as the ABC and RCCs reduced loans to them during 1995–2000. Meanwhile, the proportion of TVE loans to the total loans issued all over the country has been in steady decline, from 11% in 1995 to 5% in 1998. Considering the fixed-asset investment of TVEs, the proportion of loans from banks and credit cooperatives fell from 26% in 1995 to 18% in 1998. The financing channel for fixed-asset investment has changed from dependence on loans from financial institutions to a focus on invest-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ment by farmers, paying equal attention to loans and the absorbtion of idle social capital. In 2000, TVE loans from banks and credit cooperatives were 42 billion yuan, accounting for 16% of total investment.

EVALUATION OF THE PILOT REFORM OF RURAL CREDIT COOPERATIVES

In June 2003, the State Council announced 'the pilot project of deepening reform of rural credit cooperatives' and began a new round of reform of RCCs in the provinces or cities of Zhejiang, Shandong, Jiangxi, Guizhou, Jilin, Chongqing, Shaanxi and Jiangsu. This reform was extended to 21 provinces or cities, including Beijing, in August 2004.

This round of reform is focusing on:

- reforming the property-rights system of RCCs based on *faren* (independent business units), clarifying property relations, optimising corporate governance structure, and determining suitable forms of property rights according to different situations
- reforming the management system of RCCs, and handing over management authority of RCCs to local government.

Compared with earlier reforms, this round has made important breakthroughs in several areas. First, the system of property rights of RCCs has been diversified. Different rights patterns can be chosen according to the level of economic activity in the district and institutional operating state, such as joint-stock commercial bank, cooperative banks, *yiji faren* (completely independent business unit) or *erji faren* (affiliated RCC with independent business). However, whichever pattern it chooses, the RCC needs to verify assets and capital, broaden the scope of equity forms, and adjust equity structure based on its original shareholding. In order to diversify investment structure and keep control of RCCs away from minority interest groups, the PBOC has set some requirements for RCCs with different equity proportions (Table 8.1).

Second, the central government has allocated 38 billion yuan to RCCs in pilot areas to be used for assimilating non-performing loans. They have two options: one is *Zhuanxiang Daikuan*, a type of re-loan or on-lending with a low interest rate; the other is *Zhuangxiang Piaoju*, bills or bonds issued by PBOC which can be cashed-in when RCCs reach the requirements on non-performing loan (NPL) ratio and capital adequacy ratio set by the PBOC. Both are issued specifically for pilot reform RCCs and are used to deal

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

with NPLs. The detailed amounts are checked and ratified by the PBOC, based on half of the actual insolvency amount at the end of 2002. Meanwhile, government also offers a subsidy to RCCs that are incurring losses, to compensate for their obligation to provide inflation-proof bank savings by following macro-policy of China from 1994 to 1997. The amount of the subsidy is determined in accordance with the actual payment made on the inflation-proof interest subsidy. In terms of tax, from 1 January 2003 to the end of 2005, all pilot RCCs are exempted from enterprise income tax temporarily in western areas, while the pilot RCCs in other areas are exempted from half of the income tax they should otherwise pay. Since 1 January 2003, the tax rate for all RCCs in pilot areas has been 3%. Moreover, RCCs in pilot areas are allowed to implement flexible lending rates, which can fluctuate between the benchmark lending rate and double that.

Table 8.1 Equity structure qualifications for pilot reform of rural credit cooperatives in China

	Employee	Individual investor	Single *faren* and affiliated enterprises
Rural commercial bank	≤25%	≤5‰	≤10% 5% disclosure
Rural cooperative banks	≤25%	≤5‰ total ≥30%	≤10% 5% disclosed with records
Unified *faren*	≤25%	≤5‰ total ≥50% starting point 1000 yuan	≤5% starting point 10,000 yuan

Third, this round of reform has given more freedom to local government. The reforms have two goals:

- to transfer the management authority of RCCs to local governments, making them bear the responsibility of supervision, guidance, coordination, and service for RCCs. They are to do this by setting up provincial or city-level rural credit cooperative unions, and county-level rural credit cooperative unions, thereby separating industry management from bank regulation.
- to reduce the dependence of RCCs on central funds, establishing a mechanism of self-restriction and self-risk-bearing, but at the same time avoiding administrative intervention in RCCs due to authority handed over to counties and towns.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

During the course of the pilot reform, local governments are required to resolve the other half of non-performing loans by self-financing. In terms of designing the reform project, the central government put forward guidelines only, and local governments are expected to devise pilot reform measures and implementation details for the reform.

Evaluation and reconsideration of pilot reform of rural credit cooperatives

Combining the reform measures and their implementation, we find that, although this round of pilot reform projects of RCCs has made important breakthroughs compared with earlier ones, there are still problems in executing the process. First, there are many historical burdens and NPLs in RCCs that were caused, directly or indirectly, by central policy. Reform of RCCs will be difficult if these burdens are not removed. It would be reasonable for central government to help RCCs to solve half of the historical burdens in this round of reform. At the same time, it is also reasonable policy to compel local governments to take responsibility for RCC reform by setting a series of requirements for acquiring re-loans and cashing special bills. Nevertheless, during the implementation process, local governments have tended to make full use of the reform policy to maximise their own rents when exposed to the temptation of so great an amount of capital from central government. In order to obtain this capital, local governments adopted administrative measures to meet the requirements for capital-adequacy ratio and equity structure because it was the most effective and quickest way. The approach commonly used to reduce NPL ratio is to enlarge the denominator—that is, issue more new loans—while the approach commonly used to increase the capital-adequacy ratio is to increase public financial input, enlarge capital and expand stock.

Under these measures, the proportion of NPLs fell markedly and capital-adequacy ratios greatly improved (Table 8.2). By the end of June 2004, NPLs in eight provincial or city RCCs had fallen by 29 billion yuan compared with the beginning of the year. Also, the RCCs made 1.4 billion yuan in profit. Between the end of 2002 and the end of June 2004, RCCs in eight provinces or cities expanded their shareholding by 33 billion yuan and their capital funds reached 44 billion yuan, giving a capital adequacy ratio of 5.7%.

Table 8.2 provides some details of outcomes in six pilot reform provinces. The performance in Jilin Province looks especially impressive: by the end of June 2004, the balance of shares added up to 6.6 billion yuan, about 20 times more than the initial shares, and the capital-adequacy ratio increased from –53% to 6%. After

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

thorough investigation, it was found that Jilin Province, to make these great achievements, allocated the task of buying shares through administrative means and promised incentives to those who bought shares. Every employee bears the task of mobilising community members to buy shares, besides buying shares allocated to them. Moreover, the fulfilment of the task affects the performance assessment of the employees. The incentives include dividends, priority in loan applications, larger loans and a relaxed mortgage ratio, and a prime lending rate. Note, however, that the rapid expansion in the value of shares may be the source of a potential credit crisis. This is especially so given increased administrative intervention in RCCs by local governments, which will likely hamper further development of the rural finance market in Jilin Province.

Second, the pilot reform encourages each region to choose a pattern of reform suited to its level of economic development. While this is appropriate for China, which has diverse levels of economic development across the country, in practice most areas have chosen to establish county- and provincial-level rural credit cooperatives unions (RCCUs). The effect is 391 county-level *faren* unions, 6 rural commercial banks and 55 rural cooperative banks in 8 pilot provinces (cities). Where this reinforces administrative control, it also leads to a monopoly for each RCCU in its respective rural financial market. With reduced market competition there will be less innovation in the rural financial system.

According to the institutional requirements, the unions are to be cooperative organisations that are established through voluntary investment by member RCCs and they are to be managed democratically through a board of directors, a supervisory board and a stockholder conference. Many leaders of the unions are still appointed administratively, however, and some government officials still take up positions. This means that RCCUs have become administrative institutions.

Table 8.2 Comparison of loan capital circumstances before and after the pilot reform of rural credit cooperative in six provinces or cities in China

		Jilin	Jiangxi	Shanxi	Jiangsu	Chongqing	Guizhou
Non-performing loan proportion (%)	before	43.3	44.8	39.2	29.6	36.4	27.0
	after	13.8	35.2	27.5	10.9	26.2	13.8
Capital-adequacy ratio	before	−52.85	−7.10	−3.1	−2.8	−6.0	−0.9
	after	5.45	5.19	3.7		2.4	2.0

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Third, the intent of transferring management authority to local governments was to make them bear the responsibility and risk of RCC reform, to encourage RCCs to show self-restraint and self-risk-bearing, and to avoid heavy dependence on central capital. While it is true that in many developed, market-economy countries local governments exercise regulatory control of such financial institutions, local governments in China are pursuing political as well as economic objectives. They have goals of developing regional economies and increasing taxation incomes. Thus, it is inevitable that they will, through administrative decisions, interfere in capital allocation and the operation and management of RCCs. In addition, the pilot project requires RCCs to take responsibility for supporting the three agricultures (*San Nongs*), and this will make it possible for local governments to intervene through policy instruments.

Fourth, while the goal of this round of reform is to clarify property relations and improve corporate governance structure, there is a shortage of regulations related to property right and corporate governance in concrete reform measures. The result is that the pilot reform of RCCs is making only superficial adjustments and the internal organisation and management system remain unchanged. The personnel of RCCs change little: stockholder conferences have no real effect and neither have all sorts of elections; as *yiji faren*, county-level RCCUs still are not responsible to stockholders and members but to provincial-level RCCUs; the democratic rights of members have not been truly guaranteed. RCCs are officially controlled in the long term and lack the basis of public participation. Rural households and rural enterprises can hardly be enthusiastic about buying shares and participating in democratic management when property right is ambiguous and not well protected.

Fifth, it is not easy to get farmers and large rural business enterprises to voluntarily buy stocks in RCCs that show weak operational performance and when property rights were destroyed in the earlier rounds of reforms. In terms of equity structure, by the end of June 2004 the total capital stocks of RCCs in the whole of Jilin Province amounted to 6.6 billion yuan. Farmers' stocks had risen to 2.3 billion yuan, accounting for 35%, with the stock of employees of RCCs and big business enterprises accounting for 65%. The proportion of total equity held by farmers is too low to satisfy the POBC requirement for establishing a unified legal entity.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Recommendations for deepening the reform of rural credit cooperatives

The first recommendation for deepening the reform of RCCs is to allow a larger degree of diversification during the course of reform. This would acknowledge that there are many less-developed areas in the extended pilot provinces, cities or districts, and that the differences in economic development and markets among pilot areas are now even greater. The transfer of management authority to local governments should be differentiated according to local economic level and the development of markets. In areas with developed economies and markets, management authority can be transferred to local governments but the authority of local governments should be clearly defined and those who exceed their authority should be penalised. In other areas with less-developed economies and markets, caution should be exercised in the handing over of management authority. The reason is that the lower the economic level, the more the hunger for capital. When local governments can obtain little capital, they tend to act aberrantly in order to meet the requirements for accessing capital from central government. Meanwhile, local governments are able to control the financial resources of RCCs more easily when the market cannot allocate resources efficiently.

Second, implementation of the reform should be evaluated and mechanisms for timely revision established. The criteria for evaluation should be simple and emphasise capital-adequacy ratios and NPL proportions achieved. The changes in property-right structure and fulfilment of democratic management should also be taken into consideration in the requirements for acquiring re-loan and cashing special bills, except for capital-adequacy ratio and NPL proportion. Where necessary, penalties should be applied for failure to meet objectives. The key reason for aberrant behaviour by local government in the former stage of pilot reform was that the reform emphasised only a few criteria and the process was not evaluated or audited.

Third, the requirements for property-rights relationships and corporate governance should be stated explicitly in the measures for pilot reform. Thus, the property and democratic rights of RCC members can be protected. To improve management of property rights and corporate governance, the first step should be to establish laws and regulations to identify and protect the various rights of RCC members; second, considering the lack of public participation in RCCs, it is necessary to cultivate the awareness and participation of rural households, large crop and livestock farmers

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

and rural enterprises and to protect their democratic rights; third, a key factor in the reform is radical change in the personnel of RCCs to ensure that leaders at all levels are elected in a truly democratic way; finally, fair competition among RCCs should be encouraged and strengthened, and RCCs should be allowed to establish unions voluntarily, to unite or incorporate and to set up branches across different areas.

RECOMMENDED FURTHER REFORMS TO THE RURAL FINANCIAL SYSTEM

Building a diversified rural financial service system

A primary recommendation is that the ABC should, on the basis of commercial principles, enhance its support to leading enterprises and small and medium-scale enterprises engaging in agricultural industrialisation. The 'off-agriculture' tendency of the ABC in recent years should be reversed, and it should be developed into a bank that comprehensively supports the development of the agricultural and rural economy by providing the full range of financial services. A defined portion of deposits obtained in rural areas by the ABC should be channelled into agricultural credit.

Policy-oriented finance is an important and widely adopted supporting mechanism in accordance with requirements of the World Trade Organization agreement. Its essence is quasi-public finance, which is an effective combination of public and private finance. The Chinese Government should utilise the ADBC to integrate capital input into the countryside, and distinguish compulsory public financial inputs from subsidiary ones. Central and local governments should invest in rural public roads, significant ecological and environmental construction projects, and in research in basic agricultural science. Public-finance departments at central and provincial levels should set aside some funds for compensatory public-financial expenditures; that is to say, they should support policy-oriented financial institutions with an interest subsidy and compensation for losses due to bad or idle loans, and attract social capital to flow into agriculture and rural areas through use of small amounts of public-financial funds.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The ADBC's medium and long-term functional orientation could support improvements and progress in the following fields:

- a regulatory and control system for the main national agricultural products such as grains, cotton and oilseeds
- infrastructure construction in rural areas, and improving the conditions of agricultural production and rural living
- agricultural structural adjustment to increase farmers' incomes
- agricultural research and development, and the application of new technologies, new products, new bio-resources etc. to strengthen agricultural competitiveness
- development of agriculture and the rural eco-environment, and promotion of sustainable development of agriculture
- regional poverty alleviation initiatives to accelerate the pace at which rural people can cast off poverty.

In addition, intermediary business roles could be developed. These would include, for example, acting as a surrogate to handle the allocation and settlement of public financial funds used to support agriculture, on-lending of loans related to agriculture from international organisations and foreign governments, and agricultural insurance. Similarly, the service function of the ADBC should be strengthened. The ADBC should move away from total reliance on Central Bank re-loans, and directly finance from the capital market by issuing bonds. In this way, the ADBC would expand from a pure 'grain bank' to a comprehensive policy-oriented bank, providing better support for agricultural development, rural infrastructure construction, agricultural structural adjustment and the import and export of agricultural products.

These reforms proposed for the ADBC could be linked to changes to Post Office Savings. For example, Post Office Savings could be required to purchase ADBC's bonds. Second, the Central Bank could transfer Post-Office-Savings deposits to credit cooperatives by means of re-loans. An alternative would be to sever the financial relationship between Post Office Savings and the Central Bank and make the Post-Office-Savings business an agent of the RCCs or ABC for deposit funds obtained from counties or below. If implemented, this combination of recommendations would serve to keep more of the capital absorbed by Post Office Savings in rural areas to promote a healthy internal circulation of rural capital.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Encouraging and supporting the development of rural micro-credit institutions

Informal finance plays an important role, but does not receive the status it deserves. It emerged as a result of unsatisfactory financial institutions, dualistic characteristics of finance and difficulties in getting institutional finance in rural areas. Informal finance has played an active role in enlarging the capital base for rural production and operations, generating a flourishing rural financial market and improving financial efficiency. It has been especially important in promoting the development of individual and private enterprises in rural areas. Nevertheless, because it operates largely underground and is subject to high potential risk of losses, the government cannot effectively regulate the informal finance market. This limits its ability to bring informal finance into full play.

It has been 10 years since China implemented micro-credit pilot projects based on models from other countries. In 2001, RRCs began micro-credit business and, by the end of 2001, up to 32,000 of RCCs (about 80%) had a micro-credit service. About 25% of crop farmers took up this kind of loan. But most micro-credit projects were sustained by re-loans from the PBOC, and covered limited areas and people. Micro-credit should become a key business of RCCs and measures should be adopted to gradually expand non-mortgage loans and mutual guarantee loans. Micro-credit institutions, more generally, should be developed on a path toward sustainability.

Building on the community information they possess, RCCs should extend their efforts to launch household micro-credit and group guarantee loans by appraisal of the credit worthiness of rural households, villages and towns. Some towns, villages and even households are selected as credit towns (*Xinyong Zhen*), credit villages (*Xiyong Cun*) and credit households (*Xinyong Hu*). However, as the whole society is in a process of transition, the credit environment is far from satisfactory. The repayment rate for rural household loans of RCCs is tending to decline, which seriously affects the activity of financial institutions. In recent years, many enterprises engaged in supply and marketing, grains and TVEs, have defaulted, decamped and left loans at banks and RCCs. Seizure and appropriation of loans for poverty alleviation is prevalent and loans were often taken as grants rather than requiring repayment. Poor contract enforcement seriously affects credit risk and restricts investment of banks and RCCs in rural areas and rural enterprises.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In addition, the role of NGOs in micro-credit projects should be confirmed. Local governments and financial institutions should take measures to reduce related controls and intervention, and endow non-governmental micro-credit institutions with legitimate roles. Although governmental micro-credit projects have not yet been implemented efficiently, their coverage is much broader, enabling many poor farmers to benefit from them. The projects are significant in satisfying the financial needs of low-income farmers. However, implementation needs to be improved. The government should also encourage international and domestic organisations to establish peer-supervisory projects or other innovative projects targeted at poor people. As part of this initiative to build a micro-credit system, rules governing entry to the rural financial markets should be relaxed. This should be combined with policy initiatives to develop and cultivate informal financial institutions that will foster a diversified, efficient rural financial organisational system and provide effective competition in the delivery of financial services in rural areas.

Special attention should be paid to confirming the significance of informal lending in accordance with market principles. Measures should be adopted to actively guide the development of informal credit organisations, to curb illegal financial activities, and to gradually legalise non-institutional finance and the dynamic interaction between institutional and non-institutional financial markets. Government could privatise RCCs and allow them to establish branches in other counties. In addition, government should allow privately owned banks to be set up and should encourage overseas banks to participate in rural financial markets. Furthermore, following the practices in other countries, establishing rural savings and credit associations (RSCAs) is an alternative. RSCAs are established on the basis of existing affinity groups. In most cases, these organisations are regional and mainly serve intra-community members. Each affinity group forms an informal regional network to evaluate loan applicants. This model can be tested and extended in Chinese rural areas where non-governmental and informal credit institutions and projects are widely available. To establish RSCAs requires an improvement of laws and regulations that are beneficial to the sustainable development of micro-credit. The Banking Regulatory Commission of China should clearly define property-rights relationships, and modify laws and regulations to ensure the transparency and governance system for healthy development of such credit institutions. If the experiments succeed, it will be possible to replace and effectively supervise some informal financial institutions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Reform of an inflexible set of interest rates

As interest rate controls still exist, depositors and micro borrowers face credit quotas and their capability for savings and lending is constrained. Since the business of micro-credit increases the management cost, the PBOC permits loan interest rates to fluctuate within a certain range. Nevertheless, loan interest rates permitted by the PBOC are still too low to provide an attractive return on assets to rural credit institutions. There is still a commercial survival problem for these institutions. Interest-rate control distorts resource distribution, and induces improper resource distribution and rent-seeking behaviours. Moreover, when the inflation rate is relatively high, real interest rates may be negative, which would discourage people from holding savings in the form of deposits. As a result, the development of financial services is slow, and cannot meet the demands of small enterprises and households.

Continued interest-rate control will distort the price of capital, lead to unreasonable allocation of capital and will do harm to economic benefits and sustainable development of rural financial institutions. Strict implementation of an official interest rate will block the development of RCCs and micro-credit. Interest-rate control should be relaxed gradually, with rates allowed to float within a wider range on the basis of market demand, to meet the requirements of commercial financial institutions operating in rural financial markets. Since financial markets are closely interrelated, the opening-up of interest rates is unlikely to be achieved without interest-rate liberalisation in the whole system.

Until financial markets are fully developed, a series of policies should be adopted to keep real interest rates of deposits positive and to control the growth of interest rates of both deposits and loans. To meet the problems of credit distribution and excess demand resulting from that, government may provide external financial support, on the premise of not impairing the motivation of financial institutions to mobilise savings. In other countries of Asia, increasing the interest rate on deposits greatly improved savings.

Establish a credit security mechanism for rural financial institutions

The fragility and high risk of agriculture lead to rural loans being of higher risk than those for industrial and commercial purposes, and rural financial institutions being exposed to higher risks than those faced by other financial institutions. At the same

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

time, rural credit services are highly dispersed, which also increases the operating cost of financial institutions. For the same reasons, commercial insurance institutions are not willing to write agricultural insurance. Due to the limited financial capability of the government, policy support for rural financial institutions is far from satisfactory.

It is necessary to establish a deposit insurance company, to strengthen the credit standing of rural financial institutions, and to reduce the potential risks of financial institutions leaving the market. At the same time, a series of measures should be adopted to avoid a low repayment rate of loans caused by incomplete information in rural financial markets, e.g. group guarantees on lending and collective cooperation among borrowers. The establishment of rural social credit systems, as well as a healthy rural credit environment, will help resolve the asymmetric information problems between lenders and borrowers.

Strengthening supervision

The PBOC has been undertaking dual roles. It exerts a financial regulatory function and has become the administrator of RCCs since they left the ABC. The dual roles often conflict and this is widely regarded as one of the origins for many of the problems RCCs face. Until now, the regulatory pattern for RCCs has not differed from that for other financial institutions, and there has been no special regulatory framework for the rural financial market. To avoid the PBOC blurring its responsibility as a regulator of RCCs as well as an administrator, its regulatory functions have been handed over to the newly established China Banking Regulatory Commission (CBRC). Whether or not current problems can be solved efficiently and practically following these adjustments remains to be seen.

The successful operation of financial institutions depends on public confidence. To realise this, clearly defined laws and procedures are required for the accounts, audits and financial reports of financial institutions. Second, stable economic growth is needed. Under this condition, small enterprises are able to invest in new projects, constantly obtain profits to repay loans and, at the same time, help resolve local unemployment problems and provide services and products required by the market. In order to create such an environment, government needs to establish a set of efficient supervisory and control systems that reflect new thinking on these matters, and thereby improve its efficiency and quality. At the same time, the system should be equipped with measures for implementation of laws and regulations.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Addressing constraints to development of a diversified rural financial system

The objective of micro-credit projects is to help low-income rural families to reach an income level at which they could begin to access normal financial services. However, many of the projects did not establish special institutions in order to sustain their development. Other financial services based on market interest rates thus have difficulty competing with micro-credit services, due to the subsidies the latter receive. As a result, the development of rural financial services has been affected, especially in the poorer counties.

While formal loans generally need mortgages, it is difficult for farmers to meet the requirements of mortgages. The largest asset they possess is land, but they do not hold the ownership right, and the market for land-use rights has just been established. In Vietnam, a certificate of land-use right can be used as collateral to obtain mortgages. After certification of land-use right was promoted, loans taken by farmers increased. Other loan practices also need to be considered: displacement of mortgage, loan information system, and credit evaluation tools, as well as classification and evaluation of loans. So far, shortage of these financial standards and operating procedures has resulted in serious conflicts within rural financial institutions over ownership, corporate governance, management skill and employee incentives.

Managers, directors or other employees must be directly responsible for the growth in bank assets (and these people's remunerations should be based on the performance of bank assets). Otherwise, loan practices are always filled with more political elements than financial considerations. At present, because there are no incentives, few people are willing to engage in improving asset quality. Research by Chinese economists proves that investment quality and loan return rate would be improved with more competition. Nevertheless, the finance industry is, at present, strictly regulated. Consequently, there is little competition, especially in rural areas, a circumstance that has led to monopolisation by the RCCs.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REFERENCES

Ministry of Finance 2003. Financial annual of China 2003. Beijing, People's Republic of China.

Shi Qinghua 2002. The research about rural household saving and credit behavior on the whole and its evolvement trend. China's Economic Issues, 6, 66–78.

Ye Jingzhong, Zhu Yanjie and Yang Hongping 2004. Rural household's financial demands and rural financial supplies from the perspective of sociology. China Rural Economy, (August).

FURTHER READING

Chen Xiwen 2002. Research on the usage of capital for assisting rural economy by Chinese Government and the related management system. Report on the project.

Gerry, J.G. and Xiao, E.S. 1994. Currency in financial theories. Shanghai Sanlian Bookstore, People's Publishing House of Shanghai. (in Chinese)

He Guangwen 2003. Financial transition of China's rural economy and diversification of financial institutions. Research report.

Ma Xiaohe 2003. Dilemmas and ideology of reform of current China rural finance. Research report.

Ma Zhongfu 2001. The cooperative financial development research in rural China. Beijing, China Financial Publishing House.

Rimond, W. and Smith, G. 1994. Financial structure and financial development. Shanghai Sanlian Bookstore, People's Publishing House of Shanghai. (in Chinese)

Xiao, E.S. 1988. Financial deepening during the process of economic development. Shanghai Sanlian Bookstore, People's Publishing House of Shanghai. (in Chinese)

Zhang Hongyu 2003. China rural financial organizational structure: efficiency, defects and system innovation. Research report.

Zhang Xiaoshan and Ma Zhongfu 2002. Linking farmers to market—a research on rural intermediary organizations of Chinese farmers. Beijing, Social Science Publishing House of China.

Zhang Yuanhong and Ma Zhongfu 2002. The theories and practices in the process of contemporary rural financial development. Jiangxi People's Publishing House.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PART THREE

A NEW FRAMEWORK FOR CHINA'S GRAIN (FOOD) SECURITY

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 9

FOOD SECURITY

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

9.1 FOOD SECURITY SUCCESSES AND DEFINING A NEW APPROACH

CCICED ARD Task Force members

The importance of food security in China's development strategy is well-recognised, but it also has significant cost. The task force believes that, if China redefines its national food security goal and shifts its focus to household food security for the poor, the nation's development targets and poverty-reduction objectives can be met without compromising the nation's food security.

China is one of the most food-secure developing countries in the world, a status achieved through many decades of hard work. China's success in increasing food and fibre supply in the past 50 years to satisfy its growing population has been widely recognised. From a nation that could not meet minimal nutrition needs of its population in the early 1950s, per-capita food availability reached 3040 kcal per day in 2000, a level that is 14% higher than the average of developing countries and 8% higher than the world average. Since the early 1980s, China has shifted from being a net food importer to a major net food exporter to world markets. The improvement in food security both in terms of national aggregate supply and in relation to average household living standards creates a healthy social and political environment and lays a sound foundation for economic development. Furthermore, China has a foreign exchange reserve ranked second in the world. These financial reserves could assure food purchasing power if the nation were to experience short-term grain shortages.

Despite the record of recent years, as in previous episodes of price increases (e.g. 1988–89 and 1994–95), there has been a resurgence of concern about China's grain security by national leaders after prices rose between late 2003 and the first six

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

months of 2004. In response, the government launched several policies to promote grain production. For example, a 10 billion yuan direct subsidisation program was implemented in 2004 that is supposed to distribute cash payments to farmers in areas that are major grain producers. Leaders are planning to expand this subsidy program. Perceiving part of the problem to be a fall in cultivated land area, leaders imposed strict controls on the conversion of cultivated land to non-agricultural uses. The nation's Grain for Green program, one of the largest land set-aside programs in the developing world, was also drastically scaled down.

The actions taken by the government in 2004 raise several critical questions. Is China's food and grain supply security a serious problem? What will the situation likely be in the future? What priority commodities should be covered by a food security plan? Should China shift its focus from aggregate supply of food to household food accessibility? What is the impact of the conversion of land to industrial and infrastructure use? Has the Grain for Green program contributed to the recent price rises? Can China rely on long-term productivity growth for grain security?

FOOD AND GRAIN SECURITY

Because of the tremendous progress that China has made toward ensuring its national food security over the past five decades, the task force suggests that *there are currently no serious threats to national food and grain security in China*. In 2003, both exports and net exports (export less import) of food and grain reached historic highs. Beginning in the mid 1990s, China's grain production and grain stocks were so high that they led to more than five years of falling grain prices. As a natural consequence of the laws of supply and demand, production gradually fell during this time. By early 2003, the excess supplies of grain in storage (in government stocks and in household reserves) that had hung over China's grain markets for the previous several years gradually disappeared and grain prices began to stabilise. The increase in grain prices at the end of 2003 and throughout the early months of 2004 should be viewed as a normal and expected market reaction resulting from many years of low prices. All modern, market-oriented agricultural economies operate this way.

The rising grain prices in late 2003, far from signalling a problem in the grain sector, should be interpreted as a return to a normal market environment, providing leaders with an opportunity to meet other policy objectives. China's grain prices in May

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

2004, when measured in real terms, were about the same as average grain prices during the mid 1980s and early 1990s and lower than those in the late 1980s and the mid 1990s. The increases in grain prices should be welcomed and be seen as a victory for China's policies that were seeking to raise farm incomes. When China's farmers have faced high grain prices in the past, they have responded. High prices provide farmers with incentives to produce. In fact, they have already led to significantly higher production of wheat and early rice in 2004. Many believe that grain production in 2004–2005 will rise. Hence, high prices play a role in national food security. Finally, grain price increases provide a good opportunity for deepening grain-market reform.

While China appears to have attained a high degree of food security in terms of national aggregate supply, there are still households that do not always have access to enough food, part of China's remaining poverty problem. Despite the rapid reduction of poverty in China over the past two decades, there are still more than 100 million people in both rural and urban areas below the international poverty line (US$1/day in purchasing power parity terms). Many poor households occasionally suffer from hunger or malnutrition. The reason for this is not that there is not enough food being produced throughout China. Neither is it because there is not enough food available. The major problem for such households is that they often suffer from lack of entitlement (that is, such households do not have access to enough income to purchase the food that is available on the market). Hence, while there has been significant decline in the number of people in poverty and poverty-reduction efforts will continue to make progress, for the foreseeable future, China will still be home to many poor people and this poses the greatest food security threat.

The poor quality of China's food and potential food-safety problems pose another possible set of food-security concerns. According to some estimates, nearly 25% of cultivated land is contaminated to varying degrees by the over-use of inorganic fertilisers and pesticides. Soil and water scientists have found that fertiliser residues especially (in the form of nitrates) have been increasing in the soils and water sources in certain areas. Although it is unclear how such figures are generated, it has been reported that about 10% of China's grain, more than 20% of livestock products and nearly half of the nation's vegetable and fruit production suffer from quality problems. Excess fertiliser and pesticide use is also a waste of resources and an avoidable cost. Perhaps more worrisome, given the rapid increases in livestock production, is the high incidence of animal diseases and pests, and the serious

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

problem of animal wastes. Such problems are not solved by trade policies or by trying to force farmers to produce more (in fact, such policies often lead to poor food quality and food-safety problems), but rather are addressed by increased investment in agricultural research, extension and rural education.

Although some aspects of the nation's grain-reserve management system have been improved during the past several years (e.g. the separation of commercial trading from storage operations), it is still one of the weakest and least understood parts of China's food-security program. In many ways, despite the reforms, the grain-reserve system is dysfunctional. The rules for management and release are unclear. When should grain be sold? How much of it? At what price should grain be sold? At what price should grain be purchased? It has been estimated that China is wasting millions of dollars and prices are not being stabilised. There is also confusion among the different holders of grain. What is the role of the provincial and local grain reserves? How can provincial authorities coordinate their actions with the national government's grain reserves? The lack of transparency creates chaos in grain markets and contributes to variability in grain prices. Since no one knows the level of stocks or the quantities of planned (or actual) release, domestic producers and traders and international trading agencies cannot make decisions based on full information. Indeed, the national grain-reserve system is directly responsible for the absence of any grain storage by the private sector. Private trading companies and commercialised state-grain corporations cannot hold stocks since they would be at the mercy of unpredictable administrative decrees. In short, China's grain system operates in a way that is not transparent, is not accountable, and is at odds with the nation's market system. No other country runs its grain reserve like China. In fact, economists have shown that, during the 1990s, China's grain management system made China's prices fluctuate more than in the past and more than prices on the world market.

The most important reason to reform China's grain system and food security, however, lies in the productivity of its agricultural sector. Research by China's own economists has shown that, in the future, even if the nation completely liberalised all trade (which is beyond its current trade commitments under the World Trade Organization), most important agricultural products would continue to be produced at or near self-sufficiency levels. If China increases its investment in agricultural research, extension, irrigation and better manages its land and water resources, self-sufficiency in cereals will remain above 90%. Importantly, if leaders aggressively invest today, rice and wheat—the nation's major food grains—will still be almost

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

fully produced in China in 2020. Projections indicate that China will continue to export rice to East Asian countries, with self-sufficiency rates reaching 104–108%. Wheat will remain at 93–98% self-sufficiency. Although the nation would become a net importer of feed grains, soybeans, edible oils and sugar (which would promote trade relations with many important trading partners), by 2020, the export of vegetables, fruits, livestock and aquatic products will make China an even more important net exporter of food.

In short, even under a completely free trade regime, China would not have a food-security problem. This is because, at a national level, the overall extent of climatic variation across the landscape (and thus variation in grain production) in China is lower than almost all countries in the world. Importing 10% of grain for feed is feasible for China and should not be considered as a threat to national food and grain security. Ten percent of China's grain demand is equivalent to only 2% of the world's total production and less than 10% of world grain trade. This level of imports will not have a great impact on national grain security. The main way China can protect its food and grain security is to invest in agricultural technology and water management and promote poverty-reduction programs that will raise the incomes of China's poor.

FOOD SECURITY AND CHANGES IN CULTIVATED LAND

The task force also believes that the concerns of the government over the conversion of cultivated land to industry, urban building projects and forests are unwarranted. Unlike the current policy debate—which is not based on reliable data— the task force brief on cultivated land protection provides recommendations using a new and powerful set of data. In short, we find that the impact on grain prices of all conversion of land since the mid 1980s until today is very small and plays almost no role in the recent rise in prices. Research by the Center for Chinese Agricultural Policy also shows that Grain for Green has not affected food security and is not an important cause of recent price increases. Slowing down the growth of the non-agricultural sector and stopping China's land set-aside program to pursue a policy of restricting the conversion of land to other uses does nothing but hurt China's modernisation and environmental goals while having little impact on food security.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

POLICY RECOMMENDATIONS

The following are the task force's major policy recommendations on food security:

Shift emphasis from grain security to food-grain security

In order to maintain the spirit of China's food and grain security policies without imposing excessively costly and ineffective restrictions, the national government should redefine its food-security goals in terms of rice and wheat.

Shift emphasis from aggregate national food supply to household food accessibility

High priority should be given to poverty-reduction efforts that aim to raise the average incomes of the poor and protect them against negative income shocks.

Emphasise long-term productivity growth instead of short-term subsidy program

China's food-grain security will rely mostly on raising long-run productivity. Subsidy programs such as the 'Grain direct subsidy' that was implemented in early 2004 will be very costly, will not be appreciated by households in the long run, will reduce the government's fiscal resources for public services, and have much less effect on national grain security than investment in R&D, extension, education, health, irrigation and other rural infrastructure. China should not follow other countries, but rather should build a productive, undistorted (by subsidies) agriculture that raises the income levels of its producers and provides the nation with a high degree of food security.

Balance land uses between agriculture and other activities

Efforts are needed to ensure that land-use policies do not impede the ability to continue rapid industrial growth. Employment, income and productivity growth are all associated with the conversion of land from low-productivity agriculture to high-productivity industry and services. Good land-use planning is needed. Land-use policies should not be homogeneous nationwide and priority should be given to fast-growing industrialising regions. Food security should not be invoked as reason for slowing Grain for Green.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Change national grain-reserve management practices

Leaders need to undertake grain-market reform and change the management practices of the grain-reserve system. Rules for storage, purchases and sales of grain reserves need to be clear. No nation that wants to run a modern and efficient agricultural economy can keep its stocks secret or have an opaque reserve system.

Improve China's food-quality regulation and monitoring system

To ensure food quality and safety, international standards should be consulted to modify China's Food Sanitation Law or set up new regulations. Many countries are willing to share information on their food-safety and quality-assurance programs.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

9.2 CHINA'S FOOD SECURITY

Jikun Huang
Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Beijing, People's Republic of China

Scott Rozelle
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

INTRODUCTION

China's effort and success in increasing food and fibre supply to meet its growing population in the past 50 years is well-recognised. Per-capita food availability reached 3040 kcal per day in 2000, a level that is 14% higher than the average of developing countries and 8% higher than the world average (FAO 2002). Moreover, China shifted from being a food net-importer to a net-exporter in the early 1980s and became one of the developing countries with the highest food and grain self-sufficiency, which contributes significantly to world food security.

There has been growing concern over China's grain security by national leaders and the public since late 2003. Several events contribute to this concern. First, after grain production and storage reached historically high levels in 1998 and 1999, both fell continuously thereafter (NSBC 2004). Second, it has been frequently reported in the media that there has been a large decline in cultivated land as a result of rapid expansion of economic development zones (or districts), housing and other uses of land in both urban and rural areas. Third, the outbreak and impacts of SARS in 2003 revealed the weakness of government in dealing with various national crises

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

and security, including grain supply. Since then, leaders have called for plans and solutions to meet an emergency in grain supply should the nation face serious grain shortages in the future. The last, and probably the most important event, is the increase in grain prices in the autumn of 2003 and spring of 2004. Many agricultural officials and scholars claimed that China's grain supply is facing a great challenge and predicted that China will encounter grain crises in the coming years.

In response to the nation's grain-security concern, the government recently launched several policies to promote grain production. In 2004, an income-transfer scheme with 100 billion yuan was implemented through a 'Grain direct subsidy' program. This distributes cash to farmers on the basis of household cultivated land area in major grain-production regions. A plan is under way to increase the scale of the subsidies under this program and to expand it to cover more regions. Much stricter control of non-agricultural land use seems to have been implemented. This is reflected in a series of recent policy documents issued by the central government. Maize export subsidies were completely eliminated in April 2004, 3 years after China's World Trade Organization (WTO) accession. Grain-trading companies have recently completed import contracts with major grain-export countries. The Grain for Green program was scaled down substantially in 2004. While reduction of the Grain for Green program is largely due to problems with its implementation, the rising concern over grain security since late 2003 was also an important driver leading to its scaling down.

Governments at different levels, and academics, have expressed differing opinions and views on the current policies. Maize export subsidies have been eliminated (China's obligation to its WTO accession) and grain imports (to balance the short-term domestic supply deficit) are expected. Several questions have been raised by policy analysts inside and outside China. Is China's food and grain supply security a serious problem now? What will be the likely situation for China's food and grain security in the future? What should the focus be for China's food security (national versus household)? How serious is the removal of land from agriculture for other uses and what impacts will this have on China's grain security? What are the key determinants of China's future grain security? Can China rely on long-term productivity growth for grain security? This paper tries to answer these questions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

FOOD AND GRAIN SECURITY

Achievements in the past decades

Over the past five decades, China has made great achievements in its national food security. At the national aggregate level, China has been a food net-exporter since the early 1980s. By 2002, total exports of food and feed reached US$14.9 billion (Table 9.1). Despite food imports over time, China's net exports (exports minus imports) have been increasing and were valued at about US$5.5 billion in 2002 (Table 9.1). Moreover, China has been a major grain exporter since the late 1990s. Over the 1997–2003 period, average annual cereal imports were 12 million tonnes (NSBC 2003) and as high as 14.9 million tonnes in 2000–2003 (Table 9.1).

In the short term, although yearly fluctuations in domestic production imply that import/export of grain from/to world markets is necessary to smooth domestic market supply, China's ability to buy grain and food from the world market is outstanding among developing countries. China has a foreign-exchange reserve ranked second in the world, which assures food-purchasing ability if the nation encounters a short-term grain shortage.

Table 9.1 China's food and feed trade, 1980–2003

	1980	1985	1990	1995	2000	2001	2002	2003
Food and feed (US$ billion)								
Export	2.97	3.74	6,49	10.61	12.73	13.34	14.94	
Import	2.92	1.53	3.29	8.74	7.14	8.78	9.44	
Net export	0.56	2.21	3.20	1.87	5.59	4.56	5.50	
Cereal (million tonnes)								
Export	1.3	8.0	4.2	0.7	13.9	8.7	14.9	22.0
Import	13.0	5.8	13.7	20.1	3.1	3.4	2.8	2.7
Net export	−11.7	2.2	−9.5	−19.4	10.7	5.3	12.0	19.3

Note: food and feed include livestock and meats, milk and its products, fish and its products, grains, edible oilseeds and oils, vegetables, fruits and sugar.

Sources: Anderson et al. (2004); Centre for Chinese Agricultural Policy, Chinese Academy of Sciences, China Agricultural Policy Simulation and Projection Model.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

In the two and half decades since 1978, based on China's official poverty line, more than 230 million Chinese rural residents have escaped poverty, those under the absolute level of poverty falling from 260 million in 1978 to less than 30 million in 2002 (Table 9.2). The incidence of rural poverty has fallen equally rapidly, plunging from 32.9% in 1978 to less than 3% in 2002. The greatest reductions in poverty occurred in the years immediately after the reforms and in the 1990s. When based on the international standard of poverty, which is set at one dollar per day (in purchasing power parity, or PPP, terms), the headcount and the incidence have fallen equally rapidly (Table 9.2).

China's success in poverty reduction and improvement in food security is even more impressive when compared with circumstances in other countries. With China excluded, and using the same international standard, between 1987 and 1998 the incidence of poverty in developing and transition economies fell from 28% to 24% (World Bank 2001). The absolute number of poor in developing countries as a whole (not including China) rose about 100 million during the 1990s (ESCAP 2003). Thus, China has good reason to be proud of its achievement in fighting poverty and improving household food security. The great improvement in national food security and household living conditions creates a healthy social and political environment and lays a sound foundation for agricultural and national economic development.

Understanding the recent rise in grain prices

Our analyses show that there are no serious threats to national food and grain security in China. In 2003, both exports and net exports (exports less imports) of food and grain reached historical highs (Table 9.1). In the late 1990s, it was excess national grain reserves that led to the persistent fall in grain prices and therefore production. While there are no published data on the quantities of government grain storage in the late 1990s, as these are regarded as national secrets, most analyses of China's grain issues indicate that government grain storage amounted to 240–300 million tonnes in the late 1990s. Excess grain was gradually released into the market from storage and inventories, and largely disappeared by early 2003 when the grain price began to stabilise. The increased grain prices at the end of 2003 were a normal market reaction resulting from the decline in grain production in 2003 and the reduced national grain reserve. However, over-reaction to the grain-security issue by the government and media might also have caused grain prices to increase in early 2004, due to expectations of future grain-price increases.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 9.2 Poverty in rural China, 1978–2002

Year	Poverty based on China's official poverty line			Poverty based on international standards (US$1/day in purchasing power parity)	
	Poverty line (yuan/year)	Number of poor (million)	Poverty incidence (%)	Number of poor (million)	Poverty incidence (%)
1978		260	32.9		
1979		239	30.2		
1980		218	27.6		
1981		194	24.4		
1982		140	17.5		
1983		123	15.3		
1984	200	89	11.0		
1985	206	96	11.9		
1986	213	97	11.9		
1987	227	91	11.2		
1988	236	86	10.4		
1989	259	102	11.6		
1990	300	85	9.4	280	31.3
1991	304	94	11.0	287	31.7
1992	317	80	8.8	274	30.1
1993	350	75	8.3	266	29.1
1994	440	70	7.7	237	25.9
1995	530	65	7.1	200	21.8
1996	580	58	6.3	138	15.0
1997	640	50	5.4	124	13.5
1998	635	42	4.6	106	11.5
1999	625	34	3.9		
2000	625	32	3.4		
2001	630	29	3.2		
2002	627	28	3.1	78.6	8.7

Sources: Poverty data for 1978–1988 are from the World Bank (China: strategies for reducing poverty in the 1990s, 1992); 1989–2001 data are from the Rural Social and Economic Survey Service of NBSC (2003), 2002 data are computed by the authors based on NBSC's rural household income and expenditure survey in 2002.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Relative to changes in international grain-market prices, rising grain prices in China were nothing exceptional (Figure 9.1). World grain prices were on the rise due to a decline in grain production in 2003. These movements were more significant than those in China's domestic market. Indeed, fluctuations of both wheat and maize prices in the USA were even larger than those that occurred in China. Rising grain prices in the world market have stimulated world cereal production in 2004 and world prices have fallen since April 2004.

The rising grain price in late 2003 was a signal of China's return to a normal grain-market situation. The average grain prices in real terms in May 2004 were about the same as average prices in the 1980s and 1990s, and still much lower than those in the mid 1990s. Although the increase in grain price might have negative effects for poor and unemployed urban consumers, it raised farmers' income, provided farmers a price incentive, increased grain production in 2004–2005 and therefore played an active role in national food security for the coming years. Furthermore, high grain prices provide a good opportunity for deepening grain-market reform

Remaining challenges: regional and household food security

Despite the significant improvement in the nation's aggregate food supply and substantial reduction of poverty and therefore improvements in food security at the household level, there are still nearly 30 million rural people living below the nation's poverty line and an even larger number (about 80 million) when the international standard of poverty ($1/day PPP) is applied (Table 9.2). The pace of reduction in rural poverty has slowed down significantly since the late 1990s. Moreover, although poverty and household food security in China are considered to be primarily a rural phenomenon, recent trends in economic reforms, which were thought to cause severe urban unemployment, have raised concern about the emergence of a new phenomenon of urban poverty (Fan and Zhang 2002).

If we combine the poor in both rural and urban areas, the number could reach more than 100 million (under the international poverty standard), which still poses a threat to food security at the micro level. In the early 21st century there are still about 100 million people in China who are hungry and under-nourished (FAO 2002). Since China is undergoing rapid economic growth and most people have reached or are striving for a well-off standard of living, household food security for those 100 million people should receive more attention from policy makers and the public.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

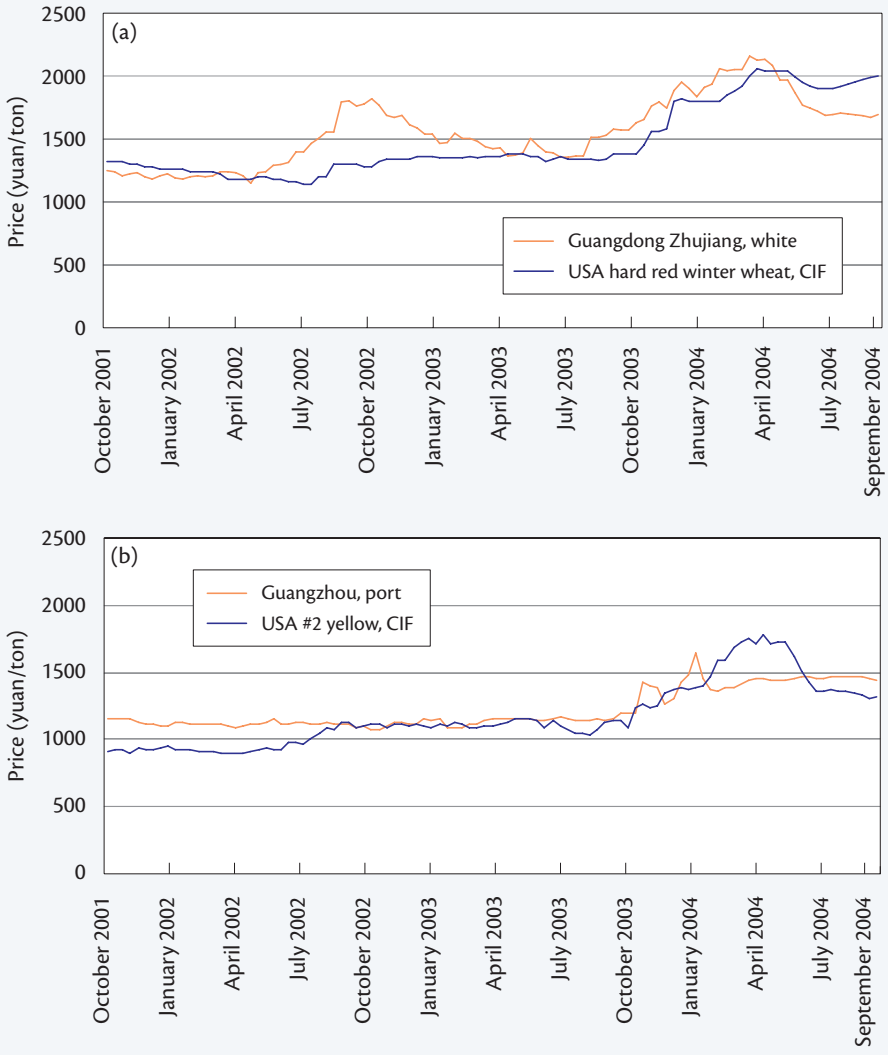

Figure 9.1 Domestic and international prices of (a) wheat and (b) maize, yuan/tonne, 2001–2004. Sources: National Grain Bureau, Grain Information Center.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Poverty and household food insecurity are concentrated in resource-constrained remote uplands (World Bank 2001) and pastoral areas. The poorest of China's poor are concentrated in resource-deficient areas and comprise almost entire communities located mostly in upland sections of the interior provinces of northern, northwestern and southwestern China. The plight of the poor in the richer provinces has gradually ameliorated. Figure 9.2 presents the most recent estimates of rural poverty incidence, based on rural household income and expenditure survey data from the National Statistical Bureau of China in 2003. They show a pressing issue of regional distribution of rural poverty and household food security. For example, while the national poverty incidence declined remarkably from more than 30% in 1990 to 8.6% in 2003, variations are significant among provinces (Figure 9.2). Rural poverty incidence ranged from less than 0.5% in Shanghai, the most developed area, to about the national average in Shanxi and Jiangxi and to 20% and more in Yunan, Xingjiang, Qinghai, Gansu and Tibet, where most minorities live.

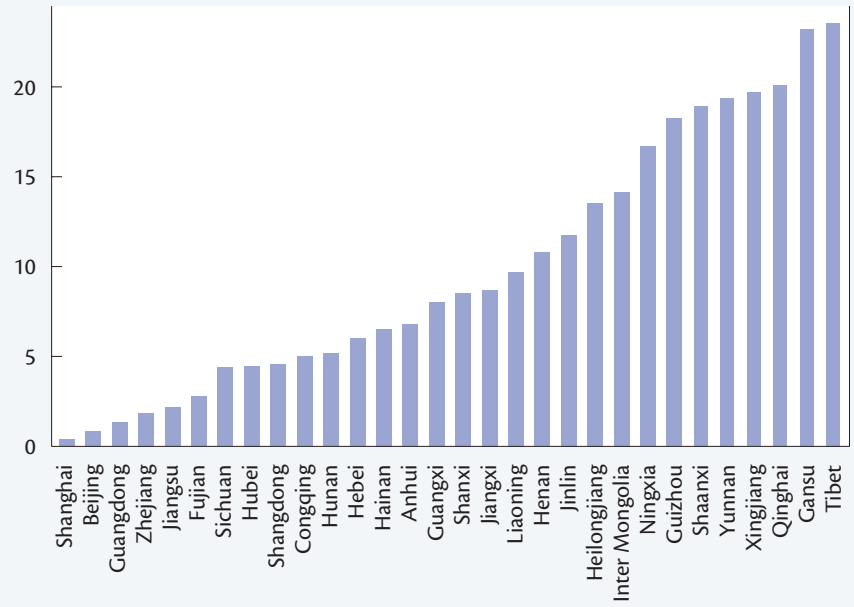

Figure 9.2 The percentage of population living on or under 1 dollar per day (in PPP) by province in rural China, 2003

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Food quality and food safety may be other major issues in China's food security. According to a report by the Chinese Academy of Sciences (CAS 2003), nearly 25% of farmland is contaminated to varying levels by various poisonous substances, and residual chemicals have been increasing in terms of variety and quantity. It also has been widely reported that about 10% of grain, more than 20% livestock products and nearly half of the vegetables have quality problems. Perhaps even more worrying are various animal diseases and pests.

Although some aspects of the grain-reserve management system have improved in the past several years (e.g. the separation of commercial trading from storage operations), it is still one of the weakest and least understood part of China's food-security program (Zhong and Zhu 2005). In many ways, despite the reforms, it is dysfunctional. The rules for management and release are unclear. There is confusion among the different holders of grain. The lack of transparency creates chaos in grain markets and contributes to greater variability in grain prices. Because no one knows the level of stocks or the quantities of planned (or actual) release, domestic producers and traders and international trading agencies cannot make informed decisions.

FOOD SECURITY IN THE FUTURE

Methodology

In order to have a better understanding of China's food security in the coming decades, projections on China's food demand, supply and trade have been made through application of the China Agricultural Policy Simulation and Projection Model (CAPSiM) developed by the Center for Chinese Agricultural Policy (CCAP). CAPSiM was developed to meet the need for a framework for analysing policies affecting agricultural production, consumption, prices and trade at the national level. CAPSiM is a partial equilibrium model. Most of the elasticities used in CAPSiM were estimated econometrically by CCAP staff using state-of-the-art econometrics and with assumptions that make our estimated parameters consistent with theory. Both demand and supply elasticities change over time, income elasticities depend on the income level, and cross-price elasticities of demand (or supply) depend on food budget shares (or crop area shares).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CAPSiM explicitly accounts for urbanisation and market development on the demand side. In supply-side analysis, account is taken of changes in technology, other agricultural investment, environmental trends and competition for labour and land. Supply, demand and trade respond to changes in both producer and consumer prices. Details of the model can be found in Huang and Li (2003).

Scenario development

In projecting China's future food economy, several alternative scenarios are formulated. Each of them embodies key assumptions on the shifts in demand, supply and the external economy. In this paper, China's food economy in 2001–2020 is examined under three alternative sets of scenarios: a baseline run (WTO accession in 2001–2005 and further trade liberalisation in 2006–2020) and two scenarios with different assumptions on agricultural R&D and irrigation investments. WTO accession is formulated as the baseline because China joined the WTO in December 2001. The base year is 2001 and the projection periods are 2002–2020. Predictions of trends and future situations are risky, including those for the food economy in China. Any projections, including those presented below, are made under certain assumptions that may change over time. However, the projections under different scenarios may help us to understand the trends and major driving forces of the food economy in the future.

Baseline scenario

On the demand side, population increase, urban expansion and income growth will continue to be the major driving forces of China's demand for food in the future (Huang et al. 1999). On the supply side, institutional reform, technology change, input increase, irrigation expansion and market liberalisation have all contributed to China's successful agricultural growth in the past. However, in the future, China's agriculture and food production growth may largely depend on technology changes, particularly on the investment in agricultural R&D and irrigation (Fan and Pardey 1997; Rozelle and Huang 2000; Huang and Rozelle 2002).

Population will remain an important determinant of food balance in the future. Population growth peaked in China in the late 1960s and early 1970s. Since then, fertility rates and the natural rate of population growth have begun to fall. In the entire period of the 1990s, the annual population growth rate was only 1% (NSBC). According to United Nation's demographic predictions (UN 2002), China's population will increase from 1.27 billion in 2001 to 1.36 billion in 2010, with an annual

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

growth rate of 0.72%. This rate of growth is considered moderate, as annual growth rate of population was only 0.70% in 2001 (NSBC 2002). According to the UN's projection, while the population will continue to increase after 2010, the annual growth rate will decline to 0.60 in 2011–2020, a level above recent projections by China's demographers. China's population will reach about 1.45 billion by 2020.

China's urban sector expanded rapidly in the past and is expected to continue to do so in the coming decades. For example, the shares of urban population increased from 27% in 1990 to 36% in 2000. Based on population projections of the United Nations (UN 2002), the shares of urban population will rise from 36% in 2000 to 44% in 2010, and 51% in 2020. Because consumption patterns in urban areas differ from those in rural areas (Huang and David 1993), we expect that urbanisation will have a strong influence on national food demand in the coming decades.

Given the past trends of urban and rural income growth and recent government concerns about growing income gaps between rural and urban dwellers, we assume that the growth of income in urban and rural areas will gradually converge in the next two decades. The baseline scenario assumes that per-capita income will continue to grow but with declining growth rates. Annual real-income growth in urban areas will gradually decline from 8% in 2002–2005 to 6%, 5% and 4% in 2006–2010, 2011–2015, and 2016–2020, respectively. The annual growth rates of per capita income predicted for rural areas are 4% in 2002–2010 and 3.5% in 2011–2020.

In the past 20 years, agricultural research investment in real terms grew by about 4% annually, but increased significantly recently. The recent recovery in research investments, together with China's commitment to a strong domestic grain economy, leads to the expectation that China will sustain its recent upturn in investment funding over the long run. Under the baseline scenario, it is assumed that the annual growth rate of agricultural research expenditure in real terms is 5% over the 2001–2020 period.

Public irrigation expenditures financed a big part of the construction of the national water control network. The investment in irrigation facilities has been by far the largest component of total construction investment in agriculture. It is several times higher than investment in agricultural research. Under the baseline, it is assumed that growth in irrigation investment will continue. The annual growth rate will remain at 4% in 2001–2020. These growth rates are higher than the average growth rates in the past 30 years, but are lower than the rates that have been achieved since the late 1990s.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

On trade policies, under the baseline scenario, the current tariff rates and non-tariff barriers are assumed to change over 2002–2010. For those agricultural commodities that have positive nominal protection rates, prices are assumed to decline as China changes policies to meet its commitments on WTO accession. These include wheat, maize, other coarse grains, soybean, edible oils and sugar crops (Table 9.3). The prices of other commodities such as rice, vegetables, fruits, livestock products (except for milk), and fish are expected to rise with China's WTO accession. It is assumed that the remaining border distortion will be eliminated by 2020.

Fertiliser price is assumed to decline by 1% in 2002–2005 (as the import tariff is lowered with China's WTO accession) and then remain constant over the remaining projection period. The opportunity costs of both crop land and agricultural labour are assumed to grow by 1% over the projection period.

Alternative scenarios

Two alternative scenarios are developed to examine the impacts of productivity-enhanced investment on China's food economy. They are high and low investments in both agricultural research and irrigation. It is noted that all assumptions embodied in the baseline remain in the alternative scenarios except for the assumptions on the growth of investment in agricultural research.

In order to see how the food economy is affected by agricultural research and irrigation investment policies, the high-productivity growth scenario assumes an improvement in agricultural productivity. The annual growth rate of agricultural research expenditure will be increased from 5% (the baseline assumption) to 7%, and the irrigation investment growth rate from 4% to 6% throughout the projection period. The low-productivity growth scenario assumes that the annual growth rate of agricultural research expenditure will decline from 5% in the baseline to 3.5%. The corresponding growth rates of irrigation investment decline from 4% to 2.5%.

The results of projections

To address the main concerns of policy makers on national deficits in food and grain supply, discussions of the projections are limited to an overall indicator of aggregate food security—the self-sufficiency rate. The results of self-sufficiency rates for major food commodities under the baseline scenario in 2001–2020 are reported in Table 9.4. The corresponding results for alternative scenarios in 2020 are summarised in Table 9.5.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 9.3 Nominal rates of protection (tariffs or tariff equivalents) of agricultural commodities in China in 2001, and assumed rates in 2005 and 2010

Commodity	2001	2005	2010
Rice	−3.0	−1.5	−0.8
Japonica	−12.0	−6.0	−3.0
Indica	0.9	0.4	0.2
Wheat	16.0	14.0	14.0
Maize	22.0	14.0	14.0
Sweet potato	15.0	14.0	14.0
Potato	15.0	14.0	14.0
Other cereals	15.0	14.0	14.0
Soybean	17.0	16.0	14.0
Cotton	18.0	14.0	14.0
Oil crops	47.0	22.5	17.3
Sugar crops	50.0	36.0	25.0
Vegetables	−10.0	−6.7	−4.4
Fruits	−10.0	−6.7	−4.4
Pork	−20.0	−13.3	−8.9
Beef	−8.0	−5.3	−3.6
Mutton	−5.0	−3.3	−2.2
Poultry	−17.0	−11.3	−7.6
Eggs	−4.0	−2.7	−1.8
Milk	42.0	28.0	22.5
Fish	−15.0	−10.0	−6.7

Source: Authors' projections.

Baseline projections show that even if the nation completely liberalised all trade (which is beyond its current trade commitments under the WTO), many agricultural products will still achieve high self-sufficiency levels in 2020 (Table 9.4). Although imports will rise or self-sufficiency rates will fall for many land-intensive food products, for those commodities where China has comparative advantage, exports will rise and self-sufficiency levels will exceed 100% under greater trade liberalisation in the coming decades.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 9.4 Projected self-sufficiency rates (%) of major foods in China under the baseline scenario (see text for explanation), 2001–2020

	2001	2010	2020
Rice	101	102	106
Wheat	99	90	96
Maize	105	80	72
Soybean	61	64	60
Edible oils	84	69	66
Sugar	96	83	76
Vegetables	101	103	104
Fruits	100	105	107
Pork	101	110	105
Beef	100	98	96
Mutton	99	96	95
Poultry	99	106	105
Milk	97	83	79
Fish	105	110	107

Source: Authors' projections.

Table 9.5 Changes in self-sufficiency rates (%) of major foods in China in 2020 under alternative scenarios (compared with the baseline scenario in Table 9.4)

	Change (%)		Self-sufficiency rates (%)	
	High R&D and irrigation investment	Low R&D and irrigation investment	High R&D and irrigation investment	Low R&D and irrigation investment
Grain	2.86	−3.27	92	86
Cereals	2.75	−3.14	91	86
Rice	1.78	−2.05	108	104
Wheat	2.8	−3.18	98	93
Maize	3.72	−4.27	75	68
Soybean	4.83	−5.46	65	55
Edible oils	6.1	−6.87	70	61
Sugar	4.36	−5.04	80	72
Vegetables	5.54	−6.27	109	99
Fruits	8.33	−9.16	115	98

Source: Authors' projection.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

It is projected that China will achieve more than 90% grain self-sufficiency and near self-sufficiency in food grains in the coming decades. China will continue to export its japonica rice to East Asian countries. After 2010, rice self-sufficiency will reach 102–106%, i.e. China will export 2–6% of its rice to the world market. Although China needs to import wheat, the imports will be less than the average imports in the 1980s and 1990s. After the initial shock of trade liberalisation, wheat imports are projected to grow after 2005 and reach their highest level in 2010, at about 10% of domestic consumption. However, China's per-capita wheat consumption has been falling and is projected to decline throughout the projection period. Rising incomes will not lead to increases in food-grain consumption in urban areas, simply because the income elasticities of demand for all grains (rice, wheat, maize and other coarse grains) are negative. In rural areas, the income elasticities in demand for rice and wheat are also estimated to be negative after 2010. Decline in per-capita grain consumption in urban areas and rapid urbanisation lead the national average per-capita consumption to decline. In 2001, per capita wheat consumption in urban areas (40 kg) was less than half of that in rural areas (82 kg).

It is projected that wheat imports will decline after 2010 and self-sufficiency levels will recover to about 96% in 2020. Moreover, after 2020 China is likely to achieve near self-sufficiency even in wheat as population growth approaches zero in the 2020s.

The nation will be a net importer of maize; imports will reach nearly 30% of domestic consumption, but this will not threaten China's food security or social and political stability. Maize is mainly used as feed. Food maize is not a staple food in urban areas. In rural areas, as incomes increase, per-capita consumption of food maize has declined significantly, from more than 30 kg in the late 1970s to less than 10 kg recently. Increasing imports of maize will promote China's livestock development, facilitate structural changes in agriculture and therefore increase farmers' income.

In short, even under a completely free trade regime, China would not have a food security problem. Importing 10% of grain (mainly feed) is feasible and should not be considered as a threat to national food and grain security. Ten per cent (or 50 million tonnes) of China's grain demand is equivalent to only 2% of the world's total cereal production and less than 10% of international grain trade. This level of imports will not have a great impact on national grain security nor be a fatal threat. The major way China can protect its future food and grain security is to invest heavily in agri-

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

cultural technology, increase the efficiency of water use in agriculture (see the results presented on the alternative scenarios) and promote poverty reduction programs that will provide the poorest of China's households with a way to procure larger quantities of food.

Although imports of soybeans, edible oils and sugar will be high, about 30–40% of domestic consumption by 2020, the export of vegetables, fruits, livestock and aquatic products will grow (Table 9.4). For example, China imported 16% (or 84% of self-sufficiency) of its edible oil consumption in 2001, and the share of imports will rise to 31% in 2010 and 34% in 2020. This occurs for soybean, rapeseed and other edible oil crops. However, the baseline scenario also projects that labour-intensive agricultural production will expand more than domestic demand. Trade liberalisation will help China to boost its horticulture, livestock and fishery sectors as the nominal protection for these products is negative. Increases in the prices of these products, accompanied by rising productivity, will enable China's production to exceed its demand in the coming years. Exports will expand.

China now exports about 1% of its vegetable production to the world market and has only minimal amounts of fruit for export. The baseline scenario projects that domestic demand will grow for both vegetables and fruits with income growth and China will gradually become an important player in vegetable and fruit export markets. It is projected that about 3% of vegetable production in China will be exported in 2010 and the share will rise to 4% in 2020. Fruits will enjoy an even higher rate.

In the livestock sector, while the increases in domestic production nearly match the increases in demand for beef and mutton, the annual production growth rates of pork and poultry will exceed growth in demand. In the next 20 years, China will be able to export about 5–10% of its pork production and 5–6% of its poultry into world markets if the rest of world opens its markets to China's meat products (Table 9.4). Obviously, part of the meat that becomes available for export is due to China's willingness to import maize, as was projected under the baseline scenario. Cheaper maize and other feed from world markets helps China boost its livestock sector.

Fish has been the number-one agricultural export commodity in China. Projection of the baseline scenario shows that past export trends will continue in the future, and fish exports will expand. The export-to-production ratio will rise from its current 5% to a peak level of 10% in 2010 and remain at 7–10% during 2010–2020 (Table 9.4).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The results of alternative scenarios show that the major way China can protect its future food and grain security at national level is to invest heavily in agricultural technology and increase the efficiency of water use in agriculture. China will be able to achieve one of the major components of its food security (grain self-sufficiency) target in the future under high research- and irrigation-investment scenarios. The only grain that will reduce to levels below 95% self-sufficiency in the long term is maize. China could maintain its grain and wheat self-sufficiency at 92% and 98% in the long term (after 2020) if the annual growth rate in agricultural research and irrigation investments could be raised to 7% and 6%. Imports could be significantly reduced for edible oils, sugar and cotton under a high-investment scenario. The difference in production between high and low scenarios could reach 7% for grain and more than 10% for edible oils, cotton, vegetables and fruits.

FOOD SECURITY AND CHANGES IN CULTIVATED LAND[1]

Changes in total cultivated lands and bio-productivity, and their likely impacts on grain production, are explored from Landsat TM/ETM digital images covering China's territory in the past 15 years, including the middle 1980s and 1999–2000, and the data since 2000 from the Ministry of Land and Resources.

The analysis shows that, in contrast to popular perception, China recorded a net increase in cultivated land of 2.65 million hectares in 1986–2000, accounting for nearly 2% of the cultivated land area in 1986 (Huang et al. 2004). During this period, although cultivated land converted to other uses totals 3.06 million hectares, new cultivated land created from other uses was 5.71 million hectares. Of the cultivated lands converted to other uses, 38% is built-up area largely located in coastal regions of eastern China.

The study also found that the average productivity of cultivated land declined by about 0.31%, since the bio-productivity of new cultivated land converted from other uses is, in general, lower than that of cultivated land converted to other uses. Despite a likely decline in total cultivated land in the future, the impacts on agricultural production will be minimal. China can maintain a healthy cultivated land base for food and agricultural production in the long term.

[1] This part of the paper is mainly based on a recent work by Xiangzheng Deng, Jikun Huang and Scott Rozelle (2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Cultivated land in China has declined significantly in recent years, but the main reason is not the notable expansion of cities and industrial development as widely perceived. Rather it was the Grain for Green program launched in China in 1999. In 2003, about 80% of the reduction in the area of cultivated land was the result of this program. In reality, between 1997 to 2003, little land was lost to urban expansion and industrial development. Recent study further shows that the Grain for Green program has had an insignificant impact on grain production, market prices and food security.

Based on the changes in cultivated land area during the years 1985–2000 reported by Huang et al. (2004) and land-use data for 2000–2003 from the State Land Bureau, cultivated land was reduced by 2.4%, with an average annual decline of only 0.14% during 1985–2003. When land changes due to the Grain for Green program are excluded, China's cultivated land had a net increase of 2.5 million hectares, or 1.85% in 1985–2003.

Considering that China has been experiencing rapid growth, the relatively low rate of decline in cultivated land is encouraging if not miraculous. China's economy in 2003 was about 8.5 times the size it was when economic reform began in 1978, but the decrease of cultivated land was only about 2%. International experience shows that rapid economic growth is often accompanied by a large shift of land from agriculture to industry, infrastructure and residential use. In Japan, for example, cultivated land area has been declining significantly during the last three decades. In the 1990s, Japan lost cultivated land at a rate of 1% per year (Uchida et al. 2004). A similar trend is evident in South Korea since the 1970s. The US is losing 0.1–0.3% per year of its agricultural land to development and land set aside for conservation.

CONCLUDING REMARKS AND POLICY IMPLICATIONS

China has a large resource base and a solid record of productivity in the past to ensure national grain and food security. China can also ensure the nation's food security in the future. In the coming years, however, China needs to make fundamental changes in national priorities for food and grain security and develop a new way to manage its grain economy. Major policy implications and recommendations are summarised below.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1. Shift emphasis of grain security from all grain to food grain

In order to maintain the spirit of China's food and grain-security policies without imposing excessively costly and ineffective restrictions, the national government should redefine its grain security goals in terms of rice and wheat, the two major food grains. This would provide considerable protection against any external economic threat while being attainable without causing major distortions.

2. Shift emphasis from aggregate national food supply to household food accessibility

While China's aggregate supply of food and grain is not a serious problem, there are still tens of millions of households that live at or under the poverty line. For many, there are times when households face a crisis in not being able to provide sufficient food to keep their members healthy and productive. The main focus of national food-security policy should be placed on these households, and measures should be implemented that raise average incomes and protect these households against negative income shocks. These will be the most effective household food-security measures.

3. Emphasise long-term productivity growth rather than a short-term subsidy program

China's food-grain security will depend mostly on raising long-run productivity. Subsidy programs such as the 'Grain direct subsidy' implemented in early 2004 will be very costly, will not be appreciated by households in the long run, will reduce the government's fiscal resources for public services, and will bring much lower benefits to national grain security than will investment in R&D, extension, education, health, irrigation and other rural infrastructure. China should not follow other countries that 'protect' their farmers by subsidies and other means, but should build a productive, undistorted agriculture that raises the income levels of its producers and provides the nation with a high degree of food security.

4. Balance land uses between agriculture and other activities

With the future of China's development relying on rapid industrialisation, great efforts should be made to ensure that land-use policies do not impede the ability to be able to continue rapid growth. Employment, income and productivity growth

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

are all associated with the conversion of land from low-productivity agriculture to high-productivity industry and services. Land-use policies should not be homogeneous nationwide and priority should be given to fast-growing, industrialising regions. Rights need to be given to farmers to ensure that those who lose their land are directly and fairly compensated. A system of land-conversion permits might be considered for use across China, allowing only a limited amount of land to be converted each year, but it is important to make such permits tradable so development can occur in the places that are most optimal. The current Grain for Green program should be continued and commitments fulfilled while increased effort is given to effective implementation.

5. Change national grain-reserve management practices

Leaders need to deepen grain-market reform and change the management practices of the nation's grain-reserve system. Rules for purchases and sales of national grain-reserve stocks need to be open; public information on markets can internalise all of the factors that will influence short- and long-run price expectations, which will affect production, storage and sales decisions.

6. Improve China's food-quality regulation and monitoring system

International standards for food quality and safety measures could be consulted to modify China's Food Sanitation Law or implement new regulations or laws on food safety to improve food quality.

REFERENCES

CAS (Chinese Academy of Sciences) 2003. Re-evaluating China's food security. Beijing, CAS, Research Report of Resource and Environmental Sciences Bureau.

ESCAP (Economic and Social Commission for Asia and the Pacific of the UNDP) 2003. Promoting the millennium development goals in Asia and the Pacific: meeting the challenges of poverty reduction. New York, United Nations.

Fan, S. and Pardey, P. 1997. Research productivity and output growth in Chinese agriculture. Journal of Development Economics, 53, 115–137.

Fan, S. and Zhang, X. 2002. Urban poverty in China: the evidence. Paper presented at the 2002 American Economics Association annual meeting, Washington DC, 3–6 January.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

FAO (Food and Agricultural Organization of the United Nations) 2002. The state of food insecurity in the world 2001. Rome, FAO.

Huang, J. and David, C.C. 1993. Demand for cereal grains in Asia: the effect of urbanization. Agricultural Economics, 8, 107–124.

Huang, J., Deng, X. and Rozelle, S. 2004. Cultivated land conversion and bioproductivity in China. Society of Photo-Optical Instrumentation Engineers, 5544, 135–148.

Huang, J. and Li, N. 2003. China's agricultural policy simulation and projection model: CAPSiM. Journal of Nanjing Agricultural University (Social Science Edition), 3(2), 30–41.

Huang, J. and Rozelle, S. 2002. Trade reform, WTO and China's food economy in the 21st century. Pacific Economic Review, 8(2), 143–156.

Huang, J., Rozelle, S., Ni, H. and Li, N. 2003. Impacts of agricultural trade and policy reforms on domestic food security in China. A report submitted to FAO, Rome.

Huang, J., Rozelle, S. and Rosegrant, M. 1999. China's food economy to the 21st century: supply, demand and trade. Economic Development and Cultural Change, 47, 737–766.

National Grain Bureau Various years. Grain price database. Grain Information Center. NSBC (National Statistical Bureau of China Various years. China's statistical yearbook. Beijing, National Statistical Press.

Rozelle, S. and Huang, J. 2000. Transition, development and the supply of wheat in China. Australian Journal of Agricultural and Resource Economics, 44, 543–571.

Uchida, E., Rozelle, S., Deng, X. and Huang, J. 2004. Changes in cultivated land due to urbanization: China in an international perspective. Policy brief presented in the second expert meeting of agricultural and rural development, China Council for International Cooperation on Environment and Development (CCICED), Beijing, 2004.

UN (United Nations) 2002. World population prospects, 2002. New York, United Nations.

World Bank 2001. Attacking poverty. Oxford and New York, Oxford University Press.

Zhong, F. and Zhu, J. 2005. Improving security and efficiency of the government grain reserve system. In: Sonntag, B.H., Huang, J., Rozelle, S. and Skerritt, J.H., ed., China's agricultural and rural development in the early 21st century: challenges, opportunities and policy options. Canberra, ACIAR Monograph No. 116, 93–114.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 10

MANAGING CONVERSION OF CHINA'S CULTIVATED LAND

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

10.1 PROTECTION OF CHINA'S CULTIVATED LAND

CCICED ARD Task Force members

ASSESSING CHINA'S CULTIVATED LAND ISSUES

Land is a critical input needed to keep the development process moving, allowing for the rapid shift of people in an orderly way from rural to urban areas. However, it is possible that as cultivated land is converted to built-up area it will conflict with national food-security goals. While little was heard about this conflict in the late 1990s through late 2003, as grain prices rose in the early part of 2004, policy makers and scholars began to debate the role of cultivated land conversion and the rise in prices. On the one hand, local leaders and developers in many parts of coastal China and in suburban areas around inland cities are in the middle of a period in which they have already committed large amounts of capital to development zones, factories and housing projects and are stressing the need for access to land so their plans can be fulfilled. Tens of millions of jobs in construction in the short run and hundreds of millions of jobs in the longer run depend on completing these projects and continuing with more in the future. On the other hand, others have labelled the conversion as an irreversible destruction of cultivated land that will hurt national food security.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

MAJOR ISSUES IN LAND PROTECTION AND ACQUISITION

Many issues have emerged in the matter of conversion of cultivated land to non-farm uses:

- The major issue is the perception that China is losing farmland at an alarming rate. The concern is that the reduction in land is reducing grain output, raising prices and weakening the nation's commitment to national food security. In recent years, estimates that China has lost more than 5 million hectares of farmland have been used to show that reduction of cultivated area is a major problem.
- Although there are many policies and regulations covering land use, it is often said that the major problem in land protection is their weak enforcement. Regulations specify that only provincial governments and the central government have the authority to approve the acquisition of cultivated land. For acquisition of high-quality cultivated land, the only jurisdiction is that of the State Council. Despite such clear regulations, however, it is known that large areas of cultivated land have been acquired without authorisation.
- It is also said that land acquisition has created large numbers of landless and unemployed farmers. According to the Ministry of Land Resources, during the period 1987–2001 about 55 million farmers have lost their land base. Observers worry that this could lead to social instability.
- One of the most pervasive problems, even in times when formal approval has been given, is that compensation to farmers is very low. On average, compensation amounts to only 5–10% of the land value. Farmers often do not know the details of the transaction and, even when they are given fair payment, believe that they were not treated fairly. The main benefits from the conversion of cultivated land into non-farm use accrue to local officials, local government coffers and land developers.

A number of factors contribute to rampant land acquisition:

- First and foremost, observers believe that unclear definition of land ownership is one of the most fundamental reasons for these problems. China's Land Management Law states that land is 'collectively owned'. Land is untitled.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Distribution has historically been controlled by village leaders with support from township officials. Such vague definitions lead to confusion when land transactions are being made.

- There is no clear land-use planning procedure. In almost no part of China is there any formal differentiation between land for public use, land for business use and land for agriculture. To add to the confusion, the Constitution and the Land Management Law state that, to meet the need of the public interest, the state may acquire land. Other regulations proclaim that users of land cannot negotiate directly with its owners; the government purchases the land from the collective and sells it to the final users. This procedure occurs even when the acquisition is for development. According to a 16 province survey, nearly half of the land acquired has been used for housing and business activities. Only 10% of acquired land is for public goods.
- Given China's ownership structure and the role that the government plays as middleman in most transactions, it is not surprising that land acquisition almost always proceeds without consulting farmers. Arbitration procedures and appeals in disputed cases are not very well defined and favour the government. When assessing the incentives for converting land, it quickly becomes evident that there are many reasons why local governments have strong incentives to acquire land. There are almost always budgetary gains associated with the land acquisition process. According to research, the budgetary gains from the process of land acquisition can account for 35–60% of government revenues.
- In response to these emerging issues, the government—both earlier and in more recent years—has developed a number of measures to deal with land-management issues. There has been a shift in land policy to emphasise protection of cultivated land, central control over cultivated land and other measures. In general, both laws and regulations on land management have become clearer and stricter.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

IDENTIFYING THE PROBLEMS

Changes in cultivated land; changes in agricultural potential

The task force believes that well-founded research can show that, at least until 2000, the food-security concerns of the government over the conversion of cultivated land to industry, urban building projects and forests were misplaced. Based on digital images from the Landsat earth-orbiting satellite covering China's territory from the mid 1980s to 1999–2000, and more recent data from the Ministry of Land and Resources, scientists of the Chinese Academy of Sciences have explored the changes in total cultivated land and its productivity, and their likely impacts on grain production. The basic findings are as follows:

- Between 1986 and 2000, although the cultivated land converted to other uses totalled 3.06 million hectares, new cultivated land created from other uses was 5.71 million hectares. Therefore, rather than suffering a decline in cultivated areas, China actually recorded a *net increase* in cultivated land of 2.65 million hectares.
- Although it is true that the quality of land that has moved out of cultivation is generally of higher quality than newly opened cultivated land, according to careful, GIS-based research, the total net decline in bio-productivity is less than 0.5%. Hence, China's overall production potential (2% increased cultivated areas minus 0.5% decreased quality) still rose by almost 1.5% between 1985 and 2000.
- Landsat-based analysis also shows that most of the change is occurring in the coastal areas and around cities—exactly in the places where the conversion should be occurring. In other words, there is no evidence of excessive waste, such as turning vast tracts of wheat or rice land in central provinces into empty development zones.
- Less is known about changes in more recent years. The Landsat-based data end in 2000. According to statistics from the Ministry of Land Resources, cultivated land loss has accelerated in recent years. However, if these data are accurate, then, while true, it is important to understand that the nature of recent land conversions is different from those in the past. The main reason for grain-area declines due to conversion of cultivated land in recent years is the nation's Grain for Green program launched in 1999. In 2003, about 80% of the total reduction in cultivated land area was due to this land set-aside program. Between 1997 and 2003, there

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

was little change in rate of conversion of cultivated land into urban expansion or industry. Moreover, unlike the land being converted into urban area, Grain for Green land is generally of extremely low quality. According to a State Forest Administration report, the average grain yields of such land are only around 50 jin per mu.

- Compared to the rest of the world, China's protection of cultivated land is outstanding. International experience shows that rapid economic growth is often accompanied by a large shift of land from agriculture to industry, infrastructure and residential use. For example, in the 1990s, Japan lost cultivated land at a rate of 1% per year. A similar trend is seen in South Korea since the 1970s. The US is losing its agricultural land at a rate of 0.1–0.3% per year to development and conservation set-aside. The fall in cultivated area in China (including Grain for Green) is only a fraction of that occurring in other countries.

Impact on prices or imports

- Since there is a net increase in total cultivated area and only a marginal decrease in quality between 1985 and 2000, not only is there no negative impact of cultivated land conversion, but also food security is increased because of the greater output potential. It is important too to note that the increase in employment from converting land to industrial uses is significant and real, and will improve household food security for those rural residents who gain new employment and enjoy rising incomes.
- According to research conducted by the Center for Chinese Agricultural Policy, the price impact of Grain for Green was minimal. Less than 5 percentage points of the 40% grain price increase that occurred between 2003 and 2004 is due to the Grain for Green program. Research shows that the reason for the small drop is twofold: one, the initial net decline from the land set-aside is small since the yields on the retired cultivated land are so low; two, yields on the rest of a farmer's cultivated land increase since they have more time available and can intensify their production on their remaining land.
- With almost no price effects, the analysis shows that the impact on imports is even smaller, and is virtually zero.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Rights to participate in the land-acquisition process and right to receive fair compensation

Although the task force believes that the trends in the conversion of cultivated land are not problematic, the process is problematic and often leads to disenfranchised farm households which have lost their land without the right to participate in the process and without the right to fair compensation. In recent years, there are very few cases where rural households end up being satisfied. Compensation is low or non-existent. The lack of transparency in the process, even when fair and justified, leaves people suspicious and unhappy. Conversion of cultivated land to non-farm uses is inevitable, but the process that alienates the former owners of the land can and must be addressed.

Rational land-use plans

While the task force does not believe that too much land has been converted and that it is generally occurring where it should be expected, this is not to say that land-use planning does not need to be improved. Currently, as in many rapidly developing nations, long-term land planning is not well done. Resources are needed to ensure well-publicised protocols and principles that set and guide land acquisition and development of industrial, residential and other infrastructure needs. In addition, the World Bank has generated evidence that land pricing and conversion regulations create a bias that gives developers and local governments incentives to convert land in suburbs and ignore development opportunities inside the city limits. In China, as in other parts of the world, the cost to build inside the city versus the rural suburbs is often several times higher in terms of land and land preparation costs. Regulations and the political voice of the residents and users inside the city limits often refocus attention outside the city. Although such decisions are often consistent with short-run cost minimisation, when all costs and externalities are included, building in the rural suburbs can have adverse consequences (in terms of land value) for those living in the cities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

KEY POLICY IMPLICATIONS

It is our recommendation that the fundamental principle underlying the policy is that the conversion of cultivated land into non-farm uses should be permitted. This is an inevitable part of development. Restricting it will retard development. If China invests heavily in productivity-enhancing projects and agricultural research and development, cultivated land conversion will **not** be a threat to national food security.

However, this process needs to be carefully managed, not just to ensure that the loss of irreplaceable, good quality cultivated land is minimised, but also, and more importantly, to ensure that the rural households that are dispossessed by the acquisition of their land are adequately compensated. To ensure a more orderly and equitable transfer of cultivated land to higher-value uses and to protect the interests of the predominantly poor rural households adversely affected by this process, the central government needs to clarify land-ownership rights and improve the legal recourse and protection available to all whose land rights are threatened.

Since Grain for Green has not contributed greatly to recent price rises and is not a threat to food security, future program expansion should not be impeded by its effects on grain production. While there may be reasons to slow down the expansion of Grain for Green, food security is not one of them.

Other distortions, such as poor land use and uneven land prices between urban core areas and suburban areas, should be rectified. Better land-use planning is needed. The nation should gradually move towards a market-based, government-regulated land-market system.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

10.2 CULTIVATED LAND CONVERSION AND BIO-PRODUCTIVITY IN CHINA

Xiangzheng Deng and Jikun Huang
Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, People's Republic of China

Scott Rozelle and Emi Uchida
Department of Agricultural and Resource Economics, University of California, Davis, California, USA

INTRODUCTION

International experience shows that rapid economic growth is often accompanied by a large shift of land from agriculture to industry, infrastructure and residential use. Cultivated land in Japan, for example, has been declining significantly during the past three decades. In the 1990s Japan lost cultivated land at a rate of 1% per year (Uchida et al. 2004). A similar trend is found in South Korea since the 1970s (Uchida et al. 2004). The US is losing its agricultural land at a rate of 0.1–0.3% per year to development and land set-aside for conservation (Uchida et al. 2004).

Although starting later than the US and its East Asian neighbours, China has grown rapidly in recent years. China's economy in 2002 was about 8.5 times bigger than what it was when the economic reform began in 1978. Rapid economic growth has significantly improved the livelihood of China's population. During the reform era (1978–2002), GDP grew at an average annual rate of about 9% (NSBC 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The growth in food and agricultural production was also substantial. During the reform era, agricultural GDP grew at around 5% annually, largely exceeding the annual population growth rate (1.2%) over the same period. Rising income and food production have considerably improved China's food security and substantially reduced the incidence and severity of poverty. Interestingly, during the period of rapid economic growth, China has been a net food exporter since the early 1980s and net grain exporter after the mid 1990s (Anderson et al. 2005).

Although China's economy grew rapidly, concern over national food security remained and, in fact, may have intensified. Structural change allowing the emergence of cash crops, new export opportunities for labour-intensive fruits and vegetables and rising wages encouraged some of China's farmers to move out of grain production. In recent years, as in Japan and Korea, urbanisation and industrialisation began to accelerate, and cultivated land began to be converted to non-agricultural uses, such as industry, residences and urban infrastructure. These trends are expected to continue into the future as China's growth is expected to double the nation's economic output during the first decade of the 21st century. Since these trends, including the conversion of cultivated land, have all occurred just as China's agricultural production hit a period over the past five years during which there have been five successive reductions in grain sown-area and production, grain security once again has become a top priority in national agricultural policy. Although prices of grain fell during most of the past five years, as soon as the price of China's major grains began to rise in late 2003, the issue of the effects on grain production, imports and food security of conversion of cultivated land into built-up area moved to the top of the policy agenda of China's national leadership. Among other actions, in the early part of 2004 the State Council issued strongly worded directives about the importance of slowing down the conversion of cultivated land to built-up area. When the price rises continued in February 2004, a directive came from the top leadership banning any further conversion, except under several extreme conditions. Interviews with local leaders, and commentaries in local and national periodicals, show that there are strong views both for and against continuing with the conversion of land among different sets of actors. Some claim it is critical to maintain national food security; others say that it will cripple China's economic growth if the ban is kept in place for long.

Surprisingly, although the issue is important and has potentially far-reaching effects, there is almost no empirical research on the economic consequences of land conversion in China. Several key questions are in need of answers:

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- During the reform era, how much cultivated land has been shifted for non-agricultural use?
- Of the cultivated area that has been lost, how much has gone to urbanisation and industrialisation?
- While land is being converted out of cultivated area, how much land has been converted into cultivated land?
- What are the implications of cultivated land changes for the nation's food security?

Answers to the above questions are critical for China to be able to formulate policies that can ensure both food security and high economic growth in the coming decades. The overall goal of this study is to answer these questions by examining the changes in the cultivated land base, the effect on productivity and its ultimate impact on food security. To meet the goal, changes in China's cultivated area over time and its conversion to built-up area and other uses due to urbanisation, industrialisation and rural settlement expansion are examined using digital images from the TM/ETM sensors carried by the Landsat earth-orbiting satellite covering China's entire territorial area during the past 15 years. After identifying areas that have changed from cultivated areas to built-up areas, we then calculate the corresponding changes in agricultural land bio-productivity, using a methodology that uses agro-ecological zones (AEZ) to produce measures of bio-productivity.

The paper has five sections. Section two briefly introduces the methodology used in the study. Section three describes the unique data-set that we use in our analysis. The results are in the fourth section. The final section draws conclusions and discusses the policy implications for the future management of China's cultivated land.

METHODOLOGY

Land-use models, 1-km area percentage data models

The vector-data model and the raster-data model are two of the most widely used models in spatial data analyses.[1] In a vector-data model, each location or point is recorded as a single coordinate (x, y). A line is a series of ordered coordinates. Areas are recorded as a series of coordinates defining line segments that enclose an

[1] <http://gis.washington.edu/cfr250/lessons/introduction_gis/spatial_data_model.html>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

area. The term polygon in our analysis means a many-sided figure (Felleman 1990; Jianping Xu and Lathorp 1994; Shupeng Chen et al. 1999). Vector-data models represent each surface as a series of isolines. For example, elevation is represented as a series of contours. While the vector-data model is useful for displaying information, its disadvantage is that it is not a convenient platform for analysing land surfaces with more than two characteristics, such as slope and elevation, along with some other aspect (Shupeng Chen et al. 1999).

An alternative to the vector-data model, the raster-data model is more like a photograph than a map. In a raster-data model, each location is represented as a cell. The matrix of cells, organised into rows and columns, is called a grid. Each row contains a group of cells with values representing some geographic phenomenon (Shupeng Chen et al. 1999). Cell values are numbers, which represent nominal data such as land-use types and measures of light intensity.

Although there are other choices, vector and raster-data models have a number of advantages (Felleman 1990; Jianping Xu and Lathorp 1994; Shupeng Chen et al. 1999). By combining the advantages of these two kinds of data models, Jiyuan Liu et al. (2002) further developed a 1-km area percentage data model (1-km APDM), or 1-km area with different land uses model, to detect and represent the land-use changes on a 1 km by 1 km grid scale. This model has been widely used in the past to analyse spatial and inter-temporal characteristics of land-use change in China (Xiangzheng Deng et al. 2002, 2003; Jiyuan Liu et al. 2002, 2003).

Based on the prototype of the 1-km APDM, we develop a set of programs to generate 1-km area percentage data. The generated 1-km area percentage data are based on map-algebra concepts, a data manipulation language designed specifically for geographic cell-based systems (Jiyuan Liu et al. 2002; Xiangzhen Deng et al. 2002). The procedures to generate the 1-km area percentage data are conducted in five steps. The first step is to generate land-use maps during the study periods, at a scale of 1:100,000. This is done by man-computer interpretation in the ArcGIS 8.02 software environment (Xiangzhen Deng et al. 2002; Jiyuan Liu et al. 2003). The second step is to generate a 1-km FISHNET vector map geo-referenced to a China boundary map at a scale of 1:10,000. The third step is to intersect the land-use change map with a 1-km FISHNET vector map. This is followed by aggregating the conversion areas for each land-utilisation type (LUT) in each 1-km grid identified by 1-km FISHNET vector cell IDs in the TABLE module of Arc/Info 8.02. Finally, the area percentage

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

vector data are transformed into grid raster data to identify the conversion direction and intensification. The design and well-established data-handling procedures ensure that there is no loss in area and produce the basic data that are used for monitoring land-use change (the encroachment of urban land onto cultivated land).

Bio-productivity

There are several ways to estimate the potential productivity of cultivated land, or bio-productivity. Whatever method is used, a number of assumptions must be made about the crops or mix of crops that can be produced on each plot of land. Other assumptions are needed to estimate the acceptable level of output, the social acceptance of land-cover conversions, and the constraints related to land use that may be overcome by technology, management and investment (Keyzer 1998; Albersen et al. 2000; Fischer 2000, 2001; Günther 2001; Heilig et al. 2000;).

The Food and Agriculture Organization of the United Nations (FAO), in collaboration with the International Institute for Applied Systems Analysis (IIASA), has developed a method of calculating bio-productivity—the agro-ecological zones (AEZ) methodology—that is now in common use. The AEZ methodology serves as an evaluative framework for biophysical limitations and production potential of major food and fibre crops under various levels of inputs and management scenarios at global and regional scales (Albersen et al. 2000; Fischer 2000, 2001). In its simplest form, the AEZ framework contains three elements: selected agricultural production systems with defined input/output relationships, termed land-utilisation types (LUTs); geo-referenced land-resources data (including climate, soil and terrain data); and procedures for calculating potential yields, matching crop/LUT environmental requirements (by land units and grid cells) with the corresponding environmental characteristics available in the land-resources database.

The land-use change (LUC) group of IIASA has applied the AEZ methodology in China to assess the cultivated land potential throughout the country. In IIASA's procedure, the land-resources inventory of China comprises 375,000 grid cells measuring 5 by 5 km. As part of the agro-climatic characterisation, Fisher et al. (2001) employed a water-balance model in each grid cell, based on monthly historical data from 1958 to 1988, to simulate when and for how long water is available to sustain crop growth. The model also uses soil moisture, together with other climatic characteristics (such as radiation levels and temperature profiles), in a simple crop growth

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

model to calculate potential biomass production and yield. In the next step, the LUC group combined the potential yield of each cell in a semi-quantitative manner with several reduction factors directly or indirectly related to agro-climatic factors (e.g. pests and diseases) and/or soil and terrain conditions (Fischer 2001). The reduction factors vary according to crop type, the specific environment of each grid cell, and assumptions about the level of inputs and management. The final result consists of attainable crop yields under various production circumstances. To ensure that the results relate to sustainable production, fallow periods are imposed, and terrain slopes and soils too susceptible to topsoil erosion are excluded (Fischer 2001). In this study, we follow the results on cultivated land production from IIASA as baseline values to estimate the changes of bio-productivity of cultivated land due to LUT conversions.

DATA

One of the strengths of our study is the quality of data that we use to estimate cultivated land use change and bio-productivity. For our purposes, digital images from satellite remote sensing are the most suitable data for detecting and monitoring LUC at global and regional scales. There are a number of choices. Satellite sensors, such as the advanced very high resolution radiometer (AVHRR), the Landsat thematic mapper (TM), and the French SPOT system, have been used successfully for measuring deforestation, biomass burning and other land-cover changes, including deforestation (e.g. Skole and Tucker 1993) and the expansion and contraction of deserts. Remote-sensing techniques also have been used widely to monitor the conversion of agricultural land to infrastructure (i.e. the process of urbanisation).

In our study, we use a LUT data-set developed by the Chinese Academy of Sciences (CAS). Our study's data are from satellite remote-sensing: US Landsat TM/ETM scenes[2] with a spatial resolution of 30 by 30 m. The database includes time-series data for three time periods: (a) the late 1980s, including Landsat-TM scenes for 1986–1989 (henceforth referred to simply as 1986 data); (b) the mid 1990s, including Landsat-TM scenes for 1995–1996 (henceforth 1995); and (c) the late 1990s, including Landsat-TM scenes for 1999–2000 (henceforth 2000). For each time period, we used more than 500 TM scenes to cover the entire country. Specifically, we use 514 scenes in the late 1980s, 520 scenes in the mid 1990s and

[2] <http://www.reidc.ac.cn>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

512 scenes in the late 1990s. The Landsat-TM images have been geo-referenced and ortho-rectified. To do this, the data team used ground control points that were collected during fieldwork, as well as high-resolution digital elevation models. Visual interpretation and digitisation of TM images at the scale of 1:100,000 were made to generate thematic maps of land cover (Xiangzheng Deng et al. 2002; Jiyuan Liu et al. 2003). A hierarchical classification system of 25 land-cover classes was applied to the data. In this study, the 25 classes of land cover were grouped further into six aggregated classes of land cover—cultivated land, forestry area, grassland, water area, built-up area and unused land (Table 10.1).

The interpretations of TM images and land-cover classifications were validated against extensive field surveys (Jiyuan Liu et al. 2002). The Chinese Academy of Sciences conducted ground-truth checks for more than 75,000 km of transects across China. During the ground-truthing, more than 8000 photographs were taken using cameras equipped with a global position system (GPS). The average interpretation accuracy for land-cover classification is 92.9% for the late 1980s and 97.6% for the late 1990s. The database from 1999–2000 was used for our analysis of current patterns of land cover in China. By comparing land-cover patterns between the late 1980s and the late

Table 10.1 The classification system of land-use categories used in this study

Land-use types	Explanations
Cultivated land	Original data include both paddy and non-irrigated uplands, which is aggregated into total cultivated land for this study.
Forestry area	Natural or planted forests with canopy covers greater than 30%; land covered by trees less than 2 metres high, with a canopy cover greater than 40%; land covered by trees with canopy cover between 10 to 30%; and land used for tea-gardens, orchards and nurseries.
Grassland	Lands covered by herbaceous plants with coverage greater than 5% and mixed rangeland with the coverage of shrub canopies less than 10%.
Water area	Land covered by natural water bodies or land with facilities for irrigation and water reservation, including rivers, canals, lakes, permanent glaciers, beaches and shorelines, and bottomland.
Built-up area	Land used for urban and rural settlements, industry and transportation.
Unused land (remaining area)	The rest of all other lands.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1990s, we determined the change in land cover for the entire country during 1986–2000. Additional details about the methodology which we used to generate the databases of land cover from Landsat-TM data have been documented by Jiyuan Liu et al. (2003).

In order to obtain even more accurate estimates of land use, we also designed a matrix to help us discount the areas in which there are thin ground objects. To do this, we used information from aerial patches based on the CAS LUC data-set. The precision of measurement was down to the centimetre level. The widths of linear objects, including small canyons, ditches and roads, were measured via the ZOOM IN functions in the ArcGIS 8.10 environment (the smallest of the magnifying functions is 10 times). Irregular, linear, thin objects were divided into more-regular ones and measured one by one, then aggregated into areas of the entire thin objects. When handling the data in this way, we guarantee the accuracy of the discounting of linear thin objects as well as the measurement for the aerial patches. In addition, for small objects, their true areas were measured rather than generalised areas (which is the traditional way and less accurate) in order to guarantee the accuracy of aerial patches and ensure that they are relatively free from aggregation errors.

RESULTS

Changes in cultivated land

Using the methods and data described above, our study shows that China's conversion of cultivated land to other uses was surprisingly low during the study period of 1986 to 2000. According to our results, the conversion of cultivated land to non-agricultural uses totalled 3.06 million hectares over that period (Table 10.2, row 1, column 6). When compared with total cultivated area in 1986, the converted land accounted for 2.21% of total cultivated land (column 7). Conversion of this amount of land implies that the annual rate of conversion of cultivated land to other uses was only 0.15% during the study period, a rate that is much lower than that experienced in many other countries during the times at which their economies were growing rapidly.

Using the output of the GIS mapping and spatial analysis, we are able to create a map showing the conversions of cultivated land into other land-use categories (Figure 10.1; Table 10.2, columns 1–5). Among land converted out of agriculture, about 38% was converted to built-up areas. The vast majority of the area is in China's eastern coastal region. We can see too that smaller shares of cultivated land in the Loess

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

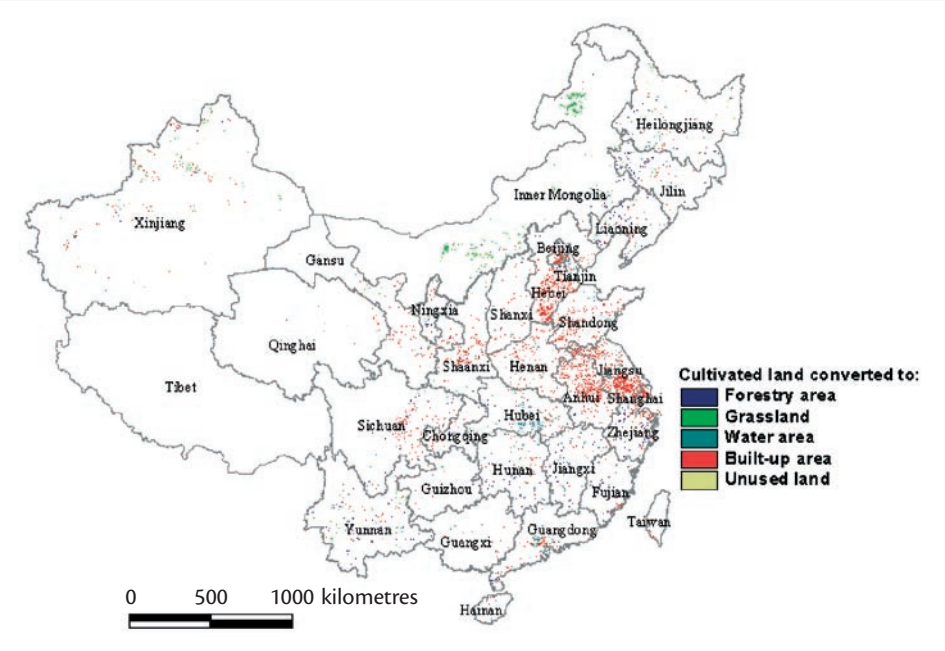

Figure 10.1 Distribution of land converted *from* cultivated land *to* other uses in China, 1986 to 2000

Plateau and the Sichuan Basin were converted into built-up areas. In addition to the area turned into industry, infrastructure and residences, 17% of the cultivated area was converted for forestry (in the south and southwest), 30% to grasslands (mostly in the northeast) and 16% to other uses.

Although a considerable area of cultivated land was converted to other uses between 1986 and 2000, during the same period an even greater area of land was converted from other uses into cultivated area (Table 10.2, row 2). Overall between 1986 and 2002, 5.71 million hectares of new, cultivated land was created (Table 10.2, column 6). As a share of cultivated land in 1986, the conversion of other land to cultivated land resulted in a gross expansion of 4.12%. Among the different types of land, most of the newly converted cultivated land, 55.23%, came from grassland, 27.76% from forested areas, and around 20% came from wetlands, the reclamation of unused land and other uses.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The mapping analysis also shows the distribution of the newly converted area (Figure 10.2). Most of the area converted from grasslands is, as expected, mainly located in the northwestern part China and the eastern parts of Inner Mongolia. In north and north-eastern China, the map shows that there were large tracts of forests that were converted to cultivated land during the study period, while some areas of Sichuan also changed from forests to cultivated area. Finally, in northeastern China, especially in Heilongjiang, large tracts of unused wetlands and wastelands were converted to cultivated area, although in some cases, the analysis shows that there was considerable conversion of one type of cultivated land (e.g. paddy) to other types of cultivated area (e.g. upland).

When looking at the aggregate record of China during the study period, we can see that the tendency to convert cultivated land into built-up area and other uses is, in large part, offset by the conversion of grasslands, forestry and other land types into cultivated area. Hence, when taking the net gain (5.71 million hectares) from the net loss (3.06 million hectares), we find that, between 1986 and 2000, the cultivated land area of China actually increased by 2.65 million hectares (Table 10.2, row 3). When compared with the base of cultivated area in 1986, China's farmers were cultivating 1.91% more land in 2000 than they were in 1986.

Comparing Figures 10.1 and 10.2 shows, unsurprisingly, that the location of land converted into cultivated area differs fundamentally from that converted from cultivated land into other uses, including built-up area. In Figure 10.3 we summarise the data by ranking the provinces by the net percentage of total cultivated area (using

Table 10.2 Conversion of cultivated land in China, 1986–2000

	Land use (million hectares)						As percentage of 1986
	Forestry area	Grass-land	Water area	Built-up area	Unused land	Total	
Change from cultivated land being converted to:	0.51	0.92	0.29	1.17	0.17	3.06	2.21
Change from cultivated land being converted from:	1.58	3.15	0.23	0.07	0.67	5.71	4.12
Net change	1.07	2.23	−0.06	−1.10	0.50	2.65	1.91

Data source: Authors' data and calculations.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

1986 as a base) that was converted into or out of cultivated land. The results of this analysis show that, in more than half of the provinces, cultivated land area decreased. In general, cultivated land fell most sharply for the large municipalities and those provinces in southern and eastern China. It should be noted that Beijing and Shanghai are the only two provinces that experienced reductions of cultivated land that exceed 5%. In contrast, in one-third of the provinces the area of cultivated land rose. Most of the provinces that experienced net increases are in northeastern and some parts of northern China.

Changes in bio-productivity due to land conversions

Using the results of the AEZ analyses in conjunction with our data on the net changes of cultivated land, we can estimate the net change in bio-production (defined as the product of cultivated land times bio-productivity) due to the conversion of land into and out of cultivated area. The effect of conversion of cultivated

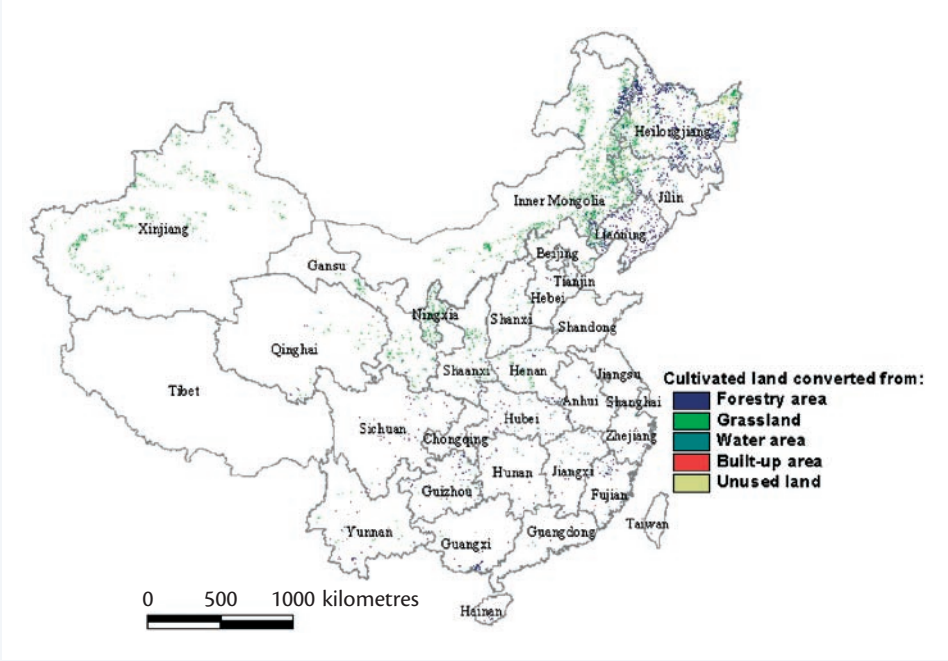

Figure 10.2 Distribution of land converted *to* cultivated land *from* other uses, 1986 to 2000

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

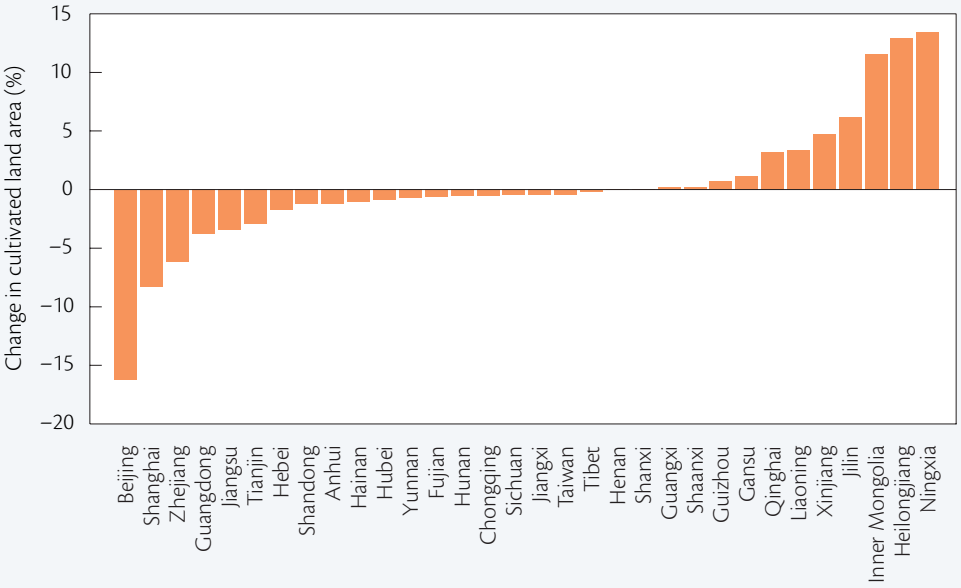

Figure 10.3 Percentage change in cultivated land area by province in China, 1986 to 2000

land is negligible. In total, the bio-production of cultivated land fell between 1986 and 2000 by 5858 billion kcal, or 0.31% (Table 10.3). This means that the average bio-productivity per unit land during the 15-year study period fell by 2.2%.

While overall there is only a small change, our analysis requires us to further disaggregate the net change by land type, so we can assess how much the conversion of cultivated land to built-up area has affected bio-production (Table 10.3). In total, the conversions of cultivated land to other uses led to a net loss of 34,829 billion kcal or 1.77% of total bio-production in 1986. Of this total amount, a decrease of 20,489 billion kcal or about 59% of the total fall in bio-production (or 20,489/34,829) is due to the conversion of cultivated land to built-up areas. The high percentage due to the conversion of built-up area is due in large part to the fact that the land being converted into built-up area is of higher quality than the other types of land moving out of agriculture. In a bio-productivity sense, higher quality is due to the fact that the converted land is in the south and east (so it can support two or more seasons) and is on less-steep slopes in areas with more precipitation. In addition, of the total reduction

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

in cultivated area due to conversion, 16.14% (or 5623 billion kcal) is due to conversion to forestry, a figure that would be higher in 2004 since the nation's Grain for Green program (or a cultivated land conversion program) did not begin until 1999.

At the same time, the conversions of other uses to cultivated land have also led to an increase of cultivated land bio-production. In total, newly converted land accounted for 28,971 billion kcal more in bio-production. As a percentage of bio-production in 1986, newly converted land raised bio-production by 1.47%. Of the total, conversions from grasslands (47.91% or 13,879 billion kcal) and forests (35.67% or 10,335 billion kcal) account for most of the increased production. Hence, between 1986 and 2000, China recorded a net decrease in bio-productivity (–2.2%), which showed that, although the quality of land that was converted into cultivated area was less than the land converted into other uses (especially for that converted into built-up area), the increased land that could be cultivated in 2000 versus 1986 significantly offset the lower productivity due to conversion to built-up area.

When ranking China's provinces by the changing rates of bio-production, we can see that there exists an obvious spatial distribution pattern (Figure 10.4). The developed provinces in northern China, e.g. Beijing and Tianjin, account for a large share of the reduced bio-production. The eastern and southeastern provinces also account for a large fraction of the reduction. In contrast, the large shares of land reclaimed as cultivated land in northeastern China, Inner Mongolia and some inland provinces help boost productivity.

Table 10.3 Bio-production shifts (measured in billion kcal) associated with changes in cultivated area in China, 1986 and 2000

	Land use (billion kcal)						As percentage in 1986
	Forestry area	Grass-land	Water area	Built-up area	Unused land	Total	
Changes from cultivated land being converted to:	5,623	2,687	5,432	20,489	598	34,829	1.77
Changes from cultivated land being converted from:	10,335	13,879	2,351	82	2,323	28,971	1.47
Net change	4,713	11,192	–3,082	–20,407	1,726	–5,858	–0.30

Data source: Authors' data and calculations.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

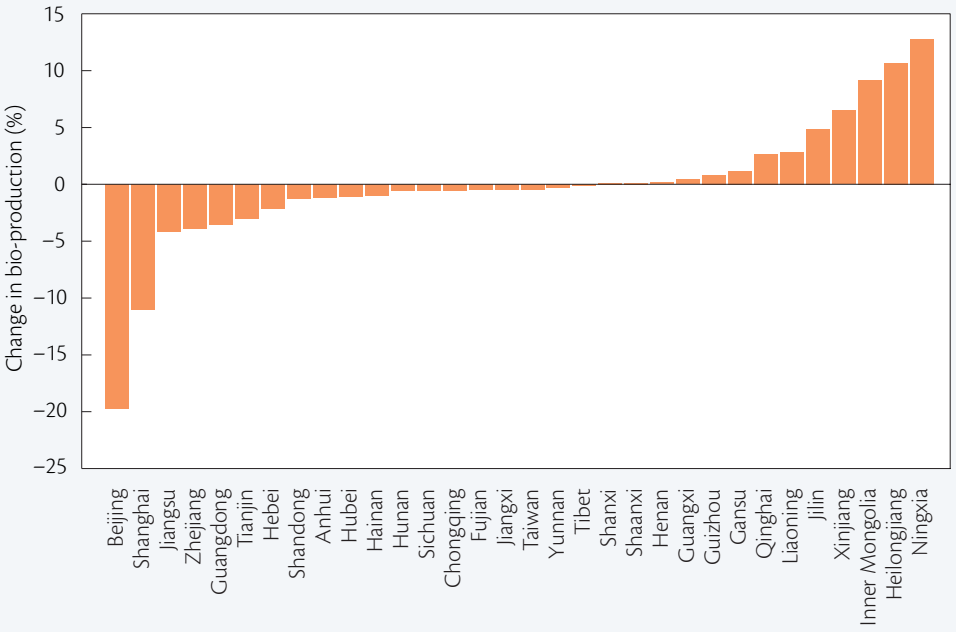

Figure 10.4 Percentage change of total bio-production associated with changes in cultivated land by provinces in China, 1986–2000

CONCLUSION

Our study finds that, contrary to popular belief in some quarters, the rapid economic growth in 1985–2000 has not resulted in a large loss of cultivated land. In fact, in terms of retention of cultivated land, China's agriculture is doing well, with the net area of cultivated land actually increasing during 1986 to 2000. Breakdown of cultivated land changes show that nearly half of the cultivated land lost went to grassland (30%) and forest (17%). Of the remainder, most went to built-up area (40%). However, there was a considerable amount of newly cultivated land as well, some shifting from grassland and some from forest area.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Although the newly cultivated area rose, bio-productivity fell. The most important reason is that the quality of the land converted from cultivated area to built-up area is higher than that converted from other uses. Despite this, however, when examined in aggregate for the entire period, the effect on bio-production is negligible. Although decline in cultivated land has been significant since 2000, most of the reduction of land was due to land conservation programs such as Grain for Green, which have little impact on domestic grain prices and the balance of food demand and supply.

When considering the main message to policy makers, one of the most important lessons is that, at least through 2000, there is no real problem. It is true that land needs strict management to facilitate its rational use in the short and long-run, but our work suggests that the current ban on land conversion is not warranted. Since the process of development is one of shifting the population from rural and agriculture to urban and industry, a complete ban on conversion, especially at the recent growth rates of China, may pose a serious threat to rapid development.

REFERENCES

Albersen, P., Fischer, G., Keyzer, M. and Sun, L. 2000. Estimation of agricultural production relation in the LUC model for China. Laxenburg, Austria, International Institute for Applied Systems Analysis, Interim Report IR-2000-027.

Anderson, K., Jikun Huang and Ianchovichina, E. 2005. Impact of China's WTO accession on rural–urban income inequality. China's Economic Review, in press.

Felleman, J. 1990. There's a GIS in your future. Government Information Quarterly, 7, 261–267.

Fischer, G. and Laixiang Sun 2001. Model based analysis of future land-use development in China. Agriculture, Ecosystems & Environment, 85, 163–176.

Fischer, G., Makowski, M. and Granat, J. 1999. AEZWIN: an interactive multiple-criteria analysis tool for land resources appraisal. World Soil Resources Report No. 87. Laxenburg, Austria, International Institute for Applied Systems Analysis; Rome, FAO.

Fischer, G., van Velthuizen, H.T. and Nachtergaele, F.O. 2000. Global agro-ecological zones assessment: methodology and results. Interim Report IR-00-064. Laxenburg, Austria, International Institute for Applied Systems Analysis; Rome, FAO.

Heilig, G.K., Fischer, G. and van Velthuizen, H.T. 2000. Can China feed itself? An analysis of China's food prospects with special reference to water resources. International Journal of Sustainable Development and World Ecology, 7(3), 153–172.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Keyzer, M. 1998. Formulation and spatial aggregation of agricultural production relationships within the land-use change (LUC) model. Interim Report IR-98-092. International Institute for Applied Systems Analysis, Laxenburg, Austria.

Jianping Xu and Lathrop, R.G. Jr. 1994. Improving cost-path tracing in a raster data format. Computers and Geosciences, 20, 1455–1465.

Jiyuan Liu, Mingliang Liu, Dafang Zhuang, Zengxiang Zhang and Xiangzheng Deng 2003. Study on spatial pattern of land-use change in China during 1995–2000. Science in China (Series D), 46, 373–384.

Jiyuan Liu, Mingliang Liu, Xiangzheng Deng, Dafang Zhuang, Zengxiang Zhang and Di Luo 2002. The land-use and land-cover change database and its relative studies in China. Chinese Geographical Science, 12(2), 114–119.

NSBC (National Statistical Bureau of China) 2003. Chinese statistical yearbook. Beijing, Chinese Statistical Press.

Shupeng Chen, Xuejun Lu and Chenghu Zhou 1999. Introduction of geographical information system. Beijing, Science Press.

Skole, D., and C. Tucker. 1993. Tropical deforestation and habitat fragmentation in the Amazon: satellite data from 1978 to 1988. Science, 260, 1905–1909.

Uchida, E., Rozelle, S., Jikun Huang and Xiangzheng Deng 2004. Changes in cultivated land due to urbanization: China in an international perspective. Policy brief presented in the second expert meeting of agricultural and rural development, China Council for International Cooperation on Environment and Development (CCICED), Beijing, 2004.

Xiangzheng Deng and Jinyan Zhang 2004. Scale-effect analysis to LUCC driving forces for the farming–pasturing interlocked area in northern China. Geography and Geo-information Sciences, 20(3), 64–68.

Xiangzheng Deng, Jiyuan Liu, Dafang Zhuang and Jinyan Zhan, 2002. Modeling the relationship of land use change and some geophysical indicators: a case study in the ecotone between agriculture and pasturing in northern China. Journal of Geographical Sciences, 12, 397–404.

Xiangzheng Deng, Yansui Liu and Tao Zhao, 2003. Study on the land–use change and its spatial distribution: a case study in Ankang District. Resources and Environment in the Yangtze Basin, 12, 522–528.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

10.3 LAND ACQUISITION IN CHINA:

POLICY DEVELOPMENT AND REFORM RECOMMENDATIONS

Ke Bingsheng and Zhou Shouyin
Research Center for Rural Economy, Ministry of Agriculture, Beijing, People's Republic of China

INTRODUCTION

Land issues are of the utmost importance for agricultural and rural development as well as overall economic development and social stability in China. This is primarily due to the twofold functions of land in Chinese agriculture: land as a production/economic tool and land as security for its smallholders. There are frequently conflicts in the efforts to let those two functions operate. For the nation as a whole, there are also conflicts between two major types of land use: for agriculture/food security and non-agricultural purposes. The conflicts have become increasingly evident in recent years, as large areas of farmland have been taken away for non-agricultural purposes, such as massive infrastructure construction and explosive urban expansion. Major problems from massive land acquisition include: (1) a sharp decline in crop land and grain production, which arouses widespread concern on food security; (2) substantial infringement of farmers' rights and interests due to unfair compensation methods and low compensation standards; and (3) social insecurity for a large number of the farmers made landless and the social instability associated with this. It is of the utmost importance and urgency to solve those conflicts so that the land demand for industrialisation and urbanisation can be efficiently met while farmland and farmers' interests are protected.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There are complex reasons for the problems, but the most fundamental ones are the deficiency of, and loopholes in, the existing land laws and regulations and their weak enforcement. The effects on landless farmers and compensation methods have changed fundamentally since the reform era. The conditions for solving the associated problems have changed completely within the new market system. In the past two decades, the scale of land acquisition, the magnitude of the challenges, the main goals and the instruments available for land-acquisition have all changed. The policy framework has not kept pace with those changes. On the other hand, it has become a nationwide phenomenon that local governments are extraordinarily enthusiastic about acquiring farmland from farmers for non-agricultural uses, leading to weak enforcement of land protection and acquisition laws and regulations.

In the second section of this paper, the development of the legal and policy framework on land acquisition in China over the past two decades is reviewed and analysed. The changes in land area are presented, then, in the third section, the major contributors to land area decline are discussed. In the fourth section, the most outstanding problems in land management and major reasons for those problems are analysed. Finally, in the fifth section, recommendations to improve the existing policy framework and its enforcement are made.

A REVIEW OF THE DEVELOPMENT OF LAND-ACQUISITION POLICY

A large number of laws, regulations and decrees have been made and promulgated by the Congress or the State Council on the matters of land use, land protection and land acquisition. Those major laws and regulations are listed in Table 10.4.

Over the past two decades, fundamental changes in land management and land-use policies have occurred. The major changes and the main features of the current policies can be summarised as follows.

First, the system of land tenure has been fundamentally changed, and individual farmers have gained use-rights to farmland. Under the Household Responsibility System introduced in the late 1970s, the ownership of the land remains with the village collectives, but the right to use the land, to gain benefit from land use, and to transfer

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

or to terminate the land-use right is granted to individual farmers, as long as the land is used for agricultural purposes. The most explicit statement of those rights is provided in the *Law for Rural Land Contracting* effective since 2003. According to the law:

> The state protects the legal right of the collective land owners, the contractual land use right of the contractors; no organizations or individuals are allowed to infringe those rights.
>
> The state protects the contractors in transferring out their contractual land use right based on their own willingness, against compensation and according to laws.
>
> The contractors…have the right of using, benefiting from and transferring the contracted land…

Table 10.4 Major land laws and regulations in China

Name of regulation	Authority	Year of promulgation/ revision
Land Management Law	People's Congress	1986, 1988,1999
Law for Rural Land Contracting	People's Congress	2003
Decree on Land Acquisition for Construction	State Council	1982
Decree on Land Use for Housing Construction in Villages and Towns	State Council	1983
Regulations on Land Reclamation	State Council	1989
Decree on Implementing the Land Management Law	State Council	1991, 1999
Regulations on Basic Farmland Protection	State Council	1992
Urgent Notice on Prohibition Misuse and Unapproved Farmland Acquisition	State Council	1992
Decree on Village and Town Planning and Construction Management	State Council	1993
Decree on Basic Farmland Protection	State Council	1994, 1999
Notice on Strengthening Land Management and Farmland Protection	State Council	1997
Notice on Streamlining All Development Zones and Enhancing Construction Land Management	State Council	2003
Decisions on deepening reform and strengthening land management	State Council	2004

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The term of the land contract was first set at 15 years, then extended for another 30 years.

Second, protection of farmland has gained increased attention from policy makers, and a basic farmland protection system has been established. The protection of farmland has long been a focus in land management laws and regulations. The *Decree on Land Acquisition for Construction* promulgated in 1982, indicated that:

> Saving land is the basic national policy. All construction projects must follow this principle to increase land use efficiency. Acquisition of farmland for construction is not allowed when there is suitable wasteland; acquisition of fertile farmland, in particular economically high-productive land such as vegetable land, garden plots and fish ponds, is not allowed for construction when infertile land can be used.

The wording of the 1999 version of the *Land Management Law* has become more explicit and strict:

> It is the basic national policy to highly cherish land, reasonably use land and strictly protect farmland. Governments at all levels should adopt effective measures to thoughtfully plan, strictly manage, protect and develop land resources, and to prohibit illegal activities of farmland acquisition.

The focus on land has been shifted from a general statement of protecting land to emphasis on protecting basic farmland. The *Decree on Basic Farmland Protection* was first formulated in 1994 and revised in 1998. It established the system of basic farmland protection. Accordingly, four types of high-quality land are defined: farmland located in the areas previously defined as production bases for grain, cotton and oilseeds; farmland with good irrigation and erosion-prevention facilities, and other potentially high-yielding land; production bases for vegetable production; and land for agricultural research and teaching experiments. In each province, designated basic farmland should exceed 80% of the total farmland. According to the law, strict protection measures should be applied to the designated basic farmland, including the following:

- The amount of the basic farmland should not decline.
- No organisations or individuals are allowed to change the nature or use purpose of basic farmland. For state-designated key construction projects that cannot avoid occupying basic farmland, the land acquisition plan can be approved only by the State Council.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Given the approval of the State Council, the acquisition of basic farmland must be compensated by the same amount of reclamation of new basic farmland by the land user. When reclamation is not possible in the locality, the land user should pay reclamation fees that can be used for reclamation in other localities.
- It is prohibited in the basic farmland areas to construct brick factories, housing projects or graveyards, to mine for construction materials or other raw materials, to dispose of solid waste, or to engage in other activities having damaging effects on basic farmland.
- No organisations or individuals are allowed to use basic farmland to develop forestry or fruit orchards, or dig fish ponds.

Third, the coverage of state land acquisition is very broad, and almost all non-agricultural construction projects have to apply for land through the state land-acquisition process. All groups and individuals must apply for state-owned land for construction. State-owned lands include those previously collectively owned and acquired by the state. This means that all construction must occur on state-owned land. When construction occurs on land not owned by the state, the land will first be turned into state ownership by the land-acquisition process. Only those lands that are used by villages or townships for business and public facilities are allowed to maintain collective ownership, though changes of land use from agricultural to non-agricultural purposes should also be approved by related authorities. In the *Decree on Land Acquisition for Construction* no distinction is made between construction for public and non-public purposes. Land needed for all kinds of construction was to be obtained by acquiring land from rural collectives. In the revised version of the *Land Management Law*, there is an article noting that: 'The state may acquire collectively owned land for the need of public interest'. This indicates that the aim of state land-acquisition is to serve the need of public interest. However, it is unclear how to judge whether the land acquired is for public interest or non-public/commercial interest. There is one exemption to this rule, namely the land for establishing township and village enterprises or for other public facilities in townships/villages, or for villagers' own housing, may retain its collective ownership when such uses are approved. This is to say, when farmers want to use their farmland for non-agricultural purposes for themselves, land ownership may remain unchanged without the state land-acquisition process, as long as such changes of land-use purposes are approved by the authorities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Fourth, the method of land-acquisition control has changed, and the jurisdiction for approving land acquisition has gradually moved to higher authorities. This is one of the measures taken to ensure stricter control of land acquisition from the agricultural sector and to reduce the tendency for local governments to misuse or overuse farmland for non-farm purposes. According to the *Decree on Land Acquisition for Construction*, acquisition of farmland with an area of 1000 mu (1 mu = 1/15 ha) or more and other land of 10,000 mu or more should be approved by the State Council. The acquisition of land in suburban areas of provincial level municipalities should be approved by the municipal government. Land acquisition in other areas should be first checked by the prefecture or county government and finally approved by the provincial government. Land parcels of less than 3 mu farmland, or 10 mu forest land or grassland, or 20 mu other land, should be approved by county or prefecture governments.

The 1998 revision of the *Land Management Law* limited jurisdiction for land acquisition more strictly, to two levels: the national level and the provincial level. Governments at county and prefecture levels were deprived of the power to approve land-acquisition plans regardless of the size of the parcel of land in question. Land-acquisition plans that have to be approved by the State Council include those involving basic farmland, non-basic farmland exceeding 35 hectares (525 mu) or other land exceeding 70 hectares (1050 mu). Land-acquisition plans not covered by the jurisdiction of the State Council are to be approved by the provincial government. The county and prefecture governments have the right to make detailed construction plans only within the framework of the approved land-acquisition application by the provincial or central government.

Fifth, the procedures for land acquisition specify that potential land users make the application, and the related government authority reviews and makes approval decisions, with very weak participation by farmers. According to the *Decree on Land Acquisition for Construction*, land acquisition usually involves the following steps:

1. Site selection. Given approval of the construction project, potential land users/units apply to the local (county/prefecture) government for land acquisition and review, after which the construction site will be selected.
2. Consultation with original land owners. Once the site is chosen, local government will arrange for the potential land user/unit and the original land owners to discuss the areas to be acquired, a compensation plan, and signing of the draft agreement.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

3. Verify the land area and finalise the agreement. Once the land-acquisition plan is approved by the appropriate authority, the local land administration will arrange the signing of the formal agreement.
4. Transfer of the land. This will be organised by the local land administration.

Sixth, upper and lower limits have been set in the regulations on compensation standards associated with land acquisition. Compensation consists of four parts: for land-use rights, personnel allocation, facility losses and crop losses. Compensation standards stipulated in the *Land Management Law* (1998) are significantly increased from those in the *Decree on Land Acquisition for Construction* (1982). According to the *Land Management Law* (1998), compensation for land-use rights should be between 6 and 10 (previously 3–6) times the average production value for the previous three years. Compensation for personnel allocation is based on the size of the farmer's family and per-capita land holding before land acquisition: between 4 and 6 (2–3 previously) times the average production value of the previous three years per person, with a ceiling at 15 (previously 10) times for the whole family. Compensation for facility and crop losses is to be determined by the provincial government. Units using suburban farmland should pay a special fee for construction on vegetable land. The provincial government can increase the compensation level to prevent a fall in a farmer's livelihood, but the combined compensations for land use and personnel allocation should not exceed 30 times the average production value of the previous three years. This restriction has been removed in a recent decision by the State Land Administration.

In October 2004, a new document entitled 'Decisions on deepening reform and strengthening land management' was released by the State Council. This demonstrates increased resolve of the central government to implement more-stringent land-management measures to protect farmland. This largely resulted from the recent warning about grain shortage after consecutive years of production decline. Major decrees in the document are:

1. It is strictly prohibited to lower land price to attract foreign investment, and those who violate this principle will be prosecuted.
2. To improve the land acquisition procedures: before the land-acquisition plan is submitted for approval, the plan, the compensation standards and new employment arrangements should be made known to farmers, and public hearings should be organised if necessary.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

3. The gains generated from land price differences between that paid to farmers by the government and that paid by land users should be first delivered to the state treasury and then divided by ratio between the central and local government.
4. A state land-supervising system is to be established to strengthen the enforcement of land management and protection laws The state will appoint a supervisor-general and send supervisors to local governments.

CHANGES IN FARMLAND AREAS IN THE PAST TWO DECADES

In China, farmland accounts for only about 13% of the total land area, far lower than most countries. The current land use pattern in China is summarised in Table 10.5.

In the past two decades, changes in farmland areas have shown the following trends.

Continued decline in total farmland area

Since the end of the 1970s, the accumulated net reduction in China's farmland is over 172 million mu, or 9% of the current land amount of 1851 million mu. The first peak appeared in 1985, when the yearly net reduction of farmland exceeded 15 million mu. It can be noticed that the reduction has become especially serious in

Table 10.5 Land uses in China, 2003

Land use	Proportion (%)
Residential and industry	2.67
Transportation	0.23
Irrigation facilities	0.38
Arable land	12.98
Horticulture	1.17
Forest	24.61
Grassland	27.68
Other agricultural land	2.68
No specific use	27.6

Source: Statistical yearbook of China 2004.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

the past four years, with the figure in 2003 standing at 38 million mu, or more than 2% of total farmland. The total amount and yearly reduction of farmland in China is presented in Table 10.6.

Farmland area measured in per-capita terms is low and continues to decline

Farmland area in China is currently below 1.5 mu per person. Due to the continued population expansion and decline in total farmland area, the farmland area per capita has been falling continuously, as indicated in Table 10.7.

Table 10.6 Annual reductions in farmland area (million mu) in China, 1979–2003

Year	Total farmland	Yearly reduction	Year	Total farmland	Yearly reduction
1979	1492.47	…	1992	1431.39	3.42
1980	1489.58	2.89	1993	1426.52	4.87
1981	1485.53	4.05	1994	1423.60	2.92
1982	1479.10	6.43	1995	1424.57	+0.97
1983	1475.39	3.70	…	…	…
1984	1467.80	7.59	1996	1951.00	…
1985	1452.69	15.11	1997	1949.00	2.04
1986	1443.44	9.25	1998	1945.00	3.92
1987	1438.33	5.12	1999	1938.00	6.55
1988	1435.83	2.50	2000	1923.00	19.13
1989	1434.84	0.99	2001	1914.00	9.26
1990	1435.09	+0.25	2002	1889.00	25.31
1991	1434.81	0.29	2003	1851.00	38.06

Sources: Data for 1979–1995, Agricultural statistics in new China, Chinese Statistical Press, 2000; Data for 1996–2002, SEPA, Report on environmental situation in China, various years; Data for 2003, Ministry for Land Resources, Report on land resource in China 2003.

Note: There is a break in the farmland series in 1996 when a national agricultural census revealed previously under-reported farmland areas of over 37%.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 10.7 Changes in total and per-capita farmland area in China, 1996–2003

Year	Total farmland areas (million mu)	Mu per capita
1996	1951	1.59
1997	1949	1.57
1998	1945	1.56
1999	1938	1.54
2000	1923	1.52
2001	1914	1.50
2002	1889	1.46
2003	1851	1.43

Sources: Data for 1996–2002, SEPA, Report on environmental situation in China, various years; Data for 2003, Ministry for Land Resources, Report on land resource in China 2003.

The reforestation program has been the main reason for farmland reduction

Table 10.8 shows where land lost to farming has gone. The largest part of the farmland reduction took place due to implementation of the Grain for Green program, which encourages farmers in mountainous western China to set aside hillside fields for ecological purposes, such as reforestation or grass planting. Farmland located on slopes steeper than 25 degrees is to be set aside. The government provides cash and in-kind grain subsidies, which are worth more than the return that could be generated from cropping this unproductive land. The policy was first trialled in three western provinces—Sichuan, Shaanxi and Gansu—in 1999, and then gradually extended to other provinces. After three years of pilot practice, the project was officially launched in more than 1000 counties (half of the total) in 25 provinces in 2002. The land set-aside program did exist before the abovementioned project, but only on a rather limited scale. It can be seen from Table 10.8, that after the Grain for Green program was introduced, set-aside areas increased dramatically. About 62% of the reduction in farmland area in the observation period is attributed to the introduction and implementation of this program.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Table 10.8 Farmland reduction (million mu) in China, 1997–2003: how the land transferred was used

	Total reduction	Con-struction	Set-aside/ reforestation	For non-crop use	Land damaged by catastrophe	Reclam-ation	Net reduction
1997	6.94	2.89	2.46	0.89	0.71	4.90	2.04
1998	8.63	2.64	2.47	1.05	2.47	4.72	3.92
1999	12.63	3.08	5.92	1.61	2.03	6.08	6.55
2000	23.49	2.45	11.45	8.67	0.93	4.37	19.13
2001	12.45	2.46	8.86	0.68	0.46	3.04	9.26
2002	30.43	2.95	21.38	5.24	0.86	5.12	25.31
2003	42.72	3.44	33.56	4.97	0.76	4.66	38.06
Total	137.28	19.89	86.09	23.09	8.21	32.87	104.26
%	100.0	14.5	62.7	16.8	6.0		

Sources: Data for 1996–2002, SEPA, Report on environmental situation in China, various years; Data for 2003, Ministry for Land Resources, Report on land resource in China 2003.

The second-largest part of the reduction in recent years is the land taken away from crop cultivation for other agricultural uses, such as fish ponds or trees, a process called 'restructuring'. In 2003, restructuring accounted for about 17% of the total decrease in farmland area.

Non-farm construction activities accounted for a large share of the land reduction

According to official statistics, the area taken away from agricultural use for construction is fairly stable, at about 3 million mu per year, making the total amount in the 7-year period from 1997 to 2003 nearly 20 million mu. However, this figure seems to be under-reported. This is because many local governments are very keen on construction projects to promote local economic growth through new investments and to gain revenue from the land-acquisition process. The many cases of illegal land acquisition reported in the national media in recent years are obvious evidence, as discussed in more detail in the following section.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The potential for reclamation is limited

From statistical figures, the area of land reclaimed annually is between 3 and 6 million mu, larger in any given year than that for construction. However, this quantitative comparison is misleading, since most of the land taken from agriculture is usually high-fertility farmland with high yields and a high cropping index, and is generally close to markets, while the newly reclaimed land is often the opposite—of much lower productivity and in remote areas. This also indicates that the potential for new reclamation in China is very limited. The newly reclaimed land is, as a rule, located in ecologically fragile areas.

MAJOR PROBLEMS IN LAND MANAGEMENT AND LAND ACQUISITION

Concerns about problems associated with land management and land acquisition have become more open in recent years. Disputes on land issues have moved to the top of the complaints of farmers to the agricultural administration at various levels. Major problems in land acquisition can be summarised as follows:

Land acquisition and misuse by development zones

By the end of 2003 (Ma Jia 2004), there were 6015 'development zones' of various kinds and at various levels nationwide, with a total area of 35,100 km², or 3.66% of the total land area in China. Huge areas have been acquired, mostly taken away from farmland, and many remain to be developed. Comparison of this figure with the existing land-use structure reveals the huge scale of land acquisition by development zones. The sum of the existing residential, industry and transportation areas is only 2.90% of the total land area in China and is exceeded by the 'to be developed' development zone areas.

Of the total 6015 development zones, 259 have been approved by the central government, 1559 have been approved by provincial governments, and the remaining 4197 were approved by prefecture, county and township governments. Over 80% of the development zone areas were taken from farmland. Some 43% of the land area acquired by development zones had not been used (Han Changfu 2003) at the end of 2003. In one prefecture in Shandong Province, there were 161 development zones approved by governments at various levels, totalling 971.3 km². Of those areas,

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

only 57% have been developed, and 47% remain idle (Liu Zhen 2003). Nationwide, there are over 900 provincial-level development zones with a total approved area of 30 million mu, of which only 13.5% had been used by the end of 2003, with the remaining 26 million mu land area lying idle.

Weak enforcement of farmland protection regulations

According to related regulations, only provincial governments and the central government have the authority to approve farmland acquisition. For acquisition of basic farmland, the only jurisdiction is the State Council. However, large areas of farmland have been acquired for establishing development zones without approval. Of the 6015 development zones, only 1818 have been approved by the State Council or provincial governments (Mu Jia 2004). It can be assumed that a very large number of the development zones have been illegally established. Since 2000, over half a million violations of land-management regulations have been detected. In 2003 alone, 178,000 such cases were found (Niu Feng 2004). According to investigation results from 10 provinces in 2003, 69% of the total development zone areas are not legally approved (Wang Weimin 2004).

Farmers interests are often not considered in the land-acquisition process

Land acquisition has created large numbers of landless and unemployed farmers, which seriously affects social stability. In the process of land acquisition, though there is some compensation to farmers, the levels are very low. On average, compensation fees are only several thousand yuan per mu, accounting for only 5–10% of the true value of the land. The remaining benefits from turning farmland into non-farm use are split among local government, the land developing companies and villages. According to some investigations, about 60% of the farmers whose land has been acquired cannot find alternative jobs or other income sources (Zhang Yan 2004). According to statistics of the Ministry of Land Resources, during 1987–2001 total acquired land areas, legal and illegal, amounted to 44.2 million mu, creating about 55 million landless farmers (Mu Jia 2004). In 2003, the Ministry of Land Resources received 3394 letters of complaint and visits from 1015 farmer groups. A large share of those complaints is related to illegal land acquisition, accounting for 52% of the complaint letters and 32% of visitors. The second-largest share is related to the issue of compensation for land acquisition, accounting for 12% of the complaint letters and 30% of the visitors (Teng Wen 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

There are a number of reasons for these problems. First, poorly defined ownership of farmland is the fundamental reason. According to the *Land Management Law*, rural land is 'farmers collectively owned'. The definition is rather vague and no further explanation can be found in the existing laws. The *Decree on Implementing the Land Management Law* provides a detailed list of land owned by the state, but without any clarification on rural land ownership or the meaning of 'farmers collectively owned'. There are three levels of 'collective unit', namely natural village, 'administrative village' (consisting of several natural villages), and township. There are several factors underlying the uncertainty of land tenure: (1) Who is the representative of the collective ownership? In practice, the village leaders usually take this role. (2) What is the relationship between ownership and contract right? Individual farmers have the contract right. A special law has been promulgated to regulate the issues in this area and protect farmers' contract rights. However, in practice, farmers are often not sure about the nature of their contract right, in particular when village leaders use the ownership right against the contract right. (3) Who are the farmers in the village? In practice, the concept of 'farmers' in land-right issues is often understood as three different groups: those doing farm work, farmers' households, and the whole village population. In all three cases, the groups are dynamic and under constant changes driven by births, marriages, deaths and various kinds of migrations. Adding those factors together leads to the aggregate effect that land acquisition encounters less resistance from farmers than under a clearly defined individual land ownership system.

Second, there is no clear separation or differentiation between land for public use and land for business use in the laws for land acquisition. In the Constitution and the *Land Management Law*, there is a statement that, to meet the need of public interest, the state may acquire land. However, in the articles related to land acquisition, all land needed for construction must first be acquired by the state, without any differentiation of public or business purposes. A large share of the acquired land has been used for business purposes. According to surveys in 16 provinces, about 35% of the acquired land has been used for housing, enterprises and other business activities. In one provincial capital in the coastal region, the share for real public goods construction accounts for only 10% (Teng Wen 2003).

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Thirdly, according to the law, land acquisition is compulsory, with little consultation with farmers. Only on the issue of compensation are farmers' opinions sought, before the compensation plan is decided. When disputes arise, it is the authority approving the land-acquisition plan that makes the final arbitration.

Fourth, the *Decree on Implementing the Land Management Law* stipulates that, when all members of a collective economic organisation become urban residents, the land collectively owned by those members will be changed into state ownership. This regulation empowered local governments to get land by changing suburban rural populations into urban populations.

Finally, the most fundamental and decisive factor is that local governments have a strong interest in land acquisition due to the budget gains associated with the process. Because the compensation level for land acquisition is low, and the acquired land is usually in a good location and of very high value, the profit to local governments from land acquisition is enormous. According to some investigations, the budget gains from the process of land acquisition and then transition of land use rights by local governments accounts for 35% to 60% of the government revenue in some prefectures and counties (Tian Yongsheng 2004). Governments at all levels can participate in the benefit-sharing process of land acquisition, from municipality, county, township and even village. This is also revealed in the complaint cases received by the central government, where the accused are mostly local governments at all levels, as well as village leaders.

MAJOR CONCLUSIONS AND POLICY-REFORM RECOMMENDATIONS

The land issue relates to long-term national food security, farmers' interests, social stability and macro-economic development. In the process of overall national economic development, it is unavoidable that more farmland will be taken away from agriculture. The existing land-administration policy needs to be further reformed to meet the reasonable demand for land for macro-economic development, to protect farmland from misuse and overuse, to protect farmers' interests and to prevent social instability arising from the creation of landless farmers.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The roots of the problem lie in constraints of the existing legal and policy framework, weak enforcement and rampant violation of laws and regulations. Therefore, both policy formulation and implementation should be reformed and improved. Major reform recommendations are as follows:

Improvement and modification of existing laws and regulations

First, measures should be taken to more clearly define land ownership in the village. This will help farmers to increase their awareness and protect their assets and property, and will also increase the awareness of the local government to respect farmers' land rights. This can be achieved through different approaches. In the long-term, privatisation is a favourable solution. This requires change in ideology and political acceptance, which should not be impossible as the privatisation of valuable assets in other economic sectors has long been practised and even encouraged. As a short-term alternative, emphasising the 'land contract right' and enhancing legal protection of this land contract right should be given more attention. This can be accomplished through an institutional arrangement. For example, individual farmers should be given a certificate of their contracted land by the central government agency or at least by provincial governments. This will increase the authority of the 'contract' and the land contract term of 30 years or longer. A certificate issued by the provincial or central government will protect the holders against intervention from local officials.

Second, the compensation mechanism for land acquisition should be reformed, regardless of the nature of the land acquisition, whether for public or non-public/commercial purposes. The market mechanism should be used in determining the value of, and the compensation levels for, the acquired land. Many scholars suggest having a clear differentiation of land acquisition for public benefit and for private business activities. A set of criteria should be set up for public-benefit activities, or an approach could be adopted whereby all activities of a public-benefit nature are listed; what is not on the list is private business. The policy implication of the two types is that there will be different land-acquisition procedures. However, in both cases, farmers should be compensated with the market value of their land, not with arbitrary levels set by local bureaucrats. The market-value compensation mechanism will serve two goals: to effectively protect farmers' interests and to reduce motivation of local governments for excessive land acquisition. For non-public/private business purposes, land-right transfer should not be compulsory, rather it should be based on

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

negotiations between farmers or farmers' organisations and potential land users. The land can enter directly into the market, without the necessity of first becoming state land. Alternatively, even without changing the current land-acquisition procedures, the market principle can be followed in the way that the state obtains the land, sells the land by auction and returns the gains to farmers. The land value will significantly increase from the change of use purpose from farm to non-farm use. Sharing this increased value between the public (government) and individual farmers should be done on clearly defined legal bases, not by the arbitrary decision of local government officials as it is practised currently. Payments to farmers could be made in two steps; the first payment before auctioning and the final payment after auctioning and other deductions. For public purposes, there would be more compulsion inherent in land acquisition. Nevertheless, the compensation levels should again be consistent with the market value of the land. Since auctioning may be impossible, the market value of similar land should be taken as a reference.

Third, a more rules-based, benefit-sharing system should be established for the value increase when farmland moves to non-farm uses. The total gain from auctioning the land could be divided into three parts: a kind of land value-added tax, cash payment to farmers and payment to a social security account set for the farmers. The establishment of a land value-added tax in place of the existing land-transfer fee system has the benefits of transparency and being rules-based. This will be of special importance in reducing the enthusiasm of township governments and village organisations for land acquisition. The township government and village organisations are often the major sources of violations of farmers' legitimate land rights. How this tax should be split between local and central government, as well as the tax rate, need further study. However, in any case, the prevailing share of the appraised land price should go to farmers with the land-contract right, taking into account both the cash payment and the payment for the social-security account. The tax rate might not exceed one-third of the total value.

Fourth, a nationwide social-security system should be established for landless farmers. For Chinese farmers, land is everything. Increased compensation levels will not solve all the problems for those becoming landless. Unlike urban residents, the rural population in China does not have a nationwide social-security system. The once and for all payment, even if significantly increased, will not provide security. As discussed in the previous paragraph, part of the gains from land acquisition should be placed in a social-security account for landless farmers. This will be a

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

very important measure to avoid social instability among landless farmers. Without such measures, even if the compensation is very high and farmers get all the money, there are great dangers that the money will be used up in a relatively short period. This system should be nationally uniform, though the level of payment and other operational details can be regionally decided. The social-security account should apply not only to farmers whose land has been acquired compulsorily, but also to farmers who voluntarily sell their land right. Depending on local conditions, local governments or central government should also make contributions to (subsidise) those accounts.

Fifth, farmers should be allowed to use their land-use rights as an asset to support investment in non-farm construction projects and get due returns. There are already experiments of this kind of practice in some coastal areas. Experience from existing practice should be reviewed, evaluated, adjusted and extended. In places where the collective organisations still have the dominant role in the local economy and the farmland is still collectively cultivated, the land-use rights of individual farmers can be transformed into market value and divided among individual farmers. In doing so, social-security arrangements can be made according to the concept discussed above.

Improving enforcement and implementation of laws and regulations

The first step to improve enforcement of the laws and regulations is to put more efforts into awareness building. The most-important point is to get better understanding of the nature of the land-use rights of individual farmers. The legitimate land rights of individual farmers should be better understood, not only by local governmental officials and village leaders, but also by farmers themselves. Local officials should pay due respect to that right and farmers should learn to use legal means to protect their right.

The second step is to improve public participation and transparency in land acquisition. In the decision-making process, conformity of any specific land-acquisition plan with land laws and regulations must be presented to the farmers involved and to the public. Public hearings should be conducted.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The third step is to improve institutional control of land acquisition. The land administration is usually the jurisdiction for approving land-acquisition plans. To secure farmers' interest and protect the agricultural resource base, the department of agriculture should also be involved in the process, since the agriculture administration generally has a close relationship with farmers' representatives. Any land-acquisition plan should also be reviewed and endorsed by agricultural administrations before sending to the public hearing.

The fourth step is to have a stricter accountability system. In order to strengthen the implementation and enforcement of the laws and regulations, the accountability system should be followed more strictly. This must apply not only to officials in charge of land administration but, more importantly, to the major leaders in the local governments, since many land-acquisition plans are made by the top government leaders in the locality.

REFERENCES

Chen Lei 2004. The truth of investment of golf field in Jimo city of Shandong Province. Sanlian Life Weekly, 19 February 2004.

Han Changfu 2003. Reforming land acquisition system to protect farmland and fundamental interest of farmers. People's Daily, 4 November 2003.

Liu Zhen 2003. The functions and problems with agricultural development parks. Statistical information network of Shandong Province.

Mu Jia 2004. How to protect farmland in China: the failures of existing policy. China Industrial Times, 3 March 2004.

Niu Feng 2004, How to protect farmland. Agricultural Information Network of Hebei Province, 16 April 2004.

Teng Wen 2003. Behind the heated land acquisition: incentives of local governments. Capital Weekly of Shang Hai Securities, 7 December 2003.

Tian Yongsheng 2004. Who are taking land from agriculture? Guangming Daily, 19 April 2004.

Wang Weimin 2004. A package of measures to solve land related problems. Chinese Estate, 14 August 2004.

Zhang Yan 2004. For farmer's sake: on reforming land acquisition system. At: <gtj.hangzhong.gov.cn>.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

PART FOUR

ENVIRONMENTAL CONSEQUENCES OF RURAL DEVELOPMENT

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 11

RURAL DEVELOPMENT AND THE ENVIRONMENT

CCICED ARD Task Force members

Implementation of the Household Responsibility System and other reform policies in 1978 and beyond, combined with new technology in seeds, fertilisers, pest control and irrigation resulted in phenomenal growth in food output in China in the past 25 years. Food-grain security goals were achieved. At least one-third of China's grain output is now used for animal feed, as Chinese consumers add animal products to their diets. China has had a positive trade balance in agriculture for 20 years. Consumer attention is now focusing on diet diversity, food safety and quality assurance.

In the process of developing China's food-production capacity, in some places and in some sectors an accumulated environmental debt remains as a legacy. It has many dimensions and includes soil erosion on cultivated lands, degradation of grasslands, salinity on irrigated lands, ineffective river-basin management, depletion of groundwater and surface aquifers, pollution of soils, air and water from excessive application rates of fertilisers and pesticides, and poor management of livestock wastes. If left unchecked, these environmental problems could be a serious threat to farm incomes and the nation's food-security aspirations. Some problems may grow as China tries to comply with World Trade Organization (WTO) standards and as consumers consider their food purchase choices.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The current environmental malaise is not a technology problem. The science associated with good land and water stewardship is well known. Much of the science and technology needed to tackle environmental problems is already in China, but investment in applied research and demonstration is low. Public extension services have been drastically reduced. The formal education level of most farmers is low. Standards and regulations covering crop input manufacture, application rates and waste management are not rigorously enforced. Input prices, especially for water, do not reflect environmental costs. The tenure situation on cultivated land and grassland is not conducive to good stewardship. Poor access to capital and credit makes adoption of new technology for better land and water management difficult to obtain.

China has been able to supply enough food for its growing population primarily by increasing the intensity of its farming systems, using modern inputs. Inorganic fertilisers and pesticides are key ingredients in this rising intensity. While judicious use of modern technologies is essential to efficient food production the world over, inappropriate uses, such as excessive application rates or imbalances in input combinations, result in serious environmental problems and food safety concerns.

China is now the world's leader in both inorganic fertiliser and pesticide consumption. In the past 30 years, while world total nitrogen fertiliser application increased by 7 times, China's nitrogen use in crop production increased 45 times. On average, nitrogen use per hectare is about 3 times the world average. Pesticides have been used on a large scale since the 1950s to protect crops from damage inflicted by insects and diseases. Recently, China surpassed Japan as the world's leading pesticide consumer. Various pesticide compounds have been produced and applied to crops. Many whose use has been curtailed or banned in other countries are still widely used in China. Among them are pesticides that are known to leave toxic residues in the environment.

Intensive fertiliser and pesticide use can have several adverse effects and the concerns are rising. In addition to the direct costs of fertilisers and pesticides, long-term, highly concentrated application of fertilisers and pesticides may contaminate farm produce, pose serious danger to the agro-ecosystem and adversely affect human health. There is growing concern about the increasing use of fertilisers and pesticides that cause pollution of rivers, lakes and the sea from run-off and seepage, and thereby become sources of ecological problems. China's accession to WTO has raised food-safety concerns due to residual effects of high rates of fertiliser and pesticide application.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Several studies have shown that high rates of fertiliser and pesticide application are partially due to ineffective extension services to advise farmers on input rates and nutrient balance. Application rates are often excessive from both biological and economic perspectives. Overuse of nitrogen has been increasing, frequently by more than 30% in rice production. Half of the applied nitrogen often simply volatilises into the atmosphere. The excessive application of pesticides is an even more serious problem, particularly in cotton and rice production. Use of proven integrated pest management (IPM) techniques is still not widespread. Pesticide application rates in China are still rising while they are falling everywhere in Southeast Asia. Pesticide applicators, many of whom are women, are exposed to alarming health risks.

Research by the Center for Chinese Agricultural Policy shows that both fertiliser and pesticide uses could increase with trade liberalisation if more-effective regulations and technology-extension systems are not implemented. Trade liberalisation will influence fertiliser and pesticide use through its effects on product and input prices and will therefore affect crop production patterns (or crop-area allocations) and application rates of inputs.

Fertiliser use is expected to increase by about 1% in 2005 and 2.4% in 2010 due to China's WTO accession (2001–2005) and further trade liberalisation under the Doha Round (2005–2010). The increases in fertiliser use come from both crop structural changes and higher application rates. Liberalisation will cause domestic fertiliser prices to fall by about 0.5% in the coming years as imports of cheaper and better fertilisers rise slightly. The areas sown to vegetables, fruits and rice will expand.

The analyses show that the impacts of trade liberalisation will have more impact on pesticide use than on fertiliser application. Liberalising the pesticide sector will lead to reductions in prices of pesticides by about 1% per year over 2002–2010. Falls in pesticide prices and price rises for horticultural crops and rice (the crops with most-intensive pesticide use) may significantly increase pesticide demand. The CCAP study shows that trade liberalisation will raise pesticide use by 3.2% in 2005 and nearly 6% by 2010.

More economically rational application rates of crop inputs and wider use of IPM and other new technologies could substantially reduce application rates and total usage and mitigate environmental concerns. A recent study by CCAP shows that nitrogen fertiliser use by rice farmers could be reduced by 20–30% without yield loss through site specific nitrogen management (SSNM). But extension of SSNM

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

requires substantial investment in training and agricultural extension. Other recent studies by CCAP show that planting of transgenic rice could reduce pesticide use by more than 90% in rice production, and Bt cotton could reduce pesticide input in cotton production by about 65%. Relative changes in fertiliser ingredient prices may result in better nutrient balance in fertiliser products used by farmers. Science and technology to support such changes are readily available from domestic and international sources. Food safety challenges from domestic and international consumers of Chinese products may induce or even force reductions in pesticide usage.

Trade liberalisation is expected to reduce China's comparative advantage in several crops including maize, wheat, cotton, sugar and edible oil. Increased imports of these land-intensive products due to WTO membership could reduce the pressure to expand agriculture in marginal areas and thus have a positive impact on land management on fragile landscapes. Pressure on scarce water supplies might also be reduced.

Demand for livestock products is increasing in response to rising incomes, changing food preferences and WTO-induced changes in relative prices. Increased livestock production and its concentration near urban areas will increase the environmental pressure associated with animal-waste management. Public policy responses and regulatory enforcement will be critical to mitigate associated environmental and health risks.

The new *Rural Land Contracting Law* vests more-secure land-user rights in the hands of farmers (see Chapter 7). This has important implications for conservation of land resources and environmental protection. More-secure rights provide incentives to undertake land-management practices that sustain long-term productivity (e.g. protecting soil carbon levels and limiting erosion) and simultaneously convey positive impacts on the environment. Also, with vested land rights, farmers have borrowing potential (collateral) for investment in improved land-management technology that protects the asset value of the land for economic and environmental benefits.

FUTURE DIRECTIONS AND POLICY IMPLICATIONS

Environmental and economic goals in agriculture can be compatible and complementary. There are many examples in developed and less-developed economies. The lessons learned in other countries can help China to leapfrog many years of international experience in dealing with environmental externalities.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

It is difficult, if not impossible, to definitively separate the environmental effects of the many developmental changes occurring in rural China—liberalisation of input and product markets, off-farm employment, education, feminisation of agriculture, new technologies, deterioration in public extension services and accession to WTO. It is important for the national government to ensure compatibility between economic and environmental objectives of rural-development policy and institutional changes.

The volume and general safety of the world food supply testify that economic and environmental objectives can be complementary. People live longer and healthier than ever before—food supply, nutritional balance and safety are important aspects of that outcome, in China and elsewhere. China therefore needs to ensure that its food-production system is compatible with international standards and practices. The following are some measures appropriate to that objective:

- The Task Force suggests that China needs to consider policy reform in its public agricultural extension system and food safety and regulatory institutions. These are urgent needs. Reform of China's food-quality regulation and monitoring systems is crucial and is in China's own public interest as the nation becomes more urbanised. It is also critical to China's future economy under globalisation. China's discerning urban consumers will purchase their food taking safety and quality into account, even if this requires purchasing *imported* commodities. Upgrading China's food quality and safety regulations and enforcement capabilities to international standards is an urgent public policy imperative. China's domestic food industry and its export aspirations are dependent on these policy and institutional adjustments.
- The development of farmer associations must be facilitated. Farmers, in their own best interests, will manage their production systems for both economic and environmental outcomes when the policy and institutional framework is conducive to such behaviour. Farmer associations have been very instrumental in furthering these changes in other countries.
- There must be increased investment in public R&D, with more emphasis on applied research. Appropriate technologies for better environmental management have been proven in China. Their widespread application needs appropriate economic incentives and education of farmers who ultimately use this information in their own production decisions.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Improved security of land rights is required. More-secure tenure creates incentives for better stewardship of resources and provides an asset base for additional investment in land-management technologies that have economic and environmental benefits.
- Success should be built on. There are many good examples of cooperation between Chinese scientists and international institutions. These need further attention to extend their reach into agricultural practice in China. A good example is collaboration between the International Rice Research Institute and Chinese scientists in developing IPM systems for pest control in rice. Initial successes in areas like Bt cotton and transgenic rice suggest high rates of return and positive environmental benefits from additional investment in biotechnology.
- Public good services in rural China need improving. Good environmental management by Chinese farmers depends on education and other public good services, access to financial services and higher incomes.
- A change in focus from national grain self-sufficiency to food self-reliance would have positive environmental impacts arising from reduced grain production on marginal lands with scarce water supplies. This is entirely consistent with China's decision to enter the WTO.
- A CCICED Task Force on Environmental Goods and Services from Agriculture could be considered. There is great potential for environmental services in many areas, including carbon sequestration, reduction of soil erosion losses, IPM technology for pest management in intensive production systems, biomass energy production from agricultural wastes, water-use efficiency and biodiversity improvement. A new task force could further elucidate these and other opportunities and assess their potential.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

CHAPTER 12

IMPEDIMENTS TO SUSTAINABLE AGRICULTURE IN CHINA

Bernard H. Sonntag
Sonntag Agricultural Services, Saskatoon, Saskatchewan, Canada

David Norse
Department of Geography, University College, London, UK

INTRODUCTION

China has made enormous strides in recent decades in agricultural productivity and food output. Despite rapid population growth and increased food demand, China has achieved a high level of food security and food production capacity, but the environmental costs have been very high (Smil 1997; Norse et al. 2001). Serious environmental degradation has occurred and is continuing and threatens the sustainability of China's food-production capacity.

Environmental degradation of the agricultural resource base is manifested in many ways including: desertification, soil erosion, reduced grassland carrying capacity, saline irrigated land, air and water pollution from excessive crop input application (Zhang et al. 1996; Zhu and Chen 2002; Yan et al. 2003), water shortages due to low water-use

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

efficiency and competition from urban and industrial users, organic matter and soil fertility loss due to burning of crop residues, and loss of biodiversity. In all of these cases, there is little evidence to suggest imminent reversal of the deleterious trends.

China's agricultural policy has had its primary focus on food-grain security at national and provincial levels. International border controls, internal trade restrictions, indirect subsidies on inputs, production quotas, R&D investment and large budgetary expenditures on grain purchases and storage are all aimed at this objective. These and other current policies and practices have become impediments to sustainability because of their adverse effects on the land and water resource base. Economic and environmental objectives are frequently in conflict.

New technology is considered to be the main driving force for continued growth in agricultural productivity. While crucial to future growth, technology, by itself, is unlikely to result in an agricultural sector that is economically and environmentally sustainable. Policies and practices need to change in order to create an atmosphere where economic and environmental objectives are complementary, and where win–win solutions are possible.

This paper describes a number of important policies and practices that have adverse environmental consequences and suggests some changes that are needed for protection of the resource base and long-run sustainability of agriculture. The paper is based mainly on the observations and findings of the Sustainable Agriculture Working Group (SAWG) of the China Council for International Cooperation on Environment and Development (CCICED) over the period 1997–2001 and which are presented in Sonntag and Sun (2002). The principal mandate of the SAWG was to make recommendations to the Government of China via CCICED on policies to improve the sustainability of agriculture in China.

COMPLEMENTARY ECONOMIC AND ENVIRONMENTAL OBJECTIVES

Economic and environmental objectives are often considered to be antagonistic or competitive. There are, however, many situations in agriculture where these objectives can be complementary. We cite some examples.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Phien and Acton (2000) assessed the use of hedgerows on sloping lands in Vietnam. Traditional practices had resulted in severe soil erosion and loss of productivity. Incorporating hedgerows into annual and perennial cropping systems increased above-ground biomass, reduced soil and nutrient losses and maintained or increased yields of alley crops between the hedgerows. The positive economic and environmental effects of hedgerows increased with time.

Heong (2000) described management strategies for pest control in rice in China. Rice pest management is dominated by prophylactic pesticide applications. Through various policies and practices farmers are encouraged to regularly apply pesticides. Research in tropical rice systems has shown that about 80% of the insecticide sprays are unnecessary and compromise natural biological control. Surveys in China have shown that insecticide applications are commonly two to three times the recommended rate (Norse et al. 2001). Thus, pesticides increase production costs, pose health risks to farmers, pollute farmland and water bodies, and have little or no positive effect on yields and may even lower them. Hence, rational pest-management strategies can reduce costs of production, health risks, and pesticide contamination, all while maintaining or even increasing yields and net farm incomes; clearly a case of potential complementarity between economic and environmental objectives.

Zentner et al. (2000) examined the agronomic, environmental and economic effects of various crop-production practices over an 18-year period in Saskatchewan, Canada. Farmers had adopted a number of new cropping practices over this period in their search for sustainability. The analysis showed that extending and diversifying crop rotations and adoption of new, reduced-tillage technology improved overall sustainability of annual crop production systems in this semi-arid region.

Lindwall and Norse (2000) noted that conservation tillage systems have been shown to improve soil and water conservation, increase water and nutrient-use efficiency, raise soil organic matter content and crop yields and boost farm incomes. All of these benefits help minimise the production of greenhouse gases and enhance agricultural soils' capacity as a carbon sink. They list several fairly universal practices that can increase soil carbon content and improve the sustainability of the farming operation but which are not fully utilised in China. These include:

- reduced tillage, direct seeding
- conversion of marginal cropland to perennial grass or trees

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- rotational grazing
- manure or compost application to land
- optimal and variable rate fertiliser application.

Avery (1996) discussed complementary relationships between environmental and economic objectives at another scale. He presented a case for high-yield agriculture and use of proven technologies for food and fibre production (economic objective) on the best land in order to prevent cultivation of wild-lands for low-yield food production (environmental objective). High yields are needed on the good land to preserve millions of square kilometres of wildlife habitat from low-yield crop production, and allow marginal cropland to be converted to more sustainable uses (Norse 1992; Bruinsma 2003). Well-managed, high-yield farming can be the best approach to prevent soil erosion, improve soil tilth and quality and reduce run-off of water. Research into more knowledge and technology for crop and animal productivity enhances our ability to protect more wild-lands.

The Prairie Farm Rehabilitation Administration (PFRA) of Agriculture and Agri-Food Canada developed a number of community pastures beginning in the 1930s to overcome problems of grassland degradation and serious wind erosion on cultivated lands in the Canadian prairies. Through application of numerous land-management techniques (fencing, stocking rate management, re-seeding of eroded areas, livestock watering systems) the carrying capacity of the grasslands has been restored and continues to improve while environmental indicators also improve (soil carbon, biodiversity, ecotourism). Other public and private grassland in the North American Great Plains area experienced similar economic and environmental improvements (Luciuk et al. 2002)

The main point of the examples cited is to demonstrate that there are many opportunities in agriculture for simultaneous attainment of economic and environmental objectives. We suggest that these and similar opportunities are available for improving the sustainability of China's agriculture. Policies, practices and institutions, however, need to change to create an atmosphere that will enable the many potential complementarities to operate effectively.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

UNSUSTAINABLE POLICIES AND PRACTICES

The SAWG studied agricultural sustainability in several regions considered to have agricultural development potential, albeit with significant environmental challenges. The main sources of information for SAWG, in addition to published sources, were local officials, farmers, scientists, SAWG member observations and international experts invited to workshops in the areas studied. Numerous economic, environmental and social issues were observed and analysed. Recommendations were made to CCICED on policy changes needed to address the principal issues. Some of the issues are discussed here as examples of policies and practices that are deemed impediments to sustainable agriculture in China.

Excessive and imbalanced use of mineral fertilisers

China has some of the highest application rates of inorganic fertilisers in the world, and well above those of most intensive production systems in developed countries (Zhu and Chen 2002). Application rates for vegetables can exceed 1000 kg/ha/year (Zhang et al. 2004a). These unsustainable practices include nitrogen application rates 10–50% or more above crop nutrient needs, and unbalanced fertiliser mixtures that commonly have inadequate potash and sometimes phosphate.

The negative consequences are both economic and environmental, and global as well as local. The economic costs hurt the farmer by raising their production costs, and the wider community through the air pollution from fertiliser factories, the eutrophication of fish ponds and lakes, and the reduction in drinking-water quality. In the case of rice, these costs are currently some 20 billion yuan/year and could at least double over the next 30 years (Norse et al. 2001). The environmental impacts of over-use also include:

- increasing numbers of red tides—up several-fold in the past 10 years
- high emissions of greenhouse gases and ammonia contributing to global climate change and local acidification of soils and freshwater ecosystems.

It follows that the solutions have to be multi-dimensional, combining technological, regulatory and economic pressures and incentives (Zhu and Chen 2002; Zhang et al, 2004b; Norse, 2005). Some options that could be considered include:

- removal of indirect subsidies on fertiliser production

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- progressive introduction of pollution taxes on nitrogen fertiliser
- improvements in soil-testing services, fertiliser quality (including affordable slow-release formulations)
- better education of farmers and extension workers, and greater incentives for them to adopt and promote sound fertiliser use.

Pesticide usage

While pesticides of various kinds are important elements in producers' technology toolkit for high productivity in food and fibre production, excessive, and often unnecessary, applications are an important impediment to sustainable crop production, especially in the intensive production regions (Mao 1996). During the past 10–20 years, there has been a growing consensus that farmers generally apply more pesticides to grain, vegetable and fruit crops than they need to for adequate pest control. This excessive use can:

- lead to illness or death of farmers
- lower farm incomes because of the unnecessary expenditure on pesticides and days off sick, which can amount to 10–20% of the pesticide expenditure
- reduce the value of fish production by over 1 billion yuan
- add to the need for costly water purification to meet drinking water standards
- adversely affect the health of consumers through cumulative consumption over time.

Yet pesticide use has been increasing. In the case of rice, it doubled in value terms between 1980 and 1997 (at constant prices), and now represents around 7% of the total material costs of rice production (Norse et al. 2001). Moreover, this is despite clear evidence from local trials in China and nationwide programs in other Asian countries that an approach called integrated pest management (IPM) can reduce pesticide (especially insecticide) use two to three-fold or more without lowering rice, cotton and other crop yields, improve farmers' net incomes and health, and protect the environment (Heong 2000). At the national level, the cost savings from reduced pesticide use can be substantial, and for China could exceed 10 billion yuan.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The need for urgent action to stop the overuse of pesticides is supported by five other trends. First, the continued reduction in the area available for grain production, which leads to more-intensive use of production inputs like fertilisers and pesticides, and greater likelihood of pest and disease outbreaks. Second, the reduction of direct funding for agricultural extension is forcing extension services to be self-funding and commonly leads to them placing too much emphasis on the sale of pesticides. Third, several government departments have conflicting roles in the regulation, production and sale of pesticides. Fourth, China's entry into the World Trade Organization (WTO) and the need to improve international competitiveness make it important to maintain farm incomes by reducing the costs of production. Fifth, pesticide residues in foods are an increasing threat to competitiveness in domestic markets, expansion of agricultural exports and to compliance with WTO requirements.

China should develop a national strategy for IPM. The strategy should become part of wider development strategies for environmentally responsible production practices and safer foods. It should be consistent with policies to reduce pesticide-residue levels in foods, and backed-up by stronger measures to ensure widespread compliance with such policies

Tillage

Intensive tillage, and the land degradation that results directly from it, are a universal problem in arid and semi-arid regions around the world. The associated practices (ploughing, disking, harrowing, removal of crop residue) cause large erosion losses, organic matter loss, destruction of soil micro-organisms, soil moisture loss, yield reductions and weed problems. Application of reduced-tillage technologies can often reverse all of these deleterious effects and produce both economic and environmental benefits. Conservation tillage technologies have been widely applied in many regions of the world where sustainability of annual crop production was in jeopardy a few decades ago (Lindwall and Norse 2000). Application of these technologies has the added benefit of carbon sequestration in agricultural soils to offset greenhouse-gas emissions from other activities.

Conservation tillage technologies are being tested and demonstrated in China. One example is the Hebei Dryland Project of the Canadian International Development Agency at the Hebei Academy of Agricultural and Forestry Sciences. Outreach activities from that project were conducted in several provinces. Adoption of the

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

technology by Chinese farmers is not occurring at a very rapid pace. One important constraint to adoption is the lack of credit availability for Chinese farmers, and a dearth of suitable equipment for some situations. Current land-tenure policy and limited financial services in rural China result in very little collateral to support the capital investment necessary for adoption of conservation-tillage technology.

Irrigation

Irrigation is a vital component of food and fibre production in China. About two-thirds of the water consumed in China is used for irrigation. About half of the cultivated area is irrigated, and yields more than two-thirds of cereal production. Cropping intensity on irrigated land is about double that on rain-fed land, and yields on irrigated land are often double those on rain-fed areas. All of these ratios vary greatly among irrigation zones—the southeast 'rice irrigation zone' (annual rainfall more than 1000 mm), the central and northeastern 'unstable irrigation zone' (400–1000 mm rainfall) and the northwest 'perennial irrigation zone' (less than 400 mm rainfall with high seasonal variability). The major portion of China's agricultural land is in the unstable irrigation zone. Thus, China's food output is highly dependent on irrigation, and food-production capacity into the future is dependent on sustainability of irrigation systems (Nyberg and Rozelle 1999).

Irrigation systems in the unstable and perennial zones are experiencing a number of problems that threaten their sustainability. These include:

- large water conveyance losses due to poor system design and construction
- soil degradation on irrigated land due to inadequate drainage
- excessive water application rates due to water pricing that is not related to the real costs of supply or the volumes used
- declining watertables in most groundwater aquifers.

These problems result in low water-use efficiency (WUE), extensive and permanent salinisation of irrigated land and lost production potential, and downstream water shortages.

A number of measures should be examined urgently to ensure the economic and environmental sustainability of irrigated production capacity, including:

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- increased investment in irrigation and drainage systems rehabilitation for improved WUE, improved water distribution among users and maintenance of productive capacity
- increased investment in water-saving technologies (land-levelling, application methods, crop selection) that reduce water demand
- introduction of systems for volumetric measurement and pricing of water to improve WUE, generate system maintenance revenue and provide environmental benefits (resource base conservation)
- establishment of self-financed irrigation-management institutions to manage water supplies and to operate and maintain irrigation systems. On large river basins where many provinces share the basin this may also require river basin authorities with powers that supersede provincial authorities to effectively manage entire basins for environmental and economic sustainability.

Food-grain security policy

The target of 95% self-sufficiency in food grains is a central tenet of China's national policy. China has achieved this policy objective despite rapid population growth and a relatively small per-capita arable land base. Institutional change (Household Responsibility System) and application of new crop-production technology are considered to have been the main factors in achieving this target.

Much of the responsibility for food-grain security was delegated to provinces and autonomous regions through the Provincial Governors Responsibility System. The provincial targets were at the same percentage level as the national target. This policy, combined with restrictions on internal grain trade, resulted in increased grain production in all areas in China, frequently on land not suitable for production of annual crops. These targets and trade restrictions have been relaxed in recent years, but they leave a legacy of degraded land in marginal grain-production areas.

The national food-security policy resulted in large mandatory provincial and local government expenditures on food-grain purchases and storage. This restricted local and provincial government fiscal capacity to undertake other initiatives targeted at environmental, developmental and social programming such as infrastructure, poverty alleviation, education, applied research and technology demonstration.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

The food-grain security policy had several deleterious environmental effects, including the following:

- Soil erosion. It resulted in grain production on fragile landscapes where annual cultivation makes land susceptible to wind and water erosion.
- Grassland degradation. Land that is fairly stable when used as grassland was converted to cultivation for grain production to satisfy production targets.
- Salinity. Production targets resulted in extensive grain production on irrigated land where inadequate systems exacerbated salinity problems.
- Water pollution. Excessive application rates of fertilisers and pesticides to ensure high yields resulted in non-point pollution of water bodies, especially in intensive cropping systems in the southeastern provinces.
- Crop residues. A high proportion of crop residues is burned. This practice has several adverse environmental effects—air pollution, carbon dioxide emissions and soil erosion.
- Comparative advantage. The regional application of the policy precluded market forces from determining efficient locations for grain production.

Some measures that could be considered to maintain a high level of food-grain security while simultaneously addressing environmental concerns include the following:

- Reduce the 95% grain supply target to a lower level to reflect China's improved capacity to utilise the international market to augment periodic shortages in grain. Even if the 95% target is retained as a national imperative, its environmental impact could be lessened substantially by permitting comparative advantage to determine where grain production should occur. Recent analyses by Huang and Rozelle (2005) conclude that conversion of large areas of low-productivity land to forestry through the Grain for Green program has had no significant impact on China's ability to meet food-security objectives.
- Re-define grain security targets in terms of food grains (wheat and rice) rather than aggregate grain (food and feed) supply. Feed-grain needs could be met through international markets.
- Increase public investment in rural public goods (e.g. R&D, extension services, education) to ensure future productivity growth.
- Establish more-secure land user rights to foster stewardship of resources.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

- Establish a legal framework for development of independent, voluntary farmer associations that pursue their own economic and business interests and responsibly manage their resource base.
- Reform rural financial services to improve financial intermediation for rural citizens

Grassland management

Serious degradation of China's vast northern and western grasslands is well-documented. The frequency and severity of spring dust storms are obvious indicators of this problem. The causes are many: too many grazing animals for too little grass, deforestation of fragile landscapes, cultivation of land not suitable for annual crop production and land-tenure policies that impede sustainable management of grasslands. The issue also has constraining social dimensions, with too many poor people dependent on the grasslands for their livelihood.

Experience and research in the North American Great Plains and elsewhere in the world has demonstrated clearly that land control is an essential element in sustainable grassland management. This has been achieved through both public and private land-management institutions. Land control enables stocking density to be matched with sustainable grassland output. Many degraded grasslands can be restored with conservative stocking rates and other grassland-management techniques. Other environmental aspects improve coincidentally—soil carbon levels, biodiversity (flora and fauna) and WUE (Luciuk et al. 2002).

Livestock waste management

China's economic success and rising incomes have led to the rapid development of the livestock sector (especially pork production) over the past 20–30 years. Average annual growth rates have been 2–5% faster than the crop sector, and the livestock sector's share of total agricultural GDP has doubled. However, these economic benefits have carried severe environmental penalties in addition to the overgrazing mentioned above. The environmental costs have been high, with large volumes of solid wastes from pig and poultry units; 40% or more of wastes being discharged without treatment into watercourses; and increasing emissions of nitrous oxide and

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

ammonia to the atmosphere. Moreover, the relative importance of this pollution is likely to grow in the future as point-source industrial and domestic wastes are brought under control.

The main issue is not a lack of appropriate technologies—these generally exist, although some may need to be imported and adapted to Chinese conditions. The problem is that there is no national strategy to deal with the waste-disposal problem. Some provinces have responded to the problem, but have been hindered by the lack of adequate regulatory and economic mechanisms to ensure compliance. Actions that should be considered and evaluated include:

- development of a national livestock waste management strategy
- enforceable discharge and emissions standards and effective waste disposal charges
- meaningful penalties for breaches in regulations
- well-targeted education programs
- planning constraints and guidelines to optimise the location of livestock production units
- support for the adoption and dissemination of appropriate technological measures.

CONCLUSIONS

We have provided some examples where it is clear that there is significant potential for complementary economic and environmental objectives, i.e. for win–win outcomes for sustainable agriculture. We have given some examples where economic and environmental objectives are in conflict in current policies, practices and institutions. These impediments should be changed in the interests of sustainable agriculture in China.

China is placing its hopes for continued output growth in agriculture on application of new technology. While vital to continued growth, technology, by itself, is unlikely to be sufficient to attain the desired outcomes. New technology, institutional change and policy change must be integrated for agricultural sustainability into the future.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

REFERENCES

Avery, D.T. 1996. The environmental necessity for higher-yield agriculture. Paper presented at the annual meeting of the American Association for the Advancement of Science, 1996.

Bruinsma, J., ed. 2003. World agriculture: toward 2015/30. An FAO perspective. London, Earthscan; FAO, Rome.

Heong, K.L. 2000. Pest management strategies for sustainable agricultural development in China. Proceedings, Integrated resource management in the red soil area of south China. Beijing, China Environmental Science Press, 139–146.

Huang, J. and Rozelle, S. 2005. China's food security. In: Sonntag, B.H., Jikun Huang, Rozelle, S. and Skerritt, J.H., ed., China's agricultural and rural development in the early 21st century: challenges, opportunities and policy options. Canberra, ACIAR Monograph No. 116, 423–444.

Lindwall, C.W. and Norse, D. 2000. Role of agriculture in reducing greenhouse gases—challenges and opportunities. In: Proceedings, integrated resource management in the red soil area of south China. Beijing, China Environmental Science Press, 147–163.

Luciuk, G., Kirychuk, B. and Ward, B.L. 2002. Economic viability and environmental considerations on the rangeland dependent livestock sector in Canada. International workshop on strategies for sustainable grassland and livestock management systems, Lanzhou, Gansu, PRC, 2002

Mao, X. 1996. Environmental ecological analysis of paddy fishery systems in Danzu County. Agro-environmental Protection, 15(5), 246–250. (in Chinese)

Norse, D. 1992. Policies for sustainable agriculture. Staff working paper 3 on technical issues in rural poverty alleviation Rome, International Fund for Agricultural Development.

— 2005. Non-point pollution from crop production—global, regional and national issues. Pedosphere, in press.

Norse, D., Li Ji, Jin Leshan and Zhang Zheng 2001. Environmental costs of rice production in China: lessons from Hunan and Hubei. Bethesda, Maryland, Aileen International Press, for CCICED.

Nyberg, A. and Rozelle, S. 1999. Accelerating China's rural transformation. Washington, DC, World Bank.

Phien, Thai, and Acton, D. 2000. Assessment of hedgerow farming systems on sloping lands in Vietnam. Proceedings, integrated resource management in the red soil area of south China. Beijing, China Environmental Science Press, 83–93.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)

Smil, V. 1997. China shoulders the cost of environmental change. Environment, 39(6), 6–9, 33–37.

Sonntag, B. and Sun, Honglie. 2000. Agriculture development and environment in critical areas in China. Beijing, Science Press.

Yan, X., Akimoto, H. and Ohara, T. 2003. Estimation of nitrous oxide, nitric oxide and ammonia emissions from croplands in East, Southeast and South Asia. Global Change Biology, 9, 1080–1096.

Zentner, R.P., Campbell, C.A., Biederbeck, V.O., Miller, P.R., Selles, F. and Fernandez, M.R. 2000. In search of a sustainable cropping system for the semiarid Canadian prairies. Journal of Sustainable Agriculture, 18, 117–136.

Zhang, W., Tian, Z., Zhang, N. and Li, Z. 1996. Nitrate pollution of groundwater in northern China. Agriculture, Ecosystems and Environment, 59, 223–231.

Zhang, W.L., Wu, S.X., Ji, H.J. and Kolbe, H. 2004a. Estimation of agricultural non-point source pollution in China and the alleviating strategies: 1. Estimation of agricultural non-point source pollution in China in early 21 century. Scientia Agricultura Sinica, 37, 1008–1017. (in Chinese)

— 2004b. Estimation of agricultural non-point source pollution in China and the alleviation strategies: 3. A review of the policies and practices for agricultural non-point source pollution control in China. Scientia Agricultura Sinica, 37, 1026–1033. (in Chinese)

Zhu, Z.L. and Chen, D.L. 2002. Nitrogen fertilizer use in China—contributions to food production, impacts on the environment and best management practices. Nutrient Cycling in Agroecosystems, 63, 117–127.

China's agricultural and rural development in the early 21st century
Edited by: Bernard H. Sonntag, Jikun Huang, Scott Rozelle and John H. Skerritt
ACIAR Monograph No. 116 (Printed version published in 2005)