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China's Ongoing Agricultural Modernization Challenges Remain After 30 Years of Reform

**Bryan Lohmar, Fred Gale, Francis Tuan,
and Jim Hansen**



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A Report from the Economic Research Service

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China's Ongoing Agricultural Modernization

Challenges Remain After 30 Years of Reform

**Bryan Lohmar, Fred Gale,
Francis Tuan, and Jim Hansen**

Abstract

Thirty years ago, China began implementing a series of reforms to improve efficiency in agricultural production. These, and subsequent, reforms reshaped China's position in the world economy. China's rapid economic development and transformation from a planned to a market-oriented economy, however, has reached a stage where further efficiency gains in agricultural production will likely hinge on the development of modern market-supporting institutions. The development of market-supporting institutions in China will bring about long-term and sustainable benefits to producers and consumers in China and the global agricultural economy. This report provides an overview of current issues in China's agricultural development, policy responses to these issues, and the effects of these policies on China's growing role in international markets.

Keywords: China, economic reform, economic development, agricultural production, agricultural trade

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Contents

- Summary iii
- Introduction 1
- Background: China’s Economic Development and Implications for Agriculture 3**
 - The Reform Period: 1978-2008 3
 - The Household Responsibility System (HRS) 3
 - Marketing Reform 4
 - Industrial Reform. 4
 - Trade Reform. 4
 - The Effect on Agriculture 5
 - Production 5
 - Marketing 7
 - Consumption 8
 - Trade 9
 - The Next Stage of Reforms. 10
- Challenges to China’s Continued Agricultural Modernization. 13**
 - Resource Management Policies 14
 - Land 14
 - Water 17
 - Agricultural Marketing Challenges. 22
 - Rural Income and Development Policies 25
 - Eliminating Taxes 26
 - Subsidies, Investments, and Price Supports 27
 - Rural Credit 28
 - Technology Development and Promotion 29
 - Agricultural Research 30
 - Biotechnology 30
 - Agricultural Extension Services 30
 - Biofuel 31
 - Biofuel Policy 31
- Implications for China’s Future Trade 33**
 - Food Grains. 36
 - Wheat. 36
 - Rice 38
 - Horticultural Products 38
 - Livestock Products 39
 - Oilseeds and Feed Grains 41
 - Oilseeds 41
 - Corn 42
 - Cotton, Hides, and Skins. 43
 - Cotton 43
 - Hides and Skins. 44
- Conclusion 45**
- References. 47**

Summary

China is the world's largest agricultural economy, producing and consuming a wide range of agricultural products. This report summarizes China's agricultural development over the past 30 years, the challenges facing China's agricultural economy, the role policy plays in addressing the needs of this developing agricultural system, and how economics and policies interact to affect trade in agricultural products.

What Is the Issue?

As the world's largest agricultural economy and an important player in world agricultural markets, China's role in international agricultural trade has implications for agricultural producers, consumers, and policymakers in the United States. While the establishment of markets for agricultural inputs and outputs has helped China raise agricultural production over the last 30 years, the country faces several issues that will be more difficult to resolve. China is currently struggling to manage stressed land and water resources, to develop modern marketing institutions and infrastructure, to boost rural incomes to keep pace with urban incomes, and to develop or adapt agricultural technologies.

What Did the Study Find?

Since adopting market-based reforms 30 years ago, China's ability to meet its food and agricultural needs has exceeded the expectations of most observers. Domestic production has satisfied most of the growing food demands of China's increasingly affluent population. As China established and developed markets, farmers diversified into livestock, aquaculture, and fruit and vegetable production while simultaneously increasing production of staple grains. In addition, millions of rural workers shifted out of agriculture to provide manpower for China's broader economic resurgence.

The enormous across-the-board increases in production suggest that China was far below its production potential before it adopted market reforms. Allowing farmers to produce according to market incentives and relaxing production quotas and restraints on inter-regional trade enabled China's farmers to use resources more efficiently, to raise productivity, and to reduce waste. Today, nearly all farm commodities and inputs are traded at market prices.

Agricultural productivity growth in China has slowed in recent years, suggesting that China's potential for achieving efficiency gains from market-based reforms is diminishing. Chinese agriculture also faces stiff challenges in allocating scarce natural resources and integrating small farms, which still largely use hand-held tools, into modern, global agricultural markets. Many of these challenges stem from carryovers of the collective period, such as collective land ownership, interventionist Government policies, or underdeveloped institutions to enforce property rights and settle land disputes.

China has the potential to achieve further efficiency gains; to do so, however, it must navigate another round of reforms addressing issues such as:

Land Tenure: Collective ownership of farmland and its allocation by village officials has led to tiny plots that increase the cost of production, increase the cost of establishing modern marketing institutions and traceability, and diminish incentives to adopt modern technologies. Collective management, along with poorly defined and enforced rights to farmland, also diminishes incentives to engage in conservation practices and reduces farmers' share of the wealth generated by economic development.

Marketing Practices: It is difficult to regulate or monitor China's fragmented and scattered farms, wholesalers, and input suppliers. Small-scale production and marketing also impede China's ability to improve food safety and quality (features in high demand in China's wealthier urban areas) in its rapidly growing food processing industries and in its expanding export markets.

Rural Income Growth: While rural incomes in China were the first to benefit from reforms, they have lagged behind urban income growth since the early 1990s. China has established many policies to increase rural incomes and promote rural development, including eliminating agricultural taxes and fees, establishing direct subsidies, input subsidies, and price supports, and reforming rural credit institutions with a focus on rural lending.

Agricultural Technology Development and Adoption: Productivity growth in China over the last 30 years benefited greatly from advances in plant and animal breeding, but there is still ample capacity to improve yields and other crop characteristics through continued research and extension. China's research system is dominated by public research institutions. Domestic private seed companies—most of them small scale—have limited capacity to engage in private research. Weak enforcement of intellectual property rights reduces private incentives to develop and market new seed varieties.

Future Role in International Markets: The extent and nature of China's agricultural trade will depend on fundamental economic forces and how effectively China addresses land tenure, marketing practices, rural income, and agricultural technology issues. As income growth and urbanization reduce demand growth for food grains, potential rice and wheat productivity increases may help China maintain near self-sufficiency. China will continue to increase production of fruit, vegetable, and livestock products, with most of this production consumed by the more prosperous consumers in China—so long as they can be assured of its safety and quality. Exports of these products will also grow if China effectively addresses those same safety, quality, and consistency issues. China will continue to be a major importer of oilseeds to meet the growing domestic demand for high-quality vegetable oils and high-protein livestock feed additives and may also become an importer of corn as domestic demand for livestock products grows. Demand for cotton and hide imports has boomed as China's exports of textiles, clothing, and shoes have expanded, but future export growth may be dampened by appreciation of China's currency, rising labor costs, and slower growth in world demand.

How Was the Study Conducted?

This report is a synthesis of past research findings from studies conducted by the U.S. Department of Agriculture's Economic Research Service and other research organizations. It builds upon the various findings by providing a common theme to understand China's current state of economic development, the role of agriculture, and the nature of policies and institutions affecting China's production, consumption, and trade.

Introduction

A visitor to China today would have a hard time imagining what the country was like before reforms that began reshaping the agricultural landscape 30 years ago. China in the 1970s was poor and isolated. Rural workers toiled on collectively owned farms in teams directed by local officials. Industrial workers staffed large State-owned enterprises where output targets and prices were determined by central planners. Each region and city was expected to be largely self-sufficient in production of most goods. State-run marketing companies, subject to the decree of central planners, were in charge of the limited trade between the regions that existed. There was little private economic activity at this time, and millions of people survived on a diet of less than 2,000 calories per day.

Today, China is one of the world's largest economies, a major importer and exporter, and a sought-after location for multinational firms. Rural workers raise a variety of crops on individually managed plots, engage in household livestock and sideline production, and travel all over the country to work in thriving industrial and service sectors. Most manufactured goods are produced in coastal areas and marketed throughout the country. The State-owned sector represents only about a third of economic output, and many remaining State-owned firms raise capital on stock markets and have joint ventures with foreign firms. Urban workers frequently change jobs, buy much of their food in modern supermarkets and convenience stores, and frequently dine in restaurants. Obesity has become a major public health issue.

Agricultural reforms played an important role in China's economic resurgence over the past three decades (Rozelle and Swinnen, 2004). Re-establishing household agricultural production was the spark that ignited the process of establishing markets and relinquishing direct Government control over the economy. Responding to these changes, farmers immediately boosted rural incomes, lifted millions out of poverty, and improved the diets of Chinese citizens. By the 1990s, similar reforms took hold in the urban and industrial sectors, and their growth began to outpace agricultural and rural growth. But agriculture continued to play a critical economic role by meeting the growing demands of wealthier, mostly urban, consumers for fruit, vegetable, and livestock products as well as traditional staple grains. A seemingly endless supply of inexpensive labor released from collective agriculture fueled China's booming manufacturing and urban construction sectors.

China is currently the world's largest agricultural economy and a leading importer and exporter of agricultural products. China's agricultural sector, however, is still changing as it responds to the rising and increasingly sophisticated demands of domestic and foreign consumers, adapts small-scale farm structure to global food markets, and competes with other sectors for labor, investment capital, and scarce land and water resources (Gale et al., 2002; Lohmar and Gale, 2008). While China has come a long way in its transition to a market economy, it still retains many of the institutional vestiges of the planned economy. Nearly all final products are bought and sold at market prices, but collective land ownership, ambiguous water rights, and

weak legal and financial systems confound market-driven resource adjustments, farm consolidations, and agricultural investment. In the absence of well-functioning market-supporting institutions, Chinese economic planners gravitate toward interventionist policies to resolve market failures. This, in turn, reduces the demand for market-supporting institutions that could resolve these issues in a more market-oriented and sustainable way. The path China takes and the policies chosen to address these issues will affect its longrun capacity to resolve them effectively.

Understanding China's recent historical development is critical to assessing the implications for China's role in world agricultural markets. The development of markets over the last 30 years, the remaining role of Government, and the emergence of market-supporting institutions are key issues underlying the evolution of China's agricultural economy. An assessment of critical issues facing China's agricultural economy—management of land and water resources, development of modern marketing chains, provision of food safety assurances, lagging rural incomes, and technology development and extension—illustrates how rapid economic growth is creating tensions stemming from the institutional legacy of the planned economy. How each of these issues is resolved will have important implications for China's future agricultural production, consumption, and trade.

Background: China's Economic Development and Implications for Agriculture

At the establishment of the People's Republic in 1949, China was still an agricultural economy in an industrializing and urbanizing world. By the late 1950s, China's leaders sought to catapult the semifeudal economy into the industrialized 20th century. Part of the plan relied on adapting Soviet-style collective agriculture to China by organizing hundreds of millions of farmers into a hierarchy of about 24,000 "Peoples Communes."¹ Except for limited cash crop production on small plots of land near individual households in some areas, all agricultural production decisions were made by local leaders in accordance with a production plan established by higher level leaders. Local leaders were obligated to deliver their quota of agricultural production to local stations run by State-owned marketing bureaus. Marketing bureaus made planned transfers of products from surplus to deficit areas at prices determined by the central Government. Agricultural prices were set low and industrial prices high to extract resources from agriculture to invest in urban and industrial development.

The Reform Period, 1978-2008

The Household Responsibility System (HRS)

When reform-minded leaders came to power in 1978, China began moving away from collective agriculture. Under a new policy, the Household Responsibility System (HRS), villages divided up collectively owned land and leased it to individual households to farm. In lieu of rent, farm households were obligated to deliver a fixed quota of their production of "strategic crops" to the State and the farm households were paid a predetermined price.² While many areas preserved elements of collective agriculture, and some villages required that certain strategic crops be produced on a portion of village land, households were largely free to farm the land as they saw fit and any production beyond the quota was theirs to consume or sell. Most importantly, farmers could produce cash crops and livestock products and sell their surpluses in rural markets. To provide opportunities for farmers to market their products, traditional rural markets were re-established throughout the countryside, and free markets were re-established in urban areas.³

Re-establishing household agricultural production autonomy and independent markets for agricultural products was the initial step in China's transition toward a market-based economy and rapid economic growth. Farmers were the first to benefit. Freed from the constraints of collective work teams and lured by high market prices, farm households shifted land and labor effort from grain production to cash crops and livestock production. Despite the shift in resources and effort, grain production rose because farmers allocated resources more efficiently than central planners. Cash crop and livestock production also boomed. Income from nonagricultural sources began to grow after reforms as rural households allocated labor to small household enterprises, expanding rural industry (known as "township and village enter-

¹ The hierarchy in the collective period was Commune-Brigade-Production Team, and these correspond roughly with today's Township-Village-Xiaozu (team).

² Strategic crops included grains, oilseeds, and cotton, but farmers were primarily obligated to deliver grain quotas, as well as quotas for cotton and oilseeds in some areas.

³ Traditional rural and urban markets were largely shut down during the collective period, except for a brief re-emergence in 1962-65.

prises” or TVEs). As urban job opportunities grew, migration to urban areas offered another alternative to farmwork.

Marketing Reform

Initial restrictions on marketing activity were eventually relaxed and inter-regional markets developed throughout the reform period. More liberal policies were intermittently reversed when they were blamed for bursts of inflation and perceived grain shortages. Once private trading networks arose, however, they were hard to rein in. By the end of the 1990s, the expansion of traders, greater marketing freedoms for private traders, and investments into transportation and communication infrastructure led to the integration of domestic markets. As marketing shifted to the private sector, Government marketing bureaus lost money because they lacked strong incentives to improve efficiency and were burdened with employment and other requirements imposed upon them, ultimately requiring Government subsidies. Many marketing bureaus were ultimately privatized and transformed into commercial agribusinesses.

Industrial Reform

By the late 1980s, China’s urban industrial economy began to blossom under reforms similar to those applied to agriculture: managers of State-owned companies were given more decisionmaking autonomy. Inefficient companies were merged with more efficient ones or shut down entirely. Moreover, the State-owned industrial sector had to compete with the more efficient rural industrial sector that rose up in the 1980s and the foreign direct-invested enterprises from the 1990s. To fuel the subsequent growth in urban and industrial areas, restrictions on labor movement were relaxed, or less vigorously enforced, so that rural workers could staff the growing ranks of industrial enterprises, urban construction projects, or take other jobs in urban areas.⁴

Trade Reform

To complement reforms to domestic production and marketing, China also liberalized trade policies to become more integrated with the world economy. Agricultural trade was long dominated by State-owned trading enterprises, monopolies for strategic products that imported and exported at the behest of State planners. For the most part, China sought to maintain self-sufficiency in agriculture, particularly for strategic products. Throughout the 1990s, however, China lowered tariffs and other trade barriers to many agricultural products. By the end of the 1990s, China had rescinded State-trading companies’ monopolies on the import and export of some strategic products, such as soybeans and cotton. In December 2001, China became a member of the World Trade Organization (WTO), which lowered tariffs further, ended the remaining State monopolies on imports and exports of agricultural products, and locked in an open trade regime along with the reformed economic policies (Lohmar, Hansen, Seeley, and Hsu, 2002).⁵

⁴ Many took jobs in the burgeoning service sector, such as in restaurants or transportation jobs, for which data are not well captured and almost certainly underestimated in official economic statistics.

⁵ Government-owned trading enterprises still wield significant influence in some crops, such as wheat and corn.

The Effect on Agriculture

China's agricultural sector is key to the country's astounding growth (Shane and Gale, 2004). Pre-1978 policies built up a reservoir of underutilized human resources in rural China with bans on labor movement and entrepreneurial activity, low farm prices, and farmer income not influenced by effort or output. In most countries, the share of population employed in agriculture plunged during the 20th century, but in China over 70 percent of workers were employed in agriculture in the late 1970s. Decollectivization released a flood of rural workers, fueling industrial growth while simultaneously boosting agricultural production to meet the food needs of a large population with rising living standards.

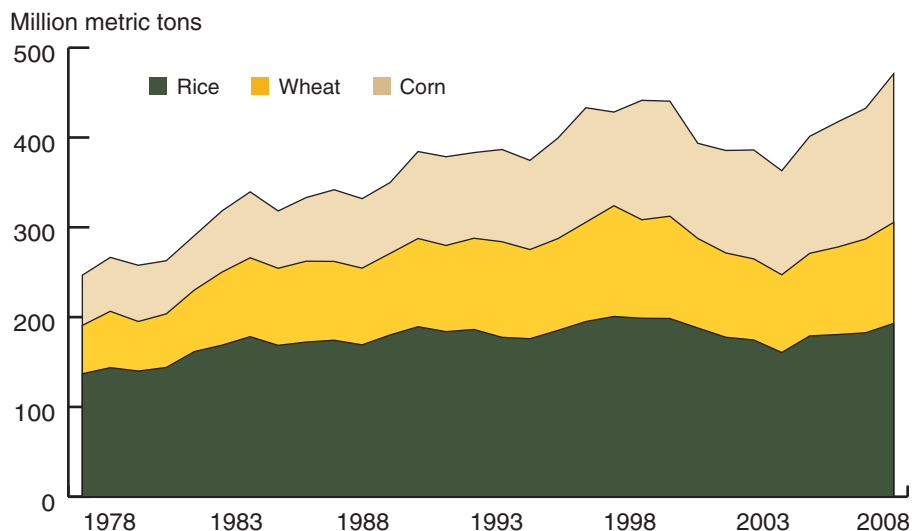
Production

China's agricultural production grew continually over the reform period despite competition for resources, particularly labor, from faster growing sectors of the economy and competition from imports as trade policies were liberalized. After reforms, grain production (rice, wheat, and corn) jumped from 247 million metric tons (mmt) in 1978 to 339 mmt in 1984 and exceeded 470 mmt in 2008 (fig. 1).⁶ Corn production grew faster than other grains to maintain exports for hard currency and to feed the growing livestock sector. Livestock production increased in the reform period, primarily for meat (mostly pork) and eggs, but in recent years, dairy production has taken off (fig. 2). For many products, China's share of world production exceeds its share of world agricultural land and, for some products, its share of world production exceeds its share of world population (fig. 3).

China's agricultural production comes almost entirely from small-scale operations. According to China's 2007 agricultural census, the country has 200 million farm households and an estimated 122 million hectares (494 million acres) of cultivated land—an average of 0.6 hectare (1.5 acres) per house-

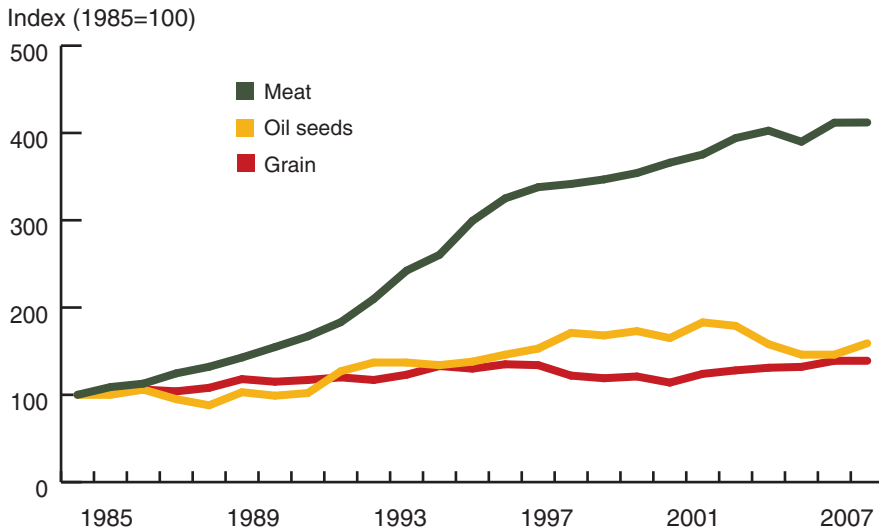
⁶ Rice volume is reported in unmilled weight. Rice loses approximately 30 percent of its weight in the milling process.

Figure 1
China's grain production increases, 1978-2008



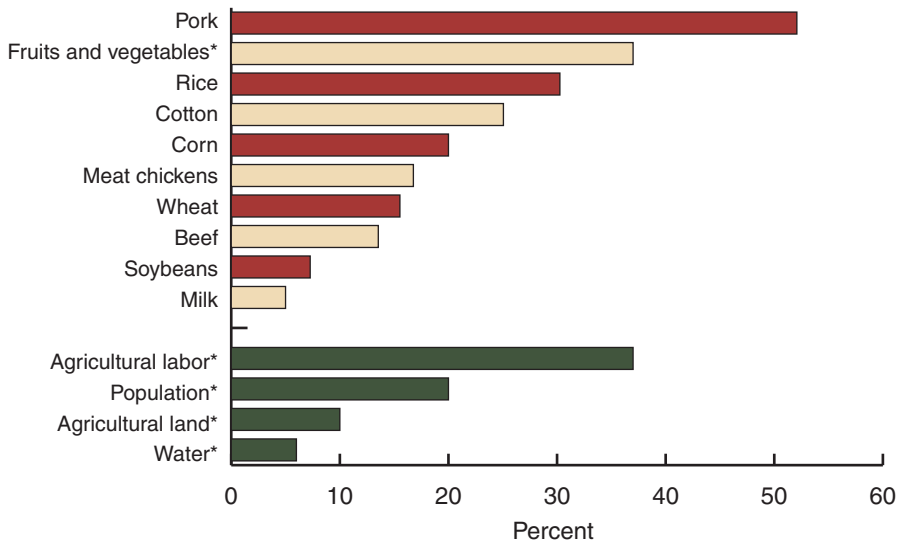
Source: China's National Bureau of Statistics (NBS) data.

Figure 2
Indexes of grain and meat production, China, 1985-2008



Source: China's National Bureau of Statistics (NBS) data.

Figure 3
China's estimated world shares of agricultural production, 2005

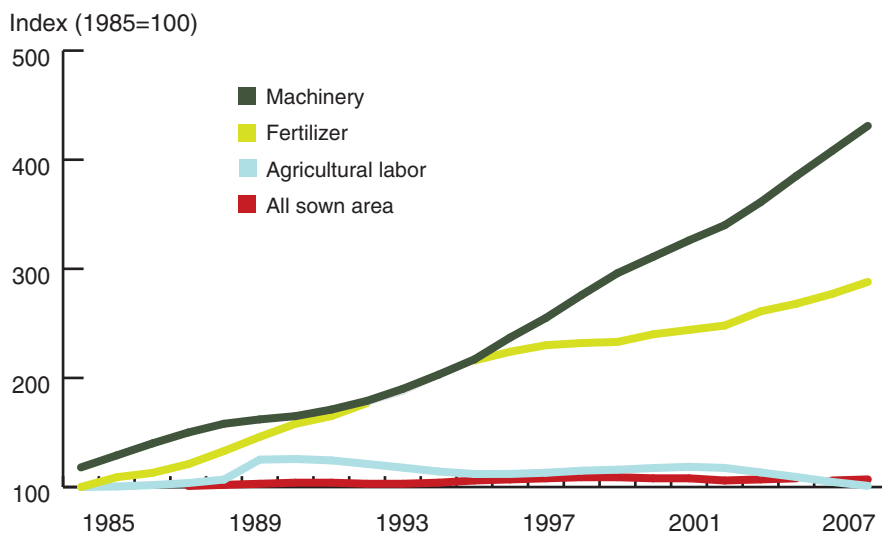


*Source: Food and Agriculture Organization data.

Source: Economic Research Service calculations based on USDA data (except where noted).

hold. These small land holdings are typically divided into several noncontiguous parcels (see, *Land* on page 14). To coax production out of such small plots, farm households engage in intensive agricultural practices, including high levels of fertilizer application and raising two or three crops per year on a single plot (fig. 4). China also relies heavily on irrigation to boost yields, with nearly 50 percent of its land supporting irrigation delivery facilities and extensive irrigation in the more arid, northern part of the country. The many crop varieties developed by China's agricultural research institutes produce high yields with irrigation and fertilizer inputs. Some varieties are bred for a short growing season to facilitate multiple-cropping.

Figure 4
Indexes of agricultural use, China, 1985-2007



Source: China's National Bureau of Statistics (NBS) data.

Markets for inputs are largely free and lightly regulated.⁷ Seeds are supplied by thousands of small seed companies that often repackage seed purchased in bulk and then sell under their own label through small seed and input supply stores located in villages and townships throughout the countryside. The pesticide industry is similarly atomized and difficult to regulate. Fertilizer is typically supplied by larger companies, but is frequently sold by private traders with shops in the county seat, rural townships, and villages or by itinerant traders who visit villages and sell from the back of their trucks. The widespread sale of counterfeit, adulterated, and poor quality farm chemicals, feeds, and veterinary drugs is a major concern for China's agricultural and commerce officials.

Marketing

State-owned marketing bureaus no longer monopolize agricultural marketing. Many of the marketing bureaus were reborn as agribusiness companies or semiofficial "industry associations." Grain marketing includes small private traders and agribusinesses, as well as local and State government-owned companies. For grains, State marketing companies compete directly with private traders, but have preferred access to Government-owned storage facilities and also are charged with purchasing grain under recently established price support programs.⁸ Market reports indicated that State-owned enterprises implementing a Government price support program accounted for 70 percent of rice purchases in late 2008. Recent surveys show that grain marketing channels vary from region to region. Many farmers prefer to sell grain to small traders who come into villages to pick up grain, saving them time and transportation costs. In some regions, large feed mills or food processors are the main purchasers.

Most horticultural and livestock products are marketed by a vast army of small traders and private marketing companies that sprang up as the production of these products grew (Huang, Otsuka, and Rozelle, 2008). Produce

⁷ Excluding factors of production, such as land and capital; efforts are currently underway to regulate the pesticide industry.

⁸ Many of the local storage facilities formerly owned by the Grain Bureau have been sold off; however, local governments are often among the new owners so that these facilities become partly Government-owned, maintaining close relations with State marketing agencies.

is typically purchased directly from farmers, often just after harvest and on the roadside, by hundreds of thousands of private traders who cruise villages and the surrounding countryside in small trucks. These traders then sell their load to larger traders or deliver it to wholesale markets where it is typically aggregated onto larger trucks for transport to faraway markets. Livestock products, particularly pork raised by farm households, are also marketed by multiple small traders, but there is also a growing contingent of large-scale farms and sophisticated agribusinesses. Small traders and brokers visit villages to buy pigs on behalf of local slaughterhouses that market most of their pork in local markets through a shrinking corps of small vendors. Supermarket chains require a more sophisticated supply chain that can guarantee refrigeration and lean pork free of banned substances. Large pork companies process frozen pork in some inland provinces, such as Sichuan, where it is then shipped to cities on China's east coast. The volume of agricultural produce going through modern marketing channels appears to be growing, but traditional supply chains operate with lower costs and recent surveys found nearly all fruits and vegetables were still marketed through traditional channels (Huang, Wu, Zhi, and Rozelle, 2008).

Consumption

As income growth elevated millions of consumers from poverty, diets improved and diversified (Lohmar, 2002; Gale, 2003; Gale and Huang, 2007). Caloric intake rose and deficiencies in vitamins and trace elements became less prevalent, but consumption of fats increased. The Chinese diet now includes fewer grain products like rice, bread, and noodles, while consumption of meats, eggs, and dairy has risen. According to figures published by China's National Bureau of Statistics (NBS), annual grain consumption by urban households fell by nearly half, from 145 kilograms (kg) per person in 1981 to 76 kg in 2006, while consumption of vegetable oils and animal protein products rose by varying amounts (table 1). The diet of China's rural population is following a similar trajectory as rising living standards spread to the countryside (Gale et al., 2005). Because rural residents' food grain consumption is so much higher than urban residents (roughly three

Table 1
Urban household annual consumption of food products, 1981-2006

Product	1981	2006	Change	
	<i>kg per person</i>		<i>kg</i>	<i>Percent</i>
Grain	145.4	75.9	-69.5	-48
Edible vegetable oil	4.8	9.4	4.6	95
Pork	16.9	20.0	3.1	18
Beef and mutton	1.7	3.8	2.1	125
Poultry	1.9	8.3	6.4	334
Fresh eggs	5.2	10.4	5.2	99
Aquatic products	7.3	12.5	5.2	71
Milk	4.1	18.3	14.2	343

Note: Table shows averages from national household surveys.

Source: Economic Research Service calculations based on China's National Bureau of Statistics (NBS) data.

times higher), urbanization is a primary driver of falling per capita food grain consumption in China.

Rising incomes and market liberalization are changing the way food is consumed in China (Gale, 2003). Meals consumed away from home are the fastest growing component of food spending (Gale and Huang, 2007). An increasing share of food is purchased in modern supermarkets, restaurants, cafeterias, and food stalls. Many urban consumers seek out quality, safety, and convenience over quantity and price. Organic food counters are now common in Chinese supermarkets, reflecting concerns about health and safety. Analysis of NBS household consumption data shows that much of the increased food spending by urban consumers reflects higher per-unit spending rather than larger quantities, an effect that is commonly attributed to preferences for quality (Gale and Huang, 2007). According to NBS data, the percent of household disposable income spent on food purchases has fallen consistently over the reform period from approximately 48 percent in 1985 to just over 26 percent in 2006.

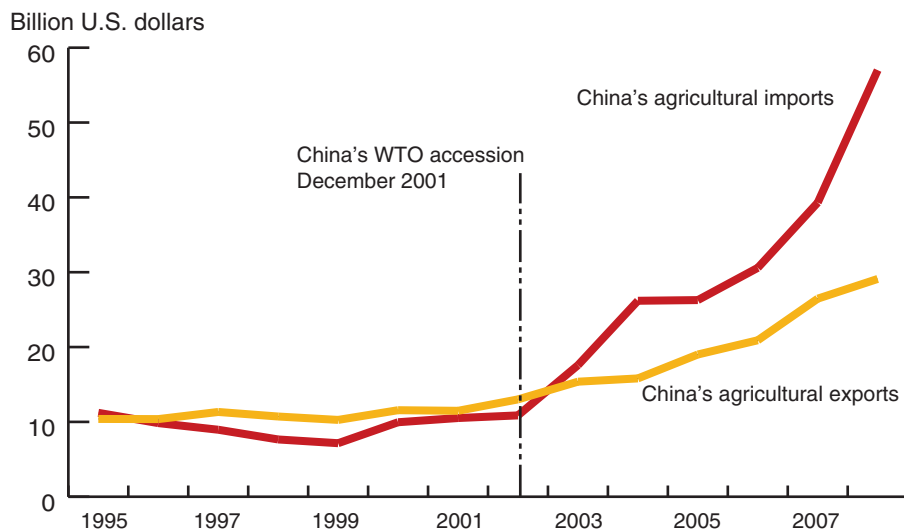
Trade

China’s agricultural imports and exports were relatively low over most of the reform period, but have risen rapidly since WTO accession.⁹ China became one of the world’s top four agricultural import countries as its agricultural imports jumped from under \$11 billion (U.S. dollars) in 2002 to over \$57 billion (U.S. dollars) in 2008. China’s agricultural exports have grown as well, but not as dramatically as imports. Agricultural exports rose from \$13 billion (U.S. dollars) in 2002 to \$29 billion (U.S. dollars) in 2008 (fig. 5). Moreover, the composition of agricultural trade has changed. Over much of the reform period, China exported corn and imported wheat, but imported only limited amounts of cotton and oilseeds.¹⁰ Today, China is largely self-sufficient in wheat, corn and rice, but it imports large amounts

⁹ Imports and exports were small relative to the size of China’s agricultural economy, but trade, both imports and exports, in specific products was at times large when compared with the world market for those products.

¹⁰ For most of the reform period, trade in all of these commodities was controlled by State trading monopolies.

Figure 5
China’s agricultural imports outpaced exports after WTO accession



Source: Economic Research Service calculations based on China customs data.

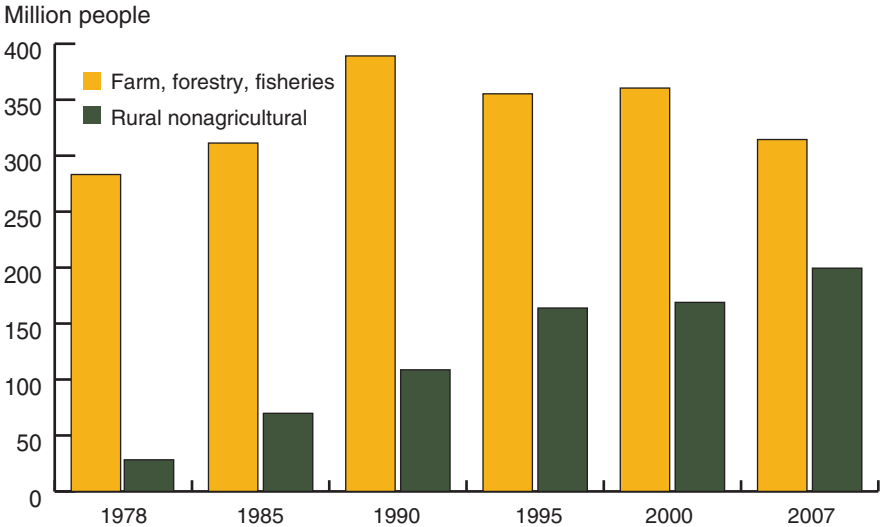
of soybeans and cotton. China has also become a major exporter of many fruit, vegetable, and livestock products, including apples, garlic, aquaculture products, poultry and pork. Since the United States is a major producer of cotton and soybeans, producers of those products have benefited greatly from trade with China. U.S. agricultural exports to China jumped from \$2 billion (U.S. dollars) before WTO accession to \$8.3 billion (U.S. dollars) in 2007. U.S. agricultural imports from China were only \$2.9 billion (U.S. dollars) in 2007.¹¹

In addition to providing low-priced food for urban and industrial workers, agriculture played a direct role in China’s rapid industrial development. Rural labor contributed heavily to the growth of the industrial, construction, and service sectors in China. Between 1978 and 2007, the number of rural workers with nonfarm employment rose from an estimated 30 million workers to over 200 million, an increase greater than the entire labor force of the United States (fig. 6).¹² By some estimates, 80 percent of rural households have some form of nonfarm employment (de Brauw et al., 2002). On average, over half of rural household income in China is from nonagricultural jobs, remittances, and investments (fig. 7). Income from nonfarm sources gives rural households funds to construct new houses, pay children’s school fees, and invest in agriculture.

The Next Stage of Reforms

China’s transformation from a closed, planned economy into a dynamic market-driven economy has been dramatic. Production and marketing reforms allow farmers more choice in their production practices, marketing venues, and income earning opportunities. This flexibility has allowed farmers to produce more staple grains while simultaneously shifting resources into livestock and horticulture production and supplying labor to the booming nonfarm economy.

Figure 6
China’s rural employment in nonagricultural sectors grows, 1978-2007

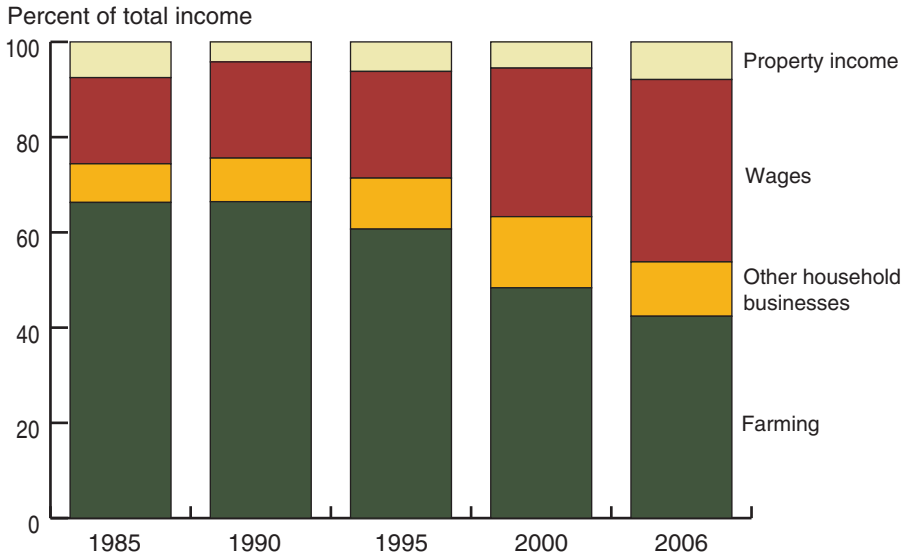


Source: Economic Research Service calculations based on National Bureau of Statistics (NBS) data.

¹¹ This figure does not include the \$2 billion (U.S. dollars) in fish and seafood imports from China or the roughly \$3 billion (U.S. dollars) in wood paneling and finished wood products, two import categories that have been rising rapidly since WTO accession.

¹² These estimates are widely believed to undercount millions of rural workers in the urban service sector.

Figure 7
China's rural household income, by category, 1985-2006



Source: Economic Research Service calculations based on China's National Bureau of Statistics (NBS) estimates of rural household "pure" (net) income.

China was able to achieve enormous production gains in the three decades after reforms, in part, because the economy produced far below its potential under central planning. Giving farmers incentives and abandoning production quotas induced farmers to work hard and produce what consumers demanded. Looser provincial self-sufficiency requirements allowed farmers to abandon crops that grew poorly in their region and specialize in products they could produce most efficiently (Carter and Lohmar, 2002). Post-1978 reforms brought forth a tremendous surge of output that showed China's production potential was greater than most observers imagined.

Three decades after reforms began, China's agricultural sector has succeeded in feeding and clothing its population, while also opening up to international markets and developing agricultural exports. But with land and water resources stretched to the limit and labor costs rising, it is unclear whether agricultural production in China can maintain its rapid growth. Future gains may require a new round of reforms that provide incentives to use land and water resources more efficiently, incentives to develop and adopt new technologies to substitute for labor or enhance the productivity of land, and incentives to increase the quality of agricultural products, including food safety. Establishing market-supporting institutions, such as clear property rights and open contract and dispute settlement mechanisms, will provide institutional support for these incentives.¹³ As land, water, and other agricultural resources increase in value, the demand for more clearly defined property rights and dispute settlement mechanisms will increase as well. Independent suppliers and farmers alike will demand dispute settlement services as they seek out assurances of quality, safety, and consistency from thousands of independent producers and input suppliers. Users of collectively or State-owned factors, such as land and water, will benefit from a more precise definition of their rights to these assets as their value increases in the rapidly growing economy. Developing a regulatory framework to

¹³ Economic historians often point to clearly defined property rights, particularly to land, and open contestable laws and courts as critical to supporting the function of markets in developed countries and helping to manage to reallocation of resources brought about by industrialization.

define property rights and resolve disputes, however, will be costly in both time and finances.

China is only just beginning to establish a more modern, market-supporting institutional framework. Recent laws help clarify rights to important resources such as land and water.¹⁴ China is also graduating more students from law schools and expanding the jurisdictional authority of the courts, while farmers are increasingly turning to courts to settle disputes over land rights (Clarke, Murrell, and Whiting, 2008).

China's path toward modernization has implications for future production, consumption, and trade. Millions of China's farm households will benefit from more secure rights to productive assets and better assurances to the quality of agricultural inputs. These changes will help farmers increase yields and reduce production costs. Increasing the integrity of marketing channels and segregating commodities to preserve quality and other attributes will allow farmers to earn premiums for higher quality and safer production practices. A variety of other policies, including rural credit and agricultural technology development and extension, will help farmers in China compete in a global marketplace. Taken together, such policies could continue the era of increased productivity, generate more and better quality food for increasingly wealthy consumers, raise rural incomes, and support China's successful integration into world agricultural markets.

¹⁴ Such as the 2002 Rural Land Contracting Law and the 2001 Water Law.

Rice fields in Guizhou Province



Photo by William Coyle, Economic Research Service.

Challenges to China's Continued Agricultural Modernization

Over the last three decades, the Chinese Government has largely relinquished its direct role in setting prices, procuring, and marketing agricultural commodities. Yet, many of the institutions that manage and regulate markets in more developed countries are not fully established in China. China's lack of market-supporting institutions, such as extensive property registration and a well-developed legal system to enforce laws and contracts, may impede the ability of the market to bring about efficient, equitable outcomes. Establishing those institutions, however, is not feasible in the short term.

Consequently, China still tends to rely on interventionist policies that use the remaining apparatus of the collective period to address issues that are typically resolved by independent institutions in more developed countries.¹⁵ While markets for inputs and outputs are well established, the Government still plays an influential "behind the scenes" role by controlling key factors of production (land and formal credit), ownership interest in some agribusiness enterprises, and arbitration of disputes. In the absence of private property and open, contestable dispute settlement institutions, Government officials play a key role in managing property rights, resolving disputes, and addressing complex problems related to food safety, environmental protection, and resource allocation.

Understanding the continued direct role of the Government in agricultural policies is important when evaluating the policy responses to the critical issues that continually confront China's leadership. Interventionist policies and practices can be implemented relatively quickly to address problems as they arise, but China's consumers and producers may be missing out on bigger longrun efficiency gains that could be achieved by establishing independent market-supporting institutions and allowing the private sector a greater role in investment and resource allocation. These more difficult reforms potentially could guide China's continued transformation into a modern industrialized economy with a healthy, dynamic agricultural sector.

China faces several challenges as it modernizes its agricultural sector. Resources in China are showing signs of over use, prompting policies to reduce intensive use of chemical inputs and promote land and water conservation. Moreover, as labor leaves agriculture, demand for more flexible land management institutions is rising. China faces several marketing challenges as consumers increasingly purchase products from supermarkets and other modern venues, expecting quality, safety, convenience, and variety similar to consumers in more developed countries. Providing additional income support to farm households as the industrial sector pulls ahead and leaves agriculture behind has become a central concern, as is common in countries at a similar level of development. Lastly, China seeks to catch up with developed countries in agricultural technologies, including biotech and biofuel technologies, which could prove vital for maintaining food and energy needs in the future.

¹⁵ There are also ideological considerations in China's Government, which promotes a "socialist market economy," that affect their policy responses, as well as political considerations regarding the employment of a large Government bureaucracy and over-staffed Government-owned enterprises.

Resource Management Policies

The impressive gains in agricultural and industrial production in China over the last 30 years were achieved, in part, by taxing land and water resources. Government officials and the growing urban middle class want to impose more stringent conservation practices to ensure the long-term health of these vital resources. Resources, including land, however, are owned and managed by Government-run entities, and the agents in charge of these resources do not typically have an incentive to use them conservatively. Reforms to improve land management and incentives to conserve could increase the efficiency by which these resources are used, boost production beyond current levels, and maintain these resources for future generations.

Land

Compared with the enormous changes in China's economy and agricultural market development, land tenure practices have changed little since the adoption of HRS. Agricultural land is still collectively owned in China and village leaders manage land on behalf of the collective owners, resulting in a complex mix of locally defined rights and practices (Lohmar, Somwaru, and Wiebe, 2002). Unclear ownership rights discourage land-saving investments, raise the cost of aggregating land, and inhibit China's capacity to deal with an expanding array of rural problems: rising labor costs, an aging rural population, chaotic supply chains, lack of traceability mechanisms, and soil erosion. China's Government has established laws to clarify and secure farm households' rights to land and allow them to rent land, without giving up collective ownership. In recent years subcontracting and rental of land use rights has become more common, encouraged by the departure of millions of farmers for urban jobs and commercialization of agriculture (see box, "China's Evolving Land Management Practices," page 15), and some farmers and companies have consolidated land into large commercial farms. Still, vague land ownership constrains land rental (Deiningner and Jin, 2007), and most of China's farm sector is characterized by small, fragmented plots of land.

Land Allocated in Small Plots

Village leaders allocate the rights to several plots to farm households. Because leaders seek an egalitarian distribution, each household typically receives 4-6 separate plots: one or two plots for grain, one plot close to the village for vegetable production, one plot on the more marginal hillside area, etc.¹⁶ Plots for growing grain are usually allocated contiguously in a large field where dozens

Fields divided and cultivated by different households



Photo by Fred Gale, Economic Research Service.

¹⁶ The 4-6 plots add up to only 1.5 acres on average, so each individual plot averages 0.25-.4 acres in size.

China's Evolving Land Management Practices

China's national laws set a general legal framework, but specific practices for managing collectively owned land vary from village to village. Some villages periodically reallocate land among households, while others have kept the original allocation made in the early 1980s. Some villages impose strict controls on land transfers, while others have devised arrangements to consolidate land and rent or subcontract it. In some villages, members pool their land and distribute shares in a stock-holding cooperative that pays dividends based on land rental payments. Some villages in areas with thriving industries hire migrants from other provinces to cultivate their land.

Many observers expected major changes in land policies to emerge from an October 2008 meeting of the Communist Party that focused on rural issues and marked the 30th anniversary of landmark 1978 rural reforms. Announcements following the meeting gave a vague assurance that farmers' land use rights would be secure for "a long time" and encouraged farmers to pursue various means of trading and transferring land use rights that were already widely practiced. Officials emphasized that farmers cannot sell their land, cannot change its use, and cannot use it as security for a mortgage. Officials have begun allowing farmers to mortgage timber or fruit orchard land in some regions, but it is not clear whether this practice will be extended to cropland.

Policy announcements promised stricter controls on land seizures, but no new policies or legal institutions were created to settle disputes. Anecdotal reports indicate that some local governments are exploring ways to improve land transfer. In one prefecture of Zhejiang, the local government established village land transfer service stations to intermediate land rentals (Jiang and Ke, 2009). The Hunan Provincial government allocated funds to waive farmers' fees for renewing land certificates and contract documents; in one prefecture of Hunan, less than half of land transfers involved a signed document, but this number was up 20 percentage points from previous years (Hou, 2008).

The return of migrants highlighted the benefits and conflicts associated with China's land tenure system. Following the 2008 downturn in the global economy, millions of rural migrants laid off from factories returned to their home villages where they had rights to land tended by family members or rented to others. Small-scale farming generates much less income than factory work, and anecdotal reports indicate that migrants were not inclined to return to farming. Still, land rights guaranteed at least a basic livelihood. Some anecdotal reports, however, noted potential disputes with lessees over land contracts and difficulties returning plots that had been consolidated into large commercial farming operations.

of households have rights to individual sections of the field that, from the roadside, looks like any grain field in the Midwestern United States.

The atomistic production structure that results from China's land tenure system raises the cost of production and of aggregating land for more commercial agriculture. Multiple trips to work on multiple small parcels add to the cost of production. Aggregating land through rental activity to obtain more commercially efficient land sizes is costly, particularly when the size of each plot is small and available plots typically are not contiguous to those controlled by the farmer interested in expanding.¹⁷ Rental markets in most parts of China may be very thin, but are growing (Deininger and Jin, 2005; Zhu et al., 2007). Village leaders may seek to coordinate some type of "unified production" on portions of village land, but most households prefer to purchase their own inputs and make their own production decisions. Direct linkages with modern supply chains are expensive to develop because of the small plot sizes, and the Government has been slow to allow farmers to organize their own producer associations to coordinate linkages.¹⁸

Taking Village Land

As the designated managers of collectively owned land, village leaders can take land away from households and allocate use rights to other households or convert it to nonfarm uses. Originally, village leaders had explicit rights to reallocate land to maintain an egalitarian distribution after births, deaths, and marriages, but village leaders no longer have explicit rights to reallocate land. Instead, households are entitled to 30-year written leases on the land allocated to them.¹⁹ Leaders still have some room to maneuver and take back land for other uses, but also do it illegally. In a 2005 survey of 1,962 farm households in 17 provinces, fewer than 1 in 5 farmers (19 percent) believed there would be no more reallocations over the 30-year period (Zhu et al., 2007). The survey question only included village reallocations of agricultural land; land reallocation for nonagricultural use was not addressed.

While policies have sought to end periodic land reallocations within agriculture, village leaders still have the right to take land from households for nonagricultural uses. Legally, village leaders must get farmers' approval and authorization from the township to convert agricultural land and must pay compensation to households according to the discounted value of that land in agricultural production over a 30-year horizon. The various means to calculate this value provide ample opportunity to dispute the final figure and, even if assessed correctly, it may be well below the value of the land in nonagricultural uses. Moreover, affected households may not be included in the deliberations to take land for nonagricultural use, and there is widespread belief that households sometimes receive only a fraction of their entitled amount. These land reallocations and perceived corruption or inadequate compensation are behind many incidents of rural unrest in China.

Land Improvement and Conservation

To boost domestic food production, as well as employ its large rural population, China has stressed land resources by farming steep hillsides and areas that other more land-abundant countries do not farm, creating soil erosion problems. Land has also been degraded by intensive chemical applications and by rarely leaving land out of production to "rest." As the agents of collective owners, village leaders have an obligation to maintain the long-

¹⁷ Rental activity may also be discouraged by reallocation policies in some villages where renting out land serves as a signal to village leaders that the land can be reallocated to another household.

¹⁸ In a 2003 survey of villages in 216 townships in 6 provinces in China, researchers found that approximately 2 percent of farm households belonged to a functional producer association (Shen et al., 2006). The Government has begun encouraging farmers to join cooperatives and producer associations since a 2007 law clarified the legal status of such organizations, but associations are small, localized, and often led by village officials.

¹⁹ According to the 2002 Rural Land Contracting Law and previous directives and laws.

term productivity of the land. As the direct beneficiaries of the use rights to the land, farm households have an incentive to maintain and improve the productivity of the land. Uncertainty over their long-term rights to the land, however, dulls farmer's incentives to make long-term productivity improving investments and rely more heavily on short-term productivity measures such as chemical fertilizers and pesticides.²⁰ While village leaders manage the land under collective ownership, they are only appointed for a fixed period. Increasing agricultural and nonagricultural production under their leadership benefits their performance evaluation, so they too do not have strong incentives to tradeoff short-term production for long-term productivity nor to prevent farm land from conversion into nonagricultural uses.

Evolving tenure security and mechanisms to pool land into more commercially viable plots will affect China's competitiveness on world markets and ensure land productivity for future generations. Lowering the cost of aggregating plots will facilitate adjustments as labor becomes more expensive and the current cohort of farmers ages. Larger commercial plots will raise farmers' incentives to carefully select and verify the quality of inputs from China's fragmented input providers to maximize profits and implement practices to ensure quality and safety.

Collective ownership is also linked with social welfare issues. Land provides social security for the elderly and acts as a safety net for rural workers who have trouble finding employment outside of agriculture. Many farmers support collective ownership and favor land reallocations that maintain an egalitarian distribution of land (Kung, 1995).²¹ While using land as an income security institution has served China well thus far, it distracts from establishing institutions to use land more efficiently in agricultural production. Establishing separate, viable institutions to provide income security will help China establish more effective land tenure policies. In Cixi prefecture, the land rental system is paired with a social security system; elderly villagers can receive land rental and social insurance payments of 400-500 yuan per month, enough to cover basic needs (Jiang and Ke, 2009). More importantly, institutions to register and enforce farmers' land rights are still underdeveloped but will be critical to further reform. Recent reforms to increase farmers' rights to land, such as the 2002 Rural Land Contracting Law, are undermined by an inability to independently register land rights and settle disputes according to the law.

Water

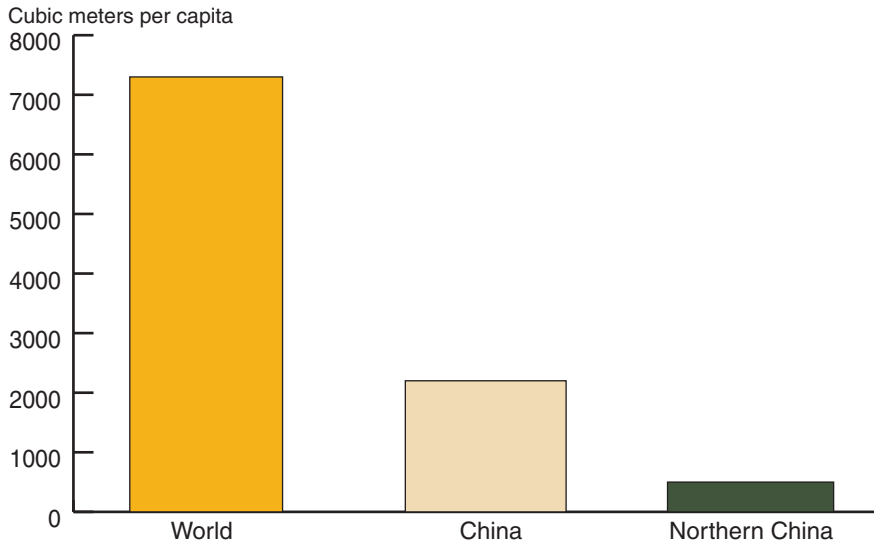
Like the United States, China's water endowment is unevenly distributed. Water is relatively abundant in the south, but it is scarce in the north (figs. 8-9). Extensive irrigation is key to China's capacity to maintain agricultural production. Important crops in water-scarce areas that rely on irrigation include wheat, corn, and cotton, as well as China's increasing production of horticultural crops.²² But in the reform period, rapid demand for water in the industrial and urban areas generated intense competition for limited water resources. Rising water demand is causing rivers to run dry and groundwater tables to fall.

²⁰ Several studies found that farmers decrease their investments when tenure is less secure in China (Jacoby, Li, and Rozelle, 2002; Deininger and Jin, 2007; Zhu et al., 2007)

²¹ Taking land for nonagricultural use has been much more contentious, but conflicts appear to focus more on the closed-door nature of the process and farmers' share of the proceeds than with the transfer of the land out of agriculture itself.

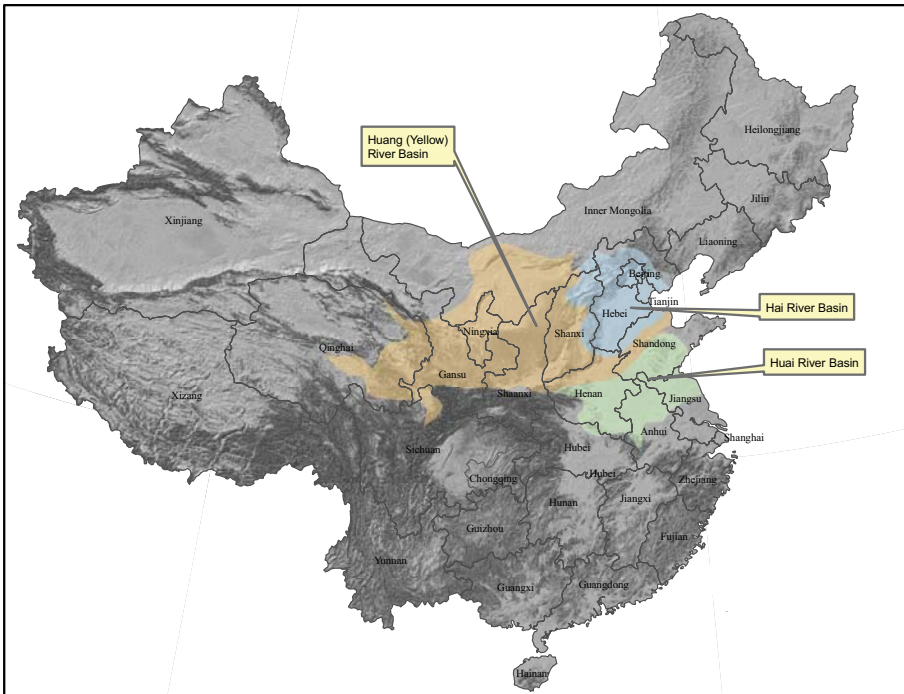
²² Although rice is heavily reliant on irrigation, most of it is produced in the water-abundant southern part of China. Much of northern China receives sufficient rainfall for agriculture in an average year, but 70 percent of the rainfall comes in the summer months (July-September), the primary growing season for corn and cotton. Winter wheat production in northern China occurs from October to June and relies heavily on irrigation during this period.

Figure 8
China's per capita water resources are below the world average, northern China even lower



Note: Northern China refers to the Hai, Huang (Yellow), and Huai River Basins, areas where water scarcity is most serious (see map below).
 Source: China's Ministry of Water Resources.

Figure 9
Areas of water scarcity in China, by region



Note: Highlighted areas represent regions of greatest water scarcity.
 Source: Economic Research Service analysis based on ESRI, Inc. data.

Water Policies

All water in China is owned by the State, and, in northern China, roughly 50 percent comes from surface sources and the remainder from ground water.²³ Surface water is managed by the Ministry of Water Resources and its local water resource offices that oversee a network of large and small irrigation districts (Lohmar et al., 2003). Efforts to promote more efficient use of surface water include management reforms that typically involve providing water managers with incentives to use less water and improve delivery services (Huang et al., 2007).²⁴ Surface water prices, however, are set by the Government and, despite price increases over the last decade, water prices remain too low for most districts to recover operating costs, much less additional revenue for investments in infrastructure improvements.²⁵

Many farmers have turned to ground water for irrigation in water-scarce northern China, but groundwater management policies are neither clearly defined nor vigorously enforced. China had the means to control ground water withdrawals during the collective period because wells were dug by Government-owned enterprises and owned by Government-run local collectives. Recently, there has been a proliferation of privately owned wells that serve irrigators and collect payments from farmers based partly on the costs of pumping and delivering the water (Wang et al., 2006). The private wells are difficult to regulate and the State, which nominally owns the water, does not receive payment for the water extracted. Since pumping costs rise as the water table falls, volumetric prices increase as ground water becomes more limited, providing some incentives to use water more efficiently.

Incentives To Conserve

China's water management policies do not provide strong incentives to conserve water.²⁶ For surface water and nearly all ground water, farmers are charged a fraction of what the water is worth in agriculture, which is a fraction of its value in other sectors.²⁷ For most ground water, the price is still low enough that farmers have little incentive to invest in improvements or adopt technology to improve irrigation efficiency (Blanke et al., 2007). For surface water, farmers typically do not pay for water by volume, but instead pay a fixed amount based on the area they irrigate. With Government-determined prices, irrigation districts earn income from the amount of water they sell, so they are not encouraged to conserve or to invest in conveyance. Some local water managers have an incentive to use surface water efficiently, but the incentive is typically to invest in and manage conveyance to the field more carefully so that more farmers receive irrigation. This increases fee remission from farm households, from which the manager may get a percentage, but does not necessarily reduce overall water use in agriculture and can reduce the return flow of water to streams or water tables, thereby reducing water availability to downstream users.

Rising water prices for farmers are a hotly debated topic in China. While raising water prices would induce farmers to conserve water, current policies are focused on reducing water costs to farmers to raise their incomes (see, rural income discussion on page 25). Moreover, water conservation conflicts with another Government priority—maintaining near (95 percent) self-sufficiency in grain (see box, “China’s Agricultural Policy Dilemma,” page 20). Higher water prices may lead to lower grain yields as farmers reduce water use. Some farmers abandoned grain production when ground water pumping

²³ In southern China, far more comes from surface water than in northern China.

²⁴ Reforms include contracting canal management out to an individual to manage or setting up a Water User Association (WUA) that identifies a manager to take over selected tasks. Some, but not all, of these managers have a direct incentive to reduce water use and improve fee remission.

²⁵ For all State-owned assets, national offices of the Price Bureau still determine price guidelines and ranges, and local Price Bureau offices set prices in accordance with these guidelines.

²⁶ China is not unique in this regard.

²⁷ The exception is when the ground water table falls deep enough that charges rise to levels where farmers choose to either conserve or switch crop patterns.

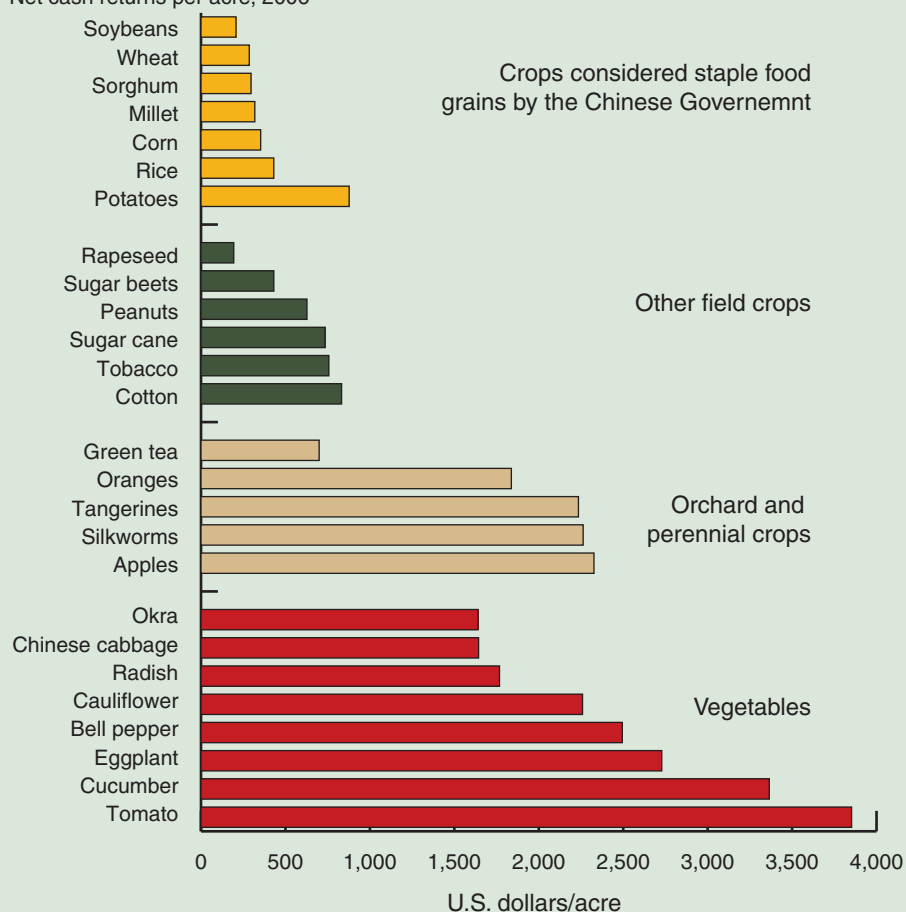
China's Agricultural Policy Dilemma

China's agricultural policies are intended to achieve multiple objectives that often conflict. While the balancing of strategic, consumer, and producer welfare objectives present tradeoffs for policymakers in all countries, the conflict between these goals has become especially clear in China.

For decades, achieving self-sufficiency in food production has been a primary strategic goal for China's agricultural policymakers. The leadership mobilized resources to increase production of grain, cotton, and other strategic crops during the collective period and this carried over into the reform period, most visibly during a campaign to boost grain output in the mid-1990s. As China further integrated into the world economy, self-sufficiency goals were relaxed for most products, but leaders still maintained near-self-sufficiency goals (95 percent) for rice, wheat, and corn.

China's farmers receive relatively low returns from grain

Net cash returns per acre, 2006



Source: Economic Research Service calculations based on China's National Development and Reform Commission data.

Since the late 1990s, policymakers have sought to simultaneously increase grain production and farm incomes. These two objectives conflict since producing grain is less profitable than other types of farming. Net cash returns earned by Chinese farmers from vegetables and fruits are several times higher than returns from rice, wheat, and corn (see figure at left).

Recent events show that rural income objectives can also conflict with urban consumer welfare objectives. International prices for most commodities rose sharply between 2007 and 2008, but Chinese officials sought to limit domestic price increases by shutting down exports of grains, cutting soybean tariffs, and importing vegetable oil. Domestic prices for some types of Chinese grain were almost 50 percent lower than international prices. Limiting the rise in prices protected consumers, but denied Chinese farmers a potential windfall.

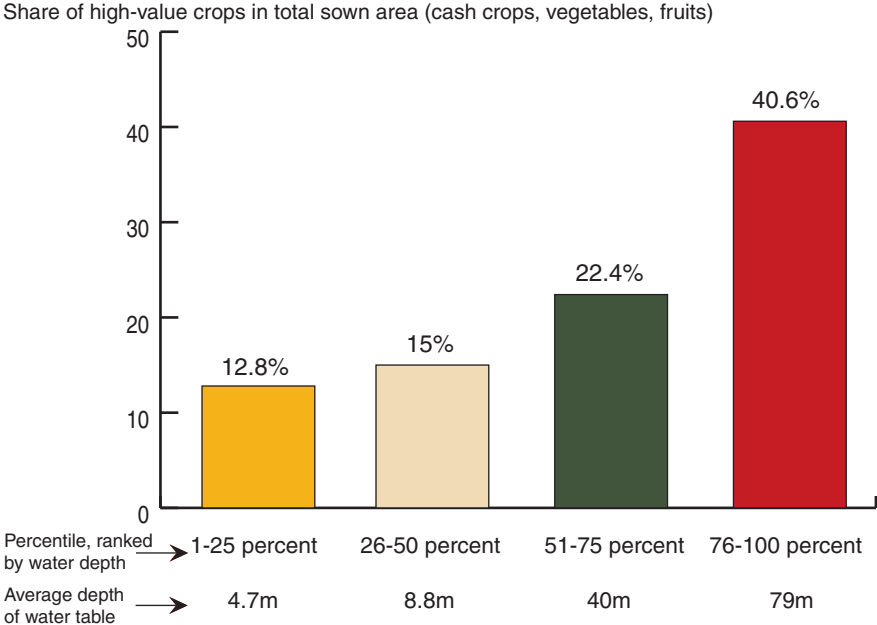
costs rose. Establishing viable water trading regimes might allow farmers to benefit by selling their water rights to higher valuing users, but this too may cause farmers to forego grain production. Experiments in water trading regimes find that they are difficult to establish because farmers are wary of losing their water rights altogether if they begin selling it to more powerful nonagricultural interests (Zhang, 2006). Thus, as with land, establishing more efficient water allocation regimes is hamstrung, in part, by under-developed property rights enforcement institutions.

The lack of regulation for ground water withdrawals also affects the severity of water scarcity. In the Hai River Basin and other parts of northern China, ground water tables are not only falling rapidly, but there is scant policy enforcement to curb the expansion of private wells. The falling water table increases the price of water beyond its economic value in wheat or other field crop production, inducing farmers to either use water more efficiently or switch to crops that bring higher returns to water. Alternatives include relatively water-intensive fruit and vegetable crops, which are both more profitable and more suited to efficient irrigation delivery technology, such as drip or micro-sprinkler irrigation (fig. 10).²⁸

While many observers see water shortages as a threat to China’s agricultural production capacity, there is little evidence that systemic water scarcity has adversely affected production to date, and China could avert future effects by improving water conservation. Conservation is occurring, albeit slowly, in surface water systems. It is also occurring somewhat inadvertently in ground water systems as the water tables are drawn down to the point that farmers switch out of grain and into crops that bring a higher return to water. If these trends continue, water shortages will likely not bring about a surge in

²⁸ Horticultural crops that bring a higher value to water may also be riskier than grain crops and require some initial investment that discourages farmers from producing them when water is less costly.

Figure 10
Farmers move into cash crops as pumping costs rise



Source: Survey by the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, of 400 villages in Hebei and Henan Provinces.

demand for grain imports. Because China's water shortages occur primarily in northern China, and China is a large country, a regional shift out of grain and cotton production would cause prices for these commodities to rise, consumers to consume less, and producers in other parts of China to produce more, dampening the demand for imports (Lohmar and Hansen, 2007).²⁹

Agricultural Marketing Challenges

China's traditional agricultural marketing system is extremely efficient, flexible, and low cost, but these efficiencies come at the expense of providing strong incentives for producers or marketing agents to achieve quality or safety. However, quality and safety characteristics are increasingly demanded by the growing food processing sector, modern retailers, middle class consumers, and export markets. The atomistic nature of production and marketing, the lack of effective contract enforcement mechanisms, and the scarcity of farmer organizations make it difficult and costly for traders, packers, and suppliers to ensure food safety and consistent quality. Investments in higher quality storage, transportation, and cold chain infrastructure would reduce waste through spoilage, allow for more regional specialization, and facilitate the distribution of imported products throughout the country.

Improving food safety has become the central challenge in China's marketing reform efforts. The Government has taken a leading role in addressing food safety issues in China, in part, because the institutional framework for markets to provide safety assurances is not yet developed. Benefits to farmers providing food safety assurances are limited because their products are typically aggregated with products from other producers in the marketing chain, often at the point of sale. Companies that institute costly measures to ensure food safety cannot recoup these costs because counterfeiting and other mislabeling are so widespread that consumers lack the confidence in private assurances to pay a high premium for them. Companies producing unsafe products have little risk of being caught and, if they are caught, they are typically not fined or liable for damages, but instead shut down and may even reopen somewhere else.³⁰ In this environment, the market will lag in providing the safety assurances that consumers demand, creating a role for Government intervention. Resolving obstacles to more market-oriented solutions, however, could provide more sustainable solutions and allow farmers to receive more of the price premiums for producing safe and high-quality products.

A weak marketing system constrains the supply of products with special attributes. Because the marketing system is not conducive to segregating higher-quality products, it prevents the farmer from producing high-quality products and selling them at a premium. Unlike food safety, high-quality fruit and vegetable products can be determined largely by consumers at the point of purchase, so there is some incentive for marketing agents and suppliers to specialize in higher quality products. In more modern economies, suppliers and processors often contract with producers or producer groups to provide products based on set guidelines to obtain specific quality and safety characteristics. In China, however, contracting for production is limited and not particularly effective because few contract enforcement institutions exist. The large number of farm households needed to produce commercially viable

²⁹ The extent to which production falls in one region and causes prices to rise depends critically on import policies.

³⁰ The majority of food processing businesses are small, often family owned, enterprises operating out of households or rented facilities with very little capital investment and are relatively mobile (Thompson and Hu, 2007).

quantities of product also raises the cost of contracting directly with farmers. The limited contracts that do exist are typically with village leaders or producer associations that coordinate production among members or village farmers. Producer associations, in particular, could facilitate adoption of technologies and good agricultural practices to produce safe and high-quality products, but the establishment of truly independent producers' associations in China has been limited to date.

Marketing issues also extend beyond horticultural products.³¹ In the past decade, China has established a program to increase wheat quality because the competitive food processing industry seeks wheat with specific quality characteristics that domestic producers have little incentive to produce. The effectiveness of this program, however, is also reduced by the atomistic nature of wheat marketing and the few incentives to segregate wheat by quality characteristics. Milk marketing and quality assurance issues stemming from the large number of small producers came to the fore in 2008 (see box below, “*Food Safety Setback: Infant Milk Production*”).

Food Safety

Improving food safety is a major issue among both China's domestic consumers and food export industries, but poses many challenges (Calvin et al., 2006; Ellis and Turner, 2008). An atomistic farm sector, coupled with

³¹ Grain marketing in China is influenced more by State-owned or State-affiliated companies than horticultural marketing, reflecting remnants of the former State-owned marketing monopolies in grains and strategic crops.

Food Safety Setback: Infant Milk Production

In 2008, a number of infants in China died and thousands were sickened after consuming powdered infant formula tainted with melamine, an industrial chemical that can cause renal failure. The milk powder incident highlighted the lack of institutional mechanisms to monitor and enforce standards in an atomistic supply and processing sector. The milk found to be adulterated came from large companies with internationally recognized food safety certifications selling well-known brands, but they procured much of their raw milk from small farmers who brought their milk to local purchasing stations operated by independent contractors. Melamine was allegedly introduced by merchants and handlers to boost the apparent protein content after the milk was watered down. In 2007, a representative from one of China's two biggest dairy companies presented the company's detailed food safety management system, which appeared to build in adequate safeguards (Zhang, W., 2007), yet its products were among those found to be adulterated in 2008. The incident also revealed apparent complicity between a company and local officials to cover up the problem and pay off victims to forestall legal action.

Following the milk powder incident, some companies began sourcing more of their milk from large company-owned farms, while others required small farmers to bring their cows to be milked at central locations. Companies also began posting their own employees at milk stations to monitor transactions. Government subsidies funded increased testing of raw milk at the point of purchase and at processing plants.

high agricultural chemical use on crops and in livestock production, increases the risks and the costs of monitoring. China's marketing and food processing sectors are also fragmented. Some estimates report that approximately 1 million food processing companies—70 percent of which have fewer than 10 employees—and probably millions more traders and merchants handle food and agricultural products. The agricultural chemical industry in China is also fragmented and without effective regulation. Counterfeiting and mislabeling products is not uncommon. Farmers' knowledge of these products, and how to use them to reduce residue at the point of consumption, is also limited.

To combat these problems, China has established a complex set of standards (central and provincial government standards; industry and private safety standards) and assigned food safety responsibilities to a number of agencies. Keeping track of the various standards is confusing to producers and consumers alike. Many Chinese standards were adapted from international models, often with modifications, and they can vary from province to province. Food safety enforcement and monitoring responsibilities are divided among several Government agencies. The Ministry of Agriculture (MOA) supports programs for improving the safety of produce and meat and testing fresh products in wholesale markets. Provincial-level offices of the General Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ) oversee domestic food processors, and the national AQSIQ office oversees safety of exported (and imported) products. The Ministry of Health inspects food service establishments. Testing of agricultural produce occurs after the fact and, with no viable traceability system in place, its effectiveness is uncertain. Monitoring hundreds of thousands of small, often family-owned food processing businesses falls on local officials who lack the incentive and training necessary to enforce laws and standards.

Many food companies wanting strict safety assurances maintain their own safety assurance programs instead of relying on Government safety standards, programs, and labels. Assuring safety, however, is relatively costly compared with China's efficient but unregulated domestic marketing. Instructing the thousands of households that produce for a given processor/supplier, monitoring their actions over the growing season, and monitoring the integrity of the marketing chain is costly. Companies with a high stake in safety assurances often resort to a vertically integrated model. This model may include leasing land from village collectives to produce products with hired labor and technical managers. This can be a tiresome process that involves negotiating with village officials, who act as agents for farm households to aggregate land into fields to form a viable production base. For products consumed fresh and prone to safety issues, such as leafy vegetables, these bases may be fenced off to reduce animal or other contaminations and monitored by around-the-clock hired workers. The produce is typically harvested by hired workers and shipped directly to company facilities to be processed.³²

While the vertically integrated production and marketing model is much more expensive than relying on the traditional marketing system, produce from China under this system is still competitively priced in export markets such as Korea and Japan. For companies producing for the domestic market, such practices are still too expensive. Acquiring production bases and producing products with hired workers entails premium prices to cover the

³² Hired workers may come from the very households renting their land to the company; often this is part of the rental arrangement.

costs of added safety assurances that exceed what most domestic consumers are willing to pay.³³

Chinese officials have adopted a version of the vertically integrated model to promote as a safety system for domestic production. This version links a processing or packing company with a “production base” of small farm contractors. Many of the links are established by Government agencies who select the processing or packing company according to certain criteria, including the capacity to provide agricultural technology and training to farmers, and these companies get preferential treatment from local governments (i.e., loans and access to land) in establishing production bases. The companies provide or specify seed varieties, livestock breeds, chemical inputs and application practices, and veterinary drugs to the production bases, and production from the bases is delivered to the company. This “company + production base + standard” model may be easier to monitor and allow traceability compared with traditional supply chains. It is also less expensive than the model used by many exporters, in which land is rented and farmed by hired workers. China’s AQSIQ requires that exported products vulnerable to safety hazards be produced in the vertically integrated model, inspecting and certifying export companies and their production bases, although most exporters have already adopted such practices.³⁴ Authorities are also cracking down on production of substandard agricultural chemicals and feeds, banning production of some foods in areas that fail environmental testing, promoting farm record-keeping, and establishing product traceability systems.

The policy whereby the Government selects firms for loans and assistance in developing production bases means the Government rather than market competition is choosing which firms will be successful. As such, it will not be as efficient as market outcomes, but it does provide coordination in an environment where coordination comes at a high premium.

China’s ability to control food safety hazards and increase confidence in its products—for both domestic and export markets—has implications for producers and consumers in the United States. When products from China suffer food safety-related setbacks in other countries, U.S. producers of those products may have an opportunity to supply those markets.³⁵ Alternatively, successfully reassuring consumers of the safety of products from China will help China compete with U.S. producers in both third-country markets and in the United States.³⁶ As China increases the stringency of its food safety enforcement, however, the costs of producing and marketing its agricultural products will rise, eroding China’s cost advantage in international markets. It will also take time to establish confidence and integrity in China’s marketing and safety system, which gives U.S. producers a niche by promoting their products as safe and high quality.

Rural Income and Development Policies

Rapid economic development invariably brings about changes in agriculture, and China is no exception to this rule.³⁷ While rural China was first to benefit from economic reforms due to the take-off of agriculture and rural enterprises, the locus of growth shifted to urban areas in the late 1980s. By the mid-1990s, urban incomes were roughly three times higher than rural

³³ Again, the price companies can charge for safety assurances is limited by consumers’ confidence in these assurances in China, where counterfeiting and mislabeling are not uncommon.

³⁴ Many of the foreign-owned companies or joint ventures with foreign companies have much more stringent standards than China’s own certification requirements.

³⁵ Sometimes food safety-related setbacks, however, reduce overall demand for those products in the affected countries and adversely affect all imports regardless of origin.

³⁶ U.S. imports from China would also compete with U.S. producers, but benefit U.S. consumers as well.

³⁷ Economically, agriculture suffers from declining relative prices as a country develops and industrializes because additional income is spent on nonagricultural products over agricultural products. In addition, agriculture must compete for resources from the faster growing sectors.

incomes (fig. 11).³⁸ Policymakers responded with a series of programs to narrow the income gap. Each year between 2004 and 2009, China's State Council issued a series of documents offering an array of policy measures and plans to improve incomes and living standards in the countryside. Rural income growth accelerated during this period but urban incomes grew even faster, and the policies were not able to narrow the urban-rural income gap.

Eliminating Taxes

In the first two decades after reforms, China taxed farmers through price policies as well as explicit taxes and fees. Prices paid for grain quota deliveries to State marketing bureaus were well below market prices, implicitly taxing farmers.³⁹ In the late 1990s, China reversed this policy by paying above-market prices for quota deliveries—an implicit subsidy for farmers. Ultimately, by the early 2000s, China eliminated the grain quota system altogether.

China also established local taxes and fees after HRS to help fund village government, infrastructure, schools, and health care facilities.⁴⁰ As with most rural policies in China, the level and means of assessing taxes and fees varied widely from village to village. Fiscal changes in the 1990s eliminated many intergovernmental transfers, and a slowdown in the rural economy in the late 1990s and early 2000s left many rural governments with a thin tax base. Many villages began assessing various fees and taxes on farmers to fund local services (fig. 12). The rising tax burden on farmers became a major policy issue. After several years of experimentation, China began a nationwide push to phase out agricultural taxes in 2004, and taxes on farmers were eliminated by 2006 (fig. 12).⁴¹

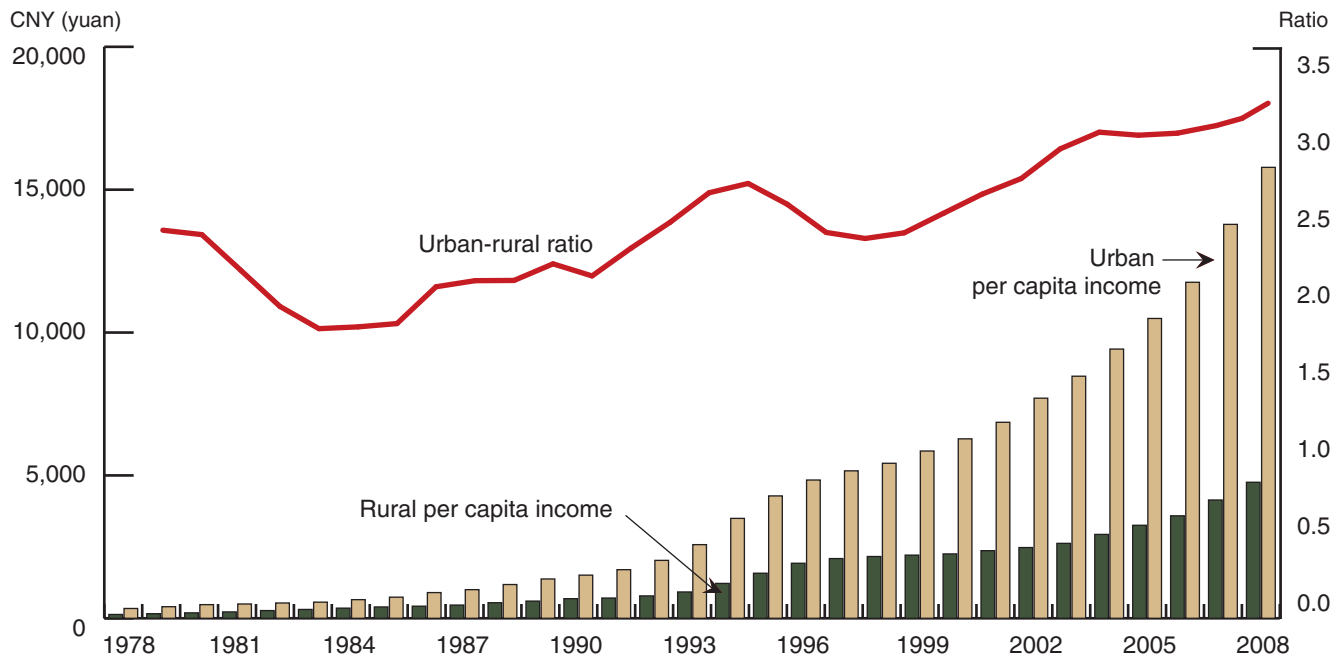
³⁸ Rural residents must pay fees for education and health care services that are of inferior quality compared with subsidized services provided to many urban residents.

³⁹ China also provided some inputs, however, such as fertilizers, at subsidized prices over some of the period.

⁴⁰ Farm households in China have a long history of paying local taxes and fees based on land area and other factors and activities.

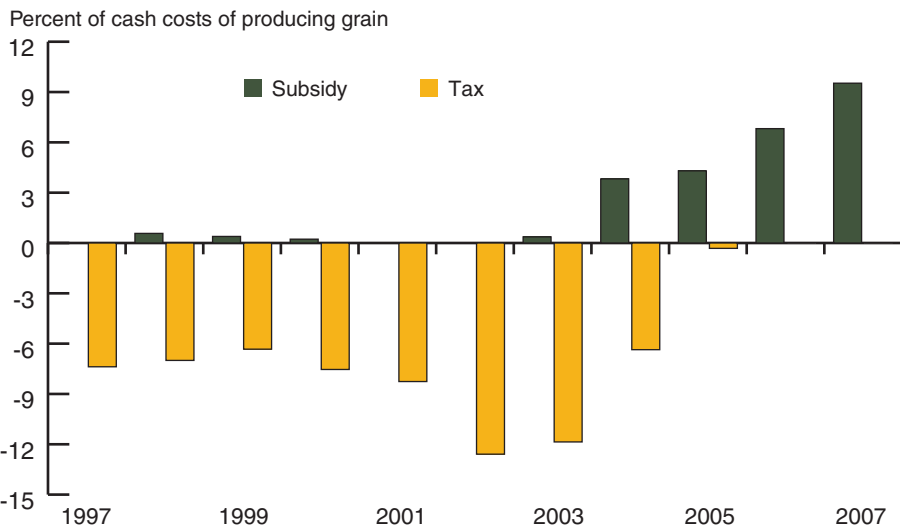
⁴¹ There is some evidence that the elimination of taxes accelerated land reallocation for nonagricultural development as a means for local government to generate revenue to replace the lost tax revenues.

Figure 11
Urban incomes exceed rural incomes in China



Source: Economic Research Service calculations based on China's National Bureau of Statistics (NBS) data.

Figure 12
China's grain taxes have given way to subsidies in recent years



Note: Ratio of tax and subsidy to cash production cost for producers of rice, wheat, and corn.
 Source: Economic Research Service calculations based on National Development and Reform Commission data.

Subsidies, Investments, and Price Supports

In recent years, China initiated a wide range of programs and subsidies aimed at rural areas (Gale, Lohmar, and Tuan, 2005). In 2004, China began to pay direct subsidies to farmers and expenditures have grown rapidly (table 2). Subsidies now include payments to grain producers, subsidies for improved dairy breeds, hog breeding farms, and large poultry farms, insurance for breeding sows, quality seeds, and machinery purchases. A subsidy to compensate farmers for rising fertilizer and fuel prices was initiated in 2007. More general rural development programs include construction of rural roads, irrigation projects, support for rural schools, a new rural cooperative health care system, worker training, support for elderly and low-income households, and subsidies for the purchase of household appliances and electronic items. The central Government reported spending nearly \$87 billion on rural programs in 2008, a 37 percent increase from 2007.

An increase in grain production coincided with the establishment of a subsidy program. Since prices also rose over much of this period, it is unclear what the net effect of subsidies was on farmers' crop choices and yields. Moreover, oilseed production dropped over the last few years, in part, because oilseed acreage was drawn into grain production. This contributed to a surge in soybean and vegetable oil imports.

In addition to direct subsidies, China introduced price supports for wheat and rice in key grain-producing provinces in 2004.⁴² If the market price falls below a minimum price set by authorities, designated grain enterprises (mostly State-owned) will purchase grain from farmers at the minimum price. Loans from the China Agricultural Development Bank to finance these purchases exceeded \$9 billion (U.S. dollars) for 2006. The grain is stored and later offered for auction at provincial grain exchanges. Wheat

⁴² The minimum procurement price was first implemented for rice in 2004 and extended to wheat in 2005.

Table 2

China's national Government increases agricultural subsidies

Year	Direct grain subsidies	Quality seed subsidies	Agricultural machinery subsidies	Input subsidies	Total
<i>billion dollars</i>					
2004	1.4	0.3	0.01	-	1.8
2005	1.6	0.5	0.04	-	2.1
2006	1.8	0.5	0.08	1.5	3.9
2007	2.0	0.7	0.26	3.6	6.6
2008	2.2	1.5	0.58	9.2	13.9
2009*	2.2	1.8	1.46	10.4	17.5

Notes: Values converted to U.S. dollars at average exchange rate for each year.

Subsidies for inputs other than seeds and machinery did not begin until 2006.

*Announced February 2, 2009.

Source: Economic Research Service calculations based on Ministry of Agriculture data.

accounted for most of the purchases under this program until the Government announced large purchases of corn, soybeans, cotton, rice, sugar, and rubber to support prices in late 2008.

Rural Credit

Rural financial institutions are riddled with bad loans that were extended to rural businesses, governments, and grain bureaus, but most farmers in China do not participate in formal credit programs (Gale and Collender, 2006).⁴³ In recent years, the Government has made reform of the rural financial system a priority. One goal of the reforms is to restore financial health to nearly insolvent rural institutions. The over-arching goal of rural financial reform is to push more capital to farmers through a massive increase in rural loans to farmers, agribusinesses, and rural development projects (Gale, 2009).

Since 2003, a complex program was put in place to reorganize, rename, and consolidate 40,000 tiny rural credit cooperatives into credit unions, cooperative banks, and commercial banks. Thousands of officials have been mobilized to conduct village-wide credit checks and organize borrowing groups to ensure that small, short-term loans of roughly 5,000 yuan (\$715 U.S. dollars) each are repaid. A postal savings bank that opened in 2007 was expected to engage largely in rural micro-lending. Pilot programs are formalizing heretofore illegal underground lenders, who account for most rural lending, and allowing city commercial banks and foreign banks to open small “village banks” and loan companies. Statistics show large increases in rural lending, yet farmers seem to have little access to formal financial markets.

Many rural investments have the potential to increase agricultural productivity, particularly livestock production. However, household-level investment is hampered by the absence of markets for land and housing. Since land cannot be bought and sold, it cannot function as collateral for loans.⁴⁴ Consequently, most farmers have few assets to secure loans, and rural lenders resort to elaborate credit guarantee schemes for short-term loans of a few

⁴³ It is not clear whether this is because they have difficulty obtaining formal credit or whether they prefer other means to support investments.

⁴⁴ Houses can technically be sold, and the lease to the collectively owned land they occupy can be transferred to the new owner, but houses are explicitly not allowed as collateral in rural China. New initiatives allow forest rights, orchard land, and agricultural marketing contracts to be used as loan collateral.

hundred dollars. Small farmers and entrepreneurs typically rely on their own savings, underground lenders, and relatives for small short-term loans.

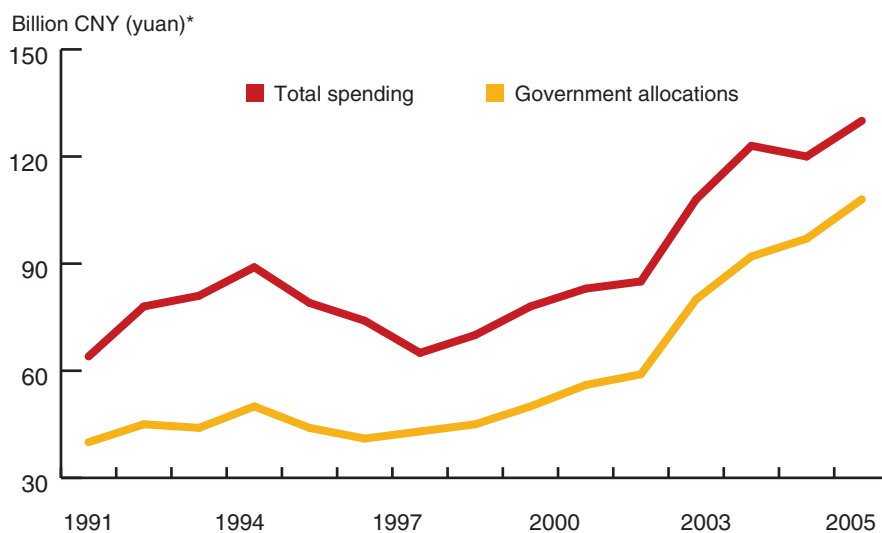
Technology Development and Promotion

Investments in agricultural research and technology contributed to China’s agricultural production gains. Since employment of land and labor in agricultural production has been stagnant or negative over the last 30 years, a large portion of China’s agricultural growth has come from productivity growth due to new technologies or specialization that uses resources more efficiently.⁴⁵ Studies show that research and new technologies released by the national agricultural research system were important components of productivity growth (fig. 13), particularly since specialization has only just begun in China (Fan and Pardey, 1997; Colby, Diao, and Somwaru, 2000; Jin et al., 2007).

While agricultural research spending has taken off in recent years, a number of factors may constrain further development and adoption of new varieties, breeds, and techniques. China’s large agricultural research expenditure is almost entirely publicly funded; private research has been slow to develop. This cautious approach since 2002 has delayed approval of a number of seed varieties developed using biotech techniques. Only *Bt* cotton and a few varieties of tomatoes and flowers have been approved for commercial use. China’s agricultural extension service is weak, and extension stations that are expected to be self-supporting pursue a mix of commercial and educational objectives that sometimes conflict. China has a portfolio of biofuel technology research, but grain-based biofuel development has been capped due to food security concerns, and most nongrain biofuel projects are still in experimental stages. Biofuels are heavily subsidized and licenses to sell it have been tightly controlled; private companies have mostly been excluded.

⁴⁵ In addition to increased applications of fertilizer and other inputs, which in many cases go hand-in-hand with the use of high-yielding seed varieties.

Figure 13
Agricultural research expenditures are rising in China



*Constant 2005 Chinese yuan (CNY) – total spending does not include private enterprises, but includes funds raised by universities and Government research institutes outside of direct Government outlays.

Source: Hu et al., 2007.

Agricultural Research

China's agricultural research system is dominated by public funding. During the 1990s, only about 1 percent of all research funding came from private sources. That percentage has likely increased since then, but is still small. While China has as many as 10,000 seed companies, less than 100 have enough resources to carry out their own research. Counterfeiting and inadequate property rights protection diminish incentives for private companies to develop new seeds. These concerns also discourage multinational seed companies from entering China's large market. Government efforts in livestock breeding are part of the country's overall investment in agricultural research, but fall far behind that of plant technology development (fig. 13). China has been active in importing foreign genetic stock for cross-breeding with domestic animals. Increased use of manufactured feed provided by foreign-invested and other private enterprises has contributed to significant feeding efficiency of China's livestock production in recent years.

Biotechnology

China benefits from investments in biotechnology and recently established a program to boost development of biotech varieties. In the late 1990s, farmers began to adopt *Bt* cotton, and today nearly two-thirds of China's cotton is a *Bt* variety. Because *Bt* cotton is resistant to bollworm and requires only about half the pesticide applications of nonbiotech varieties, adoption of *Bt* cotton lowers pesticide and labor costs and provides clear health benefits to farmers from lower exposure to pesticides (Huang et al., 2002). China has also commercialized biotech varieties of several horticultural crops, but the area sown to these crops is very small.⁴⁶

Despite having invested funds into the development of biotech varieties, which resulted in promising varieties, China is still hesitant to release biotech seeds for basic food crops due to concerns about their reception in export markets and potential effects on human health.⁴⁷ Recent surveys, however, indicate that less than 40 percent of China's urban consumers had any understanding of what biotechnology was, but 50-65 percent (depending on the food product) supported using such technology (Lin et al., 2006). Food security concerns may push the Government to approve more biotech crops.

Agricultural Extension Services

After reforms, China established a vast network of agricultural extension offices at the county and township levels that continued to expand and specialize. By the mid-1990s, the system employed over a million agents. Most counties have crop, livestock, agricultural machinery, aquaculture, and economic management stations, or centers, and many have established specialized substations for plant protection, horticulture, and soil and fertilizer technology. But China's agricultural extension network suffers from efficiency problems. Programs established in the late 1980s to make the extension stations partially self-supporting have caused many agents to spend time on administrative and commercial activities not related to extension, such as work on family planning, budget management, fire protection, village elections, and legal matters (Hu et al., 2008).

⁴⁶ Including varieties of tomatoes, sweet peppers, chili peppers, and petunias.

⁴⁷ Including corn, which is a food crop for some people in China.

Agricultural land is limited in China, so the development and extension of agricultural technologies will be critical for China to continue productivity gains. China has an extensive research system that has contributed to productivity growth both inside and outside its borders.⁴⁸ Further development of new varieties, including biotech varieties, will help China continue production gains. Improving the link between the technologies developed in the research institutes with the needs of farm households through reforms in the extension system will benefit overall system performance. Strengthening intellectual property rights would likely spur private investment for developing new varieties in China and operationalize the technologies developed in Government institutes.

Biofuel

China initiated its biofuel program in the early 2000s to use up surplus grain held in Government reserves, but the program is now viewed as a source of alternative fuels and clean energy. China does not want to miss out on technologies that could provide renewable fuel supplies. China is now the world's fourth-largest producer of fuel ethanol with production from four Government-designated plants, using predominantly corn, but also some rice and wheat, as feedstocks. A fifth ethanol plant using cassava was opened in 2008, and multiple small biodiesel plants are in operation using waste cooking oil.

Because of the conflict with grain self-sufficiency goals, China has scaled back on the ambitious biofuel production goals set out in the 11th Five-Year Plan (2006-2011) and may produce only 2-3 mmt of ethanol annually by the end of that period. China is investing in research to develop cellulosic ethanol production technology that utilizes nonfood materials (i.e., urban waste) or coproducts of food production (i.e., corn stover or straw). Until cellulosic technology is economically viable, China is emphasizing production of ethanol and biodiesel from crops, such as cassava, sweet sorghum, sweet potatoes, and jatropha, that can be grown on marginal land unsuitable for grain production. A number of demonstration projects using these feedstocks are in operation and many others are planned.

Biofuel Policy

China manages domestic fuel ethanol supply by controlling access to the State-owned petroleum industry through a quota system coordinated by China's National Development and Reform Commission (NDRC). These quotas are mandated for selected ethanol production facilities to deliver a fixed amount of fuel ethanol to the two State-owned petroleum companies (Sinopec and PetroChina) in return for a Government subsidy. All new production facilities will use nongrain feedstocks, and the current facilities using grain are expected to convert to nongrain feedstocks.⁴⁹ Some ethanol production is exported out of this State-authorized system (both fuel grade and hydrous ethanol that is sometimes dehydrated in the receiving country or a third country).⁵⁰ The demand for ethanol is managed by programs in selected cities and provinces to use blended E10 (gasoline blended with 10 percent ethanol) within their jurisdictions. In 2008, E10 was used province-wide in 6 provinces and in 27 selected cities of 4 other provinces.

⁴⁸ Many of the traits found in the high-yield dwarf rice varieties that led to the "Green Revolution" in rice throughout Asia were initially isolated and developed in China.

⁴⁹ One plant reported switching to cassava in 2008, but then reduced production due to high cassava prices.

⁵⁰ In 2006, China exported 268.9 million gallons of ethanol (roughly 0.8 mmt), about 60 percent of the authorized amount sold to the domestic petroleum industry. Exports fell sharply in subsequent years after export tax rebates for ethanol were rescinded.

The Government controls the development of biofuels. Commercial production of biofuels is only profitable when it receives a subsidy. State-owned petroleum companies constitute the only market for biofuel, and the Government has so far issued licenses to sell biofuels only to other State-owned companies. China is increasingly concerned about the competition between biofuel feedstock and food production and has scaled back plans to develop noncellulosic biofuels. Future changes will depend on China's estimation of the effect of biofuel production on grain availability and prices.

A plant that distills alcohol from cassava in Guangxi Province



Photo by William Coyle, Economic Research Service.

Implications for China's Future Trade

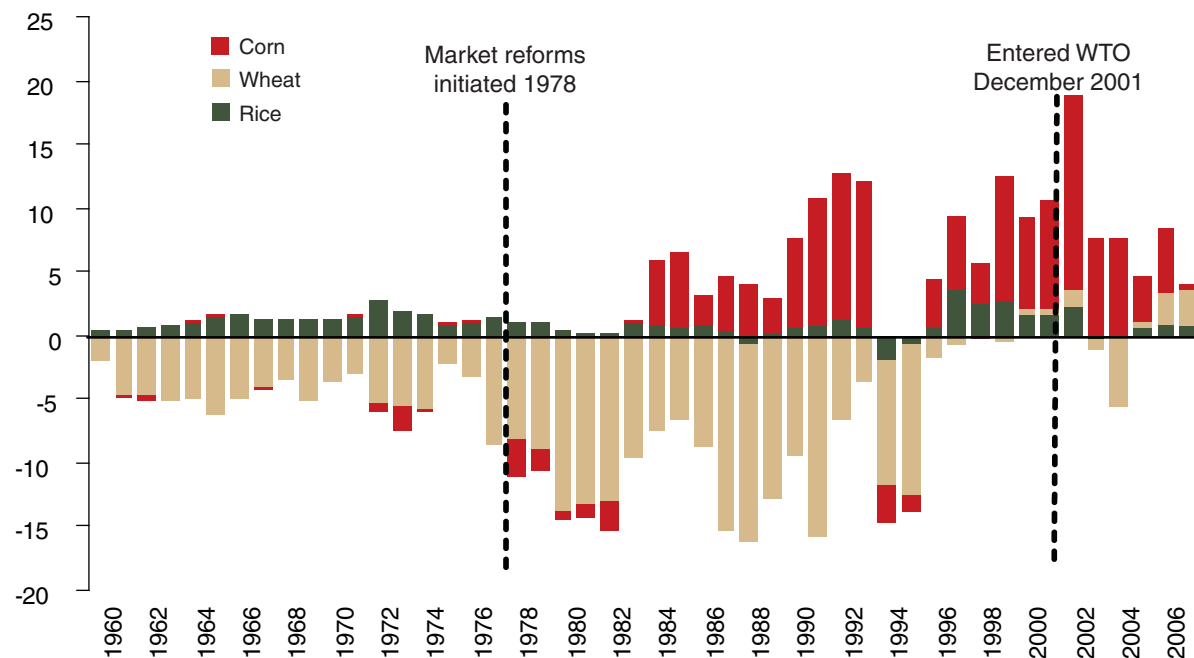
China can have a major impact on world commodity markets, but its trade has evolved in surprising ways. Before market-based reforms were initiated in 1978, China consistently imported wheat and exported modest amounts of rice each year. Beginning in the 1980s and 1990s, domestic market fluctuations were reflected in fluctuating imports of wheat and exports of corn. (fig. 14). Trade in soybeans and cotton cycled between exports and imports. Swings in commodity trade, coupled with the opaque nature of China's State-trading monopolies, contributed to uncertainty in world markets.

It was widely anticipated that China's WTO accession in December 2001 would lead to rising grain imports as the Government opened low-tariff import quotas for rice, wheat, corn, sugar, and wool and established a more transparent trading process (Lohmar, Hansen, Seeley, and Hsu, 2002). However, China remained a net exporter of corn, wheat, and rice in most years following WTO accession (Gale, 2005). Corn exports declined as excess stocks accumulated in the late 1990s diminished (Gale, 2002; 2004), and rice and wheat trade remained small (Lohmar, 2004). China has defied most forecasts by becoming a net exporter of grain since the late 1990s.

China's impact on world markets has been felt primarily in the soybean and cotton sectors. (Tuan, Fang, and Cao, 2004; Gale, 2007). China's trade in these two commodities was modest until the late 1990s, but after WTO

Figure 14
China's net exports of grains have fluctuated since 1978

Million metric tons



Notes: Negative numbers indicate net imports. Years are "market years" for each commodity.

Source: U.S. Department of Agriculture, Foreign Agricultural Service, Production, Supply and Distribution Data, November 2007. Available at <http://www.fas.usda.gov/psdonline/psdHome.aspx>.

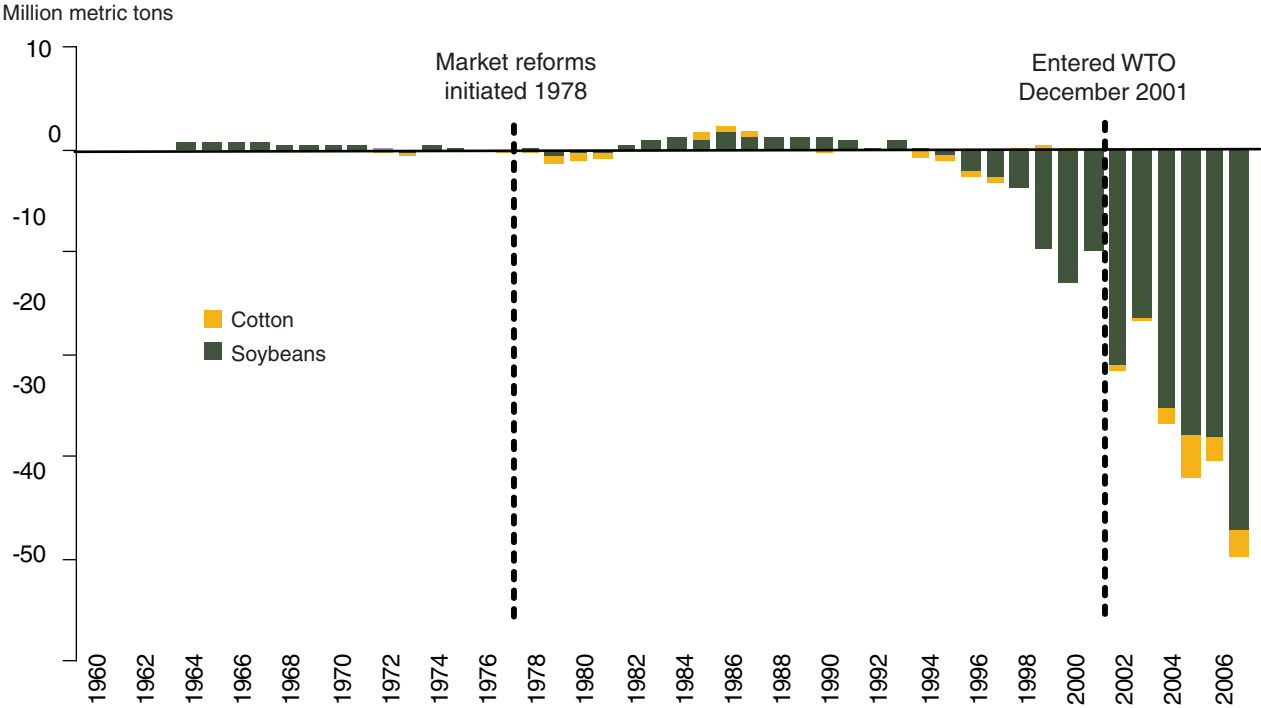
accession, imports of soybeans and cotton exploded (fig. 15). Their combined import total was close to 50 million metric tons (mmt) in 2007/08. Soybean imports reached a record 37 mmt in calendar year 2008. In comparison, net exports of corn, wheat, and rice totaled 4 mmt that year.

Fundamental economic forces like resource scarcity, urbanization, and income growth will be the main drivers of China’s future trading patterns. China’s resource endowment favors import of land-intensive crops and gives it a comparative advantage in labor-intensive goods like vegetables, fruits, and aquaculture products. The impact of basic economic forces on trade will be influenced by the issues described in the preceding section. China’s liberalization, openness to trade and investment, and efficiency in meeting its growing demand for food and fiber will be influenced by how these issues play out.

The combined forces of economic growth and shifting production toward more labor-intensive products will dampen future import and export growth in some products. Continued urbanization and income growth will result in lower per capita consumption of food grains such as rice and wheat, but greater demand for horticultural products such as fruits and vegetables. Since horticultural products are typically labor-intensive, China is well suited to produce them for its domestic market, relying less on imports.⁵¹ In addition, wheat and rice are relatively land-intensive and not produced efficiently in China relative to other more land-abundant countries.⁵² But China’s per capita demand for these products is falling, and total demand is beginning to decline as population growth slows. Thus, future imports of food grains will likely remain small.

⁵¹ China’s export capacity of these products will also be affected by domestic consumption growth.
⁵² Particularly wheat; rice is more labor-intensive.

Figure 15
China’s cotton and soybean imports surged after WTO accession



Notes: Negative numbers indicate net imports. Years are “market years” for each commodity.
 Source: U.S. Department of Agriculture, Foreign Agricultural Service, Production, Supply and Distribution Data, November 2007.
 Available at <http://www.fas.usda.gov/psdonline/psdHome.aspx>.

Economic growth and urbanization in China has increased demand for livestock products as well as textile and clothing products. Increasing demand for these products will drive demand for imports of land-intensive inputs into their production: oilseeds, feed grains, cotton, and hides.⁵³ The net effect of China's economic growth on the derived demand for imports of land-intensive inputs into livestock and textile production, however, will be affected by a number of contingencies. Demand for livestock products will continue to grow, but the extent to which additional demand is met with imports of livestock products depends on efficiency improvements in China's livestock sector and other issues, such as disease outbreaks (both in China and abroad). While most observers agree that China's domestic textile, clothing, and shoe consumption is rising, there is scant information on domestic consumption for these products. Thus, the extent to which China's domestic economic growth drives cotton and hide imports is unknown. Moreover, rising wages, the appreciating *Yuan* (CNY), and slowing growth in the world economy threaten China's rapid growth in textile, clothing, and shoe exports.

On top of these fundamental economic trends, issues in resource management, market development, improvement of rural incomes, and the development and adoption of technology will play a role in China's production, consumption, and trade in agricultural products. Improving land and water management practices will affect production of nearly all crops. Market-based prices for land and water that reflect the scarcity of these resources would raise agricultural production costs and induce producers to plant crops that use these resources less intensively or crops that bring a higher return.⁵⁴ Marketing reforms will improve China's capacity to produce and market crops and livestock products that satisfy market demand with quality, safety, standardization, and other attributes that consumers want. Price support and subsidy policies have emphasized grain production at the expense of cash crops, dampening market signals to farmers. Rural investment programs are improving basic infrastructure and human capital. Increased machinery subsidies are encouraging substitution of capital for labor as it becomes more expensive. Technology development and extension would increase the technological sophistication of all aspects of agriculture in China.

In this section, we examine the factors that will determine China's future trade in key commodities. Looking at food grains, horticultural products, livestock products, feed grains and oilseeds, cotton, hides, and skins separately, we briefly touch upon past trends and the drivers of those trends, including how these drivers may be altered as China's overall economy changes. The discussion of future trade refers to underlying economic fundamentals, as well as resource management policies, development of modern marketing practices, efforts to improve rural incomes, and technology development, relating them to trends in production and consumption of specific commodities. Moreover, we note China's past emphasis on the self-sufficiency of key strategic crops, but also that many formerly strategic crops are now fully liberalized and sourced from abroad. Past liberalization of policies for formerly strategic crops, such as soybeans and cotton, indicates that China is willing to forego self-sufficiency when costs are high and the crop is not "too strategic."⁵⁵

⁵³ China's livestock production, predominantly pork and poultry products, is relatively labor-intensive because most is backyard production from farm households. Modernization will serve to replace labor with capital, but still allow China to maintain production of livestock products. Hides from the United States are relatively land-intensive because they are produced from beef cattle raised on rangeland before entering feedlots.

⁵⁴ Recall how farmers are responding to high water pumping costs by moving to more water-intensive, but also more profitable, horticultural crops--a phenomenon that has occurred in other regions of water scarcity in the world.

⁵⁵ Products that are not necessary to maintain people's daily life.

Food Grains

Food grains, such as rice and wheat, are fundamentally land-intensive. China can utilize its resource base more efficiently by devoting more of its limited land base to activities that produce greater economic value per unit of land. That would entail importing more grains from land-abundant countries and exporting more labor-intensive products. While China has expanded production of labor-intensive commodities, it remains self-sufficient in rice and wheat. Many observers expected rising imports of grain after China's accession to WTO, but imports of land-intensive commodities were channeled into crops viewed as less vital to food security. The prospects for rice and wheat imports are attenuated by stagnant or falling domestic demand as consumers shift diets to fish, livestock products, fruits, vegetables, and processed foods. As incomes improve beyond a subsistence level, consumers substitute other foods for staple grains. Urbanization is also slowing rice and wheat consumption. On average, China's urban residents consume roughly a third the level of food grain as their rural counterparts.

China's grain production and demand for imports will be affected by improving the resource management and marketing policies discussed previously. Policies that pool land to achieve economies of size and scale will improve productivity and facilitate mechanization. Improved water practices will mitigate stress on water resources, allowing farmers to continue irrigated rice and wheat production. Using land and water resources more efficiently, however, will induce farmers to move these resources into more profitable crops and may slow the growth of grain production. While food grain products are less vulnerable to the food safety issues that have rocked China's horticultural and livestock product markets, improved marketing will enhance the value of high-quality varieties by segregating them from generic grains. Food grain producers are the primary targets of Government policy support in the form of direct subsidies, price supports, and publicly supported research.

In general, the influence of economic and policy trends is more pronounced for wheat than for rice. We will discuss how these trends affect wheat production, consumption, and trade, then follow up with a brief discussion of their effects on rice markets.

Wheat

China is the world's largest wheat producing country and, in some years, it is also a major importer.⁵⁶ Imports have fallen in recent years due to slow consumption growth and a boost in production from yield improvements and policy support (Lohmar, 2004). China's role in international wheat markets will depend on a variety of factors. Expanding the scale of farms, which could result from changes in land policies, may improve efficiency since wheat production is more easily mechanized than most other farm enterprises. Much of China's wheat production also depends on irrigation in some severely water-stressed regions in northern China, and water has much higher value in other uses than irrigated wheat, which could be easily purchased from international markets. China still seeks to maintain near self-sufficiency in wheat production. Given that China has committed to a more liberalized TRQ trade regime than other countries faced at this stage of their

⁵⁶ The European Union, which is made up of 27 countries and has a common agricultural policy, produces more wheat than China.

development, it is turning to subsidy and price support policies to maintain domestic wheat production at levels close to domestic demand.⁵⁷

China's wheat production could gain from efforts to reform the land tenure system.⁵⁸ Pooling land facilitates mechanization and standardization and reduces farmers' transportation time to multiple fields and other production costs. Large plots would also facilitate more commercial, rather than semi-subsistence, production practices (e.g., use of purchased seed rather than saved seed).⁵⁹ More commercial production would induce farmers to investigate input quality more carefully and demand quality guarantees, which would help shake-out counterfeiting and other abuses in the under-regulated seed and chemical input industries and improve yields overall. Larger plots would also facilitate the substitution of capital for labor (such as harvesting with combines), increasing overall efficiency, while larger plots with more secure rights would increase farmers' incentive to invest in long-term productivity enhancement. For example, investing in land leveling would improve water conservation and yields in China's irrigated wheat production.

While both wheat and rice production in China is heavily irrigated, wheat production is concentrated in areas with greater water stress and will be more vulnerable to water shortages. Wheat yields in China are much higher than world averages and the United States because of widespread irrigation. The Hai, Huai, and Huang (Yellow) River Basins are China's primary wheat belt, with as much as 70 percent of wheat production occurring in that area.⁶⁰ Not only does this area have limited water supplies, but the rainfall that does occur is concentrated between July and September and cannot support winter wheat that grows from October to June. Thus, most wheat production in the region requires supplemental irrigation.⁶¹ As surface water systems dry up or become more unreliable, farmers are turning to ground water to irrigate wheat as ground water tables fall in large parts of the region. Since wheat is a low-valued user of water, falling groundwater tables or other conservation policies that raise the cost of water for irrigation will decrease wheat production in the region.

Reforming marketing policies to establish segregation, traceability, or more integrity of the overall system will have some effect on wheat trade, but not large. Grains are, by nature, less vulnerable to contamination from pesticide residues or organic material because they are covered by a husk and grow well above the ground. The State-owned grain marketing system in China, however, was costly, inefficient, and believed to lose a significant percentage of the grain crop through inadequate storage practices that led to spoilage.⁶² The system was also geared to homogenous quality, and China's rapidly expanding food processing industry increasingly demands specific qualities, such as protein and gluten characteristics, to make its food products, particularly for wheat (Lohmar, Wilson, and Bu, 2006). In the past, the demand for wheat with specific quality characteristics resulted in demand for imports since those characteristics could not be reliably procured from domestic producers. Future marketing reforms, particularly the increasing role of private grain traders, will help establish niche marketing for wheat with specific quality characteristics. China's seed breeders are also developing more varieties with the characteristics in demand by food processors.⁶³ Marketing reforms may encourage more open attitudes toward reporting stock levels. Private traders can benefit from information on local and

⁵⁷ Other countries, such as South Korea and Japan, raised tariffs and other import barriers for grains to maintain domestic production when they were at similar stages of economic development. But China is committed to a TRQ regime and also appears more sensitive to high grain prices, causing increased reliance on subsidies. China's TRQ on wheat, however, is the most restrictive of all the products under TRQs (see box, "China's Historical Grain Trade and WTO Accession").

⁵⁸ This is true for the production of all grains and even horticultural products and cash crops in China.

⁵⁹ Farmers in China are increasingly producing for the market rather than for their own consumption. Roughly 40 percent of China's wheat is marketed some time over the year, with the remaining 60 percent consumed by the household or traded with neighbors.

⁶⁰ And an even higher percentage of wheat that goes to market in China.

⁶¹ An estimated 60-70 percent of wheat sown area is irrigated in this region and, since irrigated yields are much higher than rainfed yields, a far higher percentage of production depends on irrigation.

⁶² The grain marketing system has long suffered from overstaffing and financial losses. China Grain Bureau statistics show that State-owned grain enterprises cut employment by 2.36 million from 1998 to 2006, but still employed 948,500 in 2006 and incurred losses of over 3 billion yuan (\$375 million) (Nie, pp. 39-40). State-owned grain marketing companies now carry out price support programs.

⁶³ Farmer's purchases of these seeds are typically subsidized by the seed subsidy program.

national stock levels and make more informed buying and selling decisions. Stock level information will also help reduce the uncertainty that has long characterized China's participation in international grain trade.

Agricultural policy will still play a role in China's wheat trade. Direct subsidies and price supports have encouraged farmers to keep producing wheat even though it consistently brings the lowest profits among major crops in China. The Government accumulated large reserves when it purchased wheat to support prices during 2006-08. In the spring and summer of 2008, when world wheat prices were 40 percent above China's wheat price, China held large wheat reserves that could have been exported at a substantial profit without disrupting domestic markets. Instead, officials cut off most grain exports by restricting export quotas, eliminating an export tax rebate, and assessing a temporary export tax on wheat and other grains. China's wheat exports plunged from 2.3 million metric tons during calendar year 2007 to 125,000 metric tons in 2008, the lowest total since 1999.

Rice

China is the world's largest rice producer and consumer and net rice exporter in most years. This trend is projected to continue. China generally imports high-quality Jasmine rice and exports relatively low-quality Indica rice. When rural people move to cities, they tend to reduce their rice consumption as their diets become more diversified. Rice production uses large amounts of irrigation water, but it is mainly grown in southern China where rainfall and surface water are abundant. Rice is more labor-intensive than other grains, and rice production may be affected by continued rising labor costs in China.

Japonica rice produced in northeastern China is preferred by many urban consumers, and some is exported to Korea and Japan where it competes with exports from California. Some Chinese rice is also exported to Puerto Rico. China's primary rice exports are low-quality Indica varieties that go to markets in West Africa, Southeast Asia, and Central Asia. China's rice imports consist mainly of premium-priced Jasmine rice from Thailand.

Horticultural Products

China's horticultural production has boomed in the last 10 years (Huang and Gale, 2006). Growth in horticultural production is largely in response to China's growing domestic demand for these products, but exports have increased as well, particularly since WTO accession (fig. 16).⁶⁴ China is finding markets for its fruit, vegetable, and processed products exports all over the world, including Japan, South Korea, the EU, the United States, Russia, and Southeast Asia.⁶⁵ The growth in China's horticultural exports has been slowed by food safety concerns in recent years. Continued food safety concerns may dampen China's capacity to continue export growth of fruit, vegetable, and processed products, particularly to more lucrative, higher income countries.⁶⁶ Developing modern marketing chains that can provide greater safety assurances will help China overcome problems in export markets and increase domestic consumers' confidence in horticultural products.

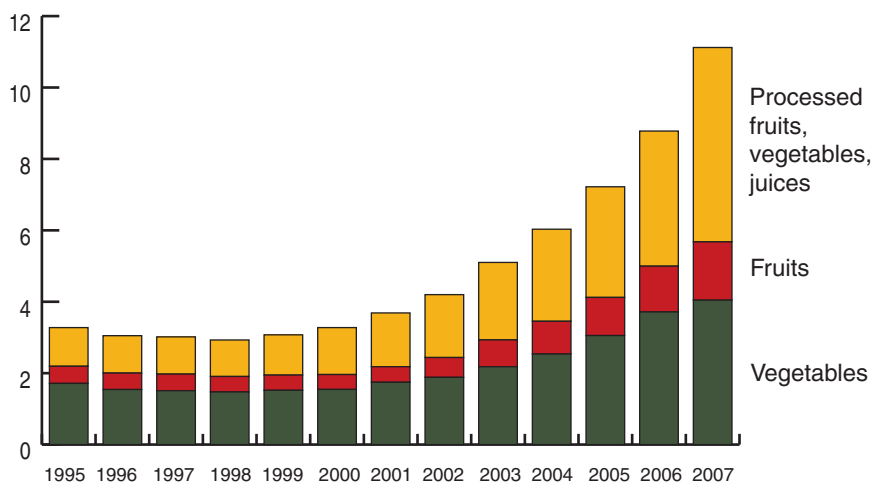
⁶⁴ Exports are still a small fraction of China's total production of these products.

⁶⁵ Many exported horticultural products are processed products, such as juices and canned, dried, pickled or frozen fruits and vegetables.

⁶⁶ Exports to Japan—China's largest food export market—plunged in 2008 after pesticide-contaminated dumplings sickened Japanese consumers and eroded confidence in foods imported from China.

Figure 16
China's exports of horticultural products grew rapidly after 2001*

Billion U.S. dollars



*Date of China's WTO accession.

Source: Economic Research Service calculations based on China customs statistics.

Other issues may serve to slow growth in horticultural production. China's continued economic growth increases wages in rural areas, eroding the profitability of labor-intensive crops. In other countries, horticultural production often relies on migrant labor: workers that arrive in time for the busy season, typically for harvest and processing, then move away until the next year. These types of periodic labor markets have yet to develop in China, constraining many regions to cultivate only as much labor-intensive crops as they can harvest with local, sometimes household, labor resources.⁶⁷ Subsidies provided to grain producers may serve to limit land going into horticultural production, but thus far these subsidies are insufficient to make grains, on average, even remotely as profitable as horticultural crops.

Other policy changes may promote horticultural production in China. Reforming land tenure and credit policies may increase the efficiency of China's horticultural production, cause farmers to shift production to horticultural crops, and even help China resolve food safety issues in horticultural products. Clarifying land rights to make land transactions more market-based would raise the opportunity cost of the land and induce farmers to shift land to higher value uses (similar to water). Land tenure policies that allow farmers to specialize and aggregate land into horticultural production will reduce costs and improve standardization. The development of farmer organizations could also serve this role. Both larger farms and farmer organizations, independently or together, would help producers bargain with marketing agents and processors to receive a larger share of the value of their production, facilitating rural income goals. Policies to provide credit for farm households may also help facilitate more modern production practices.

Livestock Products

As with horticultural products, China's consumption of livestock products has grown rapidly in recent years, and these products are predominantly

⁶⁷ This also causes households and regions to produce multiple horticultural crops with different harvesting and processing needs so they can sequence these busy seasons, rather than specialize in one or two crops.

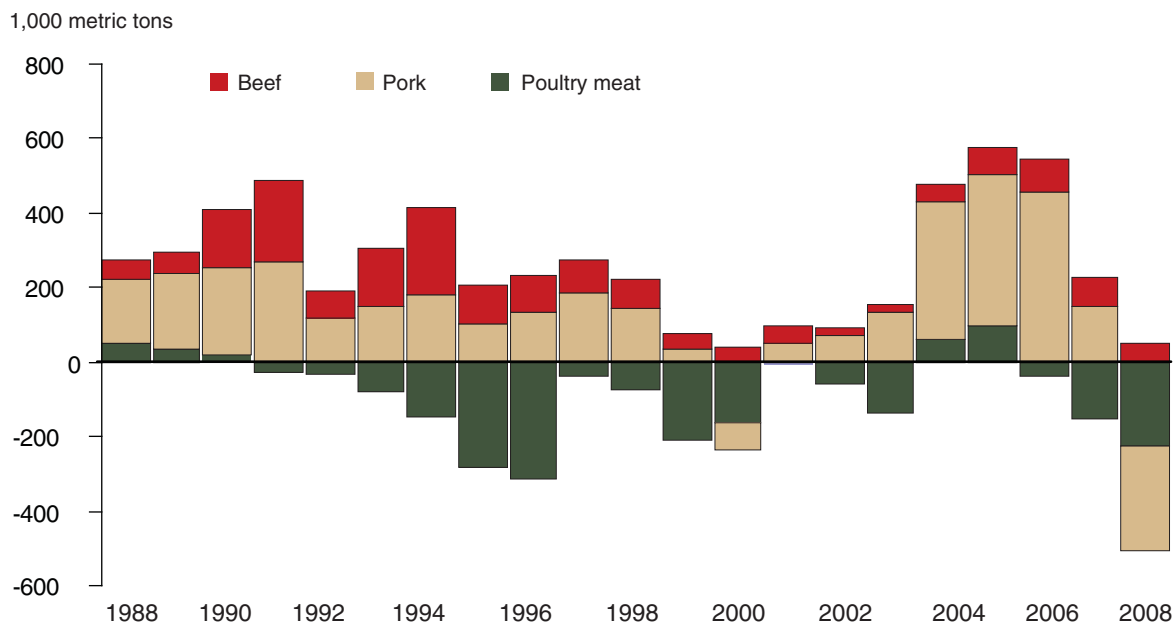
supplied by domestic producers. China's consumption of pork, poultry, beef, and fish will continue to grow as incomes and urbanization increase. Per capita meat consumption by China's wealthiest households, however, appears to have peaked at relatively low levels (Gale and Huang, 2007). These low levels of consumption in China's high-income groups suggest that the potential for greater meat consumption may be weaker than indicated by forecasts that used per capita consumption in other developed Asian countries as their benchmark. Food safety concerns and outbreaks of animal diseases periodically disrupt meat, poultry, dairy, and fish consumption and could be a limiting factor for growth in both production and consumption.⁶⁸

Despite growing domestic demand, China has been a net exporter of livestock products in most years (fig. 17). China imports mostly livestock products that are low-value in the United States, such as chicken feet, wing tips, and offal. Pork imports surged temporarily between 2007 and 2008 when China's hog sector experienced a severe downturn, but pork imports are minimal in most years. China also imports some dairy products. Demand for beef is growing, but China has not imported beef directly from the United States since the December 2003 discovery of BSE in a dairy cow in the United States. China also exports poultry, pork, and aquaculture products. Production tends to expand and contract cyclically in response to price fluctuations and periodic disease outbreaks. Officials in many areas promote livestock production as a rural development program, but many farmers are abandoning traditional "backyard" modes of livestock production. The emergence of large Chinese meat and dairy companies in recent years has pushed development of more modern livestock production by large- and small-scale farms.⁶⁹

⁶⁸ The 2004 outbreak of avian influenza in China caused Chinese poultry consumption to fall significantly, even though humans cannot contract the disease from eating cooked poultry products.

⁶⁹ A recent report by China's Ministry of Agriculture states that roughly half of China's pork production comes from producers with 50 head or more, a much larger percentage than only a few years ago.

Figure 17
China's net exports of beef, pork, and poultry



Note: Negative numbers indicate net imports.
Source: U.S. Department of Agriculture, Foreign Agricultural Service, Production, Supply and Distribution Data, November 2007, accessible at <http://www.fas.usda.gov/psdonline/psdHome.aspx>.

China's transformation from predominantly backyard production to more modern production facilities operated at the village level will be facilitated directly by the availability of rural credit and development and extension of technology. A small share of livestock production is produced in large, fully modernized production facilities with temperature-controlled buildings, compound feeds, and use of growth hormones, particularly in poultry production.⁷⁰ Household production is increasingly seen by policymakers as inefficient, and the waste from these operations contributes to environmental and water quality issues in rural areas. Thus, the Ministry of Agriculture (MOA) is engaged in a program to facilitate the consolidation of these efforts at the village level to improve their technological sophistication and curtail environmental effects. Increased availability of rural credit will assist in these efforts.

Other efforts to improve livestock production efficiency include development and importation of improved breeds. China's research institutions put less emphasis on developing livestock varieties than on seed varieties, but China has imported breeding stock to cross with domestic breeds in an effort to improve their weight gain performance and meat quality. These enhancements, along with the MOA's attempts to improve the sophistication of production at the village level, will increase China's production efficiency in livestock products.

Oilseeds and Feed Grains

As China's livestock production grows and develops, the demand for feed grains and protein meals will almost certainly increase. Given China's emphasis on maintaining self-sufficiency for food grains, the production of food grains will likely take precedence over the production of feed grains and oilseeds. Oilseed imports are already large after skyrocketing over the last decade. China has long been a corn exporter, but corn exports have fallen and imports could occur more regularly.

Oilseeds

Oilseeds and vegetable oils are among China's most important imports. China's soybean imports were negligible in the mid-1990s and reached 37 million metric tons during calendar year 2008. Soybean imports totaled \$21.8 billion in 2008, including \$8.4 billion from the United States, and imports of fats and oils totaled \$10.8 billion (U.S. dollars). Vegetable oil imports include palm oil from Southeast Asia and soybean oil from Argentina, Brazil, and the United States. China's soybean import boom has been driven by demands for vegetable oil and soymeal as a high-protein component of animal feed.⁷¹ The rising demand for vegetable oil and livestock feed is expected to continue, and China will rely on imports to meet this demand.

Research institutes in China are developing biotech soybean varieties, but unlike the United States and Brazil—the world's two largest soybean producers and China's primary suppliers for soybeans—China's Government has yet to approve any of these varieties for production. Yields for China's domestically developed biotech soybeans lag behind internationally available varieties, and this lag is one reason why China has yet to approve

⁷⁰ Many of these hormones are legally banned in China, but illegal use is common.

⁷¹ Until recently, China was a net exporter of soymeal, but still an importer of soyoil, indicating that the recent growth in soybean imports was driven more by demand for soyoil than for soymeal.

domestic varieties. There are also concerns, however, over the effects of biotech soybeans in direct human consumption. Most of China's domestically produced soybeans are used to make tofu and other food products.⁷² Once China improves its domestic biotech varieties to match internationally available biotech varieties, these varieties will likely be approved for production. If China were to adopt biotech varieties that match current yields, the adoption of these varieties would lower production costs and make soybeans more profitable, resulting in expanded acreage, higher domestic production, and lower demand for imports. The expanded acreage, however, would divert acreage from corn production, possibly increasing the demand for corn imports.

Policy support for grains affects China's production of oilseeds. Price supports and subsidy policies for grain shifted crop plantings from soybeans and rapeseed to corn, wheat, and early rice in 2007. Thus, support for grain is one factor behind the surge in oilseed and vegetable oil imports. In 2008, China expanded price supports and subsidies for soybeans and rapeseed to spur a recovery in oilseed production.

Corn

China is the world's second largest corn producer (the United States is largest). Its corn consumption for animal feed and industrial uses has been growing faster than that of rice and wheat.⁷³ Production has risen as well, as grain area shifted from food grains to corn. Despite growing demand, China has not imported significant quantities of corn since the mid-1990s. China's corn exports fluctuate from year-to-year, depending on Chinese policies and trends in international versus domestic prices (Gale, 2002; 2004). Chinese corn competes directly with U.S. corn in South Korea and other Asian markets. China's continued increase in corn consumption for feed and industrial uses will curb China's corn exports and may turn China into a corn importer.

Industry estimates suggest that corn use for animal feed has been growing at a moderate pace. Livestock feed accounts for about two-thirds of China's corn demand. Revised statistics released in 2008 by China's National Bureau of Statistics indicate that meat production rose about 3 percent per year from 1997 to 2007. Farmers in China primarily raise hogs and poultry, which convert grain to meat more efficiently than beef cattle. Corn accounts for approximately 30 percent of total livestock feed. Chinese farmers use a variety of other feeds, including wheat, rice, bran from milling these grains, sweet potatoes, fish meal, oilseed meals, and byproducts from starch and alcohol production. Chinese cattle and sheep graze in pastures, at the edge of fields, and near roadsides, consuming relatively little grain. Because of the variety of feeds used, farmers are sensitive to corn-feed prices. Livestock production, however, is modernizing and the share produced by individual households is falling as China shifts to more commercial operations. Commercial operations rely more on corn and soybean feeds, but also improve the conversion ratios to reduce feed demand per unit of meat produced. Current policies to extend credit to rural areas may facilitate the modernization of the livestock sector and have spillover effects in the corn and soybean markets.

⁷² China also exports a small amount of soybeans for human consumption, including those exported to the United States.

⁷³ In recent years, the fastest growing component of corn demand in China has been for industrial production of starches, corn sweetener, and alcohol.

Corn yields in China have significant capacity to improve, much more than for wheat and rice. China's corn yields are less than 5 metric tons per hectare (2 mt/acre), far below the United States with yields closer to 9 metric tons per hectare (3.6 mt/acre). Thus, the development and adoption of new, higher yielding varieties could significantly improve China's total corn production.⁷⁴ Improved agricultural technologies, including biotech varieties of corn, could boost corn yields and stave off import demand.⁷⁵ Improved extension services and seed industry regulation could facilitate the development and dissemination of newly developed varieties. Larger plots or development of viable producer associations could also facilitate the adoption of improved varieties by lowering research costs or raising the aggregate benefit of selecting improved varieties.

Cotton, Hides, and Skins

Another major area of agricultural imports for China in recent years has been inputs into the world's largest textile, clothing, and shoe manufacturing industry. China's production of these products not only serves the growing demand of 1.3 billion increasingly wealthy consumers, but also produces the world's largest exports of these products. China's export of these products grew throughout the 1990s, then surged after WTO accession in 2001.⁷⁶ While China is by far the world's largest consumer of these inputs, it is unclear how much goes into products sold domestically versus how much is re-exported, and this is a major component of uncertainty on international markets for these agricultural inputs.

Exchange-rate adjustment, rising labor costs in China, and slowing growth in the global economy, may affect imports of cotton, hides, and skins. After holding its exchange rate fixed for over a decade, China began allowing its currency to float upward against the dollar in July 2005 (Gale and Tuan, 2007). In the ensuing 3 years, the Chinese *Yuan* (CNY) gradually appreciated about 20 percent against the dollar, raising the cost of exports from China. At the same time, China's labor costs have been rising at double digit rates and enforcement of labor and environmental regulations has been tightened, further eroding China's international competitiveness in labor-intensive industries like textile and shoe manufacturing. These factors could slow China's export growth and temper China's demand for cotton and hide imports. A lack of reliable statistics on domestic Chinese textile and shoe production, however, has made it difficult to assess whether growth in demand by China's domestic consumers will keep its production boom going.

Cotton

China has been a major cotton importer since WTO accession in late 2001, particularly since the end of the MFA in 2004. Under China's WTO obligations, cotton is imported under a Tariff-Rate Quota (TRQ) regime similar to grains. Starting in 2003, however, China has imported cotton well beyond its 890,000 mt TRQ without imposing the prohibitive 40 percent out-of-quota tariff, providing support to its surging textile industry.⁷⁷ Cotton imports were 2 million mt or more each year from 2004 to 2008, and peaked at 3.6 million mt in 2006.

⁷⁴ Much of China's corn on the North China Plain, however, is double-cropped with winter wheat or vegetable crops and planted in June rather than in the spring, creating a much shorter growing season than U.S. corn.

⁷⁵ China has developed biotech corn varieties, but has yet to release them.

⁷⁶ China's WTO accession in 2001 allowed China to be included when the Multifiber Arrangement (MFA) was lifted in December 2004 which, until that time, imposed quotas on China's and other WTO member's exports of textile products to developed countries. Since 2001, China's textile exports have tripled, resulting in soaring demand for cotton, hides, and skins as inputs into this manufacturing bonanza.

⁷⁷ China has instead applied a complex "sliding scale" tariff on imports beyond the TRQ, which in practice has ranged from 5 to 25 percent.

China's domestic cotton production has little capacity to expand unless it encroaches on area sown to other crops. Conversely, grain subsidies and other policies to maintain grain production could limit the expansion of cotton production in many areas. China's cotton production has already benefited greatly by biotech *Bt* cotton varieties that are relatively resistant to bollworm, so future gains from technology development will be lower than for other crops where such technologies have yet to be adopted. Cotton production in China depends on irrigation, but cotton uses less water than grain crops and also grows through the summer rainy season in the eastern production region, so it is less sensitive to disruptions in supplemental irrigation than wheat. Cotton production in the western Xinjiang region depends on water from snow pack in the surrounding mountains, and this snow pack is widely believed to be threatened by climate change (see fig. 9).

Hides and Skins

In recent years, China has imported more than 2 mmt of hides and skins annually. The value of hides imported from the United States exceeds \$800 million annually. Like cotton, these products go into the manufacture of consumer items, primarily shoes and clothing, much of which are re-exported. Since China's beef industry is significantly smaller than the United States', demand for hide imports will likely continue. Processing hides and skins, however, can have negative environmental consequences, particularly on water quality. Recent efforts to improve environmental stewardship threaten the continued processing of hides and skins in China.

A ship loaded with containers is berthed at Qingdao, China's leading port for trade in agricultural products



Photo by Fred Gale, Economic Research Service.

Conclusion

China has come a long way in the last 30 years. Since reforms began in 1978, China has risen out of the inefficiencies of planned production and marketing to experience one of the longest and most robust periods of sustained economic growth in world history. This fact is even more impressive given China's large size, and the implications of its rising affluence reverberate around the world. As the world's largest agricultural economy with 1.3 billion increasingly wealthy consumers and 200 million farm households, a ripple in China's agricultural production or consumption can translate into a wave on world agricultural markets.

China is entering a new stage in its reform of markets and production practices. Agriculture now must supply quality, safety, and other attributes rather than just quantity. The environmental and natural resource costs of maintaining high agricultural output are becoming increasingly evident. The objective of maximizing economic growth has given way to a more nuanced set of goals that focus on income distribution and eroding physical and social infrastructure in rural areas. Officials now emphasize the importance of spreading technology, investment, and education to rural areas.

These issues stem from China's enormous success at generating wealth and industrial development over the last 30 years and are not unique to China. Many of these problems also have market-based solutions, but require more modern market-supporting mechanisms, such as clearly defined property rights and open, contestable, dispute settlement institutions. Such modern market-supporting institutions, however, are still in their infancy in China. The urgency of these problems, coupled with Government's continued tendency toward interventionist solutions that carry over from the collective era, results in policy solutions that could be effective, but are not necessarily efficient, and may not be adaptable to future problems. Establishing modern marketing institutions can help resolve current and future issues; however, establishing these institutions is costly and time consuming. The cost of interventionist policies is less expensive, in the short run, because the institutional legacy of the planned economy lends itself to such policies.

China's future agricultural production, consumption, and trade will depend, in part, on how these issues are resolved. Interventionist policies intended to address short-term crises may have unintended long-term consequences. In the 1990s, China sharply raised grain prices and pressured farmers to increase grain output. The resulting production surge depressed grain prices and disrupted markets during 2000-03. Such policies can also postpone needed economic adjustments, consequently building up greater pressure. Restrictions on rural-urban migration in past decades facilitated urban income growth and kept cities free of slums, but it built up a huge reservoir of surplus rural labor. The land tenure system preserved short-term stability and equality, but it has prevented adjustments needed to commercialize agriculture and generate higher per capita farm income.

Establishing independent market-supporting institutions will allow those affected by problems to address them as they arise. In addition, the path taken by policymakers in China will affect the distribution of the economic

value of production. With interventionist policies, local leaders and their agents in Government-invested businesses will want a portion of the economic returns as compensation for their efforts, dulling the incentives for producers and other businesses to respond effectively. Modern market-supporting institutions, on the other hand, will provide more opportunities for producers or more efficient processors and traders to organize themselves and directly reap the benefits of these actions.

The economic and agricultural production growth China has achieved thus far has been relatively easy to produce by establishing incentives, market-based trading, and allowing regional specialization. In order to achieve further growth, China will need to confront the more difficult issues outlined in this report. China's officials recognize many of these issues and are experimenting with many innovative policies, reforms, and plans. While many policies remain interventionist and were established by bureaucratic decree, China is tentatively increasing the authority and activity of the courts and the sanctity of laws passed by the National People's Congress, strengthening and clarifying property rights, establishing a land registration system, and experimenting with water rights trading. Reforms are evolutionary and exploratory rather than revolutionary. Continued movement to establish these institutions bodes well for China's ability to guide itself through the more complex issues that face such a large, diverse, and rapidly developing economy.

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