Agriculture and Rural Areas Approaching the Twenty-first Century: Challenges for Agricultural Economics

Conference Papers

American Agricultural Economics Association
Annual Meetings, August 7-9, 1985
Ames, Iowa

CONTENTS

ACKNOWLEDGMENTS

The Workshop Committee wishes to thank Carl O'Connor for preparing this report and USDA's Economic Research Service publishing it.

AN OVERVIEW OF THE CONFERENCE

R. J. Hildreth

Agriculture, the food system, and rural communities face a rapidly changing, and at times bewildering, array of problems as the twentieth century draws to a close. A few illustrations follow.

The emergence of a well-integrated, international economy opens new opportunities for farmers and rural people at the same time that it imposes constraints on policy makers and limits certain choices. The effects of high real interest rates and high value of the dollar on agriculture, the food system, and rural communities clearly demonstrate the importance of the fiscal and monetary policy. Rapidly changing communication technology, coupled with the computer revolution and its widespread acceptance, have brought us into the information age and created enormous new opportunities while at the same time creating the potential for serious social problems. Breakthroughs in biotechnology promise another technological revolution, opening new vistas while at the same time creating potentially serious adjustment. The interface between rural and urban communities is undergoing rapid change as the economics of industry and its location shift. And political and social change promises to transform the relationships among members of society and how we govern ourselves.

The purpose of this conference is to help the profession of agricultural economics better serve during this period of rapid transition. It seeks to redefine the issues we face as a profession and to point the way to a sharper, more relevant set of priority issues. We will attempt to do this by (1) characterizing the changing state of agriculture and the rural community; (2) assaying the changing state of economic logic and quantitive methods; (3) exploring how the analysis of problems of agriculture and the rural community can make a contribution to improvements in logic, data, and methods; and (4) identifying and defining significant problems of agriculture and the rural community and the issues needing attention by agricultural economics research, teaching, and extension.

The author is the Managing Director of Farm Foundation, and Chair, AAEA Committee on Issues and Priorities.

The conference will lead to the development of explicit statement of problems and priority issues. There is clearly a need for establishing new program thrusts, strengthening and improving existing programs, and reallocating resources, both within the profession of agricultural economics and between agricultural economics and other agricultural fields. First, it will be difficult for agricultural economics topics to be included in competitive and special grants programs unless there is a clear definition of the issues demanding priority. More generally, a sense of priority and relevance is needed if adequate funding is to be available for the profession's programs in the future. Furthermore, a sense of priority and relevance will assist individual agricultural economists in allocation of their time and energy to topics that are challenging as well as in the national interest.

The conference was planned by the AAEA Committee on Issues and Priorities over a number of years. Active involvement of all members of the Committee and interaction with the AAEA Board has led us to today's symposium.

The major starting point for our deliberations are twelve topic papers. They are:

I. Technical Innovations with Implications for Agricultural Economics

II. Domestic Food and Agricultural Policy

III. Issues in World Agriculture

IV. Quantitative Issues

V. Issues in Natural Resource and Environmental Management

VI. Developments in Economics of Importance to Agricutural Economics

VII. Management Problems of Agricultural and Rural Firms

VIII. Changes in Agricultural and Rural Institutions

IX. The Macro-Economics of Agriculture in Rural America

X. The Economics of Rural Areas

XI. Improving the Socio-Economic Data Base

XII. Human Capital for Agriculture

Three topic papers will be presented in concurrent sessions each half-day of the conference. The authors of the topic papers have received comments from a Review Panel. The Panel members will present their individual views after the presentation of the topic paper.

After the presentation of the topic paper and the Review Panel comments, three discussion groups will be held on each topic. These discussions are a very vital part of the process of moving toward a definition of priority issues. The individual participants in this conference will play a vital role in this process.

We ask each discussion group to (a) react to the paper in light of the emerging policy issues; (b) identify priority research issues without ranking them, noting the impact on research funding and comment on the issue of organizing research efforts; (c) identify priority teaching issues without ranking them, noting the impact on funding for teaching, and comment on issues of curriculum and organizing teaching efforts; (d) identify priority extension issues without ranking them, noting impact on extension funding and comment on issue of organizing extension effort. Each discussion group will focus on issues of research, teaching, and extension in their groups. It is the intention to provide for interaction among those with interest in research, teaching, and extension in every discussion group.

The review panelists will serve as rapporteurs for the discussion groups and will be responsible for writing up the major points of the discussion and turning it in to the topic chairmen by 7 p.m. each day. The topic chairmen will develop an integrated report of the discussion groups which will be turned in to a program coordinator.

The closing session on Friday morning is entitled, "Synthesis, Priorities, and Implication for Action". A synthesis of teaching issues, extension issues, and research issues will be prepared. Discussion of these reports, and implications for action will be a signficant part of the conference

The Issues and Priorities Committee will meet Friday afternoon to begin the process of drawing together the ideas developed in the conference. Emery Castle will take the leadership in drawing this material together. A report to the Board will be made in a few months after the close of the conference.

In addition to the topic papers, distinguished social scientists from the fields of agricultural history, political science, and sociology will present their views of issues facing agricultural and rural areas as well as the contributions to be made by agricultural economics.

A publication of the topic papers, review panel comments, and other social science papers will be developed and sent to members of the Association who have registered for the conference. In addition, distribution is planned of an executive summary and conclusions from the conference with regard to priority issues. This summary will be reviewed and approved by the AAEA Board, thus making it a statement of the Association.

It is the plan and desire of the Committee and the Board to arrive at a clear statement of priority issues facing agriculture in rural areas in the future and the challenges and opportunities for agricultural economics teaching, extension, and research to deal with these issues. The involvement of each one of you in the discussion groups will be important, along with the activities of the committee and our Association Board.

I cannot close these statements without an expression of great appreciation to the members of the Committee, the AAEA Board, and especially to the Cooperative Research Service/USDA, and the Economic Research Service/USDA, for their financial support in planning, conducting, and publication of the conference.

THE CHANGING ROLE OF AGRICULTURAL ECONOMICS

by Orville G. Bentley

Ladies and gentlemen, it is a pleasure to be on the campus of Iowa State University again, and to be introduced to this distinguished body by a long-time colleague and compatriot of the agricultural committee circuit, Dr. Jim Hildreth, of the Farm Foundation.

It is especially gratifying also to bring greetings from the Secretary of Agriculture, John Block, and your colleagues at the USDA on the occasion of the 75th Anniversary of the American Agricultural Economics Association.

On their behalf, and for myself, I extend heartiest congratulations to the members and to the Association for past achievements. Our best wishes to you as you move ahead to a promising future and the centennial celebration of the Association 25 years from now.

Creative institutions are essential to the conduct of our daily affairs. They are symbols of collective efforts, reflecting the capacities and the personal commitments of the people who created them. To make a lasting contribution, a professional society should be an agent for the intellectual development and continued growth of its membership. Moreover, it should provide continuity, and a sense of belonging for its membership. Much has been achieved, but yet much remains to be done, and it is in that framework that I am sure the American Agricultural Economics Association approaches its future.

Over the years it has been my privilege to have worked with many talented and dedicated people. Among them were outstanding leaders prominent in the history of your Association -- Ray Penn, Don Paarlberg, Earl Butz, Earl Heady, Carroll Bottom, Joe Ackerman, Emery Castle, and of course your Nobel Laureate, the world renowned Theodore Schultz. But there were many more. I recall with affection as I speak today, the commitment and support that I received from the department heads of Agricultural Economics at Ohio State University, at South Dakota State University, the University of Illinois, and program leaders from the Economic Research Service and the private sector.

In addition, there is a long list of distinguished scholars from your profession who have advised on program activities and served as outstanding members of various committees that I have been privileged to chair.

But however pleasant it is to reminisce about the past, the challenge is to look ahead, and a 75th anniversary is an appropriate time to do so.

The author is Assistant Secretary for Science and Education, the U.S. Department of Agriculture, Washington, D.C.

It is quite unnecessary to say to this group that "Agriculture is going through another transition." The changes are far reaching, with implications for agricultural policy, agricultural credit, shifts in production trends and consumer demands, resource allocations, competition for world markets, and a sharp increase in the availability of new technologies that will likely bring profound changes to the food/fiber system from production through utilization. Moreover, as change takes place in the agricultural sector, the obvious linkage to the economy in general will occur, with spin-offs leading to changes in the political, social and international sectors.

Unfortunately, and perhaps fortunately, there are no easy prescriptions nor foolproof models to suggest a risk-free course of action for the future. The demands on the intellectual and professional leadership of the food and agricultural system will be great in the years ahead. Sound-thinking, incisive, penetrating analyses and intellectual rigor will be at a premium as we face the difficult choices among policy options and economic production and marketing strategies.

These tough decisions will spell challenge to the agricultural economics profession, especially the young men and women who will carry leadership responsibilities in the future. We will all have to devise new approaches to problem solving, drawing heavily from every resource available. In fact, the multidisciplinary approach will likely be more the modus operandi of the future than it has been in the past. You have the training and experience to look at issues in a comprehensive manner, a skill of tremendous use to decision makers in agriculture, whether it be at the farm level or by national policy leaders.

As teachers, research scholars, and extension education specialists, our particular responsibility is for developments in science and education, in both the public and private sectors. Our challenge is to develop a team effort, mobilizing the best talent possible to answer the pressing questions that lie ahead for the clientele we serve. This means we are talking about universities, government-supported scientists and educators, and the leadership from all sectors of private industry.

Because of our particular responsibility, it seems that the matter of planning and projecting future directions for science and education takes on added significance. One of the prime reasons for this statement is that the potential changes that can be brought about as a result of developments in biotechnology and the application of new developments in molecular biology to agriculture will bring a series of changes comparable to those that we experienced through the development of hybrid seeds, improved rations for livestock and poultry, and the introduction of the chemical age in the early post-World War II era.

Now, what about our institutions?

There is no doubt that our research and educational institutions will make adjustments based on their appraisal of academic needs and new breakthroughs in science. Moreover, interaction with the clientele these institutions serve will guide program directions in research, extension education and teaching. But as these demands for research and education grow, facing budget restraints, the planning process takes on added significance.

The reason for this can be described in various ways. The common jargon these days is to talk in terms of "strategic planning," which is, in fact, an exercise in looking at long-range goals and directions that institutions are going to

take. The process itself is important to the esprit de corps of the staff in research and educational institutions.

But the benefits go far beyond the institutional context. In a highly decentralized Federal-State research system there is a need to develop a broad consensus on issues, and to set priorities for allocating resources to agreed-upon program objectives. While we say it often, we must continue to recognize that the Federal-State system derives its strength and vitality in part from its diversity and flexibility. Yet this very strength makes it more difficult to develop a conceptual framework for programs that result in a rigorous approach to solving problems and in defining future directions that our activities should take.

This diversity is greatly increased on a national and international scale. Hence, there is a critical need for building a program consensus that has substantial input from the grass roots level.

The system is complex and sometimes difficult to understand, even for those who are a part of it, whether they are at the institutional level, or think of themselves as individuals on the scientist or administrative level.

Planning is critical to developing understanding at the national level, both in the executive branch of government and in the Congress. It calls for a continuing effort on the part of the leadership in our system, whether at the University, the Agricultural Experiment Station, the Cooperative Extension Service, or at the National Program level.

There are pragmatic reasons for planning and program evaluation efforts that fall outside the development of both "tactical" and "strategic" plans. And everyone isn't necessarily concerned with the work of the individual institutions, nor with activities such as those carried out by the Joint Council on Food and Agricultural Sciences, or the Users Advisory Board. But -- whether from the public or private sector -- each of you contributes in your own way, primarily through identifying problems, the commitment of resources, and the dedicated effort on the part of scientists in utilizing their expertise in research and extension programs and in teaching students at the graduate and undergraduate levels.

It is axiomatic that change is a part of progress. Yet it is sometimes difficult for us to recognize the magnitude of outside forces having a profound effect on developments likely to occur within the agricultural system.

A complete list of changing conditions that will influence developments in agriculture would be very long, but such a list would include these considerations:

* Profitability in the Agricultural Sector

  With falling exports, lower land values, and high interest rates relative to inflation, the nation's farm sector is experiencing a very difficult time.

* Water Quality and Management

  Thirty-four states have identified agricultural nonpoint source pollution as a major cause of water contamination. In the arid west, water management issues have reached a critical stage.

* Opportunities in Biotechnology

  The potential payoffs of this research are considerable and include possible breakthroughs such as pest- and drought-resistant plants, plants that produce their own fertilizer, and vaccines that simulate the natural immunity of animals.

* Trained Personnel

  Changing issues and opportunities in agriculture require new skills (i.e., molecular biology and systems analysis) and expanded appreciation of our interconnected world.

* Diet and Health Issues

  Diet, nutrition standards, and physical well-being are pervasive points of discussion among the U.S. citizenry. Improved linkage between changing human nutrition requirements and productive research could have great payoffs for the agricultural industry.

These five items are the top priority issues recently identified by the Joint Council on Food and Agricultural Sciences for FY 1987. The Council prepares an annual priorities report as a guide for those policymakers who develop the Federal budget and for others in science and education who seek guidance concerning important national problems facing the food and agricultural system. A longer term look at the most urgent problems needing solutions is presented in the five-year plan. The Council is working on an update of that plan now.

Input for the annual priorities report is received from a broad spectrum of performers and users of agricultural research. Members of the Joint Council represent land-grant universities, the Users Advisory Board, Federal agencies, nonland-grant universities, etc., and they obtain input from organizations that represent the many components of this decentralized system.

These priorities are having an influence on decisions made in Washington -- at least in areas where they are compatible with administrative and congressional policy preferences. The funding of the competitive grants program in FY 1985 is an example of this impact.

Agricultural economics has a prominent place in the five priorities identified for FY 1987. The profitability issue needs a major input of ideas from your profession. What are the implications of current market and financial trends on the future farm economy in the U.S.? For example, options for farmers, characteristics of successful operators, and consequences of less government involvement.

At the May, 1985 meeting of the Joint Council, Michael D. Boehlje, Iowa State University, Leo E. Lucas, the University of Nebraska, and Harold D. Guither, University of Illinois/Economic Research Service, discussed what is being done at this time and some options for the future. The good work being done by these people and others should be continued and expanded.

Another dimension of the declining profit picture is identifying alternative opportunities for farmers who must find another line of work, i.e., training needs, other business opportunities, relocation, etc.

With regard to water quality, what are the most efficient ways to reduce nonpoint pollution and use scarce irrigation water, given the technology now available?

Biotechnology developments will require that we examine the potential impact of new technologies on the demand-supply situation, industry structure, government programs, and community stability to insure a smooth transition from one set of practices and interactions to another. Robert J. Kalter, Cornell University, recently completed an assessment of the bovine growth hormone on the dairy industry. The results of the study will provide invaluable insights for establishing dairy policy at the national and state levels.

Skilled personnel demands will require the agricultural economics profession to advise State and Federal administrators of research and education programs on the training needed by future economists. Are current curricula keeping up with changes occurring in the international arena? Should there be more emphasis on integrating social and biological sciences? Which combination of skills can best address emerging issues?

With regard to diet and health, changing patterns of food consumption are having significant impacts on agriculture. Predicting changing food buying habits is always a risky proposition, but having more advance knowledge of these trends would give farmers, processors and marketers more time to adjust their operations.

One theme that permeates needed economic analysis is its anticipatory character. Agricultural economists have done an outstanding job at improving the decision making process at the firm level, but more help is needed by government decision makers in anticipating future events. In addition to the Joint Council priorities, we need help in:

* Examining the consequences of regulatory trends. What are the costs to the agricultural industry of a more restricted use of herbicides, pesticides, and fertilizers?

* Determining the advantages and disadvantages of U.S. agriculture being the early adopters of technologies derived from biotechnology research, i.e., impacts on competitive status, per unit costs, community stability, etc.

* What are the likely impacts of closer collaboration between universities and Federal labs with the private sector on the development of new technologies, i.e., exclusive licenses?

The suggested agenda for agricultural economics is rather extensive. The logical question is: Where do the resources come from to tackle these important issues?

I feel the profession must take the lead in demonstrating the necessary role of agricultural economics in improving the competitive position of U.S. agriculture by addressing the following topics:

* How does agricultural economics speed up the technology adoption process?

* How do profitable farming enterprises benefit the U.S. economy?

* Why should we improve our understanding of world production and trade trends?

These and related questions need answers. Policymakers and their staffs in Washington are generally two to three generations removed from agriculture. Your programs address the broader social issues of the day, but few people outside of agriculture are fully informed about the issues and problems in agriculture. You need to show how the results of your programs can make a difference and why they need to be integrated with the biological and physical sciences.

To demonstrate that you're responsible managers, both pluses and minuses should be presented in program plans. As past initiatives phase down, i.e., energy research, be willing to share with outside groups how resources are being reallocated to current priority areas.

When preparing plans, do not react directly to critics. Examine their concerns in a constructive way and incorporate them into a forward-looking package. The agricultural economics profession has a proud history that has served the country well. When looking ahead, be positive and explain what can be done with "X" amount of resources. The approach must be holistic and not appear self-serving. To gain the attention of busy people I would strongly urge that you prioritize initiatives. Without a priority list there is no easy way to decide among a multitude of legitimate needs.

In contrast to controlled economies, such as the U.S.S.R., U.S. farmers operate as free, independent businessmen, controlling their means of production, making their own decisions, and receiving the results of their own labor and management abilities. Helping these independent farmers make the best decisions possible, given the circumstances facing them, has been a major contribution of the agricultural economist. To continue your fine work you need to show how economic studies can help the farm community and government policymakers make better decisions in the future.

In preparation for the 1985 Farm Bill, the Economic Research Service and several agricultural economists at universities prepared twenty background papers. This information was the primary foundation for the Administration's proposed 1985 Farm Bill. Similar contributions will be made in the future. Be prepared to demonstrate the nature of these future studies in clear and concise language so that the informed layman can understand. We must move out of our inner circle of professional friends to obtain the support of the community at large. Without this broadened understanding, additional financial support will be increasingly difficult to obtain.

In conclusion, thank you for inviting me to participate in the 75th anniversary of the Agricultural Economics profession. Individually, and as a group, you have made major contributions to the success of U.S. agriculture.

Tentative Draft

TECHNOLOGICAL INNOVATION WITH IMPLICATIONS FOR AGRICULTURAL ECONOMICS

Glenn L. Johnson*

Technology is one of the four driving forces in agricultural growth and development. The others include: (1) institutional improvements including the institutions of concern to students of international trade and monetary arrangements, (2) development of human capacity (capital), and (3) growth in bio/physical as contrasted to human capital. In the short run, agricultural production, consumption and investment respond to relative prices. In the longer pull, changes in productive capacity and welfare originate largely in the above four factors.

My assignment today is to concentrate on technological innovation and on the implications which technological change has for the discipline of agricultural economics. If I neglect food and agricultural policy or trade and international monetary issues, it is because time and space are limited and there are other concurrent papers and discussions on these topics. Similarly, I tend to avoid topics covered in subsequent papers and discussions such as natural resources and the environment, developments in economics not germane to the study of technology, the politics of agriculture, institutional change and the social environment except as related to technical change, macroeconomics and human capital. This means that I will concentrate on technological change as I believe our organizers intended, and the challenges it poses for us in the first part of the next century. Inevitably, this will involve a great deal of production economics, albeit in a broad sense. More specifically, my objectives and assignment are to:

(1) provide a summary of current and prospective patterns of technological change in agriculture,
(2) focus critically on concepts, theories, techniques, and approaches used by agricultural economists in studying technical change, and finally
(3) summarize needed contributions from agricultural economists.

PROSPECTIVE SUMMARY OF TECHNOLOGICAL CHANGES

In this summary, I draw on materials which Sylvan Wittwer and I have presented elsewhere (Johnson and Wittwer, 1984) and two national productivity conferences, one on crops (Brown, et al., 1975) and the other on livestock (Pond, et al., 1980). These reports, in turn, drew on the extensive literature generated by agricultural research administrators; technology analysts such as Schultz, Ruttan, Evenson, Eddleman, Sundquist, and many other individuals, and such science related agencies as the National

---

The author is a Professor in the Department of Agricultural Economics at Michigan State University, East Lansing, Michigan. This paper has benefitted from the criticisms and suggestions of James Fisher, Neal Harl, Theodore Hullar, Ronald Knutson, James Oehmke and James Tiedje. The author, of course, remains responsible for its present content.

Michigan Agricultural Experiment Station Journal Article No. _____.

Academy of Sciences (NAS), the National Science Foundation (NSF), Experiment Station Committee on Organization and Policy (ESCOP), the international research institutes, the Agricultural Research Service (ARS), the Economic Research Service (ERS) and other agencies. Many appropriate references are listed in Johnson and Wittwer (1984).

Cellular molecular biology -- genetic engineering -- has become a buzz word among people concerned with high agricultural technology. It does hold high promise in many areas but has not yet replaced conventional plant breeding and conventional work on improving livestock. To date, the major contributions have been in livestock -- particularly in the production of biologicals for controlling livestock diseases and growth. The advances which have occurred have to do with the simpler life processes for the generation of antibiotics, hormones and other substances previously producible mainly by using live, whole animals. Massive genetic reconstruction of whole animals is still something for the future; for the most part, the same is true for massive reconstructions of whole plants through molecular microbiology.

Electronics is having its impacts some of which are very practical. New and better sensors are being coupled to controls for irrigation, planting, fertilization, pesticide application and a large number of other operations. Electronics are also introducing major advances in the managerial control of production and marketing systems. The stress is on data storage, manipulation and improvement of information systems. Improved electronics are also having impacts on the structure of agriculture and agricultural business. Ability to manage contracts for the production of primary products, processed products and various marketing services is being vastly increased. These changes have potential for restructuring agribusiness and the control of agribusinesses over the producers of primary products. The role of the price mechanism in regulating production and consumption and allocating resources may substantially change in the decades ahead. A substantial substitution of both private and public electronic controls for the allocative functions of the market mechanism may take place. As such electronic capability arises, important issues will be created for persons concerned about the structure of agriculture and agribusiness in relation to government. Agricultural sectors and subsectors may be controlled somewhat like the divisions of General Motors with prices playing much different roles than at present.

Advances in agricultural engineering will continue to be important. The prospects are that the level of living of the American labor force will continue to rise and that labor will continue to get more expensive. If this is so, it will be increasingly important to save labor. "Nonrecreational" stoop labor of commercial (as contrasted to hobby) farms will be almost entirely eliminated from agriculture by early in the next century though some hobby farms, like golf courses, will use labor intensively. The labor saving technologies of the future will also be required to save fossil energy. Electronic controls will be important in doing this. Engineering procedures to complement and make it possible to farm the more fragile soils which will have to be farmed in the future will be important. Also, water saving irrigation systems will be needed. There will be continued advances in food storage, processing and product enhancement in both agribusiness and farming. In food processing, marketing and distribution, labor and energy saving technologies will be increasingly required.

There will continue to be heavy emphasis on chemicals and biologicals but with much more careful consideration to dangers of contaminating the food chain and polluting the environment. Fertilizers along with chemical and biological disease, pest and other controls will be needed in order to meet the increasing demand for food over the decades ahead.

Further efforts and accomplishments can be anticipated in the general area of integrated pest management. While success to date in developing totally integrated pest management schemes has been meager, substantial progress has been made on partially integrated schemes and more can be anticipated. The situation is more analogous to research on cancer than on infantile paralysis. There is not likely to be a Salk vaccine-like breakthrough in integrated pest management; instead, it is more likely that slow incremental, somewhat sporatic progress will take place similar to that being attained in cancer research. Nonetheless, the importance of protecting the food chain from contamination and the environment from pollution is likely to keep the integrated pest management effort going.

Projections for American agriculture indicate that international competition in commodity markets, possible energy shortages and foreign exchange needs to buy energy, demands for improved world and U.S. diets, and population growth make it advantageous for the United States to develop capacity to double agricultural production in the next half-century or so. I stress, in this connection that capacity to produce is not the same as actual production. The greater capacity to produce generated by technological research increases production only when knowledge of the technology is distributed to producers and the inputs for production (seeds, plants, machines, chemicals, etc.) in which technology is imbedded are produced, distributed, purchased and actually used by producers. I realize the importance of but do not have time to discuss the short- and long-run tendency of market controlled farm economies to outproduce effective demand at product prices which do not cover expenditures and investments. This tendency exists regardless of technology levels, as the depressed natures of agriculture in less developed countries attest, and regardless of the presence of governmental production controls and price supports, as our own 1920s attest with their remarkable similarity to the present situation (Johnson and Quance, 1972; Johnson, 1984-a). Presumably, this policy issue will be considered in a concurrent session on food and agricultural policy.

There can be no doubt about the short-run adverse effects of U.S. fiscal deficits and consequences of high interest rates and a strong dollar on U.S. exports and the welfare of U.S. farmers. International monetary developments and the trading policies of U.S. trading partners are also important. The strength of the dollar is likely to be short lived. Our trade deficits are not likely to be sustained for long without bringing on other difficulties, some of which will be intolerable.

In the long run (20 to 50 years ahead), monetary/fiscal and trade considerations are not likely to reduce the need for expanded U.S. agricultural production. Though the time lag from basic disciplinary research (only part of which is of known relevance and only part of which turns out to be relevant) to the adoption of economically viable technology is shortening, it is often much more than 15 years -- for example, I am still awaiting fulfillment of the expectations which my biological science and chemistry professors generated within me in the late 1930s about the possibility of improving photosynthesis and even replacing it with chemical engineering. Regardless of these short-term economic, political and social considerations and of the long- and short-run tendencies to outproduce effective demand, we will need to continue to improve our technology in the decades ahead. Despite the importance of technology, we should never trust that technological advance alone will get us expanded output or that overproduction, surpluses and farmer distress can be eliminated and production controlled by restraining technological research and cutting budgets for such research.

In the report cited earlier, Johnson and Wittwer found it to be nationally advantageous to strive for a 60 percent increase in capacity by 2010 and a 100 percent increase by 2030. But, capacity to produce and use of such capacity are two different things. We can

always decide to make or not make the investments and expenditures needed to convert capacity into actual production on the basis of farm management, marketing and policy studies provided we have the technology available. To have such capacity by 2030 requires an average annual growth rate of 2 percent in capacity per year. To convert such capacity into use would require cropping an additional 50 to 60 million acres by 2030. We would also need to be able to crop more intensely, to produce much higher crop yields and to use more productive livestock. Constraints on land, water and energy use would require an ability to shift agricultural production systems to more reliance on science and technology, greater human skills to handle high technology, improved institutions and policies, a much expanded and improved capital base and greater entrepreneurial and managerial skills. As in recent decades, these four factors will continue to be the four prime movers for agricultural advance. What we will actually need to produce is, of course, much more difficult to ascertain than is the need for the capacity.

REQUIRED KINDS OF RESEARCH

The agricultural research required to secure the above discussed increases in capacity and to indicate how much of this capacity to use may be classified in three categories: problem solving (PS), subject matter (SM) and basic or disciplinary (DISC).

Problem Solving (PS) Research

PS research is designed to solve specific problems on farms, for industries, for governments or in homes. Of necessity, it is multidisciplinary across the social as well as the biological and physical sciences. PS research will continue to be essential and of increasing importance, though specific problems are difficult to foresee for very far into the future.

Subject Matter (SM) Research

SM research produces information on subjects important to groups of farmers, consumers and others facing important sets of problems. SM research generates knowledge relevant for solving problems in the set but which must ordinarily be supplemented by other information in order to solve any single problem in the set. It is also multidisciplinary. SM research in agriculture is done mainly in the USDA (ARS and ERS) and agricultural college departments.

Disciplinary (DISC) or Basic Research

DISC or basic research is becoming increasingly important for food and agriculture. DISC research is that designed to improve the theories, techniques and basic measurements of a particular academic discipline such as chemistry or economics. It may or may not be of known relevance for solving a particular practical problem.

It seems worthwhile to indicate that there has been a clear increase in the relative importance of DISC or basic research in the bio/physical sciences insofar as agricultural technology is concerned and that this trend should be expected to continue. Basic advances in these disciplines are of increasing importance to the research and development (R&D) efforts of the industries (both farm and nonfarm) engaged in providing "high tech" inputs to agriculture. This development, however, does not mean that multidisciplinary PS and SM efforts on the applied end of the research spectrum are decreasing in absolute importance though they are probably decreasing in relative

importance. Thus, there seems to be no basis for concluding that the high technologies now being attained in agriculture justify diminished support for either the private or the public sector multidisciplinary SM and PS research and extension efforts to which agricultural economists make such substantial contributions. There is certainly some evidence that high technology is increasing the relative as well as absolute importance of research on such multidisciplinary subjects as fossil energy; environmental degradation; contamination of the food chain with growth hormones, carcinogens and with bacteria or viruses immune to antibiotics fed to livestock; environmental pollution; and other questions and problems growing out of high technology. Schmid (forthcoming) and others conclude that industry does that which is advantageous to it but neglects needed research where its benefits can easily escape private appropriation. There is a further legitimate public concern in those instances where the private firms find it so easy to appropriate gains that they become exploitive or so easy to impose externality costs on others that they become polluters and contaminators. Conversely, it is not always possible for entrepreneurs to capture enough of the benefits to make public R&D and problem solving research unnecessary. Thus, there seems to be little ground for believing that the increasing relative importance of high technology will reduce the amount of R&D, multidisciplinary SM and PS efforts needed in the public versus the private sector.

CONCEPTS, THEORIES, TECHNIQUES AND APPROACHES USED BY AGRICULTURAL ECONOMISTS IN ANALYZING TECHNICAL CHANGE

Our tools and approaches for analyzing technical change will require considerable improvement in the decades ahead. In this section I consider needed improvements for (1) analyzing the interrelationships among technical, institutional and human change in doing policy analyses and developmental studies, (2) studying technology assessment and values, (3) relating technology assessment to private and public risk bearing and chance taking, (4) studying the agro-ethics of technical change, (5) defining technical change, (6) studying the origin of technology, (7) understanding the distribution and adoption of technology, (8) analyzing changes in efficiency, (9) properly using duality theory, (10) conducting holistic multidisciplinary studies of technical change, (11) understanding relationships among farm management, farming systems research and technological development, and (12) understanding relationships among markets, food systems research and technological change. It is important that our tools for analyzing technical change be in good shape if we are to benefit from and avoid the damages of technological change in an appropriate manner.

Technical Change is Interrelated with Institutional Change and Human Development

There is an important interdependency in generating growth among changes in technology, institutions, human capacity (human capital) and ordinary bio/physical capital (Bonnen, 1985). A better understanding of these interrelationships among these driving forces is needed in setting agricultural science policy and in managing the further development of both less and more advanced agricultural economies.

One hesitates to use the word complementarity in considering the interrelationships among these driving forces because such usage implies an unrealistic macro agricultural production function with technical change, institutional improvements, human development and bio/physical capital as inputs. Though I am a production economist and for that reason, perhaps, carry production functions around as something of a security blanket, I am unwilling to stretch the concept of a production function that far.

It is probably best to investigate these interrelationships by treating all four of the driving forces as individually essential but largely insufficient to generate significant advances in agricultural sectors without assistance from the other three. Whether we think of complementarity or of essentiality and sufficiency, it is difficult to determine the contributions of any one of these four given no changes in the other three. If all four are inadequate and one is improved, little progress follows. If three are more than adequate and one is deficient, improvements in the deficient one make it possible to benefit from all four and to mistakenly attribute the resultant gain to which all four contribute to only one, such as technical research or education or improved markets and policies or a credit program.

The difficulty experienced in estimating returns to one of the three independently of the other two is increased by the problems encountered in quantifying technological advance, institutional improvement and human development. I believe that this is a fundamental difficulty in technology assessment and agricultural science policy studies whether we look at efforts of the Office of Technology Assessment or at the appraisals of technological advance and studies of human capital formation and institutional change carried out by such agricultural economists as Zvi Griliches, T. W. Schultz, Vernon Ruttan and a number of others.

When Ed Schuh and I tried to estimate for the World Food and Nutrition Study (National Academy of Sciences, 1977) the contributions which social sciences could make to agricultural production by improving institutions and human development, we found that the bio/physical sciences had, in effect, claimed for technological advance all of the gains which could be attained when the institutional, human skill and capital prerequisites are in place and only technological advance is added. There was, in effect, nothing left of the pie to be claimed for social science research on institutions and human development when technologies are available but institutions and human skills are deficient.

There are many examples of instances where important technological advances produce nothing because of the lack of institutional infrastructure and poor policies. One of the most important in my experience, was the development of improved oil palm varieties in Nigeria. Nigeria taxed palm oil so heavily that these varieties were little used in Nigeria. By contrast, Malaysia used the new varieties effectively to become a primary producer of palm oil because she/he had policies and institutions amenable to exploiting the new West African varieties which could outproduce wild varieties six to one under experimental conditions and probably three to one under commercial plantation conditions. Similarly, there are many readily available technologies in the developed western world which simply cannot be used in many African countries because of the inadequate investments in human capital and the defective policies and institutions of such countries. By contrast, there is the extremely rapid ready use of such technologies in Taiwan and South Korea which have both the human capital investments and the institutional structures to encourage introduction and utilization.

This relationship of technological advance, institutional improvements and human capital formation to growth in biophysical capital and development is so close that agricultural economists should stress the proportions in which the four are required in the industry, firm or country. It is more important to get together packages of the four in appropriate proportions than it is to spend time trying to estimate their separate contributions. Though I know that academicians and administrators like to be able to prove there are handsome separate payoffs for whatever they specialize in among the four in their research, extension and advisory efforts, I doubt our ability to produce accurate estimates. I believe it is more honest and more strategic to note the interrelationships

and to spend our time creating appropriate packages than it is to argue about the separate productivity of essentially interdependent activities.

The bio/physical capital which carries technological change has an important interrelationship with the other three forces; however, the relationship of this force to the others is different than those among the other three. Bio/physical capital is produced, saved and invested partially as a consequence of having the technology, the institutional infrastructure and the human capacity in place to create it. This makes bio/physical capital growth, in part, a sequential consequence of the other three. Though this is also partially true of human capital, it appears more true for bio/physical capital than for it. New technologies do not affect production until they have been converted into the factors of production which must then be produced, saved or purchased and utilized by farmers and agribusinessmen before output is affected. Bio/physical capital -- like technological advance, institutional improvement and human development -- is essential but insufficient. When we consider its sufficiency as well as its essentiality, the fact that bio/physical capital is a sequential consequence of the other three, causes it to bear a different relationship to them than it would have if it were simply a concurrent fourth necessary but insufficient condition. In our science policy and developmental analyses, agricultural economists have not done very well in handling the necessity and insufficiency of the other three. Much work remains to be done before we will adequately understand the interrelationships among these four driving forces for agricultural change.

Technology Assessment and Values

Technological assessment is necessarily a multidisciplinary subject matter or problem solving exercise which generally involves evaluation. For these two reasons, attempts to do technology assessment as a specialized disciplinary exercise in economics without attention to values are bound to be inadequate. At the problem solving level, technology assessment necessarily involves value as well as value free information as both are necessary in producing prescriptions as to "what ought or ought not" to be done or "what ought or ought not to have been done" with respect to technology. Subject matter research on new technology which has as its objective the accumulation or generation of a body of multidisciplinary knowledge useful to a rather well-defined set of decision makers facing a rather well-defined set of problems. Conceivably, such research can omit value considerations; however, this is typically not true because the word "assessment" in the phrase "technology assessment" is virtually synonymous with the word "evaluative" -- it implies prescription or problem solving. Some of the values of concern to technology assessors are monetary as when they consider prices, incomes and expenditures but others are nonmonetary as when they consider the health and esthetic consequences of food chain contamination and environmental degradation.

Many technology assessment analyses require investigation of value consequences of alternative scenarios in order to see more clearly who is hurt and benefitted by technological advance in what way, when and where. When the value consequence of alternative scenarios are discussed iteratively and interactively with decision makers and persons affected by the decisions of those decision makers, much can be learned about the nonmonetary and monetary values involved as well as more about the positivistic characteristics of requirements and consequences of alternative technologies (Rossmiller, ed., 1978). This subject is considered further in the next section on agro-ethics.

Agro-Ethics

In at least eight major conferences held in recent years philosophers and agriculturalists have considered ethical questions concerning the impacts of technological change on the food chain, the environment, life styles, hunger and the structure of U.S. and world agriculture. Prior to this meeting, Gene Wunderlich conducted a supplemental session on agro-ethics. Last February, the University of Florida, Texas A&M University and Michigan State University sponsored a conference on agro-ethics to develop teaching materials for use in the undergraduate teaching programs. Currently, the National Agriculture and Natural Resources Curriculum Project is attempting to improve undergraduate education in the agricultural sciences by developing teaching materials on the general subject of ethical and public policy aspects of domestic and international agricultural systems. This project is sponsored by the American Association of State Colleges of Agriculture and Renewable Resources as well as by the National Association of State Universities and Land Grant Colleges. In general economics and in agricultural economics there is an increasing concern with the need to do objective research on values and on policy prescriptions. This section expands on what is stated above about the value dimensions of research on technology assessment.

In setting agricultural science policy and in doing technology assessment research, agricultural economists use the maximizing calculus of economics to define optima and to predict the consequences of technological change and its regulation. Defining these optima requires knowledge of values -- monetary or nonmonetary and intrinsic or in exchange. Both prescriptive and predictive use of the optima defined by use of the economic calculus is enhanced by more accurate knowledge of values.

The philosophy of logical positivism conditions and guides much of the work of the biological and physical scientists and, unfortunately, technology assessors. This philosophic view is also important in economics (Keynes, 1963 orig. 1890; Robbins, 1949; Friedman, 1953; Johnson, Forthcoming-b). Logical positivists reject the possibility of there being objective descriptive knowledge of the values which conditions, situations and things "really have." Logical positivists accept and help generate knowledge about who values what, how much, and countenance the conversion of limited kinds of such knowledge into prescriptions via the techniques of Pareto-optimality and Myrdal's (1944, Appendix II) "conditional normativism." However, logical positivists part ways with technology assessors who attempt to describe "real values" as opposed to what values are assigned to what by whom. Yet, it is essential that technology assessors go beyond "who assigns what value to what" to deal with "what really has value" if they are to be objective, useful appraisers of technologies which hurt some persons in order to benefit others. For example, it is not enough to view cancer caused by contaminants as unobjectively and emotionally bad when cancer can be objectively described as "really possessing" the characteristic of badness. It is also to be noted that without such knowledge, we cannot recommend that externalities of technologies be internalized through non-Pareto, nonmarket interventions of governments or others with power to control and change the ownership of rights and privileges. In this instance, interpersonally valid cardinal knowledge of values (welfare) is required (Arrow, 1963; Reder, 1948). Objective as contrasted to emotional technology assessment requires that agricultural economists go beyond logical positivism, Pareto-optimality and conditional normativism to the objective study of what really has value. I do not have time today to go into what is involved in such studies and should not because I have gone into this matter at length elsewhere (Johnson, 1960, 1976, 1977, 1980, 1982-a, 1983-a, 1984-b, Forthcoming-b; Johnson and Zerby, 1973; Johnson and Brown, 1980). There is a very active literature these days on research methodology for economists. Further, certain competent philosophers, political scientists and legal theorists have attained substantial

command over economic theory, particularly when expressed axiomatically and mathematically (Harsanyi, 1982; McCloskey, 1983; McClennen, 1983; Sagoff, 1985). The inadequacies of Pareto-optimality, utilitarianism, benefit cost computations, the concept of efficiency and the difficulties encountered in analyzing tradeoffs between equality and production are being examined carefully. New logical ground is being broken but description is being neglected. Wunderlich's pre-conference meeting on such issues as part of agro-ethics was excellently organized. All of economics, not just resource economics, is entering a state of methodological and philosophic flux. Bromley's paper for this post-conference session also deals with these methodological and philosophic issues as do papers by Barkley, Deaton and Weber and Tweeten.

Technology Assessment and Risk

Agricultural economists have substantial capacity and responsibility for assessing the risks involved in creating and adopting new technologies. This involves assessing both (1) the values of gains and losses that may result and (2) the badness of paranoia attached to running risks of losses and the goodness of experiencing chances for gains.

Severe social, environmental, nutritional, health and other losses can result from the use of some new agricultural technologies. For some years now the expected utility E(u) hypothesis has been used so extensively that many agricultural economists cannot consider the risk of loss without turning to that analysis (Halter and Dean, 1971; Schoemaker, 1982; Tversky and Kahneman, 1981). There are a number of difficulties involved in using the E(u) hypothesis to analyze the risks associated with technical change. That analysis postulates cardinal knowledge of values (utilities) but does not postulate their interpersonal validity. As new technologies confer benefits on some often at the expense of imposing losses on others, interpersonally valid utility or welfare measurements are required. This makes it necessary for us to go beyond the usual E(u) analysis to measure, in an interpersonally valid manner, the values of the losses and gains resulting from use of technology before we make non-Pareto-optimal policy prescriptions.

Another fundamental difficulty involved in using the E(u) hypothesis to analyze risk has to do with the concepts of risk preference and aversion. What is typically called risk aversion by expected utility analysts has to do with the shape of a person's utility function for wealth but not with the badness (paranoia) some experience in taking risks. Similarly, what is typically called risk preference has to do with the shape of an individual's utility function for increases in wealth and income but not with the goodness (joy and pleasure) others experience when taking chances for gains. Many, but fortunately not all, E(u) analysts follow the very questionable practice of labeling persons who have increasing marginal utility for gains in income and wealth risk preferrers and those with increasing marginal disutility for losses in wealth and income risk averters. This practice is questionable because the E(u) analysis does not deal with how a person whose utility for increases in income and wealth is affected by the risks they take in order to get more of them. Similarly, it does not deal with how a person's disutility for losses in income and wealth is affected by taking the risks. This shortcoming is recognized in the current literature by Robison and Fleisher (1983), myself (Forthcoming-a) and Harsanyi (1982, p. 54).

In the future assessments of risky technological advances, we will require improvement in our ability to measure values (welfare) in an interpersonally valid way and to deal with the fear some have of taking chances as well as with the utility some derive from for taking chances for gains. Most E(u) analysts and many theorists expect populations of people to be risk averse in the sense of having a utility function for income and wealth

which decreases at an increasing rate for losses and increases at a decreasing rate with increases in income and wealth. This conclusion stands in stark contrast to the ability of the State of Michigan to sell lottery and lotto tickets. Michiganders seem to fall in one of the following categories: (1) they have utility functions which increase at increasing rates with gains in income and increases in wealth, (2) they extract a great deal of pleasure from playing lottery games or (3) they do not make their decisions on the basis of the E(u) analysis. In any event, their behavior is inconsistent with the "risk aversion" commonly postulated by the limited E(u) analysis. To date little attention has been given to applying the E(u) analysis (and alternatives thereto) to public choices in policy analyses of risky new technologies. Professional and public paranoia is particularly apparent with respect to nuclear power, food chain contamination, environmental degradation, ground water pollution and income distribution effects of new technologies. This paranoia and its converse, the joy and pleasure experienced when gambling with new technology for gains, requires that policy analysts get beyond what E(u) analysts commonly call risk aversion and preference in public assessment of the risks of adopting new technologies.

Appropriate Definitions of New Technology

Our analyses of new technology are hampered by the definitions of technological change we employ. A number of economists in their disciplinary specialization have defined a technological advance as an event which changes the parameters of a production function. For instance, Ruttan and Hayami (Forthcoming) state "we regard technological change as any change in production coefficients resulting from the purposeful resource using activity directed to the development of new knowledge embodied in designs, materials and organization" (Johnson, Forthcoming-c). One difficulty with such definitions of technical change is that they are highly specialized in economics and, within economics, on using the concept of a production function. Another difficulty is that technological change may introduce new factors of production not included in estimated production functions except as conditioning factors fixed in zero quantities. Such definitions have the additional disadvantage of distracting the analyst away from acquiring concrete knowledge of the chains of events and processes whereby disciplinary scientists make the basic discoveries used by R&D workers or inventors to create new factors of production which, in turn, have to be produced, marketed, financed and purchased by farmers and, finally, used in production.

I believe there are substantial advantages in defining a technological advance as occurring with the discovery of a new factor of production (Johnson, 1958). The new factor of production can, itself, be a new intermediate input between the production process and previously used factors of production, an example being the herringbone milking parlor which was invented by Australians shortly after World War II. It is made of conventional inputs -- concrete, steel, pipes, milking machines and wood -- but is nonetheless a new intermediate input between such primary traditional inputs and the production of milking and feeding services which are, themselves, also intermediate to the final process of producing milk in the biological systems of cows. My definition has the advantage of specifically identifying what new factors of production are important. This, in turn, focuses our attention on (1) the advantages and disadvantages to a farmer of using or investing in the new factor and (2) what is involved in producing, distributing and encouraging proper use of it. A subsequent section of this paper gives more attention to analysis of the distribution and adoption of technology.

In my own work, I have gone so far as to state that a technological change has occurred even if the new technology is used in zero amounts provided the manager involved has learned about and analyzed the new technology carefully enough to conclude that the

optimum amount to use is zero. The technological change process is complete as soon as a manager has learned enough about a technology to decide on the optimum amount to use of the new input or capital item carrying it; the fact that the optimum amount may turn out to be zero rather than some positive, quantity does not make any conceptual difference. Zero is a perfectly good number. If, after the initial adoption of a new technology in zero or any other larger amount, it "pays" to change the initial quantity because of price changes, such changes can be regarded as economic rather than a technological changes.

The Origins of Technological Change

Policy makers who desire to encourage or discourage the creation of particular new technologies need to understand their origins. The development of the induced technological change hypothesis (ITCH) (Binswanger and Ruttan, 1978; Ruttan and Hayami, Forthcoming) was an important step forward in the ability of applied economists to explain the origins of technical change. ITCH, however, does not fully explain the origins of technological change. In addition to originating with the maximizing activities of basic researchers, R&D workers, inventors, and entrepreneurs, technological change has complex origins in the chance events, insights, inspirations, social pressures, habits and curiosities of many people in the long chain of processes between basic disciplinary research at one extreme and applied research to invent and develop new bio/physical inputs at the other extreme. The hypotheses that actors in this stream are motivated by gain makes a substantial contribution but the fuller understanding of the process we still need seems to require multidisciplinary (sociological, psychological and other) as well as economic investigations of science.

The Analysis of Technical and Economic Efficiency

Bio/physical scientists and some economists persist in trying to distinguish between adjustments in production which always have a net advantage because they are technical and those which pay because of value (sometimes price) relationships. The former are referred to as technically efficient and the latter as economically efficient adjustments. Advantageous adjustments, of course, depend on (1) technical possibilities and (2) the values of inputs, products, wastes, and pollutants or contaminants. This section indicates some of the difficulties with these formulations which need to be resolved in the years ahead in order to improve our analyses of efficiency.

In recent decades, the idea of a frontier production function has gained much currency and is now widely considered in general economics literature (Farrell, 1957; McFadden, 1978; Kopp and Smith, 1980) and in the more theoretical literature produced by agricultural economists (Timmer, 1970). This literature suffers from lack of attention to the economics of shifting from one subproduction function to another of more general production functions through investments and disinvestments. Misspecification and misaggregation of inputs and outputs also create problems. The difficulties are both empirical and theoretical with the theoretical ones being the more crucial.

A carefully specified subproduction function indicates which factors of production are variable, which are fixed and at what levels, and which vary at random to generate unexplained residuals. Also, when inputs and/or outputs are aggregated into categories, a carefully specified production function will deal with input and product categories "sufficiently homogenous for purposes at hand."

A rigorously specified stochastic production or subfunction will have both interior and exterior points due to chance variations in the variables randomly generating the

unexplained residuals. As Schmidt (1977) and others point out, it does not make empirical or theoretical sense to fit a production function so that all chance variations in output become points interior to or on the fitted function.

When one makes observations of a panel of firms, one may also encounter firms which do not conform stochastically to the specification of what factors are fixed at what level, i.e., inputs which are specified to be fixed may actually vary nonstochastically from farm to farm. Such "wild card" observations may, of course, be either inliers or outliers to the subfunction one seeks to estimate depending on whether the failure to conform to specifications is an input deficiency or excess. An observed firm will be an inlier if one of the so-called fixed variables is nonstochastically present in smaller amounts than specified. Conversely, it will be an outlier if one of the supposedly fixed inputs is nonstochastically present in larger amounts than specified. Of course, it makes no sense to fit a production function so as to make these outliers into inliers and treat the result as if the offending inputs are present in greater than the "specified" amounts. What is needed is (1) to restrict observations to firms meeting the specified conditions which eliminates such inlying and outlying firms from the panel before fitting the function or (2) to observe the offending inputs and then fit a more complete function which treats them as variable inputs. Input and output aggregation errors also create similar problems.

When economists are careless in their specifications and aggregations and, hence, observe interior points to production functions, they sometimes regard the firms represented by interior points as technologically inefficient and then presume that it is always "technically" advantageous for such firms to move to the isoquant for their level of output and that, having gotten to the isoquant, they should then make an "economic adjustment" to move along the isoquant to the line of least cost combination and subsequently from there to the high profit point. The movement to the isoquant is said to involve the attainment of "technological efficiency" while the movement around the isoquant is regarded as the attainment of "price efficiency."

It should be sufficient to point out here that there are many instances in which it will not pay to move an inlier to an isoquant because the deficiency in the factor of production which causes the firm to be an inlier cannot be advantageously corrected. What is fixed and variable can be endogenously specified as a result of Clark Edwards' (1959) mathematical treatment of resource fixity (and, hence, variability) as endogenous. Though some (notably M. Johnson and E. Pasour, 1981, 1982) seem slow to realize it, Edwards' formulation is based fundamentally upon the employment of the internal opportunity cost principle with respect to unspecialized durables fixed for the firm as a whole but reallocatable within the firm (also see G. Johnson, 1982-b; Johnson and Quance, 1972). Clark's formulation also takes into account off-farm opportunity cost or salvage value for resources being disposed of and the off-farm opportunity cost or acquisition cost for resources being acquired.

If the marginal value productivity of a limiting input causing a firm to be an inlier does not justify acquisition of more of that input, the firm is economically fixed on a different subproduction function than the one being estimated. Clark Edwards' formulation indicates that it can be endogenously more advantageous for a firm to remain on an apparent interior point than it is to move to the isoquant on the subfunction being estimated. In such instances it is simply uneconomic to change and clearly what is regarded as "technically efficient" is uneconomic. In all instances in which it is "technically" advantageous to move an inlier to the isoquant, it must <u>also</u> be economically advantageous to do so, i.e., it is necessary that the additional amount of the deficient input be procurable at a cost less than or equal to what would be justified

by its expected marginal value productivity. If this is not thought to be true, a maximizing rational entrepreneur will not make the expenditure or investment. If only advantageous changes are made, then technical and economic efficiency cannot be distinguished. Similarly, there may also be outlier firms to a specified production function. Sometimes it is not advantageous to dispose of the additional amounts of inputs which make these firms outliers in which case outliers are not moved. Again, technical and economic efficiency cannot be distinguished.

In this connection, Frank Knight (1933) noted long ago the tenuous nature of the distinction between technical and economic efficiency when he wrote:

> The correct definition of efficiency is the ratio, not between "output" and "input" but between useful output and total output or input. Hence efficiency, even in the simplest energy transformation, is meaningless without a measure of usefulness or value. In any attempt to understand economic efficiency, the notion of value is more obviously crucial since most economic problems are concerned with a number of kinds both of outlay and of return, and there is no conceivable way of making comparisons without first reducing all the factors to terms of a common measure.

More recently, Kenneth Boulding (1981) made a similar point when he wrote:

> . . . it is very important to recognize that all significant efficiency concepts rest on human valuations and that efficiency concepts which are based on purely physical inputs and outputs may not be significant in human terms, or at least their significance has to be evaluated. All efficiency concepts involve a ratio of output to input in a process. The more output per unit of input, the more efficient we suppose it to be. The significance of the efficiency concept, however, depends on the significance of the outputs and inputs in terms of human valuations.

In the decade ahead we will need to do better research than we have been doing in order to understand the roles of technology changes and value changes (including prices) and efficiency.

Analyses of the Creation, Distribution and Adoption of Technology

Diffusion theory though often used by sociologists, communication researchers and administrators has severe deficiencies in explaining the spread and use of technology though it must be credited with having added important multidisciplinary dimensions to the study of the distribution and adoption of new technology. The induced technological change hypothesis (ITCH) discussed above has helped correct these deficiencies by adding a crucial economic dimension. ITCH analysts have added an emphasis on the advantages and disadvantages of creating the expendable inputs and capital items which carry new technologies.

In analyzing the process of replacing horses with tractors in the U.S. agricultural sector from the mid-twenties in the 1950s, one must analyze a process whereby farmers disinvested in horses and invested in tractors. Investment and disinvestment theory, therefore, is important in understanding what went on. The disinvestment in horses and the investment in tractors shifted farmers from one subfunction to another of the overall production function which existed after the invention of the tractor. Such shifts in subproduction functions as a result of investments and disinvestments can be treated endogenously in economic theory. Failure to do so leaves static theory bereft of ability to analyze investments and disinvestments.

A theory which shifts endogenously from one subfunction to another no longer generates a unique set of cost and demand structures. In order to understand the replacement of horses with tractors and what this did to the supply functions for agricultural products and to the demand for factors of production, it is necessary to understand when farmers find it advantageous to shift from one subproduction function to another. Clark Edwards' (1959) approach mentioned earlier for determining endogenously which subproduction function is most economic to be on has been extended by Alan Baquet (1979). Baquet refined the user cost concepts considered by Keynes (1963, orig. 1890) and Arthur Lewis (1949) for use in determining the optimum amount of services to extract from durables whether the durables carry old or new technology. Each subproduction function for producing services from durables generates a different set of cost structures and a different set of demands for the variable factors of production used in generating the services. For the most part, our analyses of technological change are inadequate in this respect. This inadequacy relates to the discussion in the next subsection of this paper.

Empirical Problems with Duality and Some Needed Extensions in Duality Theory

Considerable empirical difficulty attends the use of duality to relate product supply and input demand functions to macro and semimacro production functions for sectors, regions and countries. This difficulty is particularly acute for macro production functions for aggregates of outputs but is important even for whole farm functions for multiple product farms. Stage II for well-behaved production function generates a unique structure of marginal and total and average fixed, variable and total cost functions (seven in all) and a unique set of demand functions for the factors of production. This has been long known and is currently rigorously proven as part of what is known as duality theory. Unfortunately, (1) present versions of duality theory are theoretically incomplete and (2) are often dangerously extended in empirical work to apply to industry and sector production functions.

The theoretical incompleteness was touched upon in the section above. When entrepreneurs find it advantageous to shift from one subproduction function to another, duality theory, as now developed, does not deal endogenously with such shifts. What appears to be needed is an extension of duality theory to include Clark Edward's endogenization of investments and disinvestments as discussed above and further developed by Alan Baquet (1979) to include a new, more complete, treatment of the user costs involved in changing the amount of services extracted from fixed durables.

There is also an empirical concern about duality. If valid national and industry production functions can be estimated (or are even only postulated to exist), demand and cost or supply functions can be developed for them. In this connection, it is important to realize that production function analysts of individual farm enterprises and farms know that it is extremely difficult to overcome the aggregation problems encountered in

estimating whole farm production functions for complex farm businesses producing several products. I, for one, remember the difficulties I encountered trying to fit a whole farm value productivity function to data from a panel of west Kentucky farmers engaged in the production of beef cattle, forage, corn, strawberries, popcorn and dark (snuff) tobacco. These several products were produced with the same and different resources at different times of the year, sometimes in competition with each other in which case opportunity costs were important and sometimes not in competition with each other. It was simply impossible to aggregate these products to permit estimation of a reliable single, whole farm production function. Similar difficulties were encountered in fitting value productivity functions to whole farm data for multiple product farms in the northwestern part of Michigan's lower peninsula. Some of these farms had fruit enterprises. Most of them engaged in general livestock and crop farming as well. The fruit enterprises were so different from the crop and livestock enterprises that it was impossible to aggregate them together. The difficulty was avoided by eliminating the fruit enterprise from the farm accounts and fitting the function only to the closely related feed crop and livestock residual. Christoph Beringer (1956) fitted more than one enterprise production function to data from complex western Illinois farms instead of fitting a single whole farm function. He classified the enterprises of these complex farms into grain, forage and fat stock categories. Farms with dairy and poultry enterprises were excluded. By so disaggregating, he was able to fit meaningful separate enterprise production functions but was unable to fit reliable whole farm production functions. These above three experiences account for the dismay with which I view agricultural sector and industry macro production functions and for the dismay with which I view the use of duality theory, factor shares and lagged adjustment coefficients in studying the effect of technological change on the national and industry demand functions for factors of production and on national and industry supply functions for agricultural products. I believe that empirical aggregation and misspecification problems for both outputs and inputs are usually too great for duality and factor share computations to be trustworthy sources of supply and demand functions at national and industry levels.

Fortunately, this concern about the empirical validity of such estimates does not create severe, insurmountable theoretical difficulties. National and industry production functions are not essential parts of neoclassical supply and demand theory. In production economics, product supply and input demand functions can be derived from the consequences of entrepreneurs working with identifiable enterprise production functions at individual firm levels. Basically, what I question is transferring the use of duality from empirically valid enterprise production functions within a firm to empirically questionable macro production functions. This empirical question is, of course, a different question than the one raised above concerning the need to extend duality theory to deal with the economics of investing and disinvesting and, hence, with the economics of shifting from one subproduction function to another within a larger but empirically valid production function.

The Importance of Holistic Multidisciplinary Studies of Technical Change

McCloskey (1983) has made the general case for holistic as contrasted to highly specialized "modernistic" research. His arguments are relevant for studies of technological change. The theories relevant for the study of technological change are, therefore, drawn from many disciplines other than economics. What McCloskey argues is that specialization on the theories and empirical techniques of one discipline, economics, to the exclusion of the others is less productive than a more holistic approach which also draws upon the theories and empirical knowledge of the other relevant disciplines. Still

further, he has argued, along with Howard Bowen (1982), that this multidisciplinarity often involves the humanities and other social sciences dealing with values and prescriptions. Again, we reach the earlier conclusion about the need to study values.

In technological studies, there is a need for the analysis of scenarios involving the consequence of alternative science policies and technologies. Projective and simulation models to analyze such scenarios are sometimes rejected by those unsympathetic to quantification and large models. Also, as models for studying technical change are necessarily multidisciplinary, such models are also sometimes rejected by persons with strong interests in and preferences favoring more specialized disciplinary research.

In this connection, it is important to distinguish between size of models and the multidisciplinarity essential for effective technology assessment. Multidisciplinary models may or may not be large. Similarly, highly specialized economic models may be very large. Multidisciplinarity seems essential in developing the projection and simulation models required to assess alternative technology scenarios. In general, specialized models, large or small and whether constructed by economists, biological scientists, sociologists or humanists are inadequate. Conversely, multidisciplinary models typically beat specialized disciplinary models, large or small. The important point to make here is that the complex models needed in dealing with technological change are multidisciplinary and complex (Johnson, Forthcoming-d).

Farm management, marketing and policy studies of technical change reflect the need for holistic multidisciplinary views of technology. Farm management emerged out of the bio/physical agricultural sciences. Dairy science expanded into dairy management. Beef science and agronomy evolved into beef and crop management. These different kinds of enterprise management eventually grew into general farm management. At a later date, production economists such as myself specialized farm management so much on production economics that it lost its multidisciplinary complexity and, hence, its strength for purposes of doing relevant subject matter and problem solving research (Johnson, 1957). Marketing, too, is multidisciplinary in this same sense although here, perhaps, the relationship to institutional change has, traditionally, been more important than the relationship to technical change. Now, however, technological advances in the marketing process and distribution of agricultural products are at least as rapid as those in the production of primary products; hence, the multidisciplinarity of marketing also involves the relationship between marketing and technological change.

When farm management became unduly specialized on economics and lost its relevance, a more holistic farming systems approach emerged to partially replace it and to make up for the deficiencies of farm management as a subpart of production economics (Johnson, 1982-c). Farming systems research now plays an important role in agricultural R&D and in inventing activities which create technical change. Marketing analysts have paid attention to structure, conduct and performance studies in recent years and this is a plus because this approach is fairly multidisciplinary and holistic. Attention to the multidisciplinary relationships between technology and marketing may make it unnecessary for traditional marketing to disappear and be replaced by food systems analysis. Instead, traditional marketing can grow and change so that it need not disappear to be replaced by a successor -- food systems analysis.

FUNCTIONAL SUMMARY OF NEEDED CONTRIBUTIONS FROM AGRICULTURAL ECONOMISTS TO WORK ON TECHNOLOGICAL CHANGE

Agricultural economists do (1) research, (2) extension work, (3) resident instruction, (4) advising and consulting, (5) administrative work in government, and finally, (6) assist or serve as entrepreneurs in private enterprises. Much of this work involves technological change.

Research Responsibilities of Agricultural Economists

On the research front, agricultural economists have much work to do to improve their theories and quantitative techniques for use in contributing to subject matter and problem solving research involving technology.

With respect to disciplinary economic research, we indicated above some of the things that need to be done. To summarize, we need a better view of the complementary or other interrelationships among technical, institutional and human change. We also need to understand better how the three are related to growth in bio/physical capital. We have noted the inadequacies of our risk analyses and the need to get beyond the expected utility hypothesis. We have stressed especially the need for research on agro-ethics, the need to better define new technology and to deal with the various origins of technical change. We have seen the inadequacies of our theories concerning the distribution and adoption of new technology. Our researchers need to remedy these deficiencies by extending duality theory to include the endogenous determination of asset fixity and variability or, alternatively, investment and disinvestment. Serious questions exist about the empirical validity of macro production functions and duality which should be addressed by our more disciplinary workers. Similarly, the idea of frontier production functions is questionable as is the distinction between technical and economic efficiency. These questions should be investigated by agricultural economists and the underlying theory improved. We have seen something about the importance of holistic multidisciplinary research on technical change. More attention to holistic approaches will probably increase their respectability while revealing the deficiencies of the currently more specialized modernistic research on technical change.

Switching now to subject matter research, agricultural economists have much to contribute. Subject matter research involving technological change is multidisciplinary. My own participation in multidisciplinary teams has been particularly gratifying; however, I have been hampered by the deficiencies of general economics as discussed above. Still further, I have been hampered by our inability to do and by positivistic rejection of the possibility of doing objective research on the value conditions, situations and things really have. Agricultural economists will particularly need to research the impacts of technological change in the subject matter areas of farm management, land or resource economics, marketing, environmental studies and policies. Changes in both production and in electronic information and control technologies will have important impacts. The former will change supply, demand and scale relationships in farming and agribusiness and will also have impacts on land and water resources and, more generally, the total environment. The latter will have great impacts on the management and operation of farms and agribusinesses and, hence, on the structure of both agrarian and urban communities.

Policy studies for agriculture will need to consider the welfare impacts of changing technologies on the structures of our society as a whole and our agribusinesses including recreation and nonfarm natural industries as well as our farming sector.

Problem solving research involving technological change, will continue to be important for the work of agricultural economists. Such research will need to be done in both the public and private sectors to support extension programs and to provide for and protect the interests of the public in the creation, use and exploitation of new technologies. Because practical problems are volatile and ephemeral, it is difficult to indicate with any precision what they will be in the decades immediately ahead. In general, they will be closely related to the foreseeable kinds of subject matter research outlined in the previous section.

Extension Work and Technical Change

Shifting now to extension. Extension workers are seldom concerned with disciplinary questions. Instead, their technological concerns are mainly with (1) the dissemination of multidisciplinary subject matter research of relevance in considering problems involving new technology and (2) the solution of practical problems involving new technology. As there is really little difference between subject matter and problem solving investigations done by extension workers, on one hand, and the subject matter and problem solving research work done by researchers, on the other, the discussions above of subject matter and problem solving research are quite applicable to extension work. It is important to note that if researchers can restrain their distain for subject matter and problem solving research, they can often bring greater disciplinary excellence to bear on subjects and problem solving than can many extension workers. This can help, provided the disciplinary researchers remember to cooperate with researchers from other disciplines and to accord respectability to subject matter and problem solving research and extension. Cooperation with extension workers has the advantage of making disciplinary researchers more relevant and of helping to keep their subject matter and problem solving better focused on the practical private and social problems.

Graduate Teaching and Technical Change

I turn now to teaching with particular attention to the graduate teaching of agricultural economics (Fienup and Riley, 1980; Johnson, 1983-b). Disciplinary excellence is required, not only in economics but in the ancillary disciplines of economics -- mathematics, statistics, philosophy, logic, etc. But, that is not the end of the matter. The graduate training of agricultural economics should inculcate a respect for multidisciplinarity and research on values and prescriptions if agricultural economists are to be trained to do adequate subject matter and problem solving work on technological change.

At the undergraduate level, it must be recognized that a relatively low percentage of our students will have research careers and that many of them are headed for decision making and administrative careers in agribusiness and in government. Clearly, if they are to be called agricultural economists they should have disciplinary knowledge of economics but need not receive substantial training in doing disciplinary research. That can be left for graduate study if they become graduate students. At the undergraduate level, they need to be taught to (1) respect multidisciplinary approaches to problem solving, (2) respect multidisciplinary subject matter research, (3) understand the nature of value knowledge and of procedures for converting value free and value knowledge into prescriptions, and (4) understand the importance for agriculture of the interrelationships among technical, institutional and human change and capital growth.

Consulting and Advising

Those agricultural economists who are engaged in consulting and advising are, in effect, more specialized extension workers though they often work on private account as both short- or long-term staff members. Again, the emphasis is on the practical (on subject matter and on problem solving). Multidisciplinarity and attention to the values and prescriptions as well as to value free knowledge is important for consulting and advising on technical change.

Administrators and Entrepreneurs

Public administrators and private entrepreneurs can be regarded as more or less permanently employed consultants and advisors who bear even greater responsibility than ordinary consultants and advisors for the decisions they make and influence. Their emphasis is more on problem solving and less on subject matter than the interests of ordinary consultants, advisors and extension workers. For problem solvers, value knowledge is as important as value free knowledge and the stress is almost wholly on the prescriptive. The technical dimensions of the practical problems they address will be important but not predictably more or less important than the institutional, human and capital growth dimensions.

References

Arrow, Kenneth J. 1963. Social Choice and Individual Values (2nd Ed.), New York: John Wiley and Sons.

Baquet, Alan E. 1979. "A Theory of Investment and Disinvestment Including Optimal Lives, Maintenance and Usage Rates for Durables," Ph.D. Thesis, East Lansing: Department of Agricultural Economics, Michigan State University.

Beringer, Christoph. 1956. "Problems in Finding a Method to Estimate Marginal Value Productivities for Input and Investment Categories on Multiple-Enterprise Farms," Resource Productivity, Returns to Scale, and Farm Size, Ames: Iowa State College Press, pp. 106-113.

Binswanger, Hans P. and Vernon W. Ruttan (Eds.) 1978. Induced Innovation: Technology, Institutions and Development, Baltimore: Johns Hopkins University Press.

Bonnen, James T. 1985. "United States Agrarian Development: Transforming Human Capital and Institutions," United States-Mexico Relations: Agriculture and Rural Development, Stanford, CA: Stanford University Press.

Boulding, Kenneth. 1981. Evolutionary Economics, Beverly Hills, CA: Sage Publications, Inc.

Bowen, Howard R. 1982. The State of the Nation and the Agenda for Higher Education, San Francisco, CA: Jossey-Bass Publishers.

Brown, A. W. A., T. C. Byerly, M. Bitts and A. San Pietro (Eds.). 1975. "Crop Productivity -- Research Imperatives." Proceedings of an international conference, Oct. 20-24, 1975, Boyne Highlands, Mich. Michigan Agricultural Experiment Station and Charles F. Kettering Foundation, Yellow Springs, Ohio.

Edwards, Clark. 1959. "Resource Fixity and Farm Organization," Journal of Farm Economics 41(4):747-759.

Farrell, Michael J. 1957. "The Measurement of Productive Efficiency," Journal of the Royal Statistical Society, Series A, Vol. 120, pp. 253-281.

Fienup, Darrell F. and Harold M. Riley. 1980. Training Agricultural Economists for Work in International Development, New York: Agricultural Development Council.

Friedman, Milton. 1953. Essays in Positive Economics, Chicago, IL: University of Chicago Press.

Halter, A. N. and G. W. Dean. 1971. Decisions Under Uncertainty with Research Applications, Cincinnati, OH: South-Western Publishing Co.

Harsanyi, John C. 1982. "Mortality and the Theory of Rational Behaviour," Utilitarianism and Beyond, A. Sen and B. Williams (Eds.), Cambridge: Cambridge University Press.

Johnson, Glenn L. Forthcoming-a. "Risk Aversion vs. Aversion for Losses and Risk Preference vs. Preference for Gain," Annals of Agricultural Sciences, Series G. Polish Academy of Sciences, Warsaw.

_____. Forthcoming-b. "Economics and Ethics," Twenty-Fourth Annual Centennial Review Lecture, East Lansing: Michigan State University, Centennial Review.

_____. Forthcoming-c. "Discussion of Vernon W. Ruttan's and Yujiro Hayami's "Induced Technological Change in Agriculture," Proceedings of a workshop Developing a Framework for Assessing Future Changes in Agricultural Productivity sponsored by the National Center for Food and Agricultural Policy, Resources for the Future, July 16-18, 1984.

_____. Forthcoming-d. "Holistic Modeling of Multidisciplinary Subject Matter and Problematic Domains," Systems Economics, Don G. Miles (Ed.), Ames: Iowa State University Press.

_____. 1984-a. "Toward the Twenty-First Century: U.S. Agriculture in an Unstable World Economy: Discussion," American Journal of Agricultural Economics 66(5):597-598.

_____. 1984-b. "Ethics, Economics, Energy, and Food Conversion Systems," Food and Energy Resources, David Pimentel and Carl W. Hall (eds.), Orlando, FL: Academic Press, Inc., pp. 147-180.

_____. 1983-a. "Synoptic View," Growth and Equity in Agricultural Development, Allen Maunder and Kazushi Ohkawa (Eds.), England: Gower Publishing Co. Ltd., pp. 592-608.

_____. 1983-b. "The Relevance of U.S. Graduate Curricula in Agricultural Economics for the Training of Foreign Students," American Journal of Agricultural Economics 65(5):1142-1148.

_____. 1982-a. "Agro-Ethics: Extension, Research and Teaching," Southern Journal of Agricultural Economics, pp. 1-10.

_____. 1982-b. "An Opportunity Cost View of Fixed Asset Theory and the Overproduction Trap: Comment," American Journal of Agricultural Economics 64(4):773-775.

_____. 1982-c. "Small Farms in a Changing World," Proceedings of the Kansas State University's 1981 Farming Systems Research Symposium entitled "Small Farms in a Changing World: Prospects for the Eighties," Manhattan: Kansas State University, Paper No. 2, pp. 7-28.

_____. 1980. "Ethical Issues and Energy Policies," Increasing Understanding of Public Problems and Policies -- 1980. Proceedings of the 30th National Public Policy Education Conference held at Vail, Colorado. Farm Foundation, Oak Brook, IL.

_____. 1977. "Contributions of Economists to a Rational Decision-Making Process in the Field of Agricultural Policy," Decision-Making and Agriculture (T. Dams and K. E. Hunt, eds.), Oxford, England: Oxford Agricultural Economics Institute, pp. 592-608.

_____. 1976. "Philosophical Foundations: Problems, Knowledge and Solutions," Agricultural Change and Economic Method, European Review of Agricultural Economics, The Hague, Netherlands, pp. 207-234.

_____. 1960. "Value Problems in Farm Management," Agricultural Economics Journal XIV(1):13-31.

_____. 1958. "Supply Functions -- Some Facts and Notions," Agricultural Adjustment Problems in a Growing Economy, E. O. Heady, et al. (eds.), Ames: Iowa State College Press.

_____. 1957. "Agricultural Economics, Production Economics and the Field of Farm Management," Journal of Farm Economics XXXVIII(2):441-450.

_____ and S. H. Wittwer. 1984. "Agricultural Technology Until 2030: Prospects, Priorities, & Policies," Special Report 12, East Lansing: Michigan Agricultural Experiment Station, Michigan State Univerity.

_____ and Judith Brown. 1980. "An Evaluation of the Normative and Prescriptive Content of the Department of Energy Mid-Term Energy Forecasting System (MEFS) and the Texas National Energy Modeling Project (TNEMP)," Texas National Energy Modeling Project: An Experience in Large-Scale Model Transfer and Evaluation, Part III (Milton L. Holloway, ed.), Austin, TX: Texas Energy and Natural Resources Advisory Council.

_____ and Lewis Zerby. 1973. What Economists Do About Values -- Case Studies of Their Answers to Questions They Don't Dare Ask, East Lansing: Department of Agricultural Economics, Michigan State University.

_____ and Leroy Quance (eds.). 1972. The Overproduction Trap in U.S. Agriculture, Baltimore, MD: Johns Hopkins University Press, with the support of Resources for the Future.

Johnson, Marc A. and E. C. Pasour, Jr. 1981. "An Opportunity Cost View of Fixed Asset Theory and the Overproduction Trap," American Journal of Agricultural Economics 63(1):1-7.

_____. 1982. "An Opportunity Cost View of Fixed Asset Theory and the Overproduction Trap: Reply," American Journal of Agricultural Economics 64(4):776-777.

Keynes, John Neville. 1963 (orig. 1890). Scope and Method of Political Economy, London: Macmillan and Co., Ltd.

Knight, Frank H. 1933. The Economic Organization, Chicago: University of Chicago Press.

Kopp, R. J. and V. K. Smith. 1980. "Frontier Production Function Estimates for Steam Electric Generation: A Comparative Analysis," Southern Economic Journal 46(4):1049-1059.

Lewis, W. A. 1949. Overhead Costs, London: Allen and Unwin.

McClennen, Edward F. 1983. "Rational Choice and Public Policy: A Critical Survey," Social Theory and Practice 9(2-3):335-379.

McCloskey, Donald N. 1983. "The Rhetoric of Economics," Journal of Economic Literature XXI(2):481-517.

McFadden, Daniel. 1978. "Cost, Revenue, and Profit Functions," Production Economics: A Dual Approach to Theory and Applications, M. Fuss and D. McFadden (eds.), Amsterdam: North Holland Publishing Co.

Myrdal, Gunnar. 1944. The American Dilemma, New York: Harper Brothers.

National Academy of Sciences. 1977. World Food and Nutrition Study: The Potential Contributions of Research. Washington, DC: Commission on International Relations, National Research Council.

Pond, W. G., R. A. Merkel, L.D. McGilliard and V. J. Rhodes (Eds.). 1980. Animal Agriculture: Research to Meet Human Needs in the 21st Century. Boulder, CO: Westview Press.

Reder, M. W. 1948. Studies in the Theory of Welfare Economics. New York: Columbia University Press.

Robbins, Lionel. 1949 (orig. 1932). An Essay on the Nature & Significance of Economic Science, London: Macmillan and Co., Ltd.

Robison, Lindon and Beverly Fleisher. 1983. "Risk: Can We Model What We Can't Define or Measure?" in Risk Management Strategies for Agricultural Production Firms, Proceedings of a seminar sponsored by Southern Regional Research Project S-180 held in San Antonio, Texas, March 28-30, 1983.

Rossmiller, George E. (ed.). 1978. Agricultural Sector Planning: A General System Simulation Approach, Agricultural Sector Analysis and Simulation Projects. East Lansing: Departrment of Agricultural Economics, Michigan State University.

Ruttan, V. W. and Y. Hayami. Forthcoming. "Induced Technological Change in Agriculture," Proceedings of a workshop Developing a Framework for Assessing Future Changes in Agricultural Productivity sponsored by the National Center for Food and Agricultural Policy, Resources for the Future, July 16-18, 1984.

Sagoff, Mark. 1985. "Values and Preferences," Center for Philosophy and Public Policy, University of Maryland January 10th.

Schmid, Allen. Forthcoming. "Property Rights in Seeds and Micro-Organisms," Public Policy and the Physical Environment, R. K. Godwin and H. Ingram (eds.), Greenwich, CT: JAI Press.

Schmidt, Peter and C. A. Knox Lovell. 1977. "Estimating Technical and Allocative Inefficiency Relative to Stochastic Production and Cost Frontiers," MSU Econometrics Workshop Paper No. 7702, East Lansing: Department of Economics, Michigan State University.

Schoemaker, P. J. H. 1982. "The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations," Journal of Economic Literature 20:529-563.

Timmer, Peter C. 1970. "On Measuring Technical Efficiency," Food Research Institute Studies in Agricultural Economics, Trade, and Development IX(2):99-171.

Tversky, Amos and D. Kahneman. 1981. "The Framing of Decisions and the Psychology of Choice," Science, Vol. 211, January 30, pp. 453-458.

DOMESTIC FOOD AND AGRICULTURAL POLICY RESEARCH DIRECTIONS

by

Luther Tweeten*

No statement could better summarize nor sober what I am about to attempt than the words of T.W. Schultz (1964, p. 1004):

> A particular profession can become obsolete. We, too, are subject to these risks. Thus it should be salutary, now and then, to remove our workaday blinders and look at our approach to agricultural economics, the problems on our research agenda, the tools we use, and the way we are organized. Yet I marvel at how often we do this and how little of it is conducive to any beneficial results.

Schultz's caveat notwithstanding, I proceed recognizing that domestic food and agricultural research priorities must be designed not for the emotions and wants of the past or present but for perceived needs of the future. To help in that design is the purpose of this paper.

The paper has two major sections. The first is mostly descriptive economics: It summarizes and synthesizes what we think we know or would like to know about the economic structure and problems of food and agriculture. The second section deals with prescriptive economics: Given the economic problems and structure of agriculture, what are the

---

*Regents Professor, Department of Agricultural Economics, Oklahoma State University, Stillwater. Professional paper of the Oklahoma Agricultural Experiment Station. Comments of Filmore Bender, Bruce Bullock, Don Paarlberg, Daryll Ray, and other reviewers were very helpful. Of course, the author is solely responsible for shortcomings of this paper.

implications of alternative public policies to alleviate economic ills? A central theme here is that our prescriptive economics has been narrow and underutilized.

Emphasis herein is on agricultural rather than food policy. Policy issues regarding macroeconomic policies, international trade, and resource economics are discussed elsewhere and are treated only peripherally in this paper. The scope of agricultural policy as treated herein closely follows that employed by Brandow (1977) in "Policy for Commercial Agriculture." Although attention is on research, what I say also has implications for teaching and extension. Before suggesting broad research thrusts and selected specific research priorities, I briefly outline the past and prospective economic environment for food and agricultural policy and for research.

DESCRIPTIVE OVERVIEW

This descriptive overview describes the economic environment for food and agricultural policy. Trends in aggregate supply and demand are reviewed. This section also contains a synthesis to explain emerging agricultural problems -- a synthesis contrasted with that advanced four decades ago by T.W. Schultz. Data and analysis gaps are noted. The tough philosophical and methodological questions await the later section on prescriptive economics, however.

Past and Prospective Economic Trends

The political-economic environment for food and agriculture and hence also for research priorities depends heavily on whether the future is dominated by abundance and a depressed agricultural economy

or by shortage and high food prices. In the former environment, economic issues of farmers predominate. In the latter environment, economic issues of food and consumers predominate.

Predictions for the future are rooted in the past. The food and agricultural economy has been dominated by protracted periods of unfavorable or favorable conditions, the latter often associated with wars. For example, farmers generally experienced "hard times" from the end of the Civil War to 1896, with both the 1870s and 1880s punctuated by bursts of economic panic and farm protest movements (Tweeten, 1979, ch. 3). Farmers blamed railroads, grain exchanges, banks, the gold standard, and middlemen for their problems.

Then followed 25 years of generally favorable times for farmers. The hard times which returned in the 1920s got worse in the 1930s. Relief was attempted through cooperative input purchases and marketing and through modest commodity stock acquisitions by the Federal Farm Board. By the early 1930s these timid approaches were swamped by events. In 1933, a major government role in supporting farm price and incomes emerged that has remained to this day. Prosperity returned to the farm from 1941 to the mid-1950s and again from 1973 to 1980.

Several conclusions can be drawn from past experience. Periods of farm distress or prosperity, though sometimes extended, may be getting shorter. Agriculture is unstable because it depends on unpredictable forces of nature. But the long-term periods of farm recession and prosperity were "manmade." Low prices in the 1870s and 1880s stemmed from a conscious public decision to open new lands which increased production. Tight money supply and deflation were also factors but so little was known of the theory or application of monetary policy that

it would be hard to blame damage to the farming economy on money conspiracy.

High tariffs and failure to maintain money supply helped to make the 1920s and 1930s more unfavorable than they needed to be. Rapid advances in productivity (largely a product of prior private and public investments in agricultural research, extension, and education) played a key role in the economic difficulties of farmers in the 1950s and 1960s. Soviet grain purchases helped to bring farm prosperity from 1973 to 1980.

Erratic and overly expansionary monetary policies (aggravated by the energy crisis) in the later 1970s caused inflation which initiated the farm recession in 1980. Tight monetary policy to restrain inflation brought nationwide recession in 1981 and 1982. High real interest and exchange rates since 1982 stemming partly from high structural federal deficits continue the litany of farm economic ills caused by man rather than by nature.

Commodity programs probably helped to reduce variation in farm and food prices since 1933. But commodity programs did not serve longer-term goals such as raising net farm income, alleviating poverty, preserving the family farm, or conserving the soil (see Tweeten, 1984; Batie, 1983). In summary, the nation has a spotty record of economic policy to reduce economic shocks to agriculture or to alleviate the consequences. It is easy to believe that with appropriate economic policy research and education the nation could do better.

In looking to the future, it is cautioned that forecasters tend to be captive to current circumstances. When times are unfavorable, the tendency is to project pessimism. When times are favorable, the

tendency is to project optimism. Simply expecting current conditions to continue for the indefinite future has always been incorrect. Given these uncertainties, economic research, like food and agricultural policy itself, must be designed for all seasons.

Recent studies (O'Brien, 1984; Resources for the Future, 1984) anticipate slightly faster rates of increase in supply than in demand for food and other farm products for the next decade or two. This implies declining real farm prices in the U.S. and the world. No strong downward trend in real farm prices is projected, but there will be considerable variation around the long-term trend. Although real food prices will rise temporarily from time to time, and world food crisis will appear on rare occasions, the world's capacity to produce food will not be challenged. Food problems will be severe in some regions, especially Africa, however.

Understanding Causes of Farm Problems

Agricultural economists have invested intellectual capital in understanding the economic structure of agriculture and thereby the problems of low prices and incomes, instability, and poverty. Because it was the clearest and most comprehensive statement of its time and because many economists built on his work, T.W. Schultz's (1945) synthesis of four decades ago is worth repeating. Principal elements were:

(1) New technology and public resource development (e.g. irrigation projects) caused farm productivity to increase and caused a substitution of capital for farm labor.

(2) The competitive structure of the farming industry made it inevitable that farmers would adopt new technology. High fixed

relative to variable costs meant that farmers tended to keep farms in full production even when prices were well below full costs of production. Profitable and productive new capital inputs were introduced even when excessive land and labor were committed to agriculture.

(3) Demand for farm output increased slowly. A major reason was the low income elasticity of demand.

(4) Because supply persistently advanced relative to demand for farm output, the result was "chronic disequilibrium adverse to agriculture."

(5) Agriculture was constantly burdened with excess labor and lower earnings than in the nonfarm sector because labor mobility was impeded by lack of education and skills, poor health, lack of knowledge of nonfarm job opportunities, racial discrimination, employment barriers of organized labor, and government regulation.

(6) The agricultural economy was unstable. Agriculture's economic structure made it especially sensitive to instability in the industrial economy. Schultz predicted that chronic surpluses were likely to put in their appearance between 1947 and 1950.

His predictions left much to be desired, but Schultz's synthesis provided hypotheses for research for a decade and more. Times have changed, however, and a new synthesis must form the basis for understanding farm problems.

Productivity has indeed continued to expand farm output. Capital continues to substitute for labor and the farming industry continues to adopt new technology when it is profitable to do so. But on the whole, demand has expanded only slightly faster than productivity since 1945.

It is quite a coincidence that aggregate farm input volume was exactly the same in 1984 as when Schultz published his book in 1945 (Council of Economic Advisors, 1985, p. 340). The best single predictor of long-term trends in real farm prices has been the change in real cost of production brought about by productivity gains in agriculture.

Some excess labor remains in agriculture but farm population had nearly stabilized by 1980. Farm income per capita adjusted for tax advantages, the farm way of life, and for cost of living no longer chronically lags income per capita of nonfarmers.

Studies (see Tweeten, 1979, chs. 9, 11; December 1983, p. 904) indicate that long-term demand and supply of farm commodities are elastic. This elasticity is one reason why commercial agriculture does not display long-term tendencies to low income or low rates of return.

A large reservoir of excess labor in agriculture no longer exists but excess labor remains a problem on many mid-size and small farms. Ability of the nonfarm sector to assimilate labor from agriculture is no longer in doubt -- the excess is a small portion indeed of the nonfarm labor force. Schooling and other human resource investments in farm people have dramatically improved in the past four decades. Still, human resource and poverty problems on farms have diminished much less rapidly than our economic research and education on those problems. Poverty characterizes an estimated 20 percent of farm families. Rural areas, after resurgence in the 1970s, once again lag behind urban areas in employment and population growth. Given that farm families depend on nonfarm sources for two-thirds of their income, it is surprising that rural development policy research and education have been allowed to fall into disrepair and obscurity.

A principal remaining characterization by Schultz is instability in agriculture. Short-run demand and supply tend to be inelastic, making farm prices and incomes highly sensitive to shocks from nature and man.

In summary, the following features characterize today's agricultural economy:

(1) Inelastic short-run demand and supply make farm prices and incomes highly sensitive to shocks to either supply or demand.

(2) Elastic long-run demand and supply give agriculture capabilities to adjust over time to productivity advances -- even if supply outruns demand for farm output by the fairly narrow margins anticipated for the next two decades.

(3) Agriculture continues to be buffeted by forces of nature and public policy. Because of heavy dependence on off-farm and export earnings, agriculture is now influenced by macroeconomic policies more through resource input and commodity export markets than through domestic commodity demand. It is less buffeted by business cycles than in the past but more buffeted by inflation cycles and other "manmade" forces of macroeconomic and trade policies. Financial stress and cash-flow problems can persist for several years while resources earn less than their acquisition cost but more than their salvage value.

(4) Agriculture is characterized by high capital investment per worker (twice the rate for industry as a whole), by net debtorship (farmers owe others $100 for each $23 owed to farmers), and by dependence on exports. Each of these factors makes agriculture especially sensitive to macroeconomic and trade policies that influence real interest and exchange rates. Heavy reliance on real estate assets

also makes the farming industry sensitive to cash-flow problems caused by inflation. Inflation also causes cost-price problems because, other things equal, input prices rise more quickly than product prices (Tweeten, July 1983).

(5) Agriculture is a heterogenous industry not easily classified but three farm types stand out for policy purposes. One is large farms with annual sales of $200,000 or more. Many of these are larger-than-family size, use sophisticated management and marketing techniques to cope with cash-flow and instability problems, realize resource returns at least comparable to returns on similar resources in the nonfarm sector, and have income and wealth well above that of the average consumer or taxpayer. Such farms account for only 5 percent of all farms but for half of farm output.

A second notable type of farm is the part-time small farm with sales under $40,000 per year. Such farms are inefficient as measured by opportunity cost of resources but survive and even thrive by using off-farm income to pay for consuming a farm way of life, by using tax features to write-off farm losses against nonfarm income, and by using publicly subsidized community services. Part-time small farms have consistently favorable total income and are rarely in poverty. Small farms account for only 13 percent of farm output (sales) but for about 70 percent of all farms.

Between these farms are mid-sized family farms with sales of $40,000 to $200,000 per year. Traditionally the backbone of agriculture and rural communities, these farms have fallen on hard times. On the average, they are less efficient than large farms (although averages deceive) and have less off-farm income than

small-farms to cope with cash-flow and instability problems. In the face of narrow profit margins and large capital requirements to form an economic unit, mid-size family farms refinanced each generation find it more and more difficult to compete with small part-time farms and with large farms. They are declining not only in numbers but also in share of all farms and output. They lobby heavily for commodity programs.

A research agenda cannot be established and economic problems of agriculture cannot be understood without recognizing the above configuration of farms. Adequately sized, well-managed farms tend to be near economic equilibrium as measured by resource returns. Smaller farms accept low returns because farming is partly a consumption good. It follows that if large farms are breaking even and if other farms are not covering all resource costs, then rates of return will be below opportunity costs on the average for the farming industry despite no disequilibrium in the sense of incentives for resources to shift elsewhere. Also, if a large proportion of farm income comes as capital gain as is normal in an inflationary economy and if the family farm must save and invest a large portion of income to control assets, then current rates of return on assets will be low and cash-flow problems severe even in a well-functioning farm economy. Thus alleged major farm problems of today are equilibrium problems in contrast to disequilibrium labor problems of Schultz's day.

Some Research Suggestions

Many of the above features of the economic landscape are only dimly known. They must be regarded as unrejected hypotheses suitable for further testing. Data and analysis to promote understanding are often weak. A surfeit of farm data for national income accounts

obscures the dearth of data to measure personal income by farm type and size. Much more needs to be known of the macroeconomic impacts of federal tax policies on agriculture, particularly of the tendency for the investment tax credit, rapid depreciation allowance, and interest writeoffs to increase capital use and output, substitute capital for labor, speed the demise of family farms, and create excess capacity. Resource costs per unit of output along with other measures of production and market economies of size by commodity remain elusive or unavailable.

The profession is not in agreement on fundamental issues such as the capacity of the farming industry to adjust to changes in supply and demand, the impact of price supports and supply controls on farm exports, and the benefits and costs of an export cartel or other institutional interventions to create more "orderly" markets in agriculture. Also at issue is the impact of macroeconomic policies on farm export demand. More reliable estimates of supply and demand parameters can narrow the range of disagreement among economists, farmers, and the public at large over such issues. More reliable parameters can also improve predictions of econometric models.

Much disagreement persists over the magnitude of basic parameters such as the elasticity of demand and supply -- particularly long-run elasticities. The profession seems to favor precise estimates of an incorrect concept to less precise estimates of the correct concept. Estimates of the demand for farm output (Tweeten, 1967) including export demand were largely ignored for several years: The profession instead relied on the low price elasticity of domestic food demand to measure the relationship between price and aggregate demand. One

result was surprise at the large impact of high support prices and value of the dollar on demand in the 1980s. The profession has used precise short-run supply elasticities to gauge supply response over long-run periods. Long-run estimates were available (Tweeten and Quance, 1969) but some (see Brandow, 1977) even doubted whether long-run supply response had any meaning. One result was failure to foresee the long-term impact of government supports on excess capacity and slippage in commodity programs. For example, the wheat allotment base went from 53 million acres in 1975 to 93 million acres in 1985. Voluntary acreage diversion programs are supposed to raise income because they not only provide a direct payment but they presumably reduce output to bring higher prices and receipts working against an inelastic demand. However, wheat acreage harvested may have been greater in 1985 with a 30 percent diversion program than had there been no wheat program since 1975.

Some basic data series have been neglected. Aggregate productivity and yield trend data are limited, are subject to major revision, or are diminished in usefulness for analysis because of unavailability of data to adjust for weather. The rate of productivity growth in farm output per unit of conventional inputs was reported as follows (Council of Economic Advisors, 1985 and earlier issues):

Period	Published in: 1982	1985
	(Annual rate of increase %)	
1949-59	2.05	1.95
1959-69	1.70	1.75
1969-79	1.45	1.78

Given demand for farm output increasing nearly 2 percent per year, the first set of data suggested falling rates of productivity advances and

a bright future for farm prices and receipts in the 1980s if past trends continued. The revised numbers gave less reason for optimism.

Some basic data are not collected or published by the Economic Research Service but would be especially helpful. As noted above, one is a weather index. Another is an index of excess or reserve farm production capacity, defined as expected production in excess of market utilization at current prices with normal weather. Such excess capacity exists because the government diverts production from markets with supply control, stock accumulation, and export subsidies. At some lower price, the market would clear. Of interest is not only the extent of reserve capacity and in what commodities it is concentrated, but what conditions would eliminate the reserve.

Pressing concerns in food and nutrition economics include the impact of alternative provision for food stamp and welfare programs on nutrition of target groups. Of interest also is the impact on national health and on farmers' economic welfare of alternative measures, including nutritional guidelines, to improve diets. What are the costs and benefits to producers and consumers of food protection and safety regulations? These issues are not pursued in depth here -- additional detail is provided elsewhere (U.S. Department of Agriculture, February 1985, pp. 22, 23).

The data and research agenda could go on, but the time has come to attend to more philosophical issues. The above synthesis constitutes an economic setting and descriptive paradigm. The challenge is to analyze the implications of this synthesis for public policy.

PRESCRIPTIVE ECONOMICS

In public policy economics, researchers choose issues judged to be important to taxpayers, farmers, and consumers; to policymakers; and to themselves and the profession. I make a case below that domestic food and agricultural policy has been hampered by (a) an overly narrow conceptual paradigm, (b) by misguided notions of who is our clientele, and (c) by overspecialization. These factors influence prescriptive economics, which I defined as the analysis of options by economists to help policymakers and society decide what is the appropriate policy response to increase well-being of society confronted by economic issues such as posed in the previous section.

Our profession has sought intellectual integrity through a welfare economics paradigm defining the bounds of scientific inquiry. That paradigm for the most part has judged prescriptive economics as defined above to be unworthy because it is allegedly normative in the sense of being based on economists' value judgments of what ought to be. Instead, the argument goes, public policy economists ought to specify alternative means to reach ends given by the political system. The argument contends that economists are not to specify ends because they cannot measure utility and because, even if they could measure utility, it is the political system which must specify ends and make policy decisions.

In defending prescriptive economics, I will make a case for the following propositions:

(a) Prescriptive economics need not be normative.

(b) The Old Welfare Economics of Pareto Optimality and political system sovereignty is an inadequate guide to setting the research and education agenda in the economics of public policy.

(c) The New Welfare Economics of promoting efficiency while dealing with equity question through actual or potential compensation is also an inadequate guide to set a research and education agenda.

(d) The profession needs to get on with the task of estimating a social welfare function for use in economic analysis and in setting the research agenda for public policy economics. Public policy economics needs to present options to improve well-being for society as a whole rather than only for farmers, taxpayers, or consumers. That requires specification of a social welfare function as objective and free as possible of value judgments of researchers.

Prescriptive Economics Need not be Normative

It is traditional to divide economics into normative and positive dimensions. The term normative has been used to define the economics of "what ought to be," hence advocacy of positions grounded on value judgments of researchers rather than on facts and logic, or the promotion of allocations dictated by some arbitrarily established norm such as profit maximization. Positive economics on the other hand deals with "what is," avoids value judgments regarding goodness or badness, avoids advocacy, and only specifies alternatives to obtain objectives or ends specified by the political process.

First, let us dispose of the concept of normative in its narrowest form. It is often defined as that part of economics which deals with goodness or badness. Presumably everything economists do is judged by someone to be useful (good). All economics is normative by this definition, and the terms positive and normative are best dropped in favor of the terms discriptive and prescriptive economics. Without advocacy, prescriptive economics specifies alternative means to

achieve ends such as greater income or well-being of farmers, taxpayers, consumers, and society. As Johnson and Quance (1972, p. 45) note, prescriptive economics can be objective in that the researcher subjects concepts to tests of consistency, clarity, and workability.

The prescriptive economics called for here is not normative in the sense of advocacy of either means or ends which are no more than value judgments of researchers. But descriptive economics raises the issue of what and whose ends are to be served and what alternatives are to be analyzed. Economics is commonly defined as the science of allocating scarce means among competing ends to satisfy those ends as fully as possible. Proximate ends may be food, leisure, income, or employment. At a higher level, the ends may be equity and efficiency. The ultimate end is variously called well-being, satisfaction, utility, or absence of pain. References to "pursuit of happiness" or other terms for well-being in national documents, ubiquitous pronouncements by politicians, and statements by individuals all point to well-being of people as the ultimate goal of an economic system. Economic theory is built around rational pursuit of utility by people. Johnson and Quance (1972, p. 21) state that "the U.S. farmer operates, in substantial part, as a profit and/or utility maximizer or a loss and/or disutility minimizer." The point is that public policy economists determining means to improve well-being of society are engaged in the positivistic economics of "what is" or "what could be" rather than the normative economics of "what ought to be." Alternatively, prescriptive economics may be viewed as "what if..." or "if-then" propositions: "If society wishes to improve well-being, then the following options are means to that end." At issue is not whether individuals and society as a whole

are trying to improve well-being; instead, the issue is how economists can help them in their quest.

Inadequacy of Pareto Optimality and Political System Sovereignty

Most of us were brought up to accept Robbinsonian wisdom that "Economics is not concerned with ends as such. It is concerned with ends in so far as they affect the disposition of means" (Robbins, 1935, p. 30). Robbins' statement of positivistic economics leaves to the economist the role of specifying the implications of alternative means to reach ends given by the political process. The price system too is to be subservient to the ultimate sovereign -- the political process. Summarizing the Robbinsonian role for the economist, I (Tweeten, 1979, p. 526) stated some years ago:

> He is to be a 'social' engineer concerned with specifying alternative ways of reaching given goals. He is to be concerned with 'what is,' not with the normative economics of 'what ought to be.' For economics to be an objective science, the economist must not make value judgments that entail interpersonal comparisons of utility. He cannot take sides in policies that make some worse off, others better off. He can be a technician but not an advocate. In the role of economist, he can be an adviser but not a politician. He can maintain a political dialogue only as long as politicians are asking the questions.

R.G.F. Spitze (1983, p. 240) advances a similar theme. His position is that economists should not substitute their values for those of an ever changing society. It is difficult to fault that position. But he then goes on to imply that the political process expresses preferences of society.

Economists working for a private firm or individual quite properly might show one person how to aggrandize himself or herself at the expense of society. But publicly employed economists are hired by the

public at large to show alternative means to improve well-being of society. It is usually possible to make some individual or group better off by making someone worse off. But it is rarely possible to make someone better off without making someone else worse off. Maximizing income for farmers or any other one group will not do in public policy: Well-being must consider tradeoffs and hence ultimately must consider the welfare of society as a whole.

Acceptance of the political process as the expression of the ends of society is to accept a flawed and biased social welfare function. The political process is fragmented and distorted. Public policy economists salaried by tax dollars are not doing their job if they restrict their analysis only to alternative means to reach goals specified by farmers, agribusiness firms, consumers, taxpayers, Congressman X, or by the political process.

This conclusion must not confuse roles of government and science. Government legislates. Economic science informs. The decision process is best informed when economists specify implications of a full range of ends. Public policy economics also informs indirectly: Research, education, and extension inform the public which in turn influences government through public opinion and the vote. Public policy economists who solely wait for government to specify the research and education menu contribute to government failure, an inevitable consequence of an uninformed public and a selectively informed government.

Inadequacy of the New Welfare Economics of Efficiency

Gardner (1984, p. 62) takes issue with Spitze's fundamentally conservative

> ...'quietism,' whose essential feature is acceptance of policies as they exist based on a presumption that what a democratically elected government decides in matters of farm policy represents legitimate and appropriate public choice that, whatever criticisms we may make of it from an economist's viewpoint, cannot be objectively claimed inferior to any alternative.

Gardner escapes from the Robbinsonian trap only to fall into the confines of New Welfare Economics. It has been fashionable under the "New Welfare Economics" to argue that policies can be recommended if economic efficiency is improved so that gainers can compensate losers. Gardner (1981, p. 73) advances prescriptive economics by showing income redistributions among taxpayers, producers, and consumers as well as changes in national income as measured by net social cost under alternative policy interventions. He does not wait for the political process to request such information.

For such classical welfare analysis to guide policy decisions that assure improving well-being of society, winners must compensate losers with transfers which do not distort incentives for efficiency. Because any kind of compensation, let alone nondistorting transfers, is generally impractical, two options are open: (a) Pursue efficiency without regard to the distribution of gains and losses, or (b) estimate a social welfare function giving weight to equity and efficiency so that these components may be aggregated and options compared for their contribution to well-being. Gardner selects (a) and rejects (b). In his (1984, p. 40) words:

> The main sustained attempt to provide an objective 'public interest' ground for the critique of policy, arising from compensation principles in welfare economics, fizzles out with the practical impossibility of nondistorting transfers. This throws us back, analytically, on the social welfare function. Unless we know it, there is little we can criticize, and we don't know it.

By ruling out compensation or redistribution of income because such policies reduce economic efficiency, Gardner joins other economists in a trap which is a variant of New Welfare Economics. By implicitly holding that efficiency is of infinite value and equity is of no value, economists can pursue allocations to raise efficiency without regard to equity. That leaves economics of little or no help to policymakers in confronting the great issues of our time such as how large a safety net to provide farmers or anyone else, how to provide distributive justice, and how to estimate welfare tradeoffs between economic efficiency and equity.

Public policy economists seeking to avoid social welfare functions, marginal utility of income, and aggregate well-being fall victim to inconsistency at best and hypocrisy at worst. Brandow (1977, p. 271) is forthright in siding with the angels: "This reviewer refuses to aggregate utilities indiscriminately." Fortunately, this principle did not constrain his professional activity. He repeatedly used aggregate economic measures such as income to indicate well-being. By implicitly assuming the dollar provided the same utility to each recipient, he was also making the value judgment that a dollar of food or income to the poor and starving created exactly as much well-being as a dollar of food or income to the rich and obese. Another frequent value judgment is that society should transfer income to the poor. Either value judgment would appear to violate Brandow's stricture against aggregating utilities indiscriminately.

Neoclassical economists proffer strategies which increase income without regard to distribution while other social scientists proffer strategies to equalize income distribution without regard to economic

growth. Neoclassical economists render to equity the same obscurity which other social scientists render to economic efficiency. Dividing economics into economic efficiency and equity domains and then throwing away equity solves little. Surely, the profession can do better. Even crude quantification of marginal utilities of income would elevate analysis.

Towards a Social Welfare Function

Part of the baggage economists find difficult to discard is the proposition that utility is neither measurable nor additive. Utility can be measured although not without error. Conventional economic yardsticks such as costs, returns, and income also cannot be measured without error. Because of inevitable aggregation error, a purist would have to reject all aggregate economic variables used to formulate public policy. The issue is not whether utility can be measured and added but whether it can be measured and added with sufficient validity to provide a tool for improving public policy analysis and decisions.

Advancements have been made on several fronts in recent years in estimating utility or social welfare functions. Psychologists and sociologists have made progress in specifying the domains of quality of life (well-being) and the reliability of attitudinal scales to measure quality of life. I view some results (Harper and Tweeten, 1977; Tweeten and Mlay, 1985) as promising. Income and other explanatory variables used to predict individual well-being measured by socio-psychological scales give results useful for judging group but not necessarily individual utility. But utility estimates for a high income group versus a low income group often suffice for public policy analysis. In this sense, utility measurement is simpler in public

policy economics than in farm management. Errors tend to average out when predicting group utility but not when predicting individual utility.

Three arguments in the utility function on which increasing information is available are the foremost candidates for inclusion in the social welfare function. These are income mean, variance, and distribution. Such a function provides information on mean-variance tradeoffs and equity-efficiency tradeoffs. Calculating a socially optimal income level, variance, and distribution also requires specification of technical possibilities. Optimal tradeoffs between income mean and variance recognize that greater income security tends to reduce mean income but that society is willing to trade off some mean income to obtain greater security. Optimal tradeoffs between income level and distribution recognize that a more equal income distribution among society tends to reduce incentives along with aggregate income, but that society is willing to forego some aggregate income to obtain greater equity.

Summary Comments on Use of Descriptive Versus Utilitarian Prescriptive Economics

Contrasts between prescriptive economics and descriptive economics are summarized in Table 1. Neither approach need be normative. The prescriptive approach does not say that utility ought to be a major end of society -- it recognizes that it <u>is</u> the major end of society. Prescriptive economics then goes on to prescribe allocations consistent with the goal of maximizing utility or any other goal of society such as income equality, maximum income growth, or minimum unemployment. These prescriptions are held out as positivistic options to voters and

Table 1. Contrasts between predictive and descriptive economics

Item	Prescriptive Economics	Descriptive Economics
Orientation	Economics of what could be. Goal or ends oriented. Prescriptions "if-then" statements: If the objective is X, then here is prescription to achieve X.	Economics of what is or what will be. Need not explicitly specify a goal or end.
Role of Economic Theory	Competitive model is tautology for optimal allocation.	Competitive model provides hypotheses.
Test of Economic Theory	Ability to prescribe allocation to increase well-being or other ends. Theory useful to extent real world does not resemble its prescriptions.	Ability to predict reality. Theory useful to extent real world resembles its predictions.
Algorithm Models	Optimization. Models must be structurally sound.	Error minimization. need not have strong theoretical or structural base if predict outcomes well.

others who make decisions. No advocacy need take place. Policy makers are free to choose the utility maximizing solution or any other solution -- including those that serve wealthy special interest groups.

A major difference between prescriptive and descriptive economics is in the use of theory. Purely descriptive economists view the real world, note that it little resembles perfect competition, and declare the competitive model irrelevant. Prescriptive economists viewing the real world also note that it does not resemble perfect competition. But they view the competitive model allocations as a useful norm to judge performance of the real world. After adjusting for risk and for the costs of information and of making adjustments, prescriptive economics may indicate that it may be difficult to improve on the economic performance of a particular market that does not display the perfectly competitive structure. Policy measures to improve efficiency by atomizing an industry may entail greater costs than the measures would add to income. Whereas descriptive economics views the test of a theory as its ability to predict the real world, prescriptive economics views the allocations of the theoretical competitive model as a useful yardstick not only to measure real world performance but also to prescribe allocations to improve well-being. Competitive theory is useful, therefore, precisely to the extent the model does not resemble the real world. For example, a diagnostic device (model) to test automobile engines for malfunction would be of little value if all engines were perfect in structure and performance.

For prescriptive purposes, the competitive model is a tautology specifying marginal conditions that must hold to optimize utility. The optimal allocation conditions to maximize well-being apply equally to a

barter, socialist, or market economy. The price system is not required. In theory, administered allocations could bring about the ideal outcome. In practice, the price system may come closer but a diagnostic device is needed to compare performance of the market versus the public sector. Efficient market performance does not necessarily require perfect information, perfect mobility, or large numbers of buyers or sellers. Of course, there must be some predictive element in prescriptive economics. That is, it must be possible to say with some reliability or predictability that the allocation calculated to increase well-being will in fact do so if carried through.

Prescriptive economics may utilize optimization tools in prescribing allocations to reach objectives specified. In contrast, in its purest form, descriptive economics may make no more use of optimization than to minimize error in extending a past trend to predict future outcomes.

Finally, prescriptive economics requires the highest standards of professionalism. Prescriptive economics is abundant today, practiced by laypersons and economists alike, but much of it is superficial and subjective. My call is to bring it "off the streets" and into professional circles where hypotheses can be tested and methods can be made as objective and scientific as possible. Only by applying the very best minds and tools and subjecting procedures to continuing professional scrutiny can utilitarian prescriptive economics be tested for consistency, clarity, and workability.

Applying Prescriptive Economics to Farm and Food Problems

A typical list of farm problems would include economic instability, demise of the family farm, environmental degradations

(soil erosion, chemical pollution, etc.), and poverty. Acute problems of financial stress and excess capacity might be viewed as another phase in the cyclical instability problem characterizing agriculture. Food and nutrition problems include the influence of commercial advertising on nutrition, the influence of nutrition on health and longevity; the influence of chemical additives or red meat consumption on health and nutrition, and the availability of food to "at risk" populations such as the poor and indigent.

A traditional positivistic response is to show what is likely to happen to farm income, food prices, and perhaps to government spending with and without various types of commodity programs to correct the above problems. The result is likely to be a strong implicit argument for continued commodity programs because producers who would be made worse off by termination of commodity programs are in the best position to utilize such information to influence the political process to continue the programs. Economists using this approach become unintended advocates of commodity interests at the expense of consumers and taxpayers.

The Gardnerian neoclassical prescriptive response is to show the same results as above but to take the analysis a step further to estimate that gains to producers from government interventions are more than offset by losses to consumers and taxpayers (Gardner, 1981, p. 73). The positivistic result is an implicit argument for discontinuing commodity programs because economic efficiency and national income

would be raised.[1] Economists using this approach become unintended advocates of static economic efficiency at the expense of distributive justice and security.

The prescriptive positivistic methodology called for herein is to show all the information included in the above two approaches but to go one step further and place utility weights by income level on gains and losses of consumers, producers, and taxpayers. Net social benefit, the sum of utility gains and losses, might be positive or negative from long-run phase out of commodity programs depending not only on the level of national income but also on whether programs reduce variation in income and transfer income from high to low wealth groups.

The different welfare paradigms specify very different analysis of the poverty problem in agriculture. The conventional descriptive approach would tend to ignore poverty if the political process does not consider it to be a problem; Gardner's neoclassical analysis would treat it only so far as poverty represents foregone output from underinvestment in human capital. But the prescriptive utilitarian approach would estimate utility gains from transfers and other programs to alleviate poverty. Disincentive effects of course, would be considered in the analysis. Voters and policymakers would be provided the information and they would decide what, if any, policy changes are appropriate. In short, the prescriptive approach potentially enables

---

[1]Questions have been raised about the validity of classical cardinal welfare analysis, particularly whether static inefficiency estimated from economic distortions are reflected in dynamic real world income performance. Empirical results from Agarwalla (1983) for 31 developing countries indicated that countries with greatest economic distortions had the least economic growth in the 1970s. Nonetheless, more conceptual and applied research is needed on the relationship between market interventions and dynamic economic efficiency.

economics to address in as objective a manner as possible the major policy issues of our time. It recognizes that both the market and the political system fail; neither is capable of establishing a public policy research and education agenda serving the needs of society.

MISCELLANEOUS TOPICS

Fragmentation and compartmentalization have characterized not only food and agricultural economic research and education but also policy processes. These and other criticisms of policy research and education are discussed below.

Professional Criticism: Not Enough Policy Research?

Criticism of farm policy economics research and education was muted in early years of the profession, partly because the profession was thoroughly dominated by farm management and marketing economists unlikely to call for research and education outside their fields. However, some early criticism showed dismay over the modest amount of policy research relative to the severity of problems.

In 1926 the Social Science Research Council appointed an Advisory Committee on Research in Agricultural Economics. The committee consisted of H.C. Taylor, Northwestern, Chairman; J.D. Black, Minnesota; K.L. Butterfield, Michigan State; J.S. Davis, Stanford; L.C. Gray, Bureau of Agricultural Economics, U.S. Department of Agriculture; E.G. Nourse, Institute of Economics, Washington, D.C.; and G.F. Warren, Cornell. Their report on agricultural economics research stated that

> ...a rather large amount of this investigative work is concerned with questions of private efficiency or profit rather than public welfare or social economics...There is danger that this work...be continued unduly as routine service instead of pressing on to further genuine researches

> of the more intricate or valuable type based upon and made possible by these earlier investigations. [Witt, no date, pp. 20, 21]

In the 1930s, much research was directed at issues of tenure, credit, cooperatives, and marketing. Comparatively few studies by agricultural economists addressed macroeconomic and trade issues, although macroeconomic and trade policies in no small part caused the Great Depression. The lack of studies was partly the result of a widely held but incorrect belief that persists to this day: Agriculture could do nothing about macroeconomic policy; therefore, agricultural economists should direct their research and education to other issues.

The tardy support for agricultural policy research was in part a belated recognition of the importance of public policy to agriculture. Equally as important may have been the view that policy economics was too controversial a topic in a field dominated by interest groups preferring that many policy issues be discretely veiled. In time, numbers of agricultural economists with backgrounds and interests in macroeconomic issues increased along with willingness of agricultural deans and experiment station directors to support agricultural policy research.

Although changes in category definitions obscure results, between 1966 and 1982 approximately a 10 percentage point shift in specialization occurred from microeconomic fields (e.g. farm management, firm marketing) to macroeconomic fields (e.g. agricultural policy, international trade and development) among numbers of the AAEA (Swanson, 1984, p. 786). Still, agricultural price, income, and policy analysis accounted for only 13 percent of specializations.

Too Much Quantitive Emphasis?

At issue was not just the quantity of resources but the tools used to study the economics of agricultural and food policy. Some of the criticisms are perennial. For example, J.D. Black (p. 28) in 1928 argued that

> Just at the time when there is a trend elsewhere in the social and natural sciences away from the purely mathematical work...we agricultural economists are rushing headlong into it...Less mathematics and more logic apparently need to be the watchward at the present moment if we are not to make ourselves ridiculous in the eyes of our fellow social sciences by our excesses in methodology.

Criticism continued. Three comments from 1984 alone convey the intensity of feeling:

> This commentary assumes that the profession currently may be mesmerized by its ability to work with quantitative techniques and the flirtation with these techniques may have caused a loss of sight of some important issues now facing U.S. farms and the broader agricultural industry. [Barkley, 1984, p. 798]

> Academic agricultural economists now spend almost full time massaging their computers; policy problems rarely fit into their rigorous formulations. And those modern agricultural economists with a policy bent for the most part either work for a commodity trade association or are employed by a consulting firm which does contract work for those same trade associations or for other special interests. [Cochrane, 1984, p. 41]

> What a growing segment of our profession seems bent on doing, in part, is decorating empty economic boxes, conceptual constructs so esoterically defined as to be empirically void and irrelevant to understanding the real world. [Madden, 1984, p. 104]

Although some commentaries are more charitable (see Farrell, 1981), one cannot help but be struck by the breadth and depth of the reaction of the profession to what is widely viewed as excesses in mathematical modeling. Related critism also is directed at professional publications.

Reforming the Publication Process

Our professional publications have received much criticism. Editors of the American Journal of Agricultural Economics are criticized for a review process which encourages narrow mathematical articles because reviewers tend to accept authors' assumptions but carefully scrutinize for a logical flow from assumptions to conclusions. This favors the neat presentations in mathematical articles, however irrelevant the problem addressed and unrealistic the assumptions. The review process works against substantive policy oriented articles because real world policy analysis is seldom neat and clear cut.

According to Schultz (1964, p. 1009)

> ...most things that are published [in agricultural economics] are either not new, or they are very ephemeral. Models are virtually all a repetition of a few specialized analytical tricks and the empirical inferences based on them, when they are relevant to the real world, are short lived. There is a tendency, when perchance a seminal paper is submitted, for review editors to look upon it askance and play safe by recommending against its publication.

The situation has improved little two decades after Schultz's comment. Reforms are overdue. Editors need to give more weight to the importance of problems and conclusions in selecting articles. Perhaps publication of Choices, the magazine of applied agricultural economics, will resolve some problems.

Not Enough Interdisciplinary Policy Economics?

Farm debt stress in the 1980s traces mainly to failure of macroeconomic policies which in turn traces to the decline in encompassing institutions (politicial parties, presidential and congressional leadership, etc.) which view public policy from the

perspective of society rather than of narrow special interests. Similarly, many of the shortcomings of the public policy economics profession trace to the decline of an encompassing socioeconomic science. In an age of accumulated knowledge so vast each Ph.D. candidate can grasp only a part of it, specialization is inevitable. Compartmentalization attends specialization. A high price is paid in loss of a holistic paradigm at a time when policies and markets are ever more integrated in the real world and cannot be viewed in isolation.

A holistic approach to agricultural and food policy economics inevitably is multidisciplinary or interdisciplinary. Multidisciplinary interaction among researchers in various disciplines has long been a goal of economists but success stories are rare. On the other hand, large numbers of individual agricultural and food policy economists have performed distinguished interdisciplinary research utilizing disciplinary skills in agriculture, economics, and statistics combined in one individual.

Our profession has a long tradition of dabbling in political science. That is fitting, given the influence of political processes on economic outcomes. Conceptually, requirements for an optimal economic system and an optimal political system are similar. Political economic contributions of Harold Hoteling, Kenneth Arrow, Gordon Tullock, James Buchanan, and Mancur Olson (see Olson, 1982) suggest that a principal force behind fragmented and short-sighted macroeconomic policies is the "democratization" of federal government processes at the expense of encompassing institutions such as congressional leadership and political parties seeking to act in the

public interest. Proliferation of staffs of individual Congressmen and Senators relative to professional staffs of Congressional Offices and Committees also reduces the power of encompassing organizations to act in the public interest. Glenn Nelson (1983, p. 901) notes the tendency for agricultural and food policy decisions to be made increasingly by those outside the U.S. Department of Agriculture. A problem is that much of the federal analytical expertise needed to appraise implications of alternative policies rests in the U.S. Department of Agriculture. Separation of decisions from staff expertise compromises opportunities for sound decisions.

In short, agricultural economists traditionaly have had an interdisciplinary focus (i.e. agricultural economists also acting as political scientists or statisticians) rather than a multidisciplinary focus (agricultural economists working with political scientists or statisticians). The prescriptive economics called for herein requires more interdisciplinary and multidisciplinary work in other fields basic to understanding the economics of agriculture. Such fields include sociology and pyschology. Without economics, other social "sciences" tend toward populism. Without other social sciences, economics tends toward engineering and is unable to confront today's major socio-economic issues. I see no alternative to adding more time to Ph.D. programs and greater use of post-doctorial programs to broaden our overspecialized profession.

SUMMARY AND CONCLUSIONS

Our predictive economics is often flawed. Agricultural economists tend to project current circumstances into the foreseeable future. Yet neither boom nor bust persists. History has consistently sided neither

with the Cassandras nor with the Pollyannas. Economic analysis and public policies must be designed for all seasons.

A large reservoir of excess labor in agriculture no longer exists but redundant labor remains a problem on many mid-size and small farms. Ability of the nonfarm sector to assimilate labor from agriculture is no longer in doubt -- the excess is a small portion indeed of the nonfarm labor force. Schooling and other human resource investments in farm people have drastically improved in the past four decades. Nonetheless, some problems remain despite their obscurity in research. Poverty characterizes an estimated 20 percent of farm families but poverty is given little attention in data systems, policy research, or in farm policy debate and legislation. Rural areas, after resurgence in the 1970s, once again lag behind urban areas in employment and population growth. Given that farm families depend on nonfarm sources for nearly two-thirds of their income, it is surprising that rural development research has been allowed to fade into near obscurity.

Our base of data and parameters continues to be inadequate. Improving on the base would improve econometric models and address basic issues such as the capacity of agriculture to adjust to shocks in demand and supply.

The political-economic environment for agricultural and food policy formulation has changed radically over the years. Economic research and education too often have mirrored the fragmented political system, responding to and affirming special pleadings of interest groups. Food and agricultural policy economists employed by the public are expected to serve the public interest. The profession cannot do that if it sets its research agenda based on goals and ends articulated

by special interest groups. Both the market and the political process are flawed in their ability to specify ends or goals required for prescriptive research and education in the public interest.

Our welfare economics paradigm has not served the profession well. It has tended to favor the status quo and special interest groups. To service the wider interests of society, economists need to begin work on the professional equivalent of placing a man on the moon -- specifying a social welfare function. That does not mean turning professional interest away from problems of food and agriculture. It just means that we work with food and agricultural problems in the context of the welfare of society as a whole.

Prescriptive economics turns us from descriptions of "what is" to hypotheses of "what could be." Analytical depth and professional oversight is essential to avoid tendencies for prescriptive economics to rely on speculation and value judgments.

This is no call to replace democratic political processes by the dictates of a computer model programmed to prescribe utility maximizing solutions. Society through democratic political processes will continue to make decisions of what, when, and how to allocate -- and often the decision will be to allow the price system to allocate. I only call for adding an estimated utility increasing option to the conventional income and employment increasing options of which voters and other decision-makers are informed through education. The procedure would reduce opportunities for special interests to control the research, education, and political agenda. Professionalism is the ability to rise above special interests which see economists as tools for rationalizing special favors at the expense of society.

REFERENCES

Agarwala, R. 1983. "Price Distortions and Growth in Developing countries." Working papers No. 575. Washington, D.C.: The World Bank.

Barkley, Paul W. December 1984. "Rethinking the Mainstream." American Journal of Agricultural Economics 66(5):798-801.

Batie, Sandra S. 1983. "Resource Policy in the Future." Pp. 94-107 in M. Hammig and H. Harris, eds., Farm and Food Policy. Clemson, South Carolina: College of Agricultural Science, Clemson University.

Black, J.D. January 1928. "Research in the Prices of Farm Products." Journal of Farm Economics 10:66.

Brandow, G.E. 1977. "Policy for Commercial Agriculture, 1945-71." Pp. 209-292 in L. Martin, ed., A Survey of Agricultural Economics Literature, Vol. 1. Minneapolis: University of Minnesota Press.

Cochrane, Willard W. April 1984. "Agricultural Policy in the United States -- A Long View." Pp. 1-45 in Benjamin H. Hibbard Memorial Lecture Series. Madison: Department of Agricultural Economics, University of Wisconsin.

Council of Economic Advisors. February 1985. "Economic Report of the President." Washington, D.C.: U.S. Government Printing Office.

Farrell, Kenneth. 1981. "Commentary." Pp. 175-78 in Modeling Agriculture for Policy Analysis in the 1980s. Kansas City, Missouri: Federal Reserve Bank.

Gardner, Bruce. 1981. The Governing of Agriculture. Lawrence: The Regents Press of Kansas.

Gardner, Bruce. April 1984. "Flaws of the Market as Regulator of Agriculture: The Lack of Policy Implications." Pp. 47-65 in Benjamin H. Hibbard Memorial Lecture Series. Madison: Department of Agricultural Economics, University of Wisconsin.

Harper, Wilmer and Luther Tweeten. December 1977. "Socio-Psychological Measures of Quality of Rural Life: A Proxy for Measuring the Marginal Utility of Income." American Journal of Agricultural Economics 59(5):1000-05.

Johnson, Glenn L. and C. Leroy Quance. 1972. The Overproduction Trap in U.S. Agriculture. Baltimore: John Hopkins University Press.

Madden, J. Patrick. February 1984. "Discussion: What to Do With Those Empty Economic Boxes." Pp. 104-108 in Economies of Farm Size. Ames: Center for Agricultural and Rural Development, Iowa State University.

Nelson, Glenn L. December 1983. "A Critique of Executive Branch Decision-Making Processes." American Journal of Agricultural Economics 65(5):901-07.

O'Brien, Patrick. 1984. "World Market Trends and Prospects: Implications for U.S. Agricultural Policy." Chapter 1 in Agriculture, Stability, and Growth. Port Washington, New York: Associated Faculty Press.

Olson, Mancur. 1982. The Rise and Decline of Nations. New Haven: Yale University Press.

Resources for the Future. Spring 1984. "Feeding a Hungry World." Resources 76:1-20.

Robbins, Lionel. 1935. An Essay on the Nature and Significance of Economic Science. Second edition (1952). London: MacMillan.

Schultz, T.W. 1945. Agriculture in an Unstable Economy. New York: McGraw-Hill.

Schultz, T.W. December 1964. "Changing Relevance of Agricultural Economics." Journal of Farm Economics 46(5):1004-14.

Spitze, R.G.F. 1983. "Comments for the Panel." Pp. 237-240 in M. Hammig and H. Harris, eds., Farm and Food Policy. Clemson, South Carolina: College of Agricultural Science, Clemson University.

Swanson, Earl R. December 1984. "The Mainstream in Agricultural Economics Research." American Journal of Agricultural Economics 66(5):782-92.

Tweeten, Luther. 1967. "The Demand for U.S. Farm Output." Food Research Institute Studies 7:343-69.

Tweeten, Luther and C.L. Quance. 1969. "Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches." American Journal of Agricultural Economics 51:342-52.

Tweeten, Luther. 1979. Foundations of Farm Policy. Lincoln: University of Nebraska Press.

Tweeten, Luther, July 1983. "Impact of Federal Fiscal-Monetary Policy on Farm Structure." Southern Journal of Agricultural Economics 15(1):61-68.

Tweeten, Luther. December 1983. "Economic Instability in Agriculture." American Journal of Agricultural Economics 65(5):922-31.

Tweeten, Luther. 1984. "Causes and Consequences of Structural Change in the Farming Industry." NPA Report No. 207. Washington, D.C.: National Planning Association.

Tweeten, Luther and Gilead Mlay. 1985. "Marginal Utility of Income Estimated and Applied to Economic Problems in Agriculture." (Mimeo) Stillwater: Department of Agricultural Economics, Oklahoma State University.

U.S. Department of Agriculture. February 1985. "Economic Research Service in Transition." Washington, DC: Economic Research Service, USDA.

Witt, Lawrence. Date unknown. "Historical Highlights and Developments in Agricultural Economics." (Unpublished manuscript). East Lansing: Department of Agricultural Economics, Michigan State University.

PRELIMINARY DRAFT - To Be
Revised and Expanded

ISSUES IN WORLD AGRICULTURE - A U.S. PERSPECTIVE

John W. Mellor

ABSTRACT

INTRODUCTION

The purpose of this paper is to define the key or priority issues with respect to world agriculture subject to the analytical tools of the agricultural economics profession. World agriculture issues are defined as those that arise outside the United States but which impinge on the concerns and interests of the United States. A U.S. perspective is taken in this paper for three reasons. First, with such a vast subject as "Issues in World Agriculture" for each of which there may be many perspectives, each calling for quite different weighting of the various elements and courses of action and perhaps even a different final assessment, there must be a particular perspective. It is best to state it explicitly at the outset. Second, since this paper is being done in the context of the American Agricultural Economics Association, it seems appropriate to relate to the dominant perspectives of that particular group rather than some other particular group. Third, because of the large size of American agriculture, the major importance of trade to the prospects of American agriculture and the immense global concerns of the United States, it is possible to have a perspective from a point of view of the United States and still have a broad perspective which would be of considerable interest to other groups.

Because the range of issues in world agriculture is so immense, analysis is facilitated by a broad classification of issues that emphasizes the interacting components. I therefore divide the topic into three components:

1. International Food Flows. International food flows are extraordinarily large by past standards, growing rapidly and directed largely and increasingly from the developed to the developing countries of the world. These are relatively recent phenomena which are ill-understood and to which policy has not as yet fully adjusted. The flows are substantially commercial, but non-

The author is Director of the International Food Policy Research Institute in Washington, D.C.

commercial flow of food aid is large, controversial and its relations to commercial flows ill-understood.

2. Global Poverty. Massive numbers of people subsist in such abject poverty that they do not even receive adequate energy to achieve an active, healthy life. Such poverty is concentrated in the developing countries of the world, and there is a widely perceived need in developed countries to lift people out of such poverty and malnutrition and an unarticulated perception that it is possible to do so. Thus, the global poverty problem is also construed as a U.S. problem.

3. Unequal Distribution of Human Capital. The extraordinarily unequal incidence of human capital in the world is the basis of inequalities in development and of the concentration of poverty. Redressal of this inequality would provide increased prosperity to all nations of the world including the United States while the means for redressing this inequality lies substantially with the United States. Hence this problem, too, may be construed as a U.S. problem.

For each of these issues I will touch upon the implications to research, extension, and teaching. I will attempt to develop the importance of each of the issues and place it in its perspective relative to the others. Each of the issues is of course central to the world food and agriculture situation and, I might add, vice versa. I will attempt as I go to diagnose gaps in knowledge in these three areas and define the research needs. While the paper will treat both extension and teaching, the emphasis will be on research since once that is clear, the other two will fall rather easily into line.

INTERNATIONAL FOOD FLOWS

Net imports of basic food staples into the developing countries of Asia, Africa, and Latin America have grown rapidly from about 11 million metric tons in 1976-80. By projecting production and consumption to the year 2000 Paulino (forthcoming) depicts that flow as increasing to 75-80 million tons. Although there are a few net exporting countries in the Third World that are of course netted out of the preceding figures, they are very small in number and hardly extend beyond Argentina and Thailand. Conversely, the bulk of developed countries have become net exporters of basic food staples. Thus, what we have seen in the world is a dramatic increase in net exports from developed to developing countries.

This dramatic increase in exports from developed to developing countries is the product of structural changes in demand and supply conditions that are a natural and logical product of specific stages of economic development. As development gets underway, growth in basic food staple production tends to gradually accelerate. Since the processes for accelerating growth are basically those of shifting the supply schedules, and since those in turn depend largely on processes of complex institutional change requiring rapid expansion of supplies of trained people and the institutional structures to support them, these processes necessarily move slowly. In the meantime the total processes of development increase incomes of the mass of low income people with very high marginal propensities to spend on food. In fact, at this stage of high marginal propensities to spend on food the processes of agricultural growth with strong employment multipliers tend to push demand ahead rapidly even as supply increases (Mellor 1976). The result is that demand tends to shift much

more rapidly than supply with rapidly increasing net imports. Conversely, once the development process has neared its apogee the shift in supply schedules tends to become institutionalized and supply continues to grow rapidly. In the meantime, marginal propensities to spend on food decline sharply. As a result, as incomes move to high levels, supply tends to be shifting much more rapidly than demand, creating exportable surpluses. The peculiarity of the present situation in the world is one of massive areas and numbers of people in these two quite different stages: the one increasing exports rapidly, and the other increasing imports rapidly. Since food trade, although massive by past standards, is still a small proportion of total food production, it becomes very difficult to predict trade balances and net pressures on prices since small differences in the rate of supply shift and demand shift will have very large differences in effect on trade.

It is clear that in very recent years, with the economic slowdown in the world, demand shifters in developing countries have been held back substantially. The supply shifters which are subject to much longer term phenomena have remained relatively high. That is also somewhat true of the developed countries. The product has been tremendous downward pressure on international prices. The appearance of that pressure is, of course, greatly exaggerated in the largest exporter, the United States, because of the tremendous increase in the valuation of the dollar due to factors virtually completely extraneous to the agricultural sector. If you look at the period in the late 1960s and early to mid-1970s when world development was moving quickly, it would seem that we can see some modest upward pressure in real prices during that period. Since the processes of economic development in developing countries are now somewhat endogenous, it would not be surprising to return to the situation of the late 60's and early 70's.

I have emphasized Third World countries on the import demand side. Of course in the last decade or so the Soviet Union has also been a very major importer. In this context it is useful to see the Soviet Union as a late-stage developing country. Marginal propensities to spend on food are still quite high in the Soviet Union, partly because of relatively low incomes, perhaps reinforced by the low availability of non-food goods and services. Eventually the Soviet Union will begin to decrease its marginal propensity to spend on food and will gradually become somewhat less of an importer. It is notable that the supply growth rate in the Soviet Union has been considerably more rapid than in Western Europe. The real difference in the trade flows lies on the demand side.

A further comment that needs to be made in this context is with respect to livestock. The stage at which import demand from the developing countries becomes explosive is at that stage when livestock consumption has grown very substantially so as to be consuming a significant proportion of total basic food staples. One should recognize that in the early stages of development livestock production tends to be primarily on the basis of waste and by-product feeds. As livestock production growth accelerates, the supply of those types of feeds becomes highly inelastic, and there is a switch to the much more elastic supply of food staples that can also be used for human consumption. As that process accelerates, the proportion of basic food staples going to livestock increases. Since the demand for livestock products tends to remain quite elastic with very little change in the elasticity to relatively high levels of income, that tends to soon become the driving force in demand for basic food staples. At that stage growth in demand may significantly exceed domestic production growth and therefore give explosive growth in imports. The most dramatic case of this is Taiwan which has increased its livestock feed as a proportion of total domestic utilization of cereals from 4 percent in 1960/62 to

about 50 percent in 1980/82. Now cereal imports represent some 58 percent of total consumption of cereals (Sarma 1985). This is an extreme case, but illustrates the point well.

The Research Agenda

The research agenda follows naturally from the above exposition. While the broad outlines of global food flows are clear, the details are so unclear as to prejudice effective planning.

We need a detailed understanding of the path of the supply and demand balances in developing countries. It is quite possible that rather than the simple picture which I depict above, when supply shifters first come into substantial activity, based on basic agricultural research, supply will move ahead of demand and one might have an early or exporting phase (Tsujii 1982). Gradually the employment linkages out of agricultural growth become more powerful and then demand moves ahead more rapidly. All of this must be related rather closely to the progression with respect to the livestock sector. We need careful studies on these matters in order to understand the timing of the structural changes. The implications to the U.S. are immense, perhaps to the tune of ten millions of tons of exports with profound implications to U.S. domestic production policy.

We also need to understand more carefully the relative importance of supply shifters and price response in the developed countries. We now have a substantial literature and considerable polemics implying very substantial supply response to price in developed countries. There has been relatively little discussion in this context of the constant work of the supply shifters, how those relate to the diminishing weight of the demand shifters and what the implications are of that to aggregate exportable surpluses, and the interaction of those with price. One could go on with many examples of the importance of this, but certainly the European Common Market is a prime case. There we have supply shifters actively at work, demand shifters essentially at zero, and a high price regime. If European prices were brought down to world levels, would there be enough response to price to overwhelm the continuing effect of the supply shifters? How strong are the supply shifters? What might be done to reduce them? Are they responsive to prices? We have much speculation and little hard data on these complex questions. Indeed, we have many polemics between neoclassicists and structuralists but little analysis of the interaction of the two types of forces. One could raise similar questions for North America in this respect.

In this context of considerable uncertainty with respect to supply shifters and price response in both developed and developing countries, one has a very complex question as to at what cost food production in developing countries should be pursued over what time span. There could be little question that developing countries universally must be pursuing the basic supply shifters of agricultural research, extension, infrastructure development, and input supply. There are such vast numbers of people in the basic agriculture and food sector and capital is so constrained that it is nonsense to talk about these countries as having no comparative advantage in the food sector. One can also make the case that for substantial areas in essentially every country there is a comparative advantage in pursuing technological improvements in agriculture and obtaining a substantial rate of growth at least in certain regions from that technological advance. That is not the issue. The issue arises when one looks at expensive capital investments in agriculture for land reclamation and irrigation. How much can one afford to spend on these in view of the future world food supply balances and implicit price situation? These are clearly

projects and programs in developing countries which must have rates of return which are very low with any reasonable estimate of future prices. When appeal is made to price incentives in developing countries in the context of structural processes that take decades to foment, what price regime and hence cost regime do we have in mind? The implications of alternative policies to the major exporters are large. We need careful empirical studies on this set of questions.

We need to analyze much more carefully the appropriate commodity composition of trade in the future. This has several components. There is the whole issue of cereals trade. Clearly for several decades in the future cereals flows from the developed to the developing countries will grow. How much will they grow? At what price? What should be done to encourage it? What are the other issues that need to be raised?

Second, there is a complex set of issues with respect to trade in relatively labor-intensive agricultural commodities. This would include much of the livestock production and fruits and vegetables. What is the scope for comparative advantage and specialization among Third World countries and hence rapid growth in intra-Third World trade in these commodities? Further, what should be the long term comparative advantage for these commodities in trade between developed and developing countries? At the most simplistic level, can we sell much more of cereals if we would be willing to import more of livestock products,fruits and vegetables? How does this vary among developed countries? What are the implications to the European Community's expansion in this context? What are the implications to the location of fertilizer production and other capital intensive types of commodities?

Teaching Implications

As our knowledge grows on all of these issues, it obviously needs to be conveyed to the electorate in the United States through extension programs and to the future electorate through teaching programs. There needs to be an emphasis first on the simple issue of the interlocking of economies in the world and of the tremendous importance of the Third World to United States agriculture in this respect. The effort at selling foreign aid, particularly in the 1970s, on the basis of poverty alleviation has created a very clear mis-impression among the electorate in the United States. These are not poverty-stricken countries which have no economic need of the United States. They are countries which are beginning to develop rapidly. They of course have immense poverty problems, but in the context of rapid growth. We need to understand that and then see the relationship to commercial exports.

GLOBAL POVERTY

The Basic Issues

The bulk of the poverty in the world by any absolute standard is located in the developing countries. We can say further that what poverty in the world cannot be met by modest redistribution of income within national boundaries lies in the Third World countries. For example, in the United States it would be difficult to define poverty in a way that included more than 10 or 15 percent of the population. The population below the poverty line in the United States can be raised above it by redistribution of a modest proportion of total national income. That could not be said for developing countries. The bulk of people

in developing countries of the world are in countries in which it would be difficult to define a poverty line which included less than 20 to 40 percent of the population and that would indeed be a considerably lower poverty line than the one that would include 5 or 10 percent in developed countries.

This raises an important philosophical issue in the context of this paper, oriented as it is toward the agricultural economics profession of the United States. To what extent is concern for poverty constrained by national boundaries as contrasted to a global scope? When we ask the Rawlesian question, (Rawls 1971) do we assume that we would be plunked down as citizens of the United States of America, or is our random placement in the world to include all countries and people? I suspect that what we do in answering the Rawlesian question is to open the possibility of being plunked down anywhere but to put the probabilities of coming down in the United States considerably higher than the proportion of the U.S. population to that of the rest of the world. Thus the philosophical issue is rather complex. Let me assume, however, that Americans would think of themselves as having some concern with the probability of landing in the poverty-stricken classes in developing countries. We then see a U.S. concern and a U.S. interest in dealing with poverty in Third World countries.

One should distinguish clearly between a long-run solution to poverty problems in developing countries and the short-run solution. The long-run is one of development. If one is concerned with poverty in developing countries and is dealing with it by development, one necessarily comes down for a policy which gives primary emphasis in public policy to moving the agricultural sector and then deriving from that linkage and multiplier effects stimulating growth of other sectors of the economy (Mellor 1976). This is a growth pattern which has a high employment content and can quickly move to high rates of growth. It is fully reasonable to think that once a country has developed the minimal institutional structures and body of trained personnel that it can move to eliminating the bulk of poverty, that is getting it down to U.S. proportions within a 15-25 year period (Mellor 1976) (Mellor and Mudahar 1974).

There is also the possibility of tackling poverty in the short run. That obviously must be through redistribution and as far as the developing countries are concerned we have to think substantially in terms of redistribution from the developed to the developing countries. I am distinguishing here between foreign assistance to deal with the long term problem which I am not treating at the moment, and dealing with the short term problem. The short term problem shows itself most particularly in the form of inadequate intake of basic energy sources. In other words, it is substantially a food problem. Thus we are talking about movement of additional quantities of food, beyond what the market moves, from the surplus producing developed countries to the deficit developing countries. This has to be done in a way which does not depress domestic prices in receiving countries excessively; after all, one does not want to stand in the way of the long term solution to the problem. It obviously is simply done when the objective is to reduce poverty because one wants to see to it that it moves into the hands of people with high marginal propensities to consume food, precisely because they are very poor. There are two major vehicles for achieving this. One is through increased employment of the poor and the other is in decreasing the price of food through subsidies.

The Research Agenda

The research agenda for dealing with the long term problem of poverty is of course first research on the various elements of getting agriculture moving with

particular emphasis on agricultural research and how to optimize it, input supply and how to maximize its rate of growth, and development of infrastructure. All of this involves issues I will take up in the third part of this paper on human capital development. The second area of inquiry is how to maximize growth of employment in the context of an agricultural strategy. This is work on the linkages and multipliers between agricultural growth and non-agricultural growth and how that may be pursued most vigorously. We need a good deal more description of those processes and then movement to analysis of the policy needs.

The short-term needs are quite straightforward. We first need considerably more research on how to increase employment in the context of increased supplies of food. Second, we need to learn more about food subsidies and how they can be operated in the context of international transfers of food. In this context we need much more research on food aid since that would presumably be the primary vehicle of making these transfers.

UNEQUAL DISTRIBUTION OF HUMAN CAPITAL

The Current Situation

It is well known that there is an extraordinary disproportion of human capital in the developed countries as compared to the developing countries. Indeed, it is not oversimplified to say that that is the root of the differences in development. The basic issue here is to what extent, in what form, and in what manner is it to the interest of the developed countries to utilize their disproportionate share of human capital in order to redress the imbalance? Obiously, if it is believed that development of developing countries will be advantageous to the developed countries, then one should show interest in this issue. It is probably fair to say that this is the essential issue of foreign aid. After all, we know that pure capital transfers bring very low rates of return in developing countries precisely because of the scarcity of human capital. This is not to say that it is only human capital that should be transferred, but one should see the basic nature of human capital to the returns to other forms of capital.

While I have stated this issue in general terms, it is of particular importance with respect to the agricultural sector. Agriculture needs a vast set of complex institutions if it is to move ahead. These must be staffed by highly trained people. This ranges all the way from a tremendous amount of Ph.D. level training needed in the agricultural research systems to large numbers of people with the equivalent of Bachelor-level training to run large numbers of other institutions.

There are very complex issues with respect to the proportioning of various levels of training. There has been a recent fad of emphasis on primary school education. It is clear that in a number of African countries that has moved way out of proportion to other levels from the point of view of achieving development. Related to this is the complex issue of the role of human capital transfer at the various levels of education. One can probably make a case that this transfer is easier to make at the higher levels than the lower levels. This means that foreign assistance from developed countries may have a quite different proportion between levels than the optimal which is required within the country itself. There are complex relationships between the numbers of people trained and the institutions which are built to receive them. One cannot move without the other.

The Research Agenda

Probably the most important issue in the human capital research agenda is the relative proportioning between various levels of educational expenditure. Nearly all countries expend public revenues at a very high level on education. That is probably politically determined so that it is probably not very important to do research on what the overall expenditures should be. The proportioning is somewhat politically determined as well, but there is probably more scope with the results of research having influence in the process.

There needs to be substantial research on the role of technical assistance, that is, transfers of human capital from developed to developing countries in the process of increasing the human capital of developing countries. What is the role of the land-grant colleges in this process? What are the institutional arrangements? To what extent can expatriates be useful? What is the proportioning between expatriates to help build institutions and the training of people abroad?

TEACHING

There needs to be a tremendous development of awareness of the need for human capital transfers so that the institutions in the United States can be tuned better to this purpose.

REFERENCES

Mellor, John W. The New Economics of Growth - A Strategy for India and the Developing World. Ithaca, NY: Cornell University Press, 1976.

_____ and Mohinder S. Mudahar. "Simulating a Developing Economy with Modernizing Agricultural Sector: Implications for Employment and Economic Growth." Cornell University-USAID Technological Change in Agriculture Project Occasional Paper No. 76, June 1974.

Paulino, Leonardo. Food in the Third World: Past Trends and Projections to 2000. Washington, DC: International Food Policy Research Institute, (forthcoming).

Rawls, John. A Theory of Justice. Cambridge, MA: Harvard University Press, 1971.

Sarma, J.S. An Analysis of Cereal Feed in the Third World - Past Trends and Projections to 1990 and 2000. Washington, DC: International Food Policy Research Institute, 1985.

Tsujii, Hiroshi. Comparison of Rice Policies Between Thailand, Taiwan, and Japan: An Evolutionary Model and Current Policies. Kyoto: Kyoto University Press, 1982.

RESOURCE AND ENVIRONMENTAL ECONOMICS: KNOWLEDGE, DISCIPLINE, AND PROBLEMS*

Daniel W. Bromley

ABSTRACT

Resource economics is entering the third phase of its evolution, in which the first phase was concerned with incorporating natural resources into conventional economic models, and the second phase was concerned with elaborating those instances in which market failures persisted and required government action. The market-failure rationale is challenged as being insufficient on efficiency grounds. The emerging phase of resource economics will move beyond market-failure to a more pragmatic consideration of the political economy of resource conflicts and the structure of entitlements (institutions) that legitimize particular outcomes.

THE CONCEPTUAL CHALLENGE

Conventional resource economics recognizes problems as arising from market failure, it maintains a distinction between those things that contribute to efficiency as opposed to those things that are redistributive in nature, and it finds guidance in benefit-cost analysis where potential Pareto compensation gives license for change. In the best tradition of economics, resource economists seek to be regarded as objective scientists.

However, resource problems are entitlement--or initial endowment--problems, and as such welfare economics provides us with no unambiguous answer as to what should be done [Chipman and Moore]. As hard as we might wish it were not so, the resource economist inevitably confronts conflicts in which two or more parties are faced with unwanted and uncompensated costs, and where gains from trade are either difficult to negotiate, or are impossible.[1] The existence of joint costs, a situation in which negative effects (spillovers) transcend the nominal boundaries of firms, is determined by an entitlement structure in which not all scarce and valuable factors of production or consumption are ownable. In such a legal environment, economic agents have adopted production and consumption plans that presume ownership of necessary factors.

Starting from this presumption of rights, resource economics is about the ability of certain parties to shift uncompensated costs onto others. The social problem concerns who is able to shift such costs? On whom are these costs shifted? Which kinds of costs are most often shifted to others? And, how can existing (and future) conflicts of this sort be resolved in a manner that is both equitable, and not wasteful?

---

* Professor and Chair, Department of Agricultural Economics, University of Wisconsin-Madison. I am particularly indebted to Emery Castle, Dick Norgaard, Alan Randall, Al Schmid, and Kathy Segerson for assistance on an earlier version.

We understand that the status quo structure of entitlements defines a bundle of resource endowments, and that these entitlements also determine particular outcomes that may be regarded as efficient [Bromley 1982a; Samuels 1981]. Some of these entitlements are legitimized by statutory or common law; others are presumptive in that they have yet to be addressed either legislatively or judicially. As economists we are invited into the policy arena to comment on possible changes in this status quo. This opportunity presents us with a difficult task. Of what significance--in economic terms--is the status quo? After all, it yields for us a constellation of prices that we will use in an economic analysis of change. But if the contemplated change is to show up as a different structure of entitlements--and most resource policy does precisely that--then the new entitlement structure will give rise to its own constellation of prices. Our science provides us with no basis for judging the status quo--except for the fiction of a perfect world without transaction costs. We are asked to evaluate an existing Edgeworthian economy against a hypothetical ideal; a fictional welfare frontier is posited and we are asked to contemplate an economy inside of that frontier. In point of fact, the welfare frontier is never attainable in a world with transaction costs and we must ask about its relevance for policy. Indeed, ours is a world of efficiency loci and feasibility loci [Graaff].

Graaff considers a particular point inside of a welfare frontier whose coordinates represent the satisfaction enjoyed by members of society. A costless lump-sum redistribution of wealth by taxes and bounties will move society to a new point within the frontier.[2] Repeated applications of such redistributions will trace out a family of points known as the efficiency locus--so labeled because it traces out a series of allocatively efficient points for various distributions of welfare. It is possible to consider one of these combinations as optimal only if the efficiency locus should happen to coincide with the welfare frontier. Graaff's efficiency locus is Bator's utility possibility frontier [1957].

Graaff differentiates the efficiency (or "actuality") locus from the welfare frontier by noting that:

> The welfare frontier shows the best we can do, given tastes and techniques, in an institutional vacuum. The efficiency locus shows the best we can do if we take the existing institutional set-up as a datum. It describes the result of distributional changes (by lump-sum measures) within that framework [p. 76].

Unfortunately, any notion of an economy in an institutional vacuum is as fictional as an economy without transaction costs. Hence, the idea that economic policy can do anything to move society to the welfare frontier is of little practical or theoretical meaning. Nor does it do anything for reality to talk of costless lump-sum redistributions. Instead, economic policy must be viewed against a metric of attainability or feasibility. The feasibility locus indicates the political realities of making one person better off while holding the welfare of others at their current levels. The feasibility locus does not exist because of lump-sum redistributions, nor does it presume the institutional set up to be given; it is inscribed in utility space by feasible institutional changes.

Through any point on a feasibility locus there passes an efficiency locus indicating the results of hypothetical lump-sum redistributions in the

institutional arrangements corresponding to that point. To move along the feasibility locus via institutional change is to move from a point on one efficiency frontier to a point on another. Restated, the welfare frontier is an unattainable fiction, economic life is found on a feasibility locus, a particular point on a feasibility locus also coincides with a point on an efficiency locus, and to move along the feasibility locus is to jump from one efficiency locus to another.

While any number of studies exist regarding: (1) the willingness to pay for certain environmental goods; (2) the costs of achieving certain environmental standards; and (3) the efficiency of creating markets for emissions, I believe that the central conceptual challenge to our profession is to develop an improved understanding of the matter of entitlements--not only their existence at any particular moment, but the more vexing problem of their modification in the face of "unacceptable" performance.

In what follows I will address three particular dimensions of the problem. The first concern will be with the resolution of joint-cost situations--or with externality policy. The second concern, while related, will instead focus on the structure of entitlements that underlies situations of jointness. Finally I will discuss the matter of uncertainty as it influences natural resource policy and economics.

This treatment will not be in isolation from the kinds of resource problems that I believe we face, but the thrust of the discussion will be in the direction of the problems of resources to which economists might contribute. I have chosen this conceptual tack for several reasons. First, and possibly most importantly, it seems to me that the resource problems that loom on the horizon are of a sort that imply a different motivation for collective action than the conventional "market failure" rationale. Secondly, there is growing evidence that direct government involvement in certain domains of daily life entails its own form of failure--called "non-market failure" [Wolf]. Third, the status quo structure of presumed entitlements governing many natural resource uses has a profound influence on the way that the choice problem is framed, and hence on the outcome that seems to be preferred. My final reason for this emphasis is that there appears to be a persistent failure of economists and policy makers to view resource problems through the same set of "lenses." It follows, therefore, that the preferred solutions for each of these two participants will differ. I regard it as essential that these different perspective be understood by the theoreticians, by those who may work directly with citizens and decision makers on resource problems (say extension specialists), and by the policy makers themselves.

BEYOND MARKET FAILURE

The future success of resource economics as a policy science will depend, I believe, on the extent to which we are able to move beyond the well-known economics of Edgeworth into the much more complex economics of Pigou. This may seem surprising since Pigouvian thought is regarded to be very much in the mainstream of resource economics. However, I suggest that the economics of Pigou has simply been appropriated by the Edgeworthians and has, for the most part, been used to motivate discussions about the optimal tax on offending activities.

By a fuller recognition of the Pigouvian economy I have in mind the concept of general economic welfare or the general well-being of the community. While resource economists tend to equate Pigou with a marginal tax to reconcile private and social benefits and costs, this casts Pigou in a rather more "marginalist" light than is justified. Pigou was concerned with the inextricable linkages among citizens, both contemporaneously but also intertemporally. This linking represents a certain jointness, and jointness of costs and benefits is the very essence of resource economics. But there is a more encompassing problem of jointness that does not seem to have received the attention it deserves.

The Edgeworthian economy, familiar to us all, is a world in which individual agents compete for private goods--that is, for goods that are rivalrous in consumption. In the course of that consumption of private goods certain spillovers may occur thereby driving a wedge between private and social benefits. A similar story could be told about the Edgeworthian economy in input space for firms. This economy is one of private scarcity, functioning markets, and some externalities. We can imagine production possibility frontiers, social indifference curves, and discussions about Pareto-better moves. It is the stuff of contemporary resource economics.

By way of contrast, the essence of the Pigouvian economy is not bargaining over private goods with incidental side-effects sometimes present. Instead, the Pigouvian economy is one of pervasive visitation of unwanted costs--costs that are either of a collective-consumption nature, or that are privately borne. In the Pigouvian economy people do not only come together to trade at the margin--balancing willingness (and ability) to pay against changing marginal increments to satisfaction. Instead, the Pigouvian world is one in which individuals-- across both space as well as across generations--visit costs and benefits on others. The good Edgeworthian is inclined to view this visitation of costs as an aberration, believing that such events--when they are observed--can be corrected with "taxes and bounties." On the other hand, a modern Pigouvian would find numerous examples of instances in which joint costs are present.

In Pigou's time economists were beginning to see some of the side effects of modern technology, of crowded cities, and of unbridled individualization of economic life. Pigou was writing about the familiar technological externalities that went on to become the staple of economics textbooks--a smokey factory and a nearby laundry, a confectioner and the adjacent waiting room for a doctor, a sparking railroad and dry wheat fields. In each of those instances it was clear that the interest of the individuals so affected were incompatible.

Resource economics problems today are still dominated by the element of jointness. Problems of air quality, groundwater quantity and quality, energy exploration policies, coastal habitat problems, urban sprawl, wilderness designation and management, the management of other public lands, private forest land management, soil erosion, locally unwanted land uses (LULU's), surface water problems, marine fisheries, habitat/species preservation, mineral exploration, and the management of toxic and hazardous materials are all characterized by jointness.

This inextricable binding together of multiple interests in the ways in which natural resources are used and managed creates a special conceptual challenge to the resource economist for the quite obvious reason that not all

parties for whom these matters are of interest are able to enter consensual bargains to have their wishes expressed. The physical realities of many of these natural resource problems preclude the thoroughgoing individualization of ownership and control that is the essence of the Edgeworthian economy. Constantly to fall back on the Edgeworthian view of such matters seems to beg the ultimate questions of who has the socially sanctioned rights to undertake specific actions, who has the exposure to unwanted costs, and who must bear the burden of proof in order to be relieved of such costs, if relief is indeed warranted.

There is another difficulty with "market failure" as a motivating idea for recognizing a problem with the status quo. Some have correctly pointed out that a failure of existing market phenomena is no assurance that involvement by the state will make matters any better. Wolf [1979] writes of "non-market failure."

Dating from Pigou (and even Adam Smith, though his concerns in such matters are often ignored by his disciples) economists have understood that there is sometimes a divergence between private costs and social costs. Francis Bator [1958] seems to have popularized the concept of market failure with his classic article "The Anatomy of Market Failure." As a metaphor, market failure is convenient; like many metaphors it may have only limited analytical power.

Consider a world in which independent economic agents engage in a variety of activities, yet the actions of one hold uncompensated cost implications for another. If those costs are transmitted via the physical media rather than via the price mechanism we would consider them to be technological externalities. Conventional wisdom would recognize this as a problem of "market failure." We would say that there is a divergence between private costs and benefits, and social costs and benefits.

There are two dominant views regarding the solution to this externality problem. One view is to tax the offending party an amount equal to the marginal social damages inflicted on others, thereby internalizing the offsite costs. Another view is to create an opportunity for the two incompatible uses to bargain over the joint costs. The first view is associated with Pigou, the latter with Coase.

The Pigouvian solution requires the involvement of an authority outside of the two interacting firms and this will usually mean the government. Of course even after the imposition of the optimal tax there will remain some actual physical interdependence (joint costs) but the "efficient" level of joint costs will have been realized by the tax. Coasian opposition to the strict application of Pigou's tax on the offending activity centered on the idea that joint costs indeed require two agents in close proximity; jointness is a function of the physical proximity of two incompatible activities. In other words, many externalities would not exist if the two parties would only keep their distance. Indeed the current debate over acid-rain policy serves to remind us that the taller smokestacks have simply expanded the geographic region over which joint costs are experienced.

The Coasian solution was to recognize the dual nature of joint costs, and to establish a situation where both parties might negotiate. The Coasian solution results in a situation where following this consensual bargaining there will remain some relations involving scarce resources that lie outside of this bargained solution--and that market forces, left to themselves, cannot

internalize. Thanks to Buchanan and Stubblebine [1962], we now regard this situation as one of Pareto-irrelevant externalities.
If we are to follow the Coasian prescription there are two possible outcomes. The first is one in which no bargain can be struck between the two incompatible uses and so the status quo remains unmodified; Demsetz [1967] would offer the observation that this absence of a bargained outcome is itself optimal and that therefore the status quo structure was optimal (by which he more correctly means efficient). Others would suggest that this outcome is simply an artifact of the status quo structure of presumptive rights that forced the victim of unwanted costs to approach the source of those costs to offer payment for relief [Bromley, 1978a, 1978b, 1982a; Mishan, 1974; Samuels, 1971, 1981]. The fact that there was no change may indeed be "efficient", but such a conclusion strips efficiency of much policy interest.

The other possible outcome is one in which the two parties indeed strike a bargain so that the victim pays the offending party to reduce offsite costs somewhat, or the emittor buys off the disutility of the victim. As above, there would remain some joint costs that were not part of the bargain; the externality would have been "optimally" internalized.

It seems safe to observe that a bargained outcome in the Coasian tradition is much less common than is the failure of the parties to reach some agreement--either because they did not try, or because they tried and failed. Dahlman [1979] argues that this inability to move beyond a particular status quo outcome is a function of the existence of transaction costs. These costs are central to the concept of externalities. Indeed, Dahlman notes that:

> ...it is not possible to specify any class of transaction costs that--given individual wealth-maximizing behavior under well-specified constraints that include exchange costs--generate externalities that constitute deviations from an attainable optimum; second, that the concept of externalities--insofar as the word is intended to connote...the existence of an analytically proven market failure--is void of any positive content but, on the contrary, simply constitutes a normative judgement about the role of government and the ability of markets to establish mutually beneficial exchanges [p. 143].

Dahlman's view is that the relevance of externalities (what I am here calling joint costs) is to be found in the existence of transaction costs; such impediments to bargaining are thus a necessary condition for the persistence of unwanted costs being visited on others. Notice that transaction costs are not necessary for the persistence of physical interdependence among economic agents, for even when costless bargaining occurs there remains physical interdependence that is "not worth" eliminating.

Dahlman suggests that there is no transaction cost that can generate a Pareto-relevant externality. Put somewhat differently, Pareto-relevant externalities cannot exist on the basis of transaction costs since those costs must exist in a model of the attainable optimum. It is the presence of transaction costs that prevent the attainment of the perfect Pigouvian world, and transaction costs are quite capable of rendering the Coasian world optimal as it stands--otherwise it would change. That is, the Pigouvian solution invokes the omniscient central controller who can view the world as a

unified firm and so generate a schedule of taxes and bounties that will render all remaining technological externalities Pareto irrelevant. This is the Pigouvian Planner so denigrated by the Chicago School. In Coase's corner we see the Walrasian Auctioneer, the deus ex machina of competitive markets, attempting to iterate toward some equilibrium in which optimality will, by definition, be found. However, the presence of transaction costs implies that it may not be possible to move from the status quo--in which case things are considered (rather found, by definition) to be optimal.

But the Dahlman critique is precisely with these two stylized solutions to so-called "market failure" problems. The contemporary relevance of externalities and market failure is with reference to some Pareto optimum. Dahlman asks us to consider a properly specified (and well behaved) general equilibrium system, which for every initial endowment yields a unique general equilibrium price vector. Given current entitlements and so endowments, the economist is then able to specify a unique Pareto-optimal solution. Now, into this system admit externalities and let the Walrasian auctioneer grind out the new equilibrium price vector.

In general this new price vector and its associated allocation of resources will differ from that attained in the world without externalities. Hence, we conclude that externalities prevent the attainment of a Pareto-optimum, and the accompanying distortion is considered to be bad; it is here that the solution of government is often invoked. Since a world with zero transaction costs is also a world without externalities (by definition), the first model from above is one without transaction costs. But the second model, with externalities, is the one with transaction costs. Indeed, it is the very existence of transaction costs that differentiate the two models.

Dahlman concludes that the conventional prescription of searching for the combination of taxes and bounties that will make the second model resemble the first--and using government as the vehicle for that process--is misdirected for the simple reason that the first model is not attainable; it is a scientific fiction. Another way of stating the same thing is to suggest that the search for Paretian perfection is a quest for a fictional target.

Dahlman suggests that this problem is not unique to externality matters; the early concern with monopoly was judged against a world of perfect competition which is the first model discussed above. More recently those concerned with market structure have adopted as a norm something called "workable competition." The literature on international trade measures current performance--in the presence of tariffs and certain barriers--against the perfect world [Krueger, 1974].
But how relevant is the perfect world of zero transaction costs when one is concerned with policy formulation? Dahlman argues:

> If we include costs of transacting in the constraints that describe the conditions under which economic agents perform their individual wealth maximization, we would then describe an attainable optimum, and this is the one we should use in judging optimality and welfare problems [p. 153].

Cheung offers a variation on this same theme. He starts by questioning the very term "externality", preferring instead to focus on the nature of contracting among various interests to a resource conflict. Thus Cheung

broadens the issue from one of the willingness to contract (which is a function of transaction costs of interest to Dahlman), to the legitimacy to contract. Thus, there are two possible explanations for the persistence of joint costs: (1) the costs of delineating and enforcing the limits of exclusive rights are too high and so there is an absence of willingness to contract; or (2) contracts may not exist to define exclusivity because exclusive rights are not regarded as being legitimate.

Consider first the situation in which the various parties to a situation of joint costs have the legitimacy to contract and so the matter is simply one of the costs of arranging bargains. Here, the costs of forming exclusive rights to contract can be thought of in two stages. The first would be the costs of gathering information about the rights in question, the costs associated with bargaining over the nature of the emerging rights, and finally the costs of enforcing the contracts that have been arranged. These costs will vary according to the resource situation. For instance, on a high-seas fishery the sheer dispersion of the various agents would make this aspect very expensive indeed. In the matter of intergenerational resource problems the costs are, of course, infinite. It is in this sense that the state, acting as an agent for yet unborn citizens, undertakes contracts--on behalf of the future--with those currently living. In contrast there are other resource situations, where very few parties are involved, in which contracting costs would be quite low.

If the contracting process has been successful, then the second stage is one in which existing exclusive rights are transferred over time. There are costs associated with this transfer process, just as there are costs associated with the original definition of exclusive rights. Cheung notes that the income that can be derived from an exclusive right, or the gain from enforcing that right, depends on the existence of transferability in the market place; for without transfer the higher options may not be realized. Hence the lower the costs of contracting for transfers the higher will be the gain of enforcing exclusivity. And, the cost of enforcing exclusivity depends also on the existence of transfer and its associated costs.

Both stages then--establishment of exclusivity and the transfer of existing exclusive rights--entail transaction costs. The absence of exclusive rights can imply two quite different conditions. The first, just discussed, is that the costs of establishing exclusivity may exceed the perceived benefits attaching thereto. It is here that those who find compelling reasons for volitional exchange will advocate actions that have as their purpose the reduction of transaction costs--in a sense wishing to lower the barriers to individual contracting. But one cannot conclude that the existing situation is one of market failure; in the absence of a market, where it requires the purposeful actions of the state to permit the establishment of market processes (by lowering the transaction costs that now preclude a market), we would be hard pressed to label the status quo as a situation of "market failure" for the simple reason that no market exists. As others have commented, the absence of markets may itself be "optimal" on efficiency grounds [Demsetz].

So we come to the nub of the matter, and that is the structure of entitlements that exist--or are presumed to exist--in situations of joint costs. That is, we must deal with Cheung's second category, which is the legitimacy of any particular negotiation over joint costs. And that legitimacy depends upon the structure of legal entitlements.

THE PROBLEM OF ENTITLEMENTS

Economists, who with evident satisfaction denounce political solutions to resource allocation problems on the ground that such procedures give inordinate weight to a few "influential special interests," are surprisingly uninterested in the observation that bargained (that is, market) outcomes reflect the underlying wealth position of those able to make their interests effective with dollar "votes." The mention of this inconsistency is met with the glib reminder that political matters are quite outside of the powerful body of reasoning to which all informed economists subscribe.[3] Yet economic analysis can only operate within a structure of resource endowments and wealth positions that define the choice domains over which individuals will (can) maximize.

There are really two levels of transactions in a society. The first is concerned with negotiations and bargains over the structure of choice sets. It is here that transactions take place over the "rules of the game." To deny that this is an economic problem is to dismiss the very essence of how the second level of transactions will be circumscribed. For at this prior level of transactions there is a structure of endowments and entitlements, there is a demand for institutional change, there are costs of change as well as benefits, and there are certainly transaction costs.

But, as Arrow reminded us, there seems to be no unambiguous aggregating mechanism whereby the best outcome can be discerned. In the absence of this mechanism, indecisiveness seems to be the alternative to the more comfortable Newtonian order. For most of us the maximizing opportunities present in the second level of transactions prove irresistable to a science more at home with the calculus than with game theory.

The essence of the first level of transactions is negotiation for advantage--the determination of choice (or opportunity) sets. And those who are successful in having their interests (or claims) transformed into rights are thus assured of an income stream into the future; they have acquired property out of a mere claim. More correctly, they now have an entitlement that may be protected by a property rule, by a liability rule, or by inalienability [Bromley, 1978b].

The ability of independent agents to undertake primary transactions over the nature of opportunity sets, or secondary transactions within opportunity sets,[4] requires the prior acquiesence of the state. Recall that even in a democracy the citizens grant to the state--subject to procedural niceties--the power to control the process whereby opportunity sets will be defined, as well as to regulate behavior within those opportunity sets as individuals go about the business of daily living. These opportunity sets are defined by the institutional structure of the society under consideration. That is, entitlements (presumed or actual) derive from the institutional arrangements in place at any given moment.

What are the central concerns of the state as it contemplates the extension to individual entrepreneurs of a franchise to attempt to resolve joint costs? Some would suggest that the state, except in the rarest of circumstances, ought to define the conditions (including property entitlements) that will allow volitional exchange among parties to joint costs [Anderson; Buchanan; Coase; Demsetz]. This preference is based on familiar arguments that bargained exchange among wealth-maximizing agents will produce the largest social dividend. But the franchise raises a number of concerns, particularly in those

instances where uncertainty is present. Indeed the social legitimacy of contracts is intimately bound up with some collective sense--with the state acting as agents for the future--of the relative benefits and costs of individual contracts as opposed to some command solution to joint costs. There is also an equity question; victims of noxious wastes attempting to pay some large chemical company to take its refuse elsewhere. For the moment let us worry only about the so-called "efficiency" effects.

The existence of joint costs presents the state with a necessary choice of attempting to force a resolution, or of leaving it to the parties to work out. I have elsewhere suggested that part of the choice is dependent upon the nature of those joint costs--is the situation one of mere nuisance or are health effects probable? Are the joint costs intermittent or constant? Are there significant third-party effects? Are transaction costs high and likely to remain so, or high and capable of being reduced? Is there a unique damage function? Are irreversibilities present [Bromley, 1978b]? But there is another dimension to this choice and that is the potential costs of making the wrong decision.

When the state grants contracting rights to a variety of economic agents it does so on the assurance that the social dividend will be thus enhanced, and that there is a small risk of immoderate losses. Of course not all societies grant this franchise so willingly, but in the market-oriented countries we find this to be quite prevalent. In such settings joint costs present a special dilemma; so much economic activity is organized through markets (or through market-like arrangements) that to do otherwise is seen as the exception. Good Coasians ask why it is that all joint-cost situations cannot be resolved through volitional bargains. Others offer good reasons why this will not be done, among them being the same reasons why a number of non-environmental relationships do not occur in markets [Okun].

But having decided that volitional exchange is not the appropriate means for resolving problems of acid rain, groundwater contamination, soil erosion, wilderness preservation, hazardous wastes, and other prevalent joint-cost situations, the state is still faced with the problem of what to do. Consider the problem of acid rain. It is well understood that the large number of affected parties--and the very great distances that separate all of them--generally precludes a market-oriented solution from altering the status quo.

The electric utilities would suggest that they have a "right" to burn coal as they wish, and those who claim damages from such action should therefore bear the burden of proof--and the transaction costs--to alter the status quo. But this is not a situation of "market failure" since there is no market present; nor is it possible for a market to exist. Some, opposed to government activity with respect to acid rain, would like to suggest that the absence of a market is itself optimal--that when the benefits of reducing acid deposition finally outweigh the costs of reducing coal emissions (including the transaction costs) then there will be a change. But this position cannot be taken seriously since the legal right to dump potentially harmful matter into the atmosphere has never been granted; current emittors merely have a presumptive right (privilege) while the alleged victims have no rights [Bromley, 1982b].

On the other side of the argument, those who are opposed to any possible damages from acid deposition would claim that they have a "right" to be free of such costs; that is, they presume an entitlement structure. Indeed, the current

debate is over the very nature of the presumed entitlement structure--the victims claiming that they have a "right" to be free from the real (or potential) damages, and the utilities claiming that they have a "right" to generate electricity the cheapest way possible until it is shown that the benefits of control exceed the costs.

This situation is familiar to resource economists--we encounter it in the domain of agricultural chemical use, in soil erosion debates, in concern for rural-urban land conversion, and in other conflicts where the status quo structure of behaviors result in joint costs. The choice problem can be rather paralyzing; in the absence of better information about the long-run implications of prevailing behaviors it may be "wasteful" to insist that such behaviors be altered. And yet it is always those benefiting from the status quo who will seek delays in government action, arguing that more information is required before a correct decision can be taken.

The proponents of change will base their case on the incidence of unwanted costs, while the proponents of the status quo will rest their defense on a benefit-cost analysis that shows the uncertain future benefits of emission reductions to be outweighed by the known and current costs of emission controls. The protagonists are making two quite different arguments. One party is saying joint costs--that is, incidence--matters, the other is saying that there is yet no "market failure" and hence nothing should be done. Economists will usually feel more comfortable with the "market failure" position taken by the utilities since arguments on the incidence of costs and benefits are said to fall outside of the domain of "objective science."

However, "market failure" alone cannot motivate a solution to this problem since there is no production possibility frontier that is everywhere superior to the one that we now occupy [Lang; Mishan, 1969]. Nor is there a feasibility locus in utility space that is unambiguously superior to the one on which we find ourselves. The logic of "market failure" to motivate collective action in such conflicts founders upon an elusive target that assumes a world of perfectability. There can be no failure from an <u>attainable</u> world on efficiency grounds since the status quo finds us on a feasibility locus defined by the technical and institutional realities around us [Graaff]. Of course there is a vector of taxes and bounties that will move us from the status quo, but those taxes and bounties are predicated upon moving us to a perfect (but unattainable) world. Market-celebrating economists are correct to reject government action, but for the wrong reason. Government action is not called for to solve efficiency problems since--given transaction costs--we are already on an efficiency frontier and a feasibility locus. But neither is it correct to claim therefore that "what exists is optimal."

What exists is simply a particular configuration of resource use and outputs that carries with it a vector of costs and benefits--both their magnitude as well as their incidence. And it is the incidence of costs and benefits that motivates public action. As Randall pointed out so well some time ago, the Coasians have themselves an ironic victory; by showing that the allocation of rights has no bearing on efficiency, it can be shown that problems of joint costs reduce to simple incidence problems [Randall]. This, by the way, is what the "policy makers" have been telling us all along.

The primacy of cost incidence places special emphasis on the way in which the decision problem is formulated. Indeed, unlike efficiency analysis where we assume that the beneficiaries can compensate the losers from a particular

policy choice and still retain a surplus--the Kaldor-Hicks condition--incidence analysis focuses immediately on potential winners and losers.

This issue has been discussed by Norgaard and Hall. They show, using a consumption possibility frontier and a social indifference curve (which, unfortunately, they also refer to as a social welfare function), that transaction costs will differentially modify the consumption possibility frontier as between amenities and material goods. Indeed, depending upon the status quo structure of entitlements, that is whether polluters or victims are protected by a property rule, they show that two different output bundles are equally preferred by "society."

One output bundle, following from a restrictive entitlement on pollution, will have more amenities and fewer "material" goods than will another bundle arising from an entitlement structure that is permissive of pollution. Norgaard and Hall conclude that the "composition of output is different even though society is indifferent to the state of the law [p. 255]."

Social indifference curves, as in the Norgaard and Hall analysis, can indeed reveal social indifference between alternative entitlement structures and the output bundles that follow logically from those structures. But it is a mistake to stop here, for social indifference curves simply aggregate over preferences in some mystical way ignoring that some members of society have very strong preferences for material goods, while others have very strong preferences for amenities. It is not incorrect[5] to conclude that "society is indifferent" as between output bundle I and output bundle II, but it begs the central question of how individuals and groups with different interests in those two bundles will work to get their tastes given social sanction. And it is the social welfare function, not the social indifference curve, which reflects that aggregating process [Bromley and Bishop; Mishan 1969].

It is the aggregating property of the social welfare function, indicating who counts, that is required before we can simply dismiss two quite inconsistent output bundles as equally preferred. For it should be clear that we can have either bundle I or bundle II, but not both. How will it be decided that we will have one over the other? Precisely by the primary transactions discussed above. It is here that the economic behavior to influence entitlements--and hence output bundles--will be carried out.

To understand that process, and hence to begin to move toward an analytical treatment of primary transactions, it would seem critical that we pay somewhat more attention to the ways in which individuals view the choices before them. To that we now turn.

THE FRAMING OF DECISIONS

The presumptive rights of the status quo define a particular decision environment and require that any action be judged against that bench mark. Invariably the choice is cast as one of acting now or waiting until more (or better) information is available. That this biases action in favor of the status quo ought to be obvious--for it is always easy to protest that we do not know enough yet to be certain that any policy response would improve things. This attitude has been prevalent in debates over soil erosion, acid rain, hazardous materials, and nuclear power plants.

A benefit-cost analysis of policy choices would properly reckon the probabilities attached to alternative outcomes of pursuing a few distinct policy options. For instance, in the current debates over acid rain policy the options are usually cast in terms of percentage reductions in SO_2 (or NOx), and then one must speculate about the possible impacts on future damages from these alternatives. The concern in such policy is to provide decision makers with an array of choices and to urge adoption of that action with the highest associated expected value. There are, to be sure, several dimensions of risk in such choices.

The first is an engineering risk in that there may be some difficulty with various technological means of reducing SO_2 emissions; each particular technique carries with it an associated performance vector. The second dimension of risk is that a particular emissions regime may have associated with it a wide array of physical damage to lakes, trees, materials, and human health. Part of this problem is due to the lack of knowledge regarding transport of emissions, part is due to the transformation of emissions into undesirable chemicals which then damage valuable objects, and part is due to a lack of knowledge about the utlimate damage to a particular object from a specific dose of deposited chemicals. The third dimension of risk is a lack of good information regarding values that citizens will assign to the various resources potentially at risk by the continued deposition of acids.

Engineers are at work on the technical dimension, biologists are at work on the second dimension, and economists are at work on the third. And yet all of this research seems quite unfulfilling to a policy maker contemplating angry constituents--some who want immediate action, while others insist that government stay out. One obtains the impression that policy makers want all of this information, yet they seem hesitant to take those decisions that seem to make the most sense to the separate disciplines. Indeed, economists feel particularly frustrated about the policy outcomes [Brandl, Buchanan and Tullock].

The reasons, I submit, have to do with several dimensions of the choice process that we either do not understand, or choose to ignore. The first of these, discussed at length above, concerns the venerable distinction between doing what is "efficient" as opposed to making decisions on the basis of the incidence of costs and benefits. Politics is incidence, and so public policy is incidence policy.

The second dimension concerns the distinction between monetary and non-monetary values. While in recent times there has been a greater political demand for the determination of monetary values as regards amenities and recreational resources, there is still a great reluctance to base decisions on such monetary imputations. Such imputed values inform the decision process, but they will rarely drive it.

The final aspect of the decision process is that public decision makers seem disinclined to regard losses and gains symmetrically. That is, the "expected value" decision maker will choose the action that produces the greatest expected payoff, while the decision maker concerned to "minimize maximum regret" will choose the action that promises the smallest expected opportunity loss. Under conventional treatments of risk analysis the expected payoff is but the obverse of the expected opportunity loss. However this is a symmetry of theory that contradicts empirical reality.

Recent developments in the theory of risk analysis provide some promise for resource economists concerned with this critical problem of choice [Kahneman and Tversky; Tversky and Kahneman]. In prospect theory one can find a richer arena in which to consider the complex decision problems of environmental policy. Prospect theory partitions the decision problem into two parts: (1) framing the actions, outcomes, and contingencies; and (2) evaluating the choices to be made. The experiments of Kahneman and Tversky, along with those of a number of other researchers, confirm that people do not behave as expected utility theory predicts that they would.

In an illustration of the "certainty effect", Kahneman and Tversky found that 80 percent of their respondents preferred a sure gain of 3,000 to the following choice: a 4,000 gain with probability of 0.8 or a zero gain with probability of 0.2. The value of the sure thing is 3,000 while the expected value of the gamble is 3,200. Yet the sure thing was the dominant choice. When concerned with losses as opposed to gains they found the opposite effect. That is, a sure loss of 3,000 was preferred by only 8 percent of the respondents, while the following gamble was preferred by 92 percent: a 4,000 loss with probability 0.8, or a zero loss with probability of 0.2. In the positive domain the certainty effect contributes to risk aversion so that a sure gain is taken rather than a larger, but probable, gain. In the negative domain the certainty effect leads to risk-seeking preferences for a probable loss over a smaller--but certain--loss.

This distinction between the positive and negative domains is relevant for environmental policy because, unlike conventional investment analysis, here expenditures are being undertaken to protect against probable losses; it is critical to understand that expected payoffs from productive investments differ from expected opportunity losses from failing to make defensive investments. Consider the choices studied by Kahneman and Tversky. To keep the problem tractable let us assume away the uncertainty that relates to the biological dimension of acid rain. That is, assume that we present the policy maker with a fairly simple choice problem:

A. do nothing about acid rain and suffer certain losses in habitat valued at 3,000; or

B. install engineering devices that precipitate out acid precursors. If this action is taken there are two possible outcomes:

   1. there is an 80 percent probability that the devices will not work and we will lose the cost of the devices plus the habitat for a total loss of 4,000; or

   2. there is a 20 percent probability that the devices will work and our net losses, after paying for the devices, will be zero.

Here we have a decision problem very much like the one studied by Kahneman and Tversky. The value of the gamble in the Kahneman and Tversky experiment indicated that 92 percent of the respondents preferred option B (the control strategy in my example) to option A (do nothing about acid rain). Expected utility theory would predict that the respondents would prefer option A (do nothing about acid rain) since it has the lowest expected-valued loss. In fact, their respondents were risk seeking in the domain of losses in the hopes

of hitting the 20 percent chance of no loss. It seems reasonable to suppose that this risk preference when facing losses would be even more pronounced when environmental resources are at stake.

In the above choices there was a sure loss if nothing was done, and a fairly high probability of a loss if action were taken. In another experiment Kahneman and Tversky offered the following choices regarding possible losses:

A: 6,000 with 45 percent chance, and zero with 55 percent chance;

or B: 3,000 with 90 percent chance, and zero with 10 percent chance.

In both instances the value of the gamble is the same (an expected loss of 2,700) and yet their respondents favored option A by 92 percent to 8 percent. If we again imagine this to be an acid rain problem, it is not hard to see that option A (some control strategy that still has only a near 50-50 chance of reducing losses) might be quite preferred even though its expected value is identical to the do nothing option (B).

By discussing prospect theory I am not suggesting that the public favors doing something about acid rain (though it may). The purpose here is to illustrate that risk aversion and risk seeking have been found to have different dimensions when choices involving gains are compared with choices involving losses. In a prospect offering gains of the same magnitudes as the above losses, Kahneman and Tversky obtained an exact reversal of the above findings; 80 percent of their respondents preferred a sure 3,000 to an 80 percent chance at 4,000, even though the expected value of the latter choice is greater.

Public policy is often characterized as a process of minimizing losses as opposed to actions that will maximize gains. For such objectives policy makers are often castigated as "irrational" or wasteful. Yet it may well be that the very essence of social policy is as found in the above experiments. That is, we are willing to gamble to avoid certain losses, but we are risk averse in the domain of gains, preferring a certain gain to a chance at a much larger one.

Resource economics would seem to benefit from a more thorough consideration of prospect theory where this risk-seeking behavior to avoid losses could be given conceptual as well as empirical content. The Minimax Regret Decision Criterion from expected utility theory is one that addresses the difference between the payoff from the correct decision and the payoff from the actual decision. Because of the presence of irreversibilities in many resource choices it is reasonable to suppose that most policy makers--just as with most respondents in the Kahneman and Tversky experiments--clearly reject the formal equality of the expected value of gains and losses and would choose a strategy that would minimize their maximum regret. While under conventional assumptions that seems equivalent to choosing so as to maximize expected benefits, prospect theory suggests otherwise.

ON KNOWLEDGE, DISCIPLINES, AND PROBLEMS

I would suggest that there are three general phases in the evolution of natural resource economics. The first phase was concerned with the role of natural resources as factors of production. Economists began to build upon the Ricardian and Marshallian views of land, and then to elaborate that to other naturally occuring assets. This "production phase" was cast in Edgeworthian terms, and the economic question was one of how to use natural resources efficiently. The assumption was required that such resources were definable in discrete units, and that property arrangements (entitlements) were not in doubt. Because these premises held for land, we soon saw land combined with capital, management, and labor as inputs to be adjusted following the principle of equimarginal returns.

The second phase in the evolution of resource economics was concerned with the general failure of market processes to allocate efficiently a variety of natural resources, including land. Resource economists then became concerned with the variety of remedial actions that might be taken to rectify the observed flaws in the systems of atomistic exchange. More often than not these flaws arose because of the physical nature of many resources that precluded their discrete demarcation and ownership. Economists dealt with taxes, subsidies, unitized firms, omniscient controllers, and Walrasian auctioneers. This phase also coincided with an active federal effort to invest in natural resource projects (irrigation, transportation, recreation, hydro-electric production), and so benefit-cost analysis was frequently used to evaluate these actions.

The burden of this paper has been to argue that we are now on the threshold of a third phase in resource economics, one that will be primarily concerned with "situational conflicts" as opposed to general efficiency phenomena. It seems to me that confrontation and conflict will predominate among resource economics problems, and that the essence of that conflict will be over presumed (or actual) rights and duties on the part of those bearing joint costs. The legitimacy of existing resource uses will be challenged by those bearing unwanted costs, and the legitimacy of such challenges will be argued by those now well served by the status quo.

Resource economics will become more pragmatic, more concerned with problem solving, more empirical, and even more concerned with the development of concepts to address the emerging situational conflicts. I believe that we will be called upon to offer better conceptual guidance regarding the critical distinction between efficiency and social optimality. There <u>are</u> obvious inefficiencies that can be avoided in the design of bargaining arenas, as well as in the design of government programs that facilitate, induce, or require certain actions.

National-level (federal) programs will diminish in importance as we move away from irrigation and other large projects. Such programs will be replaced by local-level resource management, largely dominated by efforts to resolve problems of locally incompatible uses. Natural resource economics will become more explicitly--but conditionally--normative. However that will not threaten its standing as a science, for independent scientists can still assess outcomes within the conditional environment set down by the larger political context; one can certainly be objective about recording the incidence of costs and benefits, about explaining cause and effect, and about predicting alternative futures.

This evolution in problem focus and in methods can be understood as a logical extension of the long-term maturation in economic epistemology. Following the definitive review by Castle, et al, we can identify three distinct lineages to the contemporary discipline of resource economics. The first vein traces its roots to the early rationalists, Descartes, von Leibniz, and Spinoza. The rationalists believed that reason alone--unaided by experience--was sufficient to understand the world around them, and to arrive at basic truths about that world. Rationalism holds that one can logically deduce truth from "self-evident" premises; rationalism stands opposed to empiricism as a source of knowledge about the world, as well as on methods of verifying knowledge. Castle, et al, follow the rationalists through classical and marginalist thought in economics, and on into welfare economics--which stands as an attempted synthesis of marginalist and collectivist ideas. It is the deductive, predictive, and standard-setting dimensions that differentiate the rationalists from others in the economic family; there is little interest in problem solving, rather the knowledge base itself is the theatre of interest. This line of thought is referred to as the classical.

The second line is said to be the positivists, with Francis Bacon standing as the intellectual father, and with August Comte being given credit for its fullest development. Positivists were less interested in explaining phenomena than they were in simply describing the phenomena experienced. Unlike the classical lineage, the positivists were not as concerned with setting standards of performance such as improving national income. Rather, the positivists approved of a reasoned and theoretical approach to problems. Logical positivism is the latter-day version, with its attempt to model philosophy after mathematics and the natural sciences. It had as its purpose the transformation of philosophy from a speculative enquiry into an analytical one. The logical positivists believed that the meaning of a statement could only be determined by tests that applied empirical observations; it was scientific empiricism. The logical positivists maintained that statements which could not be confronted with empirical evidence were simply outside of the pale of science--or more seriously, were without any meaning. Castle, et al, regard its practioners as inductive empiricists. George Warren of Cornell would be an early agricultural economist of the positivist school.

The third line of descent is referred to as the pragmatists, deriving from Veblen and the German historical school; it has its philosophical roots in Pierce and Dewey. Methodologically the pragmatists were empiricists, though less systematically so than the positivists. Pragmatism is unashamedly problem oriented, and hence is explicitly normative, although it embraces theory in its formulations. Richard T. Ely, John R. Commons, Henry Taylor, Benjamin Hibbard and George Wehrwein were early land economists of the pragmatist school at Wisconsin.

To summarize, the rationalists--on which much of neoclassical economics is based--were knowledge, not problem, oriented. They adhered to formal deductive systems of thought, and were, for the most part, concerned with non-normative prediction. The positivists were pure empiricists, were inductive, and were also interested in non-normative prediction. In contrast to the rationalists, the positivists were less interested in knowledge for knowledge's sake. Finally, the pragmatists were principally problem oriented, strongly empirical, and explicitly normative.

Castle, et al maintain that these three lines merged during the 1920's to constitute land economics, which then evolved into what we now consider to be resource economics. But that merging cannot conceal the tensions that remain between a discipline that is pulled in one direction toward problem-solving work, and in another direction toward knowledge-oriented work. In modern usage, this is the tension between "applied" and "basic" work.

The contemporary preoccupation of resource economists with respect to deductive versus inductive, and "positive" versus "normative" can be understood as part of this struggle. The relevance of this for the current discussion is that it is the pull of "objectivity" that attracts resource economists to the "knowledge" side of the matter, while it is the desire to be relevant to important public policy issues that attracts us to the "problem" side.

Contemporary resource economics will be confronted by this choice with increasing frequency. The growth of scientific knowledge now allows, indeed, forces us to recognize causality in the world around us. Yet such certitude, or the relocation of the responsibility for events from the domain of "acts of God" to the domain of human action, brings with it the realization that something must be done. It is out of this causal link that liability is determined, and it is thus that the existence of joint costs becomes a policy variable.

In the absence of scientific knowledge about toxic chemicals, about cedar rust, about asbestos and lung problems, about soil erosion and off-site problems with fish and aquatic life, about coal dust and black-lung disease, and about mercury and brain functions, we would face a situation in which the victims simply accepted the status quo as inevitable. However, the role of new knowledge is to reduce the unexplained variation in the human condition, and to permit the establishment of cause for unwanted circumstances. But, having linked seemingly unrelated events, it is then the policy problem to resolve the conflict.

That policy process will engage resource economists to the extent that we are willing and able to operate in a decision environment that is clearly political in nature. It would seem that our skills will be of increasing relevance in the domain of primary--as opposed to secondary--transactions as described earlier. This domain of political economy would take us back to the general origins of economics. It would also require that we acquire a deeper understanding of the theory of the state, and the implications of that theory for economic decisions [Bromley, 1976]. In the absence of these changes in our perspective I worry that resource economics will become increasingly irrelevant to a world of political conflicts over joint costs.

BIBLIOGRAPHY

Anderson, Terry L., "The New Resource Economics: Old Ideas and New Applications," American Journal of Agricultural Economics 64(1982):928-34.

Bator, Francis M., "The Anatomy of Market Failure," Quarterly Journal of Economics 72(1958):351-79.

Bator, Francis M., "The Simple Analytics of Welfare Maximization," American Economic Review 47(1957):22-59.

Brandl, John E., "Distilling Frenzy from Academic Scribbling: How Economics Influences Politicians," Journal of Policy Analysis and Management 4(1985):344-53.

Bromley, Daniel W., "Markets and Externalities," in Natural Resource Economics: Policy Problems and Contemporary Analysis, ed. by Daniel W. Bromley, Hingham, Mass.: Kluwer-Nijhoff Publ., 1985. Chapter 3.

Bromley, Daniel W., "Land and Water Problems; An Institutional Perspective," American Journal of Agricultural Economics 64(1982a):834-44.

Bromley, Daniel W., "The Rights of Society versus the Rights of Landowners and Operators," in Soil Conservation Policies, Institutions, and Incentives, ed. by: Harold G. Halcrow, et. al., Ankeny, Iowa: Soil Conservation Society, 1982b. Chapter 10.

Bromley, Daniel W., "Externalities, Extortion, and Efficiency: Comment," American Economic Review 68(1978a):730-35.

Bromley, Daniel W., "Property Rules, Liability Rules, and Environmental Economics," Journal of Economic Issues 12(1978b):43-60.

Bromley, Daniel W. and Richard C. Bishop, "From Economic Theory to Fisheries Policy: Conceptual Problems and Management Prescriptions," in Economic Impacts of Extended Fisheries Jurisdiction, ed. Lee G. Anderson (Ann Arbor: Ann Arbor Science Publ., 1977), Chapter 15.

Bromley, Daniel W., "Economics and Public Decisions: Roles of the State and Issues in Economic Evaluation," Journal of Economic Issues 10(1976):811-38.

Buchanan, James M., and Gordon Tullock, "Polluters' Profits and Political Response: Direct Controls versus Taxes," American Economic Review 65(1975):139-47.

Buchanan, James N., "Politics, Property and the Law: An Alternative Interpretation of Miller et al. v. Schoene," Journal of Law and Economics 15(1972):439-452.

Buchanan, James M., and William C. Stubblebine, "Externality," Economica 29(1962):371-384.

Castle, Emery N., Maurice M. Kelso, Joe B. Stevens, and Herbert H. Stoevener, "Natural Resource Economics, 1946-75," in: A Survey of Agricultural Economics Literature, Vol. 3, ed. by Lee Martin, Minneapolis: University of Minnesota Press, 1981.

Cheung, Steven N. S., "The Structure of a Contract and the Theory of a Non-Exclusive Resource," Journal of Law and Economics 13(1970): 49-70.

Chipman, J. S. and J. C. Moore, "The New Welfare Economics,1939-1974," International Economic Review 19(1978):547-84.

Coase, Ronald, "The Problem of Social Cost," Journal of Law and Economics 3(1960):1-44.

Cooter, Robert and Peter Rappoport, "Were the Ordinalists Wrong About Welfare Economics?," Journal of Economic Literature, 22(1984):507-30.

Dahlman, Carl J., "The Problem of Externality," Journal of Law and Economics 22(1979):141-162.

Demsetz, Harold, "Toward a Theory of Property Rights," American Economic Review 57(1967):347:359 (Papers and Proceedings).

Graaff, J. de V., Theoretical Welfare Economics. London: Cambridge University Press, 1967.

Hirsch, Fred, Social Limits to Growth. Cambridge: Harvard University Press, 1978.

Kahneman, Daniel and Amos Tversky, "Prospect Theory: An Analysis of Decision under Risk," Econometrica 47(1979):263-91.

Krueger, Ann., "The Political Economy of the Rent-Seeking Society," American Economic Review 64(1974):291-303.

Lang, Mahlon George, "Economic Efficiency and Policy Comparisons," American Journal of Agricultural Economics 62(1980):772-77.

Mishan, E. J., "The Economics of Disamenity," Natural Resources Journal 14(1974):55-86.

Mishan, E. J., Welfare Economics: An Assessment. Atlantic Highlands, N.J.: Humanities Press, 1969.

Norgaard, Richard B. and Darwin C. Hall, "Environmental Amenity Rights, Transactions Costs, and Technological Change," Journal of Environmental Economics and Management 1(1974):251-67.

Okun, Arthur M., Equality and Efficiency: The Big Tradeoff, Washington: The Brookings Institution, 1975.

Pigou, A. C., The Economics of Welfare, London: Macmillan, 1962.

Randall, Alan, "The Problem of Market Failure," Natural Resources Journal 23(1983):131-48.

Randall, Alan, "Coasian Externality Theory in a Policy Context," Natural Resources Journal 14(1974):35-54.

Samuels, Warren J., "Welfare Economics, Power, and Property," in Law and Economics, ed. by: Warren J. Samuels and A. Allan Schmid, Boston: Martinus Nijhoff, 1981.

Samuels, Warren, "The Interrelations Between Legal and Economic Processes," Journal of Law and Economics 14(1971):435-450.

Tversky, Amos and Daniel Kahneman, "The Framing of Decisions and the Psychology of Choice," Science 211(January 1981):453-58.

Wolf, Charles, Jr., "A Theory of Non-Market Failure: Framework for Implementation Analysis," Journal of Law and Economics 22(1979):107-140.

Footnotes

1. While external effects can also be beneficial, I will restrict my comments here to negative external effects.

2. These costless lump-sum redistributions will redefine a new bundle of outputs which, graphically speaking, define a new Edgeworth space within the same production possibility frontier. Each new Edgeworth domain and its corresponding contract curve gives us a new efficiency locus in utility space.

3. This point is made nicely in Brandl.

4. What Samuels calls voluntary and volitional freedom [1981].

5. On reflection it may indeed be incorrect. If tastes and preferences are reflective of the prevailing institutional set-up and the output bundle emanating therefrom, then it seems only reasonable to suppose that social indifference curves are not invariant with respect to the very things under discussion here.

DEVELOPMENTS IN ECONOMICS OF IMPORTANCE TO AGRICULTURAL ECONOMICS

Rulon D. Pope

ABSTRACT

The Journal of Economic Literature is used to delineate some recent changes in focus in economics. Rapidly growing research areas of the last decade are identified. To mention some, labor/deomgraphics, macro and money, industry studies, uncertainty and game theory, and financial economics were among the leaders. These are briefly reviewed and the conclusions drawn are: (1) micro/business/ fields seem to be declining in research importance, (2) the greatest growth areas seem to have come from extending the boundaries of economic inquiry and understanding better how markets work - particularly how they assimilate information and aggregate diverse beliefs, and (3) choice under uncertainty involving strategic and non-strategic behavior has been very important and controversial. All of these areas seem to be fundamentally important to agricultural economists.

I. INTRODUCTION

The title of this paper is indeed ambitious and far exceeds my abilities to synthesize. Nonetheless, hopefully a very modest vehicle can be instrumental for stimulation of thought and discussion in this area.

Of necessity, I will be very selective and no attention will be devoted to referencing agricultural economics literature which might be directly or tangentially related to my assignment. It seems a very difficult task to communicate even a small portion of the ideas in the literature. Thus, I will concentrate on pointing to the literature and my impressions of its value.

By definition, the forecast is subjective. Interestingly, a very large debate in economics comes directly to bear on this subject. If I or you were able to forecast which areas of economics will be important to agricultural economics, then entry should occur with the accompanied rents captured by early entrants. Certainly, my own rent seeking behavior would prevent my telling you the truth free. Thus, my own behavior and the perfect markets literature might suggest that my forecast has little value.

Further, one might also inquire whether my forecase is adaptive or rational or any of the other plethora of methods used to "expect". Clearly for at least the adaptive case, present and lagged quantities are important for the forecast. For this reason, the next section begins with a review of some recent changes in emphasis in economics. It should be stressed that these marginal changes do not indicate total productivity. Indeed, I suspect that rather accepted and

The author is an Associate Professor in the Department of Economics, Brigham Young University.

standard models of demand and supply will continue to be "bread and butter" tools for agricultural economists in the foreseeable future. Yet, I suspect one will see significant refinements of these (e.g., Varian, 1984b).

II. THE RECENT PAST

A simple and hopefully useful way to assess changes in economic knowledge is to use the JEL, (Journal of Economic Literature). One could use the surveys or an analysis of bibliographic entries or readership of particular journals. Consider the entries in Table 1 which are journal publications for the journals covered by the JEL for various broad areas of economics for two time periods, 1974 and 1984. Though one worries some about possible administrative changes and the sample periods, I believe the entries indicate the changes that have and are occurring for these broad categories. 1/

Microeconomic theory articles exceed those in macroeconomics (22,23) but macroeconomics has had the largest growth rate. In other general areas, social

TABLE 1

Research Publications in the JEL

Classification Number	Classification Title	----Year---- 1974	1984
11	General Economics	152	84
12	Teaching of Economics		New (40)
20	General Economic Theory	24	41
21	General Equilibrium Theory	63	87
22	Microeconomic Theory	411	506
23	Macroeconomic Theory	198	310
24	Welfare Theory	238	211
25	Social Choice; Bureaucratic Performance	70	225
26	Econ. of Uncertainty & Info.; Game Thy. & Bargaining Thy.		New (136)
27	Economics of Centrally Planned Economies		New (88)
31	History of Economic Thought	162	264
36	Economic Methodology	31	48
41	Econ History: General	33	19
42	North America	132	140
43	Ancient & Medieval	7	12
44	Europe	64	161
45	Asia	23	17
46	Africa	4	4
47	Latin America & Caribbean	4	21
48	Oceania	18	10
50	Economic Systems	1	10
51	Capitalist Economic Systems	51	168
52	Socialist & Communist Economic Systems	138	103
53	Comparative Economic Systems	16	11
111	Economic Growth Theory & Models	124	43
112	Economic Development Models & Theories	115	174

Table 1 (continued)

Classification Number	Classification Title	----Year---- 1974	1984
113	Economic Planning Theory & Policy	191	99
114	Economics of War, Defense, & Disarmament	18	41
121	Economic Studies of Developing Countries	217	110
122	Economic Studies of Developed Countries	67	40
123	Comparative Studies (Developed & Developing Countries	48	24
124	Economic Studies of Centrally Planned Economies		New (56)
131	Economic Fluctuations	39	107
132	Economic Forecasting & Econometric Models	119	104
133	General Outlook & Stabilization Theories & Policies	204	196
134	Inflation & Deflation	166	251
211	Econometric & Statistical Methods & Models	311	350
212	Construction, Analysis & Use of Econometric Models	44	91
213	Mathematical Methods & Models	66	44
214	Computer Programs	13	5
220	Economic & Social Statistic Data & Analysis	3	38
221	National Income Accounting	119	144
222	Input-Output	31	31
223	Financial Accounts	11	11
224	National Wealth & Balance Sheets	12	14
225	Social Indicators & Social Accounts	7	13
226	Productivity & Growth: Theory & Data	24	85
227	Prices	44	76
228	Regional Statistics	6	10
229	Microdata	41	0
310	Domestic Monetary & Financial Theory & Institutions	0	16
311	Domestic Monetary & Financial Theory & Policy	331	546
312	Commercial Banking	155	232
313	Capital Markets	282	383
314	Financial Intermediaries	58	51
315	Credit to Business, Consumer, etc.	71	74
320	Fiscal Theory & Policy; Public Finance	0	28
321	Fiscal Theory & Policy	198	260
322	National Government Expenditures & Budgeting	58	95
323	National Taxation & Subsidies	213	309
324	State & Local Government Finance	98	125
325	Intergovernmental Finance Relationships	25	34
400	International Economics	0	20
411	International Trade Theory	139	163
420	Trade Relations; Commercial Policy; Internat. Econ. Integ.	0	21
421	Trade Relations	111	245
422	Commercial Policy	119	136

Table 1 (continued)

Classification Number	Classification Title	----Year---- 1974	1984
423	Economic Integration	104	80
430	Balance of Payments; International Finance	0	3
431	Balance of Payments; Mechanisms of Adjustment; Exchange Rates	170	333
432	International Monetary Arrangements	96	85
433	Private International Lending	0	21
441	International Investment & Capital Markets	65	54
442	International Business	114	94
443	International Aid	45	96
500	Administration; Business Finance; Marketing; Accounting	2	1
511	Organization & Decision Theory	94	57
512	Managerial Economics	79	104
513	Business & Public Administration	101	56
514	Goals & Objectives of Firms	36	24
520	Business Finance & Investment	1	18
521	Business Finance	128	128
522	Business Investment	113	116
531	Marketing & Advertising	149	90
541	Accounting	102	93
610	Industrial Organization & Public Policy	1	1
611	Market Structure: Industrial Organization & Corp. Strategy	176	280
612	Public Policy Toward Monopoly & Competition	89	72
613	Public Util. & Gov. Teg. of other Ind. in Private Sector	91	114
614	Public Enterprises	10	73
615	Economics of Transportation	86	107
616	Industrial Policy		New (67)
621	Technological Change; Innovation; Research & Development	120	234
630	Industry Studies	57	104
631	: Manufacturing	217	353
632	: Extractive Industries	71	88
633	: Distributive Trades	36	32
634	: Construction	10	21
635	: Service & Related Ind.	147	262
636	Nonprofit Industries: Theory & Studies		New (8)
710	Agriculture	73	54
711	Agricultural Supply & Demand Analysis	157	128
712	Agricultural Situation & Outlook	18	22
713	Agricultural Policy, Domestic & International	96	150
714	Agricultural Finance	14	39
715	Agricultural Marketing & Agribusiness	32	69
716	Farm Management; Allocative Efficiency	40	96
717	Land Reform & Land Use	71	66

Table 1 (continued)

Classification Number	Classification Title	----Year---- 1974	1984
718	Rural Economics	31	89
720	Natural Resources	0	3
721	National Resources	109	158
722	Conservation & Pollution	133	119
723	Energy		New (252)
731	Economic Geography	22	36
800	Manpower; Labor; Population	0	4
811	Manpower Training & Development	47	25
812	Occupation	41	55
813	Labor Force	72	105
820	Labor Markets; Public Policy	0	3
821	Theory of Labor Markets & Leisure	141	241
822	Public Policy; Role of Government	77	103
823	Labor Mobility; National & International Migration	59	56
824	Labor Market Studies, Wages, Employment	269	478
825	Labor Productivity	44	73
826	Labor Markets; Demographic Characteristics	25	66
830	Trade Unions; Collective Bargaining; Labor-Mgmt. Relations	0	10
831	Trade Unions	42	116
832	Collective Bargaining	52	68
833	Labor-Management Relations	42	91
841	Demographic Economics	136	277
851	Human Capital	96	60
910	Welfare Health & Education	0	15
911	General Welfare Programs	48	44
912	Economics of Education	99	73
913	Economics of Health	73	154
914	Economics of Poverty	47	42
915	Social Security	34	67
916	Economics of Crime	24	72
917	Economics of Minorities; Economics of Discrimination	94	162
918	Economics of Aging	0	New (21)
921	Consumer Economics; Levels & Standards of Living	168	329
930	Urban Economics	0	11
931	Urban Economics & Public Policy	139	93
932	Housing Economics	79	134
933	Urban Transportation Economics	31	16
941	Regional Economics	330	249

Source: Issues of the Journal of Economic Literature for 1974 and 1984.

choice and uncertainty and game theory (25,26) have had a very rapid growth rate while general equilibrium theory has stagnated (2).

As to specific areas, the following had growth rates approaching 200%: selective areas of economic history (e.g., 44) capitalistic systems (51), defense economics (114), business cycles (131), construction and use of econometric models (212), economic and social data (220 and 225), productivity and growth data (226,227), banking theory and policy (310,311,312), public finance: fiscal policy (320), trade relations and policy (421,422), international finance and aid (431,433,443), industrial organization and policy (611,616), economics of public enterprises (614), industrial studies (630,631,632,635,636), rural economics and agricultural finance (714,718), farm management, marketing and agribusiness (715,716), energy (723), labor studies (824,825,826,831,833), demographic economics (841), health economics (913), social security and aging (915,918), crime (916), discrimination (917), and consumer and housing economics (921,932).

Several areas declined. Among them are: growth, planning theory and policy (111,113), developing country studies (121,122,123), forecasting (132), mathematical methods and models (213), international investment and capital markets (441), organization and decision theory (511), business and public administration (513), marketing, advertising and accounting (531,541), antitrust (612), agricultural supply and demand (711), land reform (717), manpower (811), welfare programs (911), education (912), urban economics and policy (931,933), and regional economics (941).

In absolute terms, micro and macro theory, econometrics, money and capital markets, international exchange rates and balance of payments, taxes and subsidies, manufacturing studies, (and to a lesser extent, industrial organization), labor and consumer studies and all have entries exceeding 300 in 1984 and would seem to have an especially prominent place in economic inquiry.

In examining the above data, it seems that a few conclusions are in order. First, macroeconomic fields including money and international macro studies have boomed. Another high growth industry is demographics. Apparently one of the driving forces behind this growth is the new family economics as one peruses the titles of papers. Related growth fields involve issues of policy involving labor, social security and aging, and health, and finally industrial organization and industry studies have grown substantially. This latter group includes many studies from the Journal of Law and Economics. Finally, one sees reduction in many abstract fields of theory and more micro business related activities such as business finance, marketing, accounting, and administration.

In nearly every case, I believe that it is clear that research has responded to data and social needs. For example, the emphasis on demographics, aging, saving and social security, and health seem to be linked to changes in fertility, gender changes in the labor market, changes in the number of cohorts in various age groups (such as overall aging) and the accompanying policy dilemmas regarding taxation and the provision of health care. Similarly, the decline or stagnation of growth or general equilibrium theory may be due to a paucity of interesting disciplinary or social problems in these areas or the inability of the theory to provide meaningful insights (take your pick I prefer the latter). On the other side, game theory and uncertainty have ascended because they shed light on many observed behaviors. Therefore, I would maintain that in the long run the theory (concepts) and measurement tools useful to agricultural economics will be those which are instrumental to understanding behavior. 2/ Further, it is unclear whether, one can look to the mother discipline to provide many

management or administrative tools. These seem to fall on the other side in the demarcation between business and economics.

III. RATIONAL EXPECTATIONS AND EFFICIENT MARKETS

The rapid rise in macroeconomics and finance is traceable in many respects to a few economic events and intellectual stimuli. The stagflation of the 1970's, the apparent impotence of stabilization policies, and the move to floating exchange rates were key events. The intellectual genesis of the resurgence was due to work by Friedman, Muth, and Lucas with the latter considered the dominant figure. Lucas created an equilibrium model of the business cycle based upon intertemporal substitution of labor when most heretofore business cycle models presumed disequilibrium.

One might summarize one result from Lucas's work by

$$(1) \quad y_t = y_p + b\, e_t$$

where y_t is actual output and y_p is full employment output, 3/ e_t is the forecast error by the public of the money stock, and b is a constant. Thus, money forecast errors can affect actual output but if the money stock is fully anticipated then there is no effect of money growth on real output.

Lucas's work has been extremely influential and I think a fair assessment of its import is given by Tobin (no great fan of monetarism):

> "The ideas of the second counter-revolution are too distinctive and too powerful to be lost in the shuffle. They are bound to shape whatever orthodoxy emerges. The durable ideas are more methodological than substantive-internally consistent derivations of rational expectations and rational behavior embodied in the structural equations of a general equilibrium macroeconomic model. These ideas are already being mobilized to explain the causes of informational imperfections, long term contracts and other commitments, incompleteness of capital markets. . .".

Thus, Tobin views this work as contributing mainly to methodology. Indeed, if anticipated policy has no real effects, then one might guess that contracts overlapping through time and other institutional features regarding information might be important explanations of the business cycle (Fischer). Thus, a rather new institutional economics has been spawned.

Since, macro is the subject of another paper in this conference, I would like to discuss the micro or price theoretic implications of Lucas's work. First, one must acknowledge that Lucas almost singlehandedly, by including the concept in his work which was widely read, is responsible for the interest in rational expectations though Muth originally proposed the idea. An agricultural economic genealogy might be helpful. First, Nerlove improving on others' work, substantially altered agricultural economics by proposing and popularizing the adaptive expectations (and partial adjustment) models of supply and demand response. The profound impact of this contribution is documented by Askari and Cummings. The research focuses on the right issue: decisions involve uncertainty and one must make these decisions by forecasting future states of nature. Yet any one who has used these models knows of many inherent weaknesses such as persistent biased expectations of price. Thus, in principle, the adaptive expectation method (with a cob-web as a special case) can lead to considerable stupidity on the part of economic agents. However, these methods have now had a long and successful contribution in studying agricultural markets.

It is interesting that agricultural commodities were cases mentioned in the literature where rational expectations were seen as reasonable. To illustrate the basic notion, Muth posited that it was irrational for individuals to persist in beliefs which might not be consistent with the process generating the random variable, say price. Thus, Muth posited as a positive economic proposition that the rationally expected price is the conditional expectation of the reduced form of an economic model. To illustrate, let demand be of the form

$$(2) \quad q_t = b_0 + b_1 p_t + b_2 y_t + e_t$$

where the b's are parameters, p_t is own price at time t and q is the corresponding quantity demanded, y_t is income, and e_t is an iid random disturbance. Supply is also conventionally defined by

$$(3) \quad q_t = c_0 + c_1 p_t + c_2 z_t + u_t$$

where p_t is an expected price at time t-1 which would occur at time t, the c's are parameters, z is an exogenous variable and u_t is an iid disturbance. The rationally expected price is $E(p_t | I_{t-1})$ where I_{t-1} is the information available at t-1. Thus, since the model is assumed to contain all information,

$$(4) \quad {}_{t-1}p_t = [(c_0 - b_0) + c_2 \, {}_{t-1}z_t - b_2 \, {}_{t-1}y_t][/(b_1 - c_1)$$

where the double subscripts denote predicted values (Eckstein). For example, ${}_{t-1}z_t$ is the predicted value of z given information available at t-1. Thus, rational expectations requires that the market behaves as if it knows the parameters (b's and c's) as well as unbiased predictions of exogenous variables (z and y). Wallis and others have suggested that the exogenous variables could be predicted by time series methods. Thus, rational expectations can be viewed as giving structure to distributed lag models in the exogenous variables. 4/

There have been many attacks on rational expectations including that the expectation in (4) should be based on an objective notion rather than on subjective distributions. A difficulty for researchers is that one is ultimately lead to explanations of market behavior in order to obtain expected price even if one wishes to study a region, state or country. Rather than list all potential problems here, I think that as a concept Lucas and others have successfully launched it to supremacy (Sheffrin). Expectations of the future should be forward looking and based upon the process which generates the random variable.

There is one issue that is particularly relevant for agricultural economists. Might the futures market form a rationally expected price thus destroying the need for all of the machinery indicated in (4). Indeed, it would be if equation (4) is the reduced form for the futures market at planting time. Arbitrage arguments may lead one to believe that this is so. Empirically, it seems that there is some evidence that the futures market does not contain any more predictive power than rationally expected prices (Sheffrin) but this seems to beg the issue raised above. Ultimately, this issue will be resolved by empirical work. However, a rational expectations model with inventories and government programs is substantially different than the one indicated above and there is every reason to suspect that the two expectations are different. In any event, it seems that rational expectations is and will continue to be important research agenda in agricultural economics for some time.

The Lucas Econometric Critique

A second contribution by Lucas which has relevance to agricultural economists deals with the stability of econometrically estimated parameters. The argument was first posed as a cost of adjustment model in which Lucas argued that all parameters in a distributed lag model really included prices and thus were not stable (Lucas). In a more recent attack, the issue is raised more subtly and deals directly with dynamic policy. With rational expectations, expectations of

say price depend upon expected government policy. This is seen by interpreting weather as a government variable in equation (4). The actual future may not be known with certainty but suppose that the policy can be written as a mathematical rule with noise. For example, target price adjustments may be linearly related to the difference between income and some target income. In such case, a change in the rule (parameters of the equation) will alter the coefficients of the supply equation, (3), because the form of expectations change. Thus, existing parameter estimates could not be used to forecast the impact of a policy rule change. This criticism seems valid and with the change in agricultural policy rules every few years, the criticism may be especially relevant. Acknowledging the validity of this criticism will hopefully cause policy analysts to build a more fundamentally consistent model of behavior under uncertainty or lead to research which demonstrates that the Lucas criticism is not empirically very important.

Rational Expectations and Efficient Markets

It is also clear that the rational expectations arguments have become intricately involved with the so-called efficient market hypothesis. Rational expectations are conditional expectations and are unbiased. Thus, they obey

$$(5) \quad p_t = {}_{t-1}p_t + e_t$$

where e_t is the random disturbance and the forecast is arbitrarily chosen as a one period ahead forecast. Thus, rational expectations resemble the random walk or martingale property of much of the weak form of Fama's efficient market tests. Fama has proposed further elaborations of the test embodied in (5) based upon additional and/or insider information (semi-strong and strong forms of the efficient markets hypothesis).

Efficient Markets

Another issue studied by market theorists is whether market price could reveal all available information in the sense that it is a sufficient statistic for all information (Grossman, Grossman and Stiglitz). The general conclusion of this literature seems to be that when information is costly, then the market price is not a sufficient statistic which can be observed by uninformed traders in order to make informed decisions. Further, the incentive to collect costly information exists such that an equilibrium without rents is obtained. It appears that this crucially hinges upon the types of uncertainty and requires that the number of uncertainties be greater than the number of markets (Allen, Sheffrin). In other cases, information gathering does not occur since one can likely costlessly observe price which is a sufficient statistic for all information held in the market.

The studies of markets by financial economists has in my opinion altered the course of economics. They have forced us to more carefully think about what it means for markets to be rational and informationally efficient (e.g., Roll). What information is and does, it's demand and supply components, and how it affects market outcomes is an important growing area and its growth is in large part due to the developments in this field. This research has also spawned a more thoughtful consideration of market adjustments and how goods markets might be different than markets for financial instruments (e.g., inventories). If many markets have the martingale or random walk property, then it has extremely important implications for forecasting economic variables. For example, Hall, using the efficient markets and rational expectations notion, argued that consumption in the U.S. was a random walk property. Empirical work has done little damage to this hypothesis. This implies that the best forecast of tomorrow's consumption is today's consumption. One need not build

an elaborate intertemporal econometric model to explain the evolution of consumption. A similar careful analysis in agricultural economics for agricultural income, consumption, land values, etc. would prove informative.

IV. DEMOGRAPHIC ECONOMICS

A second growth area noted in Table 1 is demographic economics. A large subarea here is the new family economics with demographics and labor also growing rapidly. This area is also intimately connected to the economics of consumption and probably Gary Becker (or T.W. Schultz) is considered to be associated with its genesis more than anyone else. Becker and his students have pushed economic research into new areas of behavior such as fertility, marriage, divorce, human capital, altruism, intergenerational transfers and the evolution of income and wealth, and many other activities of economic life. It is curious that the family as an economic institution had received so little economic study in light of its economic importance and the large amount of research by sociologists and other social scientists. Perhaps, it is due to so many non-market transactions within the family.

Since this literature is so broad, it is impossible for me to even given a sense of the important developments in each area. The recent book by Becker summarizes much of his thinking on the family. Examples of some of the questions studies by Becker are mentioned below. Is labor to be specialized within or without the home? How is work to be divided among the sexes? Why are some societies monogamous while others are polygamous? Why do higher-income men in the U.S. marry at younger ages and have more stable marriages? Why have the urban and rural fertility differences been narrowing or eliminated in most countries of the world? How does fertility interact with investment decisions regarding children (labelled quality, these might involve human and social capital and/or nutrition and health)? What is the relationship of inherited traits or family effects to the accumulation of wealth and income? How do taxes and bequests affect the rise and fall of families (with respect to income)? Why do family heads bequest at death when inter vivos giving is generally less costly due to tax considerations? Might one see more sibling rivalry with regard to the distribution of family income rather than the generation of family income? That is, might siblings fight over parental giving but always pursue actions which maximize family income? How does altruistic behavior affect job choices by spouses?

Becker, using theoretical and empirical analyses, provides very interesting and compelling answers or conjectures to these questions. The framework is the economic model of the rational self-interested or altruistic man. Many have found this work lacking in insight or repulsive since the economic model is used to analyze many problems which have seemed beyond economic man (see Hannan and Ben-Porath for a review). Yet, it seems to me that this exercise forces economists to consider more carefully data and explanations within the traditional province of sociologists and psychologists (perhaps the exchange between agricultural economists and rural sociologists will resemble an earlier time). At this point, there seems little doubt that the economic model is a powerful descriptor of behavior. As the general economy and much of the agricultural sector in particular, changes demographically (such as trends in off-farm work, fertility, and aging), these research issues are bound to become more important.

Related research in this area not only involves many interesting labor supply issues (e.g., mobility) but other consumer or household issues. For example,

the effect of nutrition is an important related field (e.g., Pitt and Rosenzweig). With the current famine conditions worldwide, this will no doubt grow in importance. Similarly, as policy debates involving distributional issues continue, it seems that agricultural economists will become more interested in issues of income and wealth distribution and accumulation.

V. THE NEW INDUSTRIAL ORGANIZATION

Also apparent from Table 1, is the recent growth in industrial organization. For some years, this was a substantial but modestly growing industry in economics. In the last decade, it seems to have gained a lot of momentum. Also, it naturally includes many industry studies perhaps not thought to be I-O. For example, much of the economics of regulation and Law and Economics belongs to this heading in the JEL. Further, many of the applications of experimental economics deals with these issues.

I will first mention an area which I see as impressive and relevant. It is the contestable market theory associated with Baumol, Willig, Panzar and others. The basic claim of the theory is that the set of conditions which lead to efficient resource use are much less restrictive than previously thought. This requires that the notion of efficiency be stated and the one that seems most appropriate is the Ramsey notion of efficient pricing that say utility is maximized subject to constraint (such as zero profit). Under a set of conditions, most notably costless reversible entry and a Nash type reaction by incumbent firms, the Ramsey prices can be attained in many cases without regard to the number of players (even natural monopoly). Though the assumptions are strong, it gives one pause when concentration ratios are used for efficiency prescriptions or measures.

In many respects, this theory or its forerunners have involved significant advances in the theory of the multiproduct firm, whether competitive, monopoly, or whatever. For example, the papers on economies of scope by Panzar and Willig are, I believe, fundamental to agriculture. 5/ For two outputs, A and B, and cost function C, the scope issue involves the comparison of $C(A,0) + C(0,B)$ and $C(A,B)$. Scope economies are shown to result from quasi-public inputs. That is, inputs which have somewhat the property that use in one output does not diminish the available inputs use in other outputs. 6/ Further, this literature establishes the relationship between scope economies and the existence of multiproduct firms. Why are Wisconsin dairy farms multiproduct when many in California are single product? What is needed is a careful integration of the certainty theory with scope economies and uncertainty. Secondly, the Ramsey second best argument seems relevant for a wide range of agricultural issues. Perhaps one should define efficiency more broadly and look for optimally distorted agricultural policies. 7/ This approach is prevalent in public finance in deriving optimal taxes (Atkinson and Stiglitz).

There are also a host of industry issues which have been studied in this literature that seem not to have received similar attention in the agricultural sector. For example, it does not seem that agricultural economics has focused on contract theory as much as I-O or Law and Economics. There has been scant attention paid by agricultural economists to share rental or lease arrangements and the possibility that labor will shirk and require incentive contracts or monitoring (the principal-agent problem). Yet, the ascendancy of shared ownership by labor, so called direct marketing schemes (pyramid like notions) franchises, bonuses (which resemble two-part tariffs), share land leasing, and

other incentive based contracts and hierarchies, indicates that this area is an important issue (e.g., Singh).

Though agricultural economic literature has dealt extensively with agricultural commodity programs, there has not been a similar enthusiasm for other regulation issues and industry studies. One such area is the theory of rent seeking associated with Stigler, Posner, and Peltzman. This literature argues that an industry group, say in agriculture, will expend resource sin order to seek or maintain rents when expected benefits are not less than expected costs. Perhaps a corollary is that rents accrue most to politicians when a credible threat to a policy change is made (Mueller). In any event, we need to sort out transfers from real reductions in welfare (pests, see Rausser). Thus, the profession may have expended more energies developing the supply curve of milk than the supply of rent seeking by dairy associations. Hence we may know more about welfare triangles than we do about the overall welfare losses to society (and congressional voting behavior). 8/

VI. RISK AND GAMES

It is perhaps arbitrary that uncertainty is separately listed here especially since we have already discussed expectations. As a theory, it is only a tool for understanding behavior. Yet, as noted in Table 1, risk theory seems to be an dominant force in the research agenda. Much behavior just cannot be understood without using some form of uncertainty theory (see, e.g. Hey).

Yet, in spite of the enormous impact of expected utility theory, the dominant theory, there is a groundswell of opposition beginning with psychologists and moving to economists. The opposition to the theory comes not from the poor performance of the theory empirically in market settings but from experimental evidence that the axioms are systematically violated. The basic axioms are: the individual can order the set of distributions; the ordering is transitive; if distribution 1 is preferred to 2 is preferred to 3, then there exists a convex combination of 1 and 3 that is indifferent to 2 (continuity); and independence, or for any arbitrary distribution 3 a convex combination of 1 and 3 is preferred to a convex combination of 2 and 3 where 1 is preferred to 2.

Among the empirical results that seem important are: (a) the relative invariance of a person's gambling and insurance purchasing behavior to changes in wealth and the sensitivity of choice to the problem context (framing effects), (b) violation of the independence axiom as illustrated by the Allais paradox, (c) violation of the independence axiom by being oversensitive to changes in small probability events--that is, individuals even when presented with objective probabilities act as if they transform these probabilities in a systematic way, (d) decision makers violate transitivity. Others could be added. Schoemaker recently reviews much of this evidence.

In addition, there are attacks on orthodoxy that come indirectly from information theory. Bayesian learning may not describe how learning takes place (Viscusi). Secondly, Heiner argues that uncertainty brings into play errors in decisions. These errors lead to more rigid behavior (rules of thumb) than is implies by expected utility maximization. 9/ Further, free information may be discarded if it reduces reliability of behavior. 10/

These challenges to the new orthodoxy have spawned recent research aimed at generalizing expected utility. These include eliminating the independence axiom of expected utility (Machina); eliminating the independence plus transitivity

axiom (Fishburn); and less formalized methods of dealing with the above objections (e.g., prospect theory-Kahneman and Tversky); and considering more carefully how errors in decision making affect behavior and proposing a way to evaluate reliability (Heiner); considering ways to coherently consider certain and uncertain multiattribute preferences (Selden).

Though in my opinion, none of the above theories have demonstrated great empirical promise, I believe that some will. Machina's theory provides a coherent explanation of the troubling facts with expected utility being a local approximation to his more general expected utility analysis. Fishburn finds a new skew-symmetric bilinear functional representation of preferences when independence and transitivity are relaxed but a new reasonable symmetry axiom is inserted. Heiner develops a condition based upon marginal costs and benefits which leads to reliable behavior but has only provided anecdotal evidence of its relevance.

How does this research impact on agricultural economics? Since risk is inherent to many decisions by producers and consumers involving natural resources and food and fiber, it seems incumbent upon the profession to lead the way in testing propositions about behavior. Normative risk analysis will have little impact if the tenants of some of the theories outlined above are more descriptive. For example, do we know very much about the production possibility for responding to information or do we as economists continue to ignore the wealth of information that psychologists have generated on this matter.

Some of the information on the relevance of these theories will no doubt come from experimental economics--an area in which I predict agricultural economists will become more interested. Yet, I believe that the research of Knez et al. is very relevant here. Markets may behave essentially as the theory predicts even though a group (perhaps large) behaves in a systematic way contrary to the theory. This can occur because it is the marginal decision makers which dictate market changes. In this respect Knez et al. found experimental evidence to support expected utility theory. Further, Viscusi has presented some evidence that some of the troublesome violations of expected utility are consistent with Bayesian learning theory. In any case, these issues can only be understood clearly with empirical research about how people respond.

Games

Game theory has been with us for several decades but has had very minimal impact on agricultural economics. According to Schotter and Schwodiauer, it has met with cyclical interest. During the 1950's, it was used extensively to study oligopolies and duopolies. Interest waned until game theory was revitalized as economists studies general equilibrium adjustments. Competitive and Pareto outcomes could be modelled in a game theoretic way (the core). Since this brought a new way of viewing general equilibrium results but few new results, interest again waned during the 1960's and 1970's. 11/ Finally, beginning in the 1970's, a large body of literature developed inquiring about the role of institutions in allocation mechanisms. Thus, the new theory of institutions is based heavily on game theoretic notions. This is in marked contrast to traditional economics which for the most part has presumed institutional arrangements.

To illustrate one such result from public choice. Hurwicz, and Green and Laffont showed that there does not exist allocation mechanisms for public goods, which satisfy the balance condition of a Lindahl equilibrium (taxes=benefits for each individual) such that telling the truth about benefits is a dominant

strategy. That is, there is a strong tendency to under-report benefits. Groves and others have developed cost share allocation rules that lead to the truthful revelation of preferences. This rule essentially internalizes the externality of being untruthful. However, as the above impossibility result shows, the resulting mechanism cannot be balanced. Thus, bankruptcy is a possibility.

One such application which is by now standard in graduate training is the possibility of strategic behavior of firms (Varian, 1984a). Consider a conjectured impact of a firm's behavior on output price, dp(Y)/dy, where Y is industry output, y is a firm's output, and p is market price. The firm will maximize profit by choosing y so that

(6) $p(Y) + (dP/dY)(2dY/dy)y = \text{marginal cost}.$

For a competitive firm, dp/dy=0. For a Nash-Cournot firm, the firm takes other firm's output as given (see the contestable market discussion) and thus dY/dy is one. For a monopolistic firm dY/dy is Y/y and marginal revenue equals marginal cost. Finally, for the general case of Stackelberg equilibrium behavior, dY/dy is any correct prediction (conjectural variation) of how the industry responds as the firm's output increases. All of the above can be appropriately changes if price is the initial decision variable.

The above game theoretic notions not only provide a taxonomy but have important policy implications. Recently, in the Journal of Political Economy, Sullivan (building on Sumner) used the conjectural variations framework to analyze the degree of monopoly power in the cigarette industry. He found that the industry is characterized by a substantial degree of competition. Thus, one can attempt to measure social costs without resorting to concentration ratios and the like.

As one views applications in public choice and other areas, it is clear that an impressive revolution is underway. Not only is the traditional bargaining problem dealt with, but a host of I-O and agency applications are apparent. Thus, it seems that is not so much that new equilibrium solutions have been discovered as that new applications of fairly old notions are prevalent (e.g., Milgrom and Roberts, Bell and Zusman).

VIII. CONCLUDING REMARKS

Empirical applications of nearly all economic concepts can be found in the literature in journals in each field and in general applied journals like the Review of Economics and Statistics. Any explanation of the future use of economic concepts must model the reduced form for such knowledge. It seems to me that an induced innovation hypothesis about the generation and use of such information is descriptive in the long run. That is, behavioral issues and policy will drive the reduced form. Much of the literature reviewed above deals directly with attempting to understand economic behavior--behavior which may extend beyond traditional agricultural economic studies of the rural economy, food, and resources. As indicated in Table 1, economics may be drifting further away from micro-business related topics and moving more towards the functioning of markets which may imply only rudimentary knowledge of such micro topics. Thus, areas like demography only become important to agricultural economists when social science is allowed to have its head without the ever present bridling implied by the short run need for improved market efficiency, policy relevance, and clientele satisfaction. I believe that this will happen and that is why I have not forecast that more sophisticated versions of standard commodity models will rule the day. Just as natural resource economics may be viewed as an important extension of the traditional field of agricultural economics, I predict, for example, that regulation (political economy), labor

and demographic economics will similarly become important as we deal with understanding rural behavior and issues germane to the sector.

FOOTNOTES

1/ Analysis of other time periods revealed similar differences. The reason that a single month was used was to avoid some of the double counting that occurs throughout a year.

2/ This may mean that lots of disciplinary issues are investigated in the short run and received or discarded. However, the trends in Table 1 seem to me a clear indication that interesting social science problems are not on the whole internally defined.

3/ All variables are generally though to be logs so that changes are percents.

4/ I am struck by the irony that rational expectations is to replace time series or ARIMA type forecasts of price but virtually requires these procedures to forecast exogenous variables in agricultural applications since there are almost always contemporaneous exogenous variables.

5/ I attempted to deal with this problem poorly in my dissertation. The basic issues regarding managerial attention and related inputs seem crucial for much behavior.

6/ It is interesting (to me) that Dr. Ivan Lee suggested to me the innovation of modelling multiproduct agriculture using public inputs. Thus, the rather extensive development of scope economies in my Ph.D. thesis (prior to Panzar and Willig) is due Dr. Lee.

7/ Chambers suggests this line of argument but a thorough treatment with regard to agricultural policy seems lacking in the literature. Since stabilization is an important rationale of policy, it would seem that a Ramsey type analysis must include risk.

8/ Rausser has mentioned some of the literature on the economics of regulation and political economy in general. It seems to me that many of the issues about how policy is formed are second order small to the literature on rent seeking at this time. My position is that rent seeking is a good place to start. This literature is quite undeveloped and certainly future work will sharpen the measurements of societal losses and distributional effects of policy.

9/ This work is not without criticism, see Bookstaber and Langsam. Heiner's most recent work seems to have solved many unclear features of his theory.

10/ This is called the informational overload paradigm in some marketing and psychology literature.

11/ An exception might be the Scarf algorithm for computing the core of an economy.

REFERENCES

Allen, B. "Generic Existence of Completely Revealing Equilibria for Economies with Uncertainty When Prices Convey Information." Econometrica, 49(1981):1173-99.

Askari, H., and J.T. Cummings. "Estimating Agricultural Supply Response with the Nerlove Model: A Survey." International Economic Review, 18(1977):257-92.

Atkinson, A., and J. Stiglitz. Lectures on Public Economics. New York: McGraw-Hill, 1980.

Bailey, Elizabeth and Ann Friedlander. "Market Structure and Multiproduct Industries." Journal of Economic Literature, XX(1982):1024-1048.

Baumol, W.J., J.C. Panzar, and R.D. Willig. Contestable Markets and the Theory of Industry Structure. Chicago: Harcourt Brace, Jovanich, Inc., 1982.
Becker, G. A Treatise on the Family. Cambridge: Harvard University Press, 1982.
Bell, C. and P. Zussman. "A Bargaining Theoretic Approach to Crop Sharing Contracts." American Economic Review, 66(19-76):528-88.
Chambers, R. "Least Cost Subsidization Alternatives." Forthcoming American Journal of Agricultural Economics.
Ekstein, Zvi. "A Rational Expectation Model of Agricultural Supply." Journal of Political Economy, 92(1984):1-19.
Fama, E. "Efficient Capital Markets: A Review of Theory and Empirical Work." Journal of Finance, 25(1980):383-423.
Fischer, S. "Long-term Contracts, Rational Expectations, and the Optimal Money Supply Rule." Journal of Political Economy, 85(1977):191-205.
Fishburn, P. "Nontransitive Measurable Utility." Journal of Mathematical Psychology, 26(1982):31-67. See also "Transitive Utility." Journal of Economic Theory, 31(1983):293-317.
Green, J., and S. Laffont. "Characterization of Satisfactory Mechanisms for the Revelation of Preferences for Public Goods." Econometrica, 45(1977):427-38.
Grossman, S. "Further Results on the Informational Efficiency of Competitive Stock Markets." Journal of Economic Theory, 18(1978):81-101.
Grossman, S., and J. Stiglitz. "The Impossibility of Informationally Efficient Markets." American Economic Review, 70(1980):393-408.
Hannan, M. "Families, Markets, and Social Structures." Journal of Economic Literature, 20(1982):67-72.
Heiner, R. "Origin of Predictable Behavior: Further Modeling and Applications." American Economic Review, 75(1985):391-96.
Hey, J. Uncertainty in Microeconomics. New York: New York University Press, 1979.
Hogarth, R., and H. Kunreuther. "Ambiguity and Insurance Decisions." American Economic Review, 75(1985):386-90.
Kahneman, D., and A. Tversky. "Prospect Theory: An Analysis of Decision Under Risk." Econometrica, 47(1979):263-291.
Knez, P., Y. Smith, and A. Williams. "Individual Rationality, Market Rationality, and Value Estimation." American Economic Review, 75(1985):397-402.
Lucas, Robert Jr. Studies in Business Cycle Theory. Cambridge: MIT Press, 1981.
Machina, M. "Expected Utility Analysis Without the Independence Axiom." Econometrica, 50(1982):227-323.
Milgrom P., and J. Roberts. "Price and Advertising Signals of Product Quality." Unpublished paper, Yale, 1984.
Mueller, D. Public Choice. London: Cambridge University Press, 1979.
Muth, J. "Rational Expectations and the Theory of Price Movements." Econometrica, 29:315-35.
Nerlove, M. The Dynamics of Supply: Estimation of Farmers' Response to Price. Baltimore: John Hopkins, 1958.
Panzar and Willig. "Economies of Scope." American Economic Review, 71(1981):268-72.
Peltzman, S. "Toward a More General Theory of Regulation." Journal of Law and Economics, 19(1976):211-40.
Pitt, M., and M. Rosenzweig. "Health and Nutrient Consumption Across and Within Farm Households." Review of Economics and Statistics, 67(1985):212-23.
Posner, R. "The Social Costs of Monopoly and Regulation." Journal of Political Economy, 83(1975):807-27.

Ramsey. "A Contribution to the Theory of Taxation." Economic Journal, 37(1927):47-61.
Rausser, G. "Political Economic Markets: PERTs and PESTs in Food and Agriculture." American Journal of Agricultural Economics, 64(1982):821-83.
Roll, R. "Orange Juice and Weather." American Economic Review, 74(1984):861-880.
Selden, L. "A New Representation of Preferences Over 'Certain Uncertain' Consumption Paris: The Ordinal Certainty Equivalent Hypothesis." Econometrica, 46(1978):1045-1060.
Scarf, A., and T. Hansen. The Computation of Economic Equilibria. New Haven: Yale University Press, 1973.
Schoemaker, P. "The Expected Utility Model: It's Variants, Purposes, Evidence and Limitations." Journal of Economic Literature, 20(1982):529-63.
Schotter, A., and G. Schwodiauer. "Economics and the Theory of Games." Journal of Economic Literature, 18(1980):479-527.
Sheffrin, Steven. Rational Expectations. Cambridge: Cambridge University Press, 1983.
Singh, N. "Monitoring and Hierarchies: The Marginal Value of Information in a Principal-Agent Model." Journal of Political Economy, 93(1985):599-609.
Stigler, G. "The Theory of Economic Regulation." Bell Journal of Economics, 2(1971):3-21.
Sullivan, D. "Testing Hypotheses about Firm Behavior in the Cigarette Industry." Journal of Political Economy, 93(19-85):586-598.
Sumner, D. "A Measurement of Monopoly Behavior: An Application to the Cigarette Industry." Journal of Political Economy, 89(1981):1010-19.
Tobin, J. "The Monetarist Counter-Revolution Today--An Appraisal." Economic Journal, 91(1981):29-42.
Varian, H. Microeconomic Analysis. New York: W.W. Norton and Co., 2nd edition, 1984a.
Varian, H. "The Non Parametric Approach to Production Analysis." Econometrica, 52(1984b):579-597.
Viscusi, W. Kip. "Are Individuals Bayesian Decision Makers." American Economic Review, 75(1985):381-85.
Wallis, K. "Econometric Implications of the Rational Expectations Hypothesis." Econometrica, 48(49-73.

THE CONTINUED POLITICAL POWER OF AGRICULTURAL INTERESTS

Christopher K. Leman and Robert L. Paarlberg

ABSTRACT

Some observers have interpreted the rise of international trade issues and the involvement of consumer, environmental, and other groups in debates on farm policy as indicating a decline in the power of agricultural interests. Examining recent political outcomes in four issue areas (commodity programs, international farm trade, regulation, and western land and water), this paper concludes that agricultural power remains remarkably strong. However, political power within the narrow farm sector may no longer be adequate to ensure farm prosperity. Efforts by agricultural interests to compensate for this new inadequacy by extending their influence to the non-farm policy arena may also meet with frustration. If farm interests are to be better served, the political power of agriculturalists must be put to better use within the farm sector itself.

INTRODUCTION

Politics is a struggle for power, a struggle in which agricultural interests were long seen as particularly successful. In recent decades, however, a suspicion has grown that organized agricultural interests have been losing power to interests from beyond the farm sector. Traditional commodity programs have come under attack; labor, consumer, and environmental groups have entered the farm policy debate; the 1977 and 1981 farm bills passed by the narrowest of margins; and farm exports have on several occasions been suspended, either in deference to domestic consumers or in the interest of foreign policy. Regulatory laws that were passed in the 1970s did not exempt agriculture as had major earlier laws, and federal courts issued decisions regarding regulation and western land and water that were widely lamented by farmers.

This paper reexamines the political power of farm interests in four leading issue areas: 1) commodity programs; 2) international farm trade; 3) regulation; and 4) western land and water. In each of these four areas, organized agricultural interests retain significant political power. At the same time, this continued power over "farm policy" narrowly defined sometimes does little to protect the modern farm sector from sudden changes in the larger policy environment.

If organized agricultural interests are still powerful, within their traditional farm sector domain, this would only be in keeping with certain

---

Christopher K. Leman is a Consultant-in-Residence at Resources for the Future and an Associate at the Center for International Affairs at Harvard University; Robert L. Paarlberg is an Associate Professor of Political Science at Wellesley College and an Associate at the Center for International Affairs at Harvard University.

longstanding characteristics of the U.S. political system. American politics has long been characterized by relatively strong sectoral interest groups, owing to the weakness of national parties, and especially to the division of federal power between Congress and the Executive (Schattschneider, Key). Despite some recent recovery of presidential powers (now that a decade has passed since the post-Watergate weakening of the presidency), the executive bureaucracy--certainly the Agriculture Department--remains decentralized and resistant to direction from above, while Congress remains fiercely independent, and radically individualized. Congress in the past dozen years has been marked by weakened party leadership, erosion of the seniority system, and proliferation of relatively autonomous committees, subcommittees, and caucuses. Interest groups of all kinds have exploited the situation, becoming more numerous and more specialized, making larger campaign contributions and mobilizing more expert advice on their behalf (King, 1978 and 1983). Other things equal, organized agricultural interests should be sharing in these political gains.

Other things are not, however, equal. Farming no longer dominates rural areas either physically or economically as it once did. The number of counties with agriculture as their main source of income decreased from about 2,000 in the 1950s to about 700 in the 1970s--one-fifth of the nation's total (Deaton and Weber in this volume; Castle and Goldstein). The share of the U.S. population now living on farms has continued its relentless decline, and stands today at less than 3 percent. This demographic decline would appear by itself to dictate a reduction of farm sector political power.

But farming itself remains financially well endowed, and it still enjoys a prosperous and populous rural base from which to seek political power. An important trend in the 1960s and 1970s was the "population turnaround," with many people moving to rural areas as nonagricultural industries expanded, retirement patterns changed, and military bases spread (Beale). Although some rural areas were again losing population in the 1980s, others were stable or growing--particularly those whose economies already combined farming with a number of other activities.

Even with a steady decrease in numbers since the 1930s, over two million farms remain. Moreover, the number of holders of agricultural land has declined little in decades, still totalling about four million (Boxley; Geisler et al.). These numbers compare with only several companies that manufacture automobiles, 127 that produce aluminum, 3,900 that manufacture computers, and 5,700 that operate sawmills (Dun and Bradstreet). In fact, farms represent nearly one-quarter of all the nation's businesses. Farms are in every state (hence in the constituency of every U.S. senator) and an unusually large number of Congressional and state legislative districts (Rowland and Dubnick). Dairy farms alone number roughly 200,000 and are found in 80 percent of all Congressional districts. With such significant political resources still at their disposal, farm sector interests might yet be able to exercise considerable power.

COMMODITY PROGRAMS

The legislative struggle which takes place every four years to reauthorize federal farm commodity programs is often used to gauge the political strength

of the organized agricultural interests, traditionally known as the "farm coalition." In the 1970s this coalition apparently lost strength since it was unable to maintain legislated commodity programs based upon traditionally rigid concepts such as "parity." The Agriculture Act of 1970, followed by the farm bills of 1973 and 1977, moved commodity programs away from high and inflexible price supports, and toward what came to be described as greater "market orientation." Some concluded from these legislative events that the farm coalition was in a terminal decline.

It was not unreasonable to expect this decline, since the U.S. population living on farms had by the 1970s already decreased far below the 25 percent share of the 1930s, when federal commodity programs were first enacted. The political over-representation of rural districts was also on its way to being reduced, due not only to mandatory census adjustments but also to a 1962 court-ordered redistricting of state legislatures. Rural districts, which had constituted 83 percent of an absolute majority of the U.S. House of Representatives as late as 1966, fell to only 60 percent of a majority by 1973 (Destler, p. 31). In 1973, for the first time, farm state legislators seeking to reauthorize commodity programs had found it necessary to join in an awkward coalition with backers of organized labor and consumer interests. From evidence such as this, astute observers like James T. Bonnen (1980, p. 317) concluded that "There is no longer a stable or viable political coalition for the support of food and agriculture legislation."

Some saw a continuation of the decline of the farm coalition during the early 1980s, when an even more "market-oriented" farm bill, the Agriculture and Food Act of 1981, passed the House of Representatives by a spare margin of just one vote (205-203). A southern member of Congress predicted that it would be "the last farm bill." One political scientist concluded from the difficult legislative history of this "uncommonly austere" legislation that "The future of federal farm programs remains in doubt" (Peters, pp. 169-170).

Yet reports of the imminent death of federal commodity programs proved to be greatly exaggerated. In retrospect, the programs set in place by the 1981 farm bill were anything but "austere." They were the most lavish in history. Commodity program outlays during the first four years of the Reagan administration totalled $53 billion, a 228 percent increase compared to the $16 billion spent during the preceding Carter years. Farm payment outlays, which had averaged only $2.9 billion per year over the entire decade of the 1970s, increased to $11.7 billion in 1982, and to $18.9 billion in 1983. In 1982, considering all federal food and agriculture programs together, the U.S. Department of Agriculture spent an equivalent of $13,412 for every farm worker in the country, which was more than ten times as much as had been spent in 1960, a decade prior to the alleged demise of the "farm coalition." These USDA expenditures had held steady at roughly 6 percent of total federal budget outlays, the same as in 1960, even though the overall federal budget had grown dramatically (Luttrell, p. 12). This continuing increase in program outlays per farmer might even support the argument that the "farm coalition" has grown stronger rather than weaker.

These surprising results stem partly from the logic of political organization. Although consumer groups can claim to represent a larger share of the voting public, they find it more difficult to organize and to mobilize their numbers, as the marginal incentive for any one individual to participate is not very

strong. (Olson, Ch. 1; Berry). Consumer groups have always relied significantly on alliances with labor unions, which however have pursued consumer issues only episodically, and have themselves lost membership and power in recent years. In contrast, the smaller relative size of the farm sector affords better opportunities for political organization. Farm numbers may have declined, but farm income and wealth have increased, so more funds have become available for the deployment of experts, lobbyists, and political contributions (Browne). The rise of consumer and environmental opposition has also energized farm groups to defend their interests more effectively (Guth). The multiplication of agricultural pressure groups horizontally into particular commodities and vertically into agribusiness and trading interests could have been a source of fragmentation, but the group leaders and their allies within parallel Congressional subcommittee structures have generally been able to forge consensus.

However, it is not only the relative political strength of the farm coalition that determines the generosity of federal commodity programs. What determines the size of program outlays is most of all the changing commercial health of the farm sector. When agriculture is doing well on its own, as it was throughout most of the booming 1970s, the need felt by agriculturalists to secure for themselves expensive commodity program outlays is greatly diminished, just as the ability of non-agriculturalists to challenge those program outlays is greatly enhanced.

During the decade of the 1970s, the overall rate of return to investment equity in farm production assets increased to a remarkably prosperous 12.5 percent, up from only 6.8 percent during the previous decade (National Planning Association, p. 42). In 1973, average farm family income actually exceeded that of the non-farm sector. Agriculture was winning what really mattered, so it could afford to lose ground to non-agricultural interests in the struggle to control commodity programs. Non-agricultural interests, led by consumers, labor organizations, and environmentalists found themselves less advantaged, and intervened in the farm policy-making process simply to protect themselves. They scored a number of apparent political victories in the process, but without taking away from the farm coalition much of lasting political significance. When early in the decade of the 1980s commercial and financial conditions in the farm sector once more turned downward, the farm coalition responded by redoubling its attention to the preservation of commodity programs, and was able to re-establish its traditional claim to compensatory relief from the public sector.

It is still too early to extend this analysis to include the political outcome of the current 1985 farm bill debate. But in the opening phase of that debate, organized agricultural interests showed a remarkable ability to deflect the Reagan administration from its planned attack on expensive farm commodity programs. The administration had hoped to bring commodity program spending under control through an immediate reduction of loan rates, limitations on non-recourse loans, elimination of the farmer-owned reserve, and a phase-out of deficiency payments and acreage reduction. Agriculture alone was to absorb about 12 percent of the total federal spending cuts proposed by the administration, as farm program spending was to be cut roughly by half (Journal of Commerce).

But to the distress of budget-cutters in the executive branch, Congress spent the first two months of its 1985 session in a debate over measures which would increase farm spending. A handful of farm belt senators defied both the White House and the Senate majority leadership by launching an emotional campaign to increase farm debt relief, paralyzing the normal business in Congress for nearly six weeks. Administration tacticians tried at first to condition any additional debt relief upon farm state acceptance of "market-oriented" commodity programs, but to no avail. By then organized agriculturalists were playing effectively upon an underlying sympathy felt by the wider populace for deeply indebted farmers. A poll taken in late January had revealed that 65 percent of the U.S. adult population thought it a "bad idea" to spend less on farm aid so as to reduce the budget deficit (New York Times). Sensing its disadvantage, the administration tried to cut losses by agreeing to liberalize the terms of an existing $650 million farm loan guarantee without any quid pro quo on commodity programs.

But the farm policy agenda was by then firmly in the hands of those who wanted to talk about relieving burdensome farm debts rather than cutting expensive commodity programs. Defying threats of a presidential veto, Congress passed a $2.5 billion farm credit bill which would have provided an expensive advance on commodity loans to grain and cotton farmers. The president quickly vetoed this "massive new bailout," but remained powerless to return the debate to his own original objectives. Having been forced to play the villian's role in this minor battle with agriculturalists over debt relief, Reagan found it difficult to regain the upper hand in his more important battle to bring commodity programs under control.

At this point a larger political question must be asked. How significant is this demonstrated ability of the farm coalition to continue to secure commodity program benefits whenever the farm sector finds itself under stress? The relative potency of the traditional commodity programs has been diminished in recent years by the increased indebtedness of the farm sector, and by the continuing integration of that farm sector into the overall U.S. economy, as well as the world economy. But they are more vulnerable to such influences today. The commodity programs, designed to support and to stabilize farm product prices, are no longer the most powerful means, in this new environment, to provide well targeted relief to agriculture. The debt-to-income ratio on today's average farm is ten times as high as it was 35 years ago, making commodity prices less important for many farmers today than interest rates (Boehlje, p. 237). Largely self-sufficient fifty years ago, when commodity programs were first enacted, farmers now purchase nearly 60 percent of everything they use, making them more sensitive to input costs (such as equipment or energy costs), and to price levels in the wider economy which commodity programs cannot hope to control. The increasing importance of off-farm income to many farm operators has further increased the impact of the overall economy on the farm sector (Nelson, p. 698). Today's farms are also more dependent on exports, and therefore more sensitive to fluctuating conditions in the larger world economy. In this environment, the inward-looking features of U.S. domestic commodity programs can easily be swamped by the production response of foreign competitors, or by adverse foreign exchange rate fluctuations. Trying to offset a loss of farm export earnings exclusively through domestic commodity program manipulation (for example, by raising domestic prices and cutting production) usually invites a further loss of world market share.

The experience of the 1980s is instructive in this regard. Despite a fivefold increase in yearly commodity price support spending by the federal government between 1981 and 1983, real net farm income still declined by nearly half (Duncan and Drabenstott, p. 32). The 1983 Payment-in-Kind (PIK) program alone transferred an average of $12,000 per farm to the agricultural sector, yet did little to relieve the stress of many heavily indebted farmers.

What indebted farmers needed much more than high commodity prices was a reduction in real interest rates. Interest expenses as a percentage of total production expenses in the farm sector had doubled by 1982, compared to a dozen years earlier, due to a sudden turnaround in U.S. monetary policy and in economic conditions worldwide (P. Paarlberg, Webb, Morey, and Sharples, p. 82). The farm sector finds it hard to adjust to a sudden rise in real interest rates, because it uses more of its debt to finance fixed assets over a longer term, compared to many industries which use more of their debt for short-term inventory financing (Boehlje, p. 240). So long as real interest rates remained high, little could be done for financially stressed farmers through commodity program manipulations.

Even a one percentage point drop in the average rate of interest on outstanding farm debt would translate by itself into a $2 billion decrease in farm production expenses (P. Paarlberg, Webb, Morey, and Sharples, p. 82). And the best way to reduce interest rates without reflating the economy would be by reducing federal budget deficits. By one estimate, a federal deficit reduction of about $150 billion between 1984 and 1989 would do enough, by way of lowering interest rates and dollar exchange rates, to increase annual net farm income (other things being equal) by anywhere from 25 percent to 60 percent--or $6.4 billion to $15.4 billion (Galston, p. 39). To accomplish as much through traditional commodity programs in the absence of an interest rate reduction would be prohibitively expensive to taxpayers. It would also be an inequitable use of public resources, since commodity program benefits are so poorly targeted (with the largest one percent of all farmers capturing roughly one-fifth of all payments). Seeking to remedy the current stress of the farm sector through commodity program manipulation is therefore to commit a double error: ". . . [A]n income policy focusing on surpluses and supply control may not only miss the target vis-a-vis the (financial stress) problem, but also--because most of the support will go to larger farms, whereas farms of all sizes are exhibiting financial stress--such a program may miss the target audience as well" (Boehlje, p. 240).

If traditional commodity programs prove inadequate to protect agriculture from larger problems (such as macroeconomic shocks), would organized agriculturalists be well advised to spend less time defending commodity programs, and more time lobbying the Federal Reserve Board, or the Treasury Department, or the Office of Management and Budget, in hopes of turning fundamental U.S. macroeconomic policy more to agriculture's advantage? Prior to the adoption of the commodity programs, farmers were deeply concerned about such questions as monetary and tariff policy, and enjoyed some success in influencing them (Benedict). In confronting this difficult dilemma today, organized agriculturalists should be aware that their considerable power within the narrow arena of farm policy may be more difficult to transfer to the larger macroeconomic policy domain. This power is now narrowly based on disproportionate representation within the agriculture committees of the

Congress, and on the clientelism which still pervades the Department of Agriculture. They would enjoy neither of these advantages beyond the narrowly defined food and farm policy arena. Their continuing grip over commodity policy has also derived, to some extent, from their specialized understanding of the farm sector and the sometimes intentionally arcane language and detail of farm programs and legislation. This sort of influence is entirely useless in non-farm policy settings, where arcane language and programmatic detail will block the influence of agriculturalists.

Agriculturalists command respect when food and farm programs are at issue, but their views might be dismissed and their influence might be diluted to nothing in the political battle over defense spending, or over tax incentives for the oil and gas industry, or social security reform. If they were to retarget their scarce political resources away from farm sector policies and toward the pursuit of a broad non-farm macroeconomic policy objective such as deficit reduction, they might find themselves making perfect economic sense, but exercising no measurable influence. In fact, this tactic might leave their own legitimate farm sector interests less stoutly defended and hence more vulnerable to a coordinated external attack. Such an attack might be invited if agricultural interests are seen as hostile to non-farm spending. Powerful non-farm interest groups could strike back at all farm programs.

Recognizing this unhappy political reality, organized agricultural interests will probably continue, in times of farm sector distress, to seek public policy relief through manipulation of the less potent instruments under their control, such as commodity programs. But in doing so they may only experience increasing frustration. Beyond their current size, these programs may quickly become unacceptable not only to budget officials and non-agriculturalists but also to disaffected elements within the farm coalition itself.

Holding the farm coalition together under the less severe budget conditions of 1981 was difficult enough. The administration was momentarily successful in splitting off southern "boll weevil" farm state senators from the defense of grains and dairy programs. In retaliation, dairy state senators supported an amendment to cut back the peanut program. Farm bloc unity could not be restored until the legislative struggle finally reached the floor of the House. Since 1981, in part due to commodity program distortions, farm bloc unity has come under an added strain. Two agricultural interest groups not previously prominent in commodity policy debates, the agribusiness sector and the livestock producer associations, have recently assumed a higher profile, so as to block any continuation of existing farm policies which might lead to a replay of the 1983 PIK program, which took one-third of U.S. cropland out of production, increased feed costs to livestock producers, and reduced the sales of agribusiness companies both at home and abroad. The PIK program, plus the 1983 decision to encourage the slaughter of dairy cattle by paying farmers to reduce dairy production, brought the National Cattlemen's Association, the National Pork Producer's Council, and the National Broiler Council into an alliance for the first time, with the American Farm Bureau Federation, milk processors, and consumer groups, in opposition to the status quo in domestic commodity programs.

The continued power of organized agricultural interests to enact commodity programs thus represents an uncertain form of farm sector protection. Even if those programs could be enlarged, they would continue to be swamped by

macroeconomic shocks from beyond the farm sector. And in the meantime, the costs, the inequities, and the distortions associated with the enlargement of these programs might make them politically intolerable not only to consumers and taxpayers, but to critical elements of the farm coalition itself.

INTERNATIONAL FARM TRADE

The continued power of organized agricultural interest also deserves to be recognized, and then qualified, in the area of international farm trade. Here, as with commodity programs, the power of agriculturalists to control critical policy actions over narrow farm issues has been largely preserved. But the significance of such actions, within a larger policy context, has measurably declined.

A decade ago it was fashionable to suspect that agriculture was losing control over narrowly defined farm trade policy to domestic consumer interests and to the concerns of foreign policy. Under organized pressure from consumer interests, in the mid-1970s, a remarkable sequence of executive actions had been taken to restrain farm exports--a soybean embargo in 1973, followed by a brief suspension of additional grain sales to the Soviet Union in 1974, followed by an even more significant sales suspension to the Soviet Union and to Poland in 1975. President Nixon had given an apparent endorsement to this new drift in U.S. farm trade policy in 1973, when he explained that "in allocating the products of America's farms between markets abroad and those in the United States, we must put the American consumer first" (Destler, pp. 50-59). Foreign policy concerns too seemed to have taken over from agricultural ones. Despite his own earlier rejection of the selective use of "food power," President Jimmy Carter shocked agriculturalists in January 1980 by placing a partial suspension on grain and other farm sales to the Soviet Union, officially invoking reasons of foreign policy and national security to "punish" the Soviets for their recent invasion of Afghanistan.

From today's vantage point, the fear that agriculturalists had lost control over farm trade policy seems much less justified. The exceptional farm export suspensions of the mid-1970s were little more than one temporary byproduct of a farm export environment which otherwise could not have been more favorable to U.S. agriculture. The decade of the 1970s deserves to be remembered as one in which U.S. farm exports were at last being more effectively promoted, rather than willfully constrained. The U.S. balance of trade in agricultural products, which had stood at only $1.9 billion in 1971, increased to $9.3 billion in 1973, and reached a stunning $25 billion by the end of the decade. It should not have been surprising that this surge in farm exports would call forth a more significant defensive political reaction from those domestic consumer groups who felt their interests momentarily at risk. During the first six months of 1973, as this remarkable farm export surge was getting under way, the index of consumer prices for food in the U.S. rose by a politically intolerable 15 percent. Increased foreign demand was by no means the only cause of higher domestic food prices, but a coalition of domestic consumer advocates and cost-of-living watchdogs was nonetheless able, in the extraordinary context of the times, to seize upon farm exports as a convenient political scapegoat, and to impose a few marginal export restraints.

But agricultural interests were quick to fight back. In 1975, midwestern grain interests were successful in forcing President Ford to lift his brief suspension of farm sales to the Soviet Union, and to negotiate a long term agreement which guaranteed minimum sales of at least 6 million tons a year for at least the next five years. Then in 1977 these same interests were able to insert into U.S. farm legislation a little noticed "embargo insurance" provision, which required the Secretary of Agriculture to move commodity loan rates all the way up to 90 percent of parity in the event of any future export suspension undertaken for reasons of tight domestic food supplies. The purpose of this legislation was not so much to ensure compensation in the event of a renewed farm export suspension, as to prevent such a suspension by making it too expensive for the president to contemplate (R. Paarlberg, p. 130).

Agriculturalists were surprised by the 1980 grain embargo, which escaped coverage under their "insurance" scheme because it had been undertaken for official reasons of foreign policy and national security, rather than to protect consumers under circumstances of tight domestic supplies. But the larger impact of the 1980 embargo decision would be an even more dramatic reassertion of exclusive farm interest control over farm trade policy. The first reaction of farm interests was to insist upon generous domestic compensation for as long as the embargo remained in place. The compensation which they received cost the federal government an estimated $3.4 billion for Fiscal Year 1980 alone (Library of Congress, pp. 5-6). In light of the fact that U.S. grain exports worldwide continued to expand throughout the period that this partial and ineffective embargo was in place, this was generous compensation indeed.

Just the same, U.S. agriculturalists went on to use their considerable political muscle in 1981 to hold President Reagan to his campaign promise to lift the embargo, overcoming determined opposition from the Secretary of State and most of the rest of the foreign policy community in the process. Sales to the Soviet Union were resumed and negotiations on a new long term agreement were initiated (with the State Department no longer the lead agency), despite an intensifying crisis in Poland in 1981, and despite the otherwise unyielding cold war attitudes of the Reagan administration. On the advice of his political handlers, Reagan made the conscious decision to treat agriculture as an exception, and to separate farm trade from the conduct of the rest of his foreign policy. Farm trade policy decisions were taken not within the foreign policy community, but by Reagan's Cabinet Council on Food and Agriculture, where foreign policy considerations were never prominent (Haig, p. 82).

Even the declaration of martial law in Poland, in December 1981, was not enough to alter the new wide-open farm export sales policies of the Reagan administration. Despite an imposition of economic trade sanctions in every other area, including high-technology products, computers and oil and gas equipment, grain sales to the Soviet Union were permitted to continue, and were encouraged to expand. The president announced unambiguously that "the granary door is open" (U.S. Department of State, p. 4). By using this double standard for agriculture during the Polish sanctions crisis, Reagan suffered harsh criticism from U.S. allies in Western Europe, who were being pressured by the United States to make no exceptions in their own Soviet sales restrictions. Far from sacrificing U.S. farm exports to the interests of foreign policy, Reagan was by 1982 doing precisely the opposite.

Organized agricultural interests had seen to it earlier that he would have little choice in the matter. Those interests had earlier inserted an additional new embargo insurance provision to the 1981 farm bill, which specified that producers would have to be compensated at 100 percent of parity in the event of any future foreign policy embargo which singled out agricultural products. This provision alone would be enough for the foreseeable future to discourage any reimposition of a selective farm product embargo. later in 1982 agriculturalists then went farther to insert an even more potent "contract sanctity" provision into the commodity futures trading act, which obliged the President to allow contracted farm sales to continue even in the event of an across the board embargo. And finally in 1983, U.S. farm export interests once again used their enormous influence over farm sales, to press for the completion of a new long term farm trade agreement with the Soviet Union. Under the terms of this agreement, which was to run through 1988, guaranteed "embargo-proof" Soviet access to the U.S. market would be increased by 50 percent (R. Paarlberg, pp. 134-136).

In light of these decisive actions, it is difficult to argue that organized agricultural interests have lost control of farm trade policy, either to consumers or to foreign policy officials. In parallel fashion to commodity programs, their political control had only temporarily been challenged in the 1970s, at a time when exports were growing so rapidly that the farm sector did not need much public policy protection anyway. As soon as U.S. farm exports stopped growing (and in some cases even while those exports were still growing), the dominance of agriculturalists in the farm trade policy area was fully re-established.

As with domestic commodity policy, however, the political control which agriculturalists were able to reassert over farm trade policy was by no means adequate to ensure the desired end result. As control over farm trade policy was reconsolidated in the 1980s, as consumer and foreign policy advocates were being shouldered aside, and as public expenditures for farm export promotion were steadily expanded, the U.S. share of international farm exports nonetheless continued a steady decline. Narrowly defined farm trade policies, no less than narrowly defined commodity policies, were being swamped by adverse macroeconomic effects which the narrow farm sector policy remedies were powerless to control.

The rapid growth of U.S. farm exports during the decade of the 1970s had not been caused by any sudden change in narrowly defined U.S. farm export policy. It was largely a consequence of record income growth among importing countries, sustained in many instances through easy credit, plus a favorable downward realignment of dollar exchange rates. When the world economy fell into both a deep recession and a severe liquidity crisis after 1981, and when dollar exchange rates began to soar following a dramatic turnaround in U.S. monetary policy, there was little that narrowly defined farm export policies could do to repair the damage to the nation's farms.

Between 1981 and 1985, USDA authorizations for the Public Law 480 program increased from $1.4 billion to $2.3 billion, and authorizations for commercial export credit programs increased from $1.9 billion to $5.3 billion, but the volume and the value and the market share of U.S. farm exports nonetheless declined (National Commission on Agricultural Trade and Export Policy, p. 79). Between 1981 and 1983 alone, despite the rapid expansion of costly commercial

farm export credit programs, the total value of U.S. farm exports fell by 17 percent. In their frustration, organized agricultural interests used their narrow power over farm export policy to secure even more ambitious export promotion policies, including in 1985 a three year $2 billion "in kind" export subsidy program. Although billed as a victory for agriculture, this new farm export program was no more likely than its predecessors to offset the much larger impact on U.S. farm exports of adverse macroeconomic trends. Even if it worked perfectly (and export subsidy programs never do, least of all those which flood markets with "in kind" surplus commodity payments), this program could not hope to increase the total value of U.S. farm exports by more than 2 percent. Macroeconomic forces had overwhelmed conventional sector-specific farm trade actions. By one calculation, foreign farm sales were falling by 16 percent with every 20 percent increase in the exchange rate of the dollar abroad. According to Jim Longmire and Art Morey (1983, pp. v,21), "macroeconomic factors have had, and will have, a much greater impact on U.S. farm program stocks, farm exports, and agricultural prices than many of the more direct export subsidy arrangements currently in place or under consideration."

Almost as futile would be an attempt to make U.S. farm exports more competitive abroad through isolated adjustments in domestic commodity loan rates. Without denying that those loan rates have been set too high, nonetheless dollar exchange rates have been volatile enough to swamp significant domestic farm price adjustments. Between 1980 and 1983, the U.S. domestic price of corn, adjusted for inflation, actually fell by 5 percent. But due to higher dollar exchange rates, the price for U.S. corn paid by foreign customers increased by 35-40 percent, wiping out foreign sales.

So the ability of farm interests to control narrowly defined farm policy issues is again an inadequate source of protection for the farm sector. Control over traditional farm trade policy instruments--ranging from export restrictions to export subsidies--does not translate automatically into export growth. The policy variables most important to export growth lie well beyond the traditional farm policy arena. The include not only U.S. macroeconomic policy (which can drive up exchange rates), but also U.S. industrial trade policy (which can reduce the foreign exchange available to U.S. farm trade customers abroad), and U.S. international finance and assistance policy (which can help foreign governments to become better customers for U.S. farm products, by stimulating growth and rescheduling external debt).

Unfortunately, no matter how powerful agriculturalists might be within the narrow area of farm trade, they cannot hope to exert decisive influence over these larger international economic policy areas. Nor would it be entirely sufficient if they could do so. Just as U.S. farm policy can be swamped by non-farm policy, so can the actions of the U.S. be swamped, within the larger world economy, by the offsetting policy actions of other governments or by the autonomous actions of the international private sector.

This being the case, even the most powerful agricultural interests will have to plan on a farm trade policy environment which continues to administer periodic shocks to the U.S. farm sector. They will not be able to eliminate these shocks by stretching their power to control the rest of U.S. foreign economic policy, nor will they be able to offset the full impact of these shocks through a more ambitious manipulation of narrowly defined farm trade policies. They

will make their largest contribution instead by using their well established power within the farm sector to help promote farm programs, farm structures, farm financing and marketing mechanisms better suited to absorbing these shocks.

REGULATION

Early federal regulation of the farm sector was largely economic in nature and was generally welcomed by agricultural interests. For example, the Pure Food and Drug Act of 1906 and various subsequent laws providing for safety, purity, grading, and labeling have enhanced the market for agricultural products, funding publicly services that otherwise would have had to be provided privately (Nadel; Hinich and Staelin). Some of the farm commodity programs discussed above operate through regulation, as by marketing orders. The operation of these various instances of government regulation has been so consistent with the economic interests of farmers that Theodore Lowi (1978, pp. 68, 69) has argued: "Agriculture is that field of American government where the distinction between public and private has come closest to being eliminated.... Agriculture has emerged as a largely self-governing federal estate within the federal structure of the United States."

Recent decades, however, have brought an increase in federal regulation for broader social purposes, especially environmental and occupational ones, that are less consistent with the immediate economic interest of farm operators (Bardach and Kagan). The rise of such regulation in the 1970s seemed to be compromising the farm sector's traditional autonomy. New laws like the Occupational Safety and Health Act of 1970, the Water Pollution Control Act Amendments of 1972 (amended and renamed in 1977 the Clean Water Act), and the Federal Insecticide, Fungicide, and Rodenticide Act of 1972--among others--did not exempt agriculture as had earlier laws regarding transportation, labor, social security and so on. Federal court decisions soon increased the sting to farmers of each of these new environmental laws. Agricultural groups were not active in the initial debates on some of these laws, and it is possible that if they had been, the laws would have contained provisions limiting the regulation of farms (Kramer, pp. 209-10). However, once the laws were passed, farm groups quickly mobilized to secure this same result. Over half of the lobbyists employed by the general farm organizations are now assigned to regulatory questions (Bonnen, 1984). As a result of such efforts, the new regulatory laws have been amended and their implementation has been influenced, leaving farms less firmly regulated overall than any other major economic sector.

Federal pesticide legislation had to affect farms, because they account for more than 70 percent of the nation's pesticides by weight (EPA, 1984, p. 2-8). Some farm states took the initiative in regulating pesticides, in the hope that by discouraging misuse they would forestall federal efforts to ban use of pesticides entirely (Manley and Hadwiger). FIFRA in 1972 transferred jurisdiction over pesticides from the Department of Agriculture to the Environmental Protection Agency, but Congress rejected the Nixon administration's proposal to require permits for the use of particularly dangerous pesticides. Subsequent amendments to FIFRA and administrative actions left pesticide regulation more to the states, such as in whether to register a substance for certain uses, when to grant exceptions to these rules, and how to license applicators. C. K. Rowland and Roger Marz (1981) show that

despite the transfer of pesticide regulation from USDA to EPA, lower-level administration by the state departments of agriculture has left the law quite loose in application.

Farm uses of pesticides have often been the last to be prohibited. For example, although EPA in 1979 ordered an emergency supervision of the use of the herbicides 2,4,5-T and Silvex in forestry and most other uses, it continued to allow them in certain range and crop uses, suspending them there only in the mid 1980s, and only when demand had declined. Generally, the use of pesticides on public lands has been more controversial than on private lands. In 1972 EPA prohibited the use on federal lands of 1080, an anti-coyote poison that is still widely used on private grazing lands. (After years of protest by ranchers, the agency in 1985 authorized its limited use on federal lands.) On the other hand, 2,4,5-T and Silvex continued to be used on public grazing lands for years after they were banned in forestry.

Sediment, nutrients (usually nitrogen, phosphorus, and potassium from fertilizers and livestock waste), chemicals, and naturally occurring elements (including salt and metals) in agricultural runoff can pollute lakes, streams, and groundwater. In fact, farms supply more than half of the nation's loadings of phosphorus, nitrogen, and sediment, among other pollutants (EPA, 1984, p. 1-14). Water pollution controls were greatly tightened in principle in the 1972 water pollution amendments, which required permits for point sources of pollution and for alterations in wetlands. The law established a state-run process for areawide "208" plans regarding point and nonpoint sources, but for nonpoint sources there was no requirement for permits or other enforcement. The law applied as much to farms as to other sources of water pollution, but a series of actions by Congress and by Republican and Democratic administrations alike reduced its impact on farms (Radosevich and Skogerboe, pp. 96-104). Under pressure from farm groups, the Nixon administration EPA quickly exempted from the permit requirement the outfalls from irrigation operations of less than 3,000 acres and livestock operations with less than 1,000 head (silvicultural activities were also exempted). EPA emphasized point and urban sources in the "208" plans, while stressing that the states should regulate nonpoint sources on a voluntary basis and make use of the existing soil and water conservation districts and the Soil Conservation Service, an approach also preferred by the Office of Management and Budget, which discouraged new spending.

Most states were only too happy to take this loose approach, as locally generated non-point pollution was often not a major problem within their borders, imposing its greatest costs on other states downstream. Even a state like Iowa with considerable concern about water quality did not force landowners to adopt a practice without governmental sharing of the cost, and cost-sharing funds for this purpose were virtually nil (Crosson and Brubaker, p. 167).

Federal cases brought by the Natural Resources Defense Council led courts in 1975 to order a change in this selective approach. One decision forced EPA to include nonpoint and rural sources in the "208" plans; as a result the agency adopted regulations requiring that these plans identify "best management practices for agricultural lands. Another court decision struck down EPA's exemptions of small irrigators and feedlots from the requirement for a permit. EPA began to design a system of general permits for such cases, while

encouraging outraged irrigators to amend the law if they did not want to be covered (Anderson). Few such permits were ever issued, because in the Clean Water Act of 1977, Congress declared irrigation outfalls--no matter how large and concentrated--to be nonpoint sources, and no longer to be subject to permits. In the debate on this legislation, efforts to strengthen the nonpoint program by requiring the states to enforce "best management practices" were turned back by a coalition of agricultural and timber interests. And when a third major court decision in 1975 had expanded the number of wetlands whose alteration required a permit, Congress in 1977 narrowly rejected an effort to loosen the regulation of wetlands, but exempted many agricultural and silvicultural activities from the existing constraints.

Whereas federal constraints on industrial and municipal pollution--much of which was from point sources--remained strong and were even strengthened in some ways by the Clean Water Act, regulation of agricultural pollution was not strengthened, and, although already weak, was weakened still further. The only real advance was establishment of the Rural Clean Water Program, under which the federal government would share the cost of improvements voluntarily installed by farmers. The Carter administration initially opposed the appropriation of any funds for the initially Rural Clean Water program. In 1978 an effort by Senator John Culver (Democrat-Iowa) to expand the program, and in doing so to amend the Clean Water Act to require the states to impose some mandatory controls on nonpoint sources, was defeated, having run afoul of conflicts and between the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS) and their respective Congressional supporters (Risser).

The 1977 legislation left considerable discretion to EPA in how to deal with nonpoint water pollution. As under Presidents Nixon and Ford, EPA's leadership during the Carter administration was preoccupied with other programs, and put little staff or budget into nonpoint questions, while placing a high priority on maintaining good relations with farm groups. As a former EPA official from the period recalls, "You'd have farmer Brown mad at you, and all those tractors surrounding your building" (Interview, July 3, 1985). Thus in 1978 the EPA administrator announced that the agency would approve state "208" plans that had no provision for mandatory enforcement so long as a voluntary approach could be shown to be effective (EPA, 1978). State water quality officials who had labored for consensus with agricultural interests on acceptance of some mandatory controls saw their efforts disintegrate; one accuses EPA of having "welched" on earlier requirements (Heft). In Ohio, for example, where the legislature was debating a water quality law, EPA's announcement was followed the next day by legislative action eliminating water quality regulators' enforcement authority for agricultural sediment. Recent debates over the renewal of the Clean Water Act have continued to show a pattern of success of agricultural interests. Although a Senate subcommittee in 1983 approved a bill requiring the states to have enforcement authority for non-point sources and denying federal commodity payments to farmers who pollute, these provisions were respectively defeated or weakened at the committee level.

In a few cases, water pollution from farming has encountered overwhelming opposition. An example is the impact of irrigation runoff on wildlife refuges, which generally are wetlands and hence can be damaged by it. In 1985 the Department of the Interior decided to shut down the runoff into the Kesterson National Wildlife Refuge from 40,000 acres irrigated from projects of the

Bureau of Reclamation in California's San Joaquin Valley. However, this case is rather unusual. The critical pollutant at Kesterson was selenium, an unusually strong poison that was killing or pitifully malforming birds. Moreover, groundwater quality was threatened, prompting the state Water Resources Board to declare the refuge a toxic dump and order the federal government to clean it up. Further sharpening the issue at Kesterson was that like many other wildlife refuges, it is covered by the Migratory Bird Treaty Act, which reflects international obligations and is enforced by criminal penalties. Very few instances of agricultural runoff are likely to encounter so powerful a combination of factors.[1]

Even a politically potent regulatory effort like that regarding hazardous waste has not always been pressed as successfully on farms. Much recent regulation has focused on concentrated disposal sites rather than on-site hazardous waste, much of which is located on farms.

Every president since Franklin D. Roosevelt has tried to eliminate the Agricultural Conservation Program (administered by ASCS) on the grounds that the soil and water practices it funds often do more for production than conservation, miss the most irresponsible farmers, and reach virtually every county with some semblance of a farm, with little regard to where the real problems are (Leman, 1982). For similar reasons, the Reagan administration also has sought to eliminate the Soil Conservation Service's technical assistance programs, which have been quite evenly spread even though the erosion problem was never uniform and has shifted over the years. The continued survival of both the Agricultural Conservation Program and SCS this year, in the midst of a national fiscal crisis, is a tribute to the power of farmers and the new involvement of environmental groups in soil conservation questions. The administration has had only moderate success in its effort to target these programs on the trouble spots.

A basis for the popularity of soil conservation with farm groups in contrast to their stance regarding programs in pesticides, hazardous waste, and water quality is its voluntary approach. The soil conservation movement began in the 1930s with a willingness to consider mandatory approaches, but very quickly abandoned this option as too controversial. Thus proper soil conservation practices have not been required even as a condition for receiving commodity payments. After years of opposition to such "cross-compliance," farm groups seem to have accepted a mild form of it in current debates over the 1985 farm bill--in exchange for the support of environmentalists for a "conservation reserve" that pays farmers to idle worn land but, like other soil conservation efforts, tends not to concentrate on where most improvement can be achieved.

Resistance in farm areas has also reduced the reach of the Occupational Safety and Health Act of 1970. For example, the 1977 and subsequent annual appropriations acts have totally exempted from the 1970 law farms with ten employees or less--an exemption that other small businesses enjoy only if they have a better than average safety record. The regulations implementing the law exempt all farms from certain "general industry" standards, including an obligation to communicate to employees information about possible exposure to hazardous chemicals and to assure them access to records about their exposure to such chemicals and about other medical conditions. Another exemption is from the requirement that workers be provided toilets and fresh water. Only after repeated court orders did the Occupational Safety and Health

Administration (OSHA) review the field sanitation issue, deciding in 1985 to continue the exemption.[2] Aside from such formal exceptions, federal and state administration of safety and health regulations has been looser regarding farm work. For example, with the development of pesticides that degrade more quickly in the soil but are more toxic, field workers are facing new dangers that regulators have inadequately addressed (Wasserstrom and Wiles). Whereas the exposure to pesticides of all other workers is regulated by OSHA, that of farm workers is regulated by EPA, which has less authority in the workplace and is required under FIFRA to rely on state administration. For these various reasons, the injury and death rate in such industries as mining, logging, and construction has improved much more quickly in the last decade than in farming, which now rivals them as the most hazardous of major occupations (National Safety Council).

The Fair Labor Standards Act of 1938 was first extended to farm work in 1967, although it still exempts small farms; the only other small businesses exempted are retail establishments. No farm employer, no matter how large, is subject to the requirement to pay overtime. The age at which child labor is prohibited is lower than in other economic sectors; under certain circumstances, children as young as ten years old can legally be employed.

Agricultural workers have always been excluded from the provisions of the National Labor Relations Act of 1935. In the 1960s and early 1970s the nation was gripped with controversy over a national boycott of table grapes called by the United Farm Workers of America (UFWA) and backed by nonagricultural unions. The campaign helped produce in California an Agricultural Labor Relations Act recognizing the right of farm workers to bargain collectively. However, in the past decade the drive to unionize farm workers has declined nationwide. In addition to California, UFWA has been able to win contracts in only one other state (Florida) and has been so frustrated by administration of the California law that it initiated in 1984 a new boycott, a call that seems to have been considerably less successful than the earlier one, perhaps reflecting the weaker position of labor in American politics.

An important regulatory trend at the state and local level is zoning to limit and direct the development of rural land, requiring that much of it be kept in agricultural or silvicultural uses. Although these laws have appreciably curtailed the farmer's traditional option to sell land to developers, they have been applied loosely enough to allow the continuation of substantial development of rural land. In the process, the owners or operators of agricultural land have received substantial concessions, including "right to farm" laws, tax breaks, purchases of development rights, and generous loans.

With some exceptions, regulation for environmental quality and occupational safety is considerably looser on farms than it is in other economic sectors. Public interest groups have made surprisingly few criticisms of this situation. Industries and municipalities that are more tightly regulated have also publicly had few complaints, perhaps recognizing the decisive political power of agricultural interests in this matter.

WESTERN LAND AND WATER

In the other three cases examined in this paper, the involvement of government in agriculture is largely indirect, in the form of financial payments,

regulation, and the like. In the West, however, government--especially the federal government--has a more direct role in that it owns lands that are commercially grazed (or logged) or it builds and operates projects that supply water for irrigation.

Livestock interests long named the terms under which they used federal grazing lands, enjoying most of the benefits of ownership with few of its responsibilities. Despite the rise of competing land uses and groups, the ranchers' power remains impressive, based particularly in recent years on pleas about their difficult financial situation. Bitter opposition has slowed decades of effort by the federal agencies to reduce permitted grazing levels, most recently by language since 1980 in the appropriations acts requiring that any reduction by the Bureau of Land Management (BLM) of ten percent or more not be made until administrative appeals by permittees have been acted upon--a process that can take up to two years. Some ranchers have also long resisted federal restrictions informally by grazing more livestock than officially permitted. Livestock interests have repeatedly turned back fee increases, such as by 1978 legislation that established a formula based on "ability to pay," under which the fee has actually fallen in recent years to $1.35 per animal unit month (1985), about one-fifth the estimated fair market value (USDA and USDI). Congress is now considering proposals to make this formula permanent. In 1982, the Reagan administration even proposed to sell off tens of millions of acres of federal lands, especially those for grazing; opposition came from many quarters, but contributing to the withdrawal of the proposal was that the ranchers made it clear that they preferred their existing permits to having the opportunity to purchase the lands (Leman, 1984). Even so, the administration gave ranchers more power over the public grazing lands by taking several actions to allow them to own water rights there (Schmidt).

Environmental activism has particularly focused on public lands. The timber industry has felt the brunt of this pressure in restrictions on how logging can be conducted and in the banning of logging entirely by adding some federal lands to the National Wilderness Preservation System. A 1974 federal court ruling upset ranchers greatly by agreeing with the Natural Resources Defense Council that BLM must prepare environmental impact statements on its decisions to issue grazing permits. However, as this effort has proceeded, only moderate reductions have been made in the amount of grazing allowed. As budgets have tightened, BLM has relied increasingly on the permittees themselves to monitor range conditions. Grazing is the only commodity use that has continued largely unabated in wilderness areas; ranchers have had to accept restrictions in construction, and they cannot use vehicles, but they have not been prevented from operating as have loggers and miners. Generally, ranchers have not faced as much environmental opposition as have the latter groups; in fact they have allied with environmental groups on such issues as restricting strip mining, requiring that mined lands be reclaimed, and blocking federal eminent domain needed for the construction of coal slurry pipelines. Without support from environmental groups, ranchers who own the land's surface probably would not have gained the right to veto plans to mine federally owned subsurface coal (through the Surface Mining Control and Reclamation Act of 1977).

Some would see a decline in the power of the farm interests in the fact that no major new federal reclamation projects have been authorized or started since 1976. However, this falloff is more apparent than real, because Congress previously had authorized a large backlog of projects that persists today.

Also, many federal projects that are already in operation have or are gaining authorization for much additional construction, and starts have continued in recent years. The states have become primary defenders of irrigators in their search for public works solutions to pollution problems (e.g., projects to increase water supplies or control salinity in soil and runoff) that otherwise must be solved by retiring federally irrigated acreage from production (Howe, p. 27). And state-financed water projects seem to be becoming more common, as in Texas, with irrigation being a prominent purpose.

But more important now perhaps than how much more water will become available through construction is how the water from existing projects will be allocated. Although environmentalists are concerned about allocation, their concern is not as uncompromising as was their opposition to the projects before they were constructed, nor is it as automatically contrary to the wishes of irrigators. As western economies and political patterns evolve, irrigators face demands from municipal and industrial water users, while legal and political changes increase the water needs of fisheries (for the maintenance of a minimum stream flow) and Indian tribes. Already the total acreage under irrigation in the Southwest has begun to decline. But the key question in this transition is at what rate farmers will lose water and under what terms; the indications are that these questions are being settled in ways rather agreeable, and in some cases very agreeable to the irrigators (Ingram). More than 85 percent of the West's water consumption--an impressive proportion by any measure--is for irrigation, and even with the reductions that are in prospect it will continue high (Frederick). Despite the ongoing expiration of their long-term contracts for the water, irrigators are often getting preferential treatment in obtaining new contracts over the objections of other users who are willing to pay more for it. Transfers of water out of irrigation have generally produced compensations for farmers, such as construction to help them subsist on less water of poorer quality, or generous financial compensation.

The two great purposes of the Reclamation Act of 1902 were to settle large parts of the arid West, and to promote farming by small, local operators. The first purpose was impressively achieved largely through massive subsidies of the farmer. Although the projects supposedly were to pay for themselves through fees for the water, in fact repayment was with no interest. Congress repeatedly lengthened the repayment period and set the payments according to farmers' "ability to pay," and various other legislative or administrative measures reduced their share still further (Campbell). By 1977 it was estimated that still only about 19 percent of the real project costs of agricultural water supply projects had been repaid (North and Neely).

The second purpose of the Reclamation Act--to provide water from the federal projects only to small landholdings farmed by local residents--was far less faithfully observed. Large landholders within reach of the new projects initially withheld land from sale, but amendments in 1914 and 1926 to the Reclamation Act required the recipients of federal water who had lands in excess of the allowable total to sell them in amounts that would distribute the land more equally. However, Congress exempted several projects (e.g., the Big Thompson project in Colorado) from this requirement, and when the supporters of other projects were unable to obtain a similar change in the law, they obtained administrative rulings that did so (e.g., for the Imperial Valley Project in California) or pressed the Bureau of Reclamation not to enforce the law (e.g., in the Salt River Project in Arizona and the Central Valley Project in

California). A federal court in 1976 ordered the Department of the Interior to end many of these abuses and to enforce the Reclamation Act's acreage limitation provisions. However, political pressures immediately arose to legalize many of the previous infractions via the Reclamation Reform Act of 1982, which along with some features distasteful to large irrigators secured gains that their predecessors only dreamed of. The legislation increased to 960 acres the size of farms that would receive Reclamation water at subsidized rates, allowing farms whose holdings were in excess of this amount to receive water while charging them for its full cost. The residency requirement was entirely eliminated. In addition, the 1982 amendments specifically exempted several major projects (e.g., the Central Arizona project, the Big Thompson project, and Army Corps of Engineers irrigation projects in California), so that excess acreage there continued to receive subsidized water with no requirement that the excess land be sold or that the full cost of the water be paid.

As the competition for water has intensified, the state governments' role in regulating water rights has become more important. State water law favors those with an early claim, many of whom are farmers. In cases where new procedures are being established, as in groundwater, farmers seem to be holding their own (Ingram, pp. 139-42; Andrews and Fairfax).

Western ranchers and irrigators alike have had considerable success in influencing federal and state authorities. As Maass and Anderson find stress in their study of irrigation and politics in the United States and Spain, "unified local interests can use or manipulate governmental institutions to achieve their purposes" (1978, p. 274). They observe:

> The most powerful conclusion that emerges from the case studies is the extent to which water users have controlled their own destinies as farmers, the extent to which the farmers of each community, acting collectively, have determined both the procedures for distributing a limited water supply and the resolution of conflicts with other groups over the development of additional supplies. With important variations, to be sure, local control has been the dominant characteristic of irrigation in these regions, regardless of the nationality or religion of the farmers, the epoch, whether formal control is vested in an irrigation community or in higher levels of government, the forms of government at the higher levels, and perhaps even the legal nature of water rights (p. 366).

CONCLUSIONS

The continuing decline in the numbers of farms and farmers may have reduced the overall political power of the farm sector. But it has also reduced the social cost of aiding those that remain in farming, and consequently has reduced the quantity of power needed by farmers to remain sovereign in their own domain. When measured on a per-farmer basis, aid to agriculture has been on the rise rather than in decline. In proportion to their numbers, farmers are stronger than ever.

Of course, the issues that matter to agricultural interests have expanded in recent decades beyond "farm policy" narrowly defined to include general

economic policies and conditions, international trade questions, and the regulation of environmental quality and occupational safety. Agricultural interests face new groups in these new debates and in debates on the traditional farm commodity programs. Although some observers interpret these developments as a decline in agricultural power, we suggest that today's political struggle reflects a significant continuation of that power. The political resources available to agricultural interests remain impressive, especially in contrast to those of the groups that had supposedly displaced them. Farm commodity policy continues to be written largely within the farm sector. True, the commodity programs are no longer as powerful an instrument of compensation or protection as they once were, but neither are they the only such instruments today. Agriculturalists have secured farm trade policies that are often at variance with the general thrust of U.S. foreign policy. They have obtained unusually favorable treatment in environmental and occupational regulation. And they have maintained excellent terms in the management of western federal land and water.

Agricultural interests also seem to be benefitting from the Reagan-era devolution of power from the federal government to lower levels. For example, farmers long preferred to keep regulation at the state level, hoping to forestall stricter federal intervention. Even where strong federal laws exist, the delegation of important responsibilites to the states has helped moderate their impact, as in water quality and pesticides. The state departments of agriculture, which are closely responsive to farmers, have often been given a major role in administering programs that affect them.

With the help of some new allies, especially environmental groups, agricultural interests generally have continued in their ability to assert sovereignty in many areas that closely affect them, and thus still in many ways reflect the exclusive self-governing system described by Lowi (1978, p. 69). More strongly perhaps than any other private landowners, farmers have insisted that property rights entitle them to freedom from government control. The desire for a voluntary approach has meant that regulatory laws have been written, amended, and administered in ways that often have treated farmers more permissively than other groups. Where the federal government is helping the farmer with loans and commodity payments, there has been a hesitation to apply conditions on this help, despite the fact that federal payments to recipients other than farmers have long been used to enforce environmental, civil rights, and other requirements (ACIR). Even with federally owned lands and water projects, farmers and ranchers, have successfully invoked traditions favoring local sovereignty. One thoughtful observer has written: "Farm and conservation policy are so drenched in this hands-off rhetoric that we tend to forget it is an artifact of politics, not an inviolable principle of law" (Cook, p. 106).

Considering the extent of public investment in the private farm sector, and the fact that public and private agricultural lands encompass most of the country's area and consume much of its water, it is impressive that the sovereignty of the farm sector has received so little challenge. Yet agriculture is enough of an underpinning of the rural economy and landscape, and hence of the nation's patrimony, that concern for its survival will continue to convince many of its need for sovereignty. And in any case, the diversity and geographic extensiveness of farming will hamper any public policy that does not rely significantly on the voluntary cooperation of farmers. It is arguable that past resistance by agriculturalists has saved federal regulators and land and

water agencies from adopting some policies that would never have worked. But special treatment needs to be recognized as such, so that its social costs will be accepted consciously rather than by political inertia, as has more often been the case. For example, although the argument for special treatment for farms has been made regarding many different policies, perhaps some claims are more justified than others, and not all are needed for agricultural survival.

Can agriculturalists be judged powerful even though their numbers continue to decline? Some would say no, citing farm failures as a primary reason for the exodus from agriculture. But farmers have been leaving U.S. agriculture for nearly a century, and at a changeable rate which has little apparent connection to the political power of the "farm coalition." During the 1950s and 1960s, despite the supposed strength of that coalition, farm numbers declined by approximately three percent a year. Then during the mid to late 1970s, when the farm coalition was supposed to be losing its power, this rate of decline actually slowed, to under one percent. Now in the mid-1980s, under surprisingly adverse macroeconomic conditions, the rate of decline has momentarily accelerated, but only to five percent (Riemenschneider). Farm disappearances are now catching up to where they might have been if the earlier trend had been maintained.

Some agriculturalists would not feel powerful unless they could bring this farm loss trend to a total halt. But at least some realize that their power will be used to a better effect by allowing some farm operators who cannot adopt efficient production techniques to yield to those who can. It is this process of productivity growth and adjustment which allows those who remain in farming to prosper.

Smoothing the necessary movement of resources in and out of the farm sector, so as to reduce the social and economic costs which accompany this adjustment process, would be a more worthy goal of farm policy. Using their demonstrated political power over arrangements within the farm sector, agriculturalists are well positioned to author such policies. They might begin by revising or dismantling those existing policies which have at times disrupted or retarded the adjustment process within the farm sector.

U.S. grains policies conspicuously disrupted the cyclical adjustment process during the mid-1970s, both at the beginning and at the end of the upturn in market prices which was then taking place. Those policies were always one step behind, first restraining production, subsidizing exports, and dumping stocks too quickly into a tightening market, and then encouraging farmers to borrow and to expand just as the market was going slack (Gardner, p. 104). Government farm payments alone made net farm income less stable between 1976 and 1981 (Tweeten, p. 928). More recently, it has been the growth of highly leveraged farming, with reduced liquid assets, which has disrupted adjustment under conditions of cyclical downturn. It may be time to reconsider those federal farm policies which encouraged this sort of farming in the past, including price-stabilizing commodity programs which reward land acquisition by paying out benefits "per bushel" of production, poorly targeted subsidized farm credits (especially economic emergency and disaster loans), and a variety of existing farm-related tax rules which shelter those who purchase land. These distortions have been compounded by distortions also in the fields of agricultural trade, regulation, and western land and water. The impact of these distorted policies tends to compromise legitimate public policy goals

beyond the commodity area as well. Before agricultural economists go any farther in trying to design new programs to facilitate farm sector adjustment, they would do well to shed more light on those existing programs which inhibit (which is to say, postpone and disrupt) an adjustment process which without such programs would be difficult enough.

The existence of such programs raises a final point. A political scientist would assume that the bias favoring large farmers in some of these existing programs is no accident. It no doubt reflects a considerable inequality of political power within the farm sector. The emphasis throughout this analysis has been upon the political power of the U.S. farm sector as a whole, in opposition to non-farm interests. An equally important research issue is who within the farm sector controls the exercise of that power. It would not be surprising, if the farm sector is like any other, to find those with the most money and the most land exercising this power on their own behalf, while trying to disguise their advantage behind populist endorsements of "family farming." It is somewhat surprising that the national broadcast media have embraced and promoted this skewed conception of the farm sector.

This sort of power concentration within agriculture would explain a great deal about how agriculturalists have been using their considerable political influence. They have been using that influence not to target farm program benefits toward viable middle-sized operators who are suffering from a temporary bout of financial or commercial stress, but rather to hold in place farm programs which give the largest benefit to those with the smallest need.

It will always be less contentious, among agriculturalists, to look away from those concentrations of power which exist within the farm sector, and to focus instead upon the more unifying theme of aggregate farm sector strength in opposition to the rest of the economy. That is what we have done here. Having found aggregate farm sector strength to be largely undiminished, however, we would now suggest moving the debate forward, to examine the distribution of public benefits from the use of that strength.

NOTES

For comments on an earlier draft or other assistance we wish to thank Margaret Andrews, Cris Coffin, Kenneth D. Frederick, Don Hadwiger, Robert H. Nelson, Glenn Nelson, Henry Peskin, and Richard Wahl. Indispensable word processing help was provided by Maybelle Frashure.

[1] Also notable about the Kesterson situation was that although the Department initially decided to deny federal water to 40,000 acres, an agreement was reached under which the local irrigation district would receive an extension allowing it to undertake various measures to stem the pollution without removing the land from production, and thus continue to receive the water.

[2] About a third of the states--including leading agricultural states like California, Florida, and Texas--require some form of sanitation facilities for field workers. However, these regulations are generally not as strict as the proposed federal standard.

REFERENCES

Advisory Commission on Intergovernmental Relations, Regulatory Federalism: Policy, Process, Impact, and Reform (1984).

Anderson, Kathe, "The EPA General Permit Program," in James P. Law and Gaylord V. Skogerboe, eds., Irrigation Flow Quality Management: Proceedings of a National Conference, Fort Collins, Colorado State University, 1977).

Andrews, Barbara T. and Sally K. Fairfax. "Groundwater and Intergovernmental Relations in the Southern San Joaquin Valley of California: What Are All These Cooks Doing to the Broth?" University of Colorado Law Review 55,2 (Winter 1984).

Bardach, Eugene and Robert A. Kagan, eds. Social Regulation: Strategies for Reform. San Francisco, Institute for Contemporary Studies, 1982.

Beale, Calvin L. "The Population Turnaround in Rural Small-Town America." Rural Policy Problems: Changing Dimensions. eds. William P. Browne and Don F. Hadwiger. Lexington Books, 1982.

Benedict, Murray R. Farm Policies of the United States, 1790-1950: A Study of their Origins and Development. New York: Twentieth Century Fund, 1953.

Berry, Jeffrey M. "Consumers and the Hunger Lobby." Food Policy and Farm Programs. eds. Don F. Hadwiger and Ross B. Talbot, Proceedings of the Academy of Political Science 34,3 (1982):68-78.

Boehlje, Michael. "Agricultural Policy and Financial Stress." Agriculture, Stability, and Growth. Reports from a Public Policy Study of the Curry Foundation. New York: Associated Faculty Press, 1984. 237-240.

Bonnen, James T. "Observations on the Changing Nature of National Agricultural Policy Decision Processes, 1956-76." Farmers, Bureaucrats, and Middlemen: Historical Perspectives on American Agriculture. ed. Trudy Huskamp Peterson. Washington, D.C. Howard University Press, 1980. 309-342.

_____. "U.S. Agriculture, Instability, and National Political Institutions: the Shift from Representative to Participatory Democracy." United States Agricultural Policies for 1985 and Beyond. (Tucson, Arizona: Department of Agricultural Economics, University of Arizona and Resources for the Future, 1984).

Boxley, Robert F. "Farmland Ownership and the Distribution of Land Earnings," Agricultural Economics Research (forthcoming).

Browne, William P. "Farm Organizations and Agribusiness." Food Policy and Farm Programs 198-211.

Campbell, David C. "The Pick-Sloan Program: A Case of Bureaucratic Economic Power." Journal of Economic Issues 18,2 (June 1984):449-456

Castle, Emery N. and Mark Goldstein. "Income Distribution, Poverty, Natural Resources, and Public Policies: Conceptual and Research Issues." Rural Development, Poverty, and Natural Resources. Workshop Paper Series, Washington, D.C.: National Center for Food and Agricultural Policy, Resources for the Future, 1984.

Cook, Ken. "Commentary: Agricultural Nonpoint Pollution Control: A Time for Sticks?" Journal of Soil and Water Conservation 40,1 (January-February, 1985).

Crosson, Pierre R. and Sterling Brubaker. Resource and Environmental Effects of U.S. Agriculture. Washington, D.C.: Resources for the Future, 1982.

Destler, I. M. Making Foreign Economic Policy. Washington, D.C.: Brookings, 1980.

Dun's Marketing Services, 1985 Standard Industrial Classification Statistics.

Duncan, Marvin, and Drabenstott, Mark. "Another Troubled Year for U.S. Agriculture." Federal Reserve Board of Kansas City, Economic Review, December 1984. 30-41.

Frederick, Kenneth D. with James C. Hanson. Water for Western Agriculture. Washington, D.C.: Resources for the Future, 1982.

Galston, William A. A Tough Row to Hoe: The 1985 Farm Bill and Beyond. Roosevelt Center for American Policy Studies. Washington, D.C., 1985.

Gardner, Bruce L. The Governing of Agriculture. Lawrence, Kansas: Regents Press of Kansas, 1981.

Geisler, Charles C., Nelson L. Bills, Jack R. Kloppenburg, Jr. and William F. Waters, "The Structure of Agricultural Landownerships in the United States, 1946 and 1978," Search, Agriculture 26 (Agricultural Experiment Station, Cornell University, 1983).

Guth, James L. "Consumer Organizations and Federal Dairy Policy." The New Politics of Food. eds. Don F. Hadwiger and William P. Browne. Lexington, Mass.: Lexington Books, 1978: 123-27.

Haig, Alexander M. Caveat: Realism, Reagan, and Foreign Policy. New York: Macmillan, 1984.

Heft, Floyd, letter to the editor, Journal of Soil and Water Conservation, (March-April 1985).

Hinich, Melvin J. and Richard Staelin. Consumer Protection Legislation and the U.S. Food Industry. New York: Pergamon Press, 1980.

Howe, Charles W. "The Coming Conflicts over Water." Western Water Resources: Coming Problems and the Policy Alternatives. Boulder, CO., Westview Press, 1980.

Ingram, Helen. "Water Rights in the Western States." Food Policy and Farm Programs, 134-43.

Inside E.P.A., July 1, 1983 ("Chafee Drops CWA Nonpoint Controls Plan, Under Farm/Industry Pressure").

Journal of Commerce, March 26, 1985, p. 11A.

Key, V.O. Public Opinion and American Democracy. New York: Knopf, 1961.

King, Anthony O., ed. The New American Political System. Washington, D.C.: American Enterprise Institute, 1978.

_____, ed. Both Ends of the Avenue: The Presidency, the Executive Branch and Congress in the 1980s. Washington, D.C.: American Enterprise Institute, 1983.

Kramer, John. "Agriculture's Role in Government Decisions," Consensus and Conflict in U.S. Agriculture: Perspectives from the National Farm Summit eds. Bruce L. Gardner and James W. Richardson. College Station, Texas: Texas A&M University Press, 1979.

Leman, Christopher K. "Political Dilemmas in Evaluating and Budgeting Soil Conservation Programs: The RCA Process." Soil Conservation Policy, Institutions, and Incentives. eds. Harold Halcrow, Melvin Cotner, and Earl Heady. Ankeny, Iowa: Soil Conservation Society of America, 1982.

_____, "The Revolution of the Saints: The Ideology of Privatization and Its Consequences for the Public Lands." Selling the Federal Forests, ed. Adrien E. Gamache (Seattle: College of Forest Resources, University of Washington, 1984).

Longmire, Jim, and Morey, Art. Strong Dollar Dampens Demand for U.S. Farm Exports. Foreign Agricultural Economic Report Number 193, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., December 1983.

Lowi, Theodore J. The End of Liberalism: The Second Republic of the United States New York: W. W. Norton, second ed., 1979--first published in 1969.

Luttrell, Clifton B. "Down on the Farm with Uncle Sam." International Institute for Economic Research, Original Paper 43, Los Angeles, 1983.
Maass, Arthur and Raymond L. Anderson. ...And the Desert Shall Rejoice: Conflict, Growth and Justice in Arid Environments. Cambridge, Mass.: MIT Press, 1978.
Manley, Ardith L. and Donald F. Hadwiger. "Taking 'Cides: The Controversy over Agricultural Chemicals." Farmers, Bureaucrats, and Middlemen, 200-221.
Nadel, Mark V. The Politics of Consumer Protection. Indianapolis: Bobbs Merrill, 1971.
National Commission on Agricultural Trade and Export Policy. Interim Report to the President and Congress. Washington, D.C., March 1985.
National Planning Association, State of American Agriculture, 1984. Washington, D.C., 1984.
National Safety Council. Work Injury and Illness Rates, 1984 Edition (1984).
Nelson, Glenn L., "Elements of a Paradigm for Rural Development," American Journal of Agricultural Economics 66,5 (December 1984).
New York Times, January 23, 1985, Poll with CBS on Farm Attitudes, p. A11.
North, Ronald M. and Neely, Walter P. "A Model for Achieving Consistency for Cost-Sharing in Water Resource Programs." Water Resources Bulletin, 13,5 (October 1977) 572-580.
Olson, Mancur, The Rise and Decline of Nations: Economic Growth, Stagflation, and Social Rigidities (New Haven: Yale University Press, 1982).
Paarlberg, Philip L., Alan J. Webb, Arthur Morey, and Jerry A. Sharples, Impacts of Policy on U.S. Agricultural Trade. International Economics Division, Economic Research Service, U.S. Department of Agriculture. Washington, D.C., December 1984.
Paarlberg, Robert L. Food Trade and Foreign Policy. Ithaca, N.Y.: Cornell University Press. 1985.
Peters, John C. "The 1981 Farm Bill. Food Policy and Farm Programs: 157-173.
Radosevich, George E. and Gaylord V. Skogerboe, Achieving Irrigation Return Flow Quality Control through Improved Legal Systems, report to the Environmental Protection Agency, no. 600/2-78-184 (December 1978).
Riemenschneider, Charles. "Redressing the Farm Problem: More Aid Would Not Have Worked." New York Times, March 10, 1985.
Risser, James. "Agricultural Pollution Fight Tangled in Political Snarls," and "Rural Water Cleanup is Dead for the Year," Des Moines Register (September 15 and 16, 1978).
Rowland, C.K. and Roger Marz. "Gresham's Law: The Regulatory Analogy." Policy Studies Review, 1981.
Rowland, C. K. and Mel Dubnick. "Decentralization of Agriculture." Food Policy and Farm Programs. 212-222.
Schattschneider, E.E. Party Government. New York: Holt, Rinehart and Winston, 1942.
Schmidt, William E., "U.S. May Lose Control of Western Rangeland," New York Times (February 14, 1983).
Tweeten, Luther. "Economic Instability in Agriculture: The Contributions of Prices, Government Programs and Exports," American Journal of Agricultural Economics, vol. 65, no. 5 (December 1983): 922-931.
U.S. Department of Agriculture, Forest Service and Department of the Interior, Bureau of Land Management. 1985 Grazing Fee Review and Evaluation. (1985).
U.S. Department of State. Bureau of Public Affairs. U.S. Foreign Policy and Agricultural Trade. Current Policy no. 535. (January 10, 1984).

U.S. Environmental Protection Agency. Deputy Assistant Administrator for Water Planning and Standards. "Regulatory Programs for Nonpoint Source Control," Revised Program Guidance memorandum No. 31, Nov. 14, 1978.

_____, Nonpoint Source Pollution in the U.S. (January 1984).

U.S. Library of Congress, Congressional Research Service. Agriculture: U.S. Embargo of Agricultural Exports to USSR. Issue Brief IB80025. (August 1981).

Wasserstrom, Robert and Richard Coiles, Field Duty: U.S. Farm Workers and Pesticide Safety (Washington, D.C.: World Resources Institute, 1985).

MANAGEMENT PROBLEMS OF FARMS AND AGRICULTURAL FIRMS

R. P. King and S. T. Sonka*

ABSTRACT

The operating environment of rural firms is characterized by instability and change. This is encouraging managers to adopt new methods that rely more on information and strategic flexibility. In the future, five problem areas will demand increased managerial attention: managing innovation and change, managing risk, organizational design, information system design, and human resource management. Management research will need to be more problem-oriented and interdisciplinary, with general managers and their problems being the central focus. Extension and teaching programs should share this focus, emphasizing problem solving and effective information use.

INTRODUCTION

Management issues have been a central focus of research, teaching, and extension efforts in agricultural economics throughout the history of our profession. Describing the profession's early years, Cochrane (1983, pp. 63-66) notes that prior to 1910, nearly all work in agricultural economics was in the area of farm management. In the years that followed, a second strand of development in the profession concentrated on problems related to the marketing and distribution of agricultural products. This led to increased involvement by agricultural economists in the analysis of market structure and agricultural policy alternatives. Efforts to develop solutions to management problems encountered by farm supply and product processing and marketing firms were also, however, an important aspect of the work in this tradition. Today, farm and agribusiness management are strongly emphasized in most undergraduate teaching and state extension programs, and agricultural economists continue to be active in a wide range of management research efforts.

This paper examines the potential for agricultural economists to contribute to the future development and implementation of concepts, practices, and tools designed to make the managers of farm and agriculturally-related firms more effective. In this discussion, the term "farm" refers to farms and ranches directly involved in agricultural production. The term "agriculturally-related firm" refers to those firms that supply farm inputs and process farm outputs. In one sense, the focus of this paper is unusually broad, since the firms considered range from small, part-time farms to very large corporations that

* Robert P. King is an Associate Professor of Agricultural and Applied Economics at the University of Minnesota. He holds the E. Fred Koller Chair in Agricultural Management Information Systems and is Associate Director of the Strategic Management Research Center. Steven T. Sonka is Professor of Agricultural Economics at the University of Illinois at Urbana-Champaign. Seniority of authorship is not assigned.

operate on an international scale. On the other hand, two factors help narrow this focus and make it more manageable. First, the managers of all these firms operate in the same broad economic, technical, and political environment, and that environment has an increasingly important impact on the problems they face and the choices they can make. Although individual responses to changes in this environment may be different, the problems posed by it are often quite similar. Second, managerial work across this wide range of firms is being profoundly affected by changes in the need for and access to information. Again, responses to these changes are likely to differ, but the issues facing managers and the opportunities agricultural economists will have for improving managerial effectiveness are not firm specific. In the discussion which follows, then, differences across firms will be recognized, but common problems, issues, and opportunities will be emphasized.

This paper is divided into three major sections. The first outlines the current situation and suggests that a dominant current and future concern of the managers of rural firms will be to define strategies and procedures that will allow them to respond more effectively to change. Information is viewed as a key element in such strategies. The second major section describes five broad problem areas of critical importance to the managers of rural firms. These are: managing innovation and change, risk management, organizational design, information system design, and human resource management. The paper's final major section evaluates the potential for agricultural economists to contribute to the solution of management related problems. In this discussion, the separate functions of research, extension, and resident instruction are considered.

RESPONSE TO INSTABILITY AND CHANGE AS A CENTRAL THEME

Management is the process by which decisions about allocating a firm's resources to meet desired ends are analyzed, made, and implemented. In order to perform these functions, a manager must consider the resources available to the firm and the technical possibilities for combining them, the opportunities offered and constraints imposed by the firm's environment, and the goals and objectives of the firm.

The importance of environmentally-based opportunities and constraints has, in recent years, gained increased attention in the general management literature. Tracing the evolution of managerial concerns and responses in American business firms, for example, Ansoff notes an increased preoccupation by managers with the problem of responding to uncertainty and rapid change in technology, market conditions, and socio-political forces. Ansoff attributes this to a marked increase in the turbulence of the economic environment. He notes:

> From the mid-1950s, accelerating and cumulating events began to change the boundaries, the structure, and the dynamics of the business environment. Firms were increasingly confronted with novel unexpected challenges which were so far-reaching that Peter Drucker called the new era an Age of Discontinuity.
>
> (Ansoff, p. 33)

Ansoff goes on to note that this was in marked contrast to conditions in the first half of the century, when the environment was more stable and manageable. In those years, problems related to exchange rates, inflation, government

policies, and rapid technological change were secondary to "the business of business"--technical efficiency and effective marketing.

The experience of rural firms closely parallels that of other businesses. In his historical analysis of American agriculture, Cochrane (1979) describes the period from 1933 to 1970 as one of technical revolution in an environment characterized by relatively stable market conditions and a steady stream of mechanical and biological innovations. At the farm level, management concerns centered around the adoption of new technologies, efficient resource use, and the expansion of farm size to take advantage of scale economies associated with increased mechanization. Managers of agriculturally-related firms focused their attention on growth strategies designed to allow them to take advantage of rapid increases in the use of purchased inputs and significant expansion in the demand for processing and distribution services in the expanding food marketing industry.

Cochrane characterizes the period since the 1970s as one of world integration, instability, and uncertainty. During this period, the managers of farm firms have shifted the focus of their attention to risk management, adaptation to sudden changes in technology and industry structure, and financial management and control. Some farm operators have pursued aggressive growth strategies, while others have chosen to diversify their operations through off-farm investment and employment. Managers of agriculturally-related firms have been forced to devote more attention to responses to structural shifts in the farm firms they serve; product innovation opportunities afforded by new technological developments; and problems stemming from monetary, fiscal, and trade policy decisions. Growth rates for the nonfarm segment of the agricultural sector have slowed somewhat, but individual firms have become larger as a result of mergers and consolidations.

Evidence of the Increased Importance of Instability and Change

Evidence of the importance of instability and change in the contemporary agricultural sector is broad-based, as are the sources of instability and change. Numerous reports and articles have described the changing structure of farming (e.g. Schertz; U.S. Senate; Tweeten, 1984) and the effects these changes will have in agriculturally-related firms (e.g. Dahl; Hamm; Minden). Other studies have documented increases in price and income instability (e.g. Sonka and Patrick) and have explored the forces underlying that instability (e.g. Firch, Tweeten, 1983). The causes of rapid change and increased instability are numerous and often interrelated. However, three broad categories of contributing factors are: changes in weather patterns, increased integration of the agricultural sector into the national and world economy, and technological change.

Weather is a fundamental source of uncertainty in agricultural production. The importance of climate events for agricultural production was dramatically illustrated by the unexpected crop shortfalls and resulting worldwide food scarcities of the early 1970's. Since then several episodes have occurred in which climatic extremes have had a marked impact on domestic and international levels of agricultural output. The agricultural/climate relationship has been extensively studied in recent years (National Defense University; Parry and Carter). Resulting predictions of future climate patterns are controversial and sometimes contradictory. However, analysts have documented that summer weather conditions during much of the 1950's and 1960's in this country were unusual because of the relative absence of extreme weather events (Oram). As climatic

patterns have returned to normal in recent years, then, climate induced shocks to agricultural markets have become more frequent and pronounced.

Today's U.S. agriculture is tightly integrated within the national and international economies (Dorner). For farm firms, this has made the problem of understanding the economic and political environment much more important. Commodity markets are affected by a much wider range of forces, making price levels more volatile and difficult to forecast. In addition, public policies that materially affect agricultural firms are no longer limited to traditional price and income support programs. International relations, domestic monetary and fiscal policies, and trade initiatives all can have profound effects on the economic performance of farm firms. For example, the high real interest rates stemming from recent monetary and fiscal policy have been a major factor in the current farm financial crisis. Finally, new participants, such as those who represent environmental concerns and consumer interests, have recently entered into farm policy debates.

Because their performance is intertwined with the financial well being of farm firms, increased integration of agriculture into the national and world economies has had similar impacts on agriculturally-related firms. In addition to the problems caused by rapid structural change and greater instability in both farm input and agricultural commodity markets, however, higher degrees of economic integration have also broadened the scope of opportunities and competition these firms face. Agriculturally related firms are moving into new markets for traditional products and so must compete in an increasingly international setting. In addition, as agriculturally-related firms develop new products, such as financial and information services, they face unfamiliar domestic competition. For example, agriculturally-related firms offering on-line information services face competition from television networks, publishers, retail merchandisers, computer manufacturers, and telecommunications companies. Clearly, the boundaries of the farm supply industry are changing rapidly.

Technological change is a third major source of instability and change for farm and rural firms (Swanson and Sonka). Over the past fifty years, the agricultural system has had to adapt to massive changes in production and processing technology. Particularly significant have been technical advances in farm machinery design, fertilizer responsive plant varieties, livestock breeding, pesticides and animal health products, grain storage and handling technology, and food processing technology. At the farm level these changes have resulted in considerable increases in physical productivity and in the scale of individual operations. They have also led to a marked increase in the importance of agriculturally-related firms in the overall food system.

Although predictions of technological progress are often faulty, the potential for future biotechnological advances to markedly affect agricultural production seems high (Johnson and Wittwer). For example, a recent analysis considered the potential for growth hormones in dairy cattle (Office of Technology Assessment). This innovation was estimated to increase production by 23 percent per cow for those dairy farms able to adopt it. Such an increase would significantly alter supply/demand relationships if widely adopted. Information technology is another area where significant advances are being made. New developments in computer hardware and software, storage technology and telecommunications systems are altering the economics of acquiring and using information.

Innovations in biotechnology and information technology have yet to be implemented on a wide scale in agriculture. Their impacts are likely to be far reaching but are difficult to predict. In part, this stems from the fact that these technologies have different characteristics from other recent innovations in agriculture. Innovations based on biotechnology and information technology often have value primarily because of the information embodied in them. Because of the public good characteristics of such products and the resulting confusion over public and private sector roles in their development, markets for these innovations may fail without public intervention. In addition, patent and copyright protection for such products is often poorly defined and difficult to enforce. As a result, the uncertainty associated with further developments in information technology and biotechnology is considerable.

Information as a Response to Instability and Change

Managerial methods, organizational structures, and the problems that demand managers' attention have all evolved in response to these changes in the economic, technological, and institutional environment of the agricultural sector. Sonka (1985b) has identified three historical stages of management practices in agriculture that help characterize these changes: the pre-industrial stage, the industrial stage, and the information stage. This typology emphasizes differences in the role of information as the basis for understanding the evolution of management problems and practices. As such, it is also useful for gaining insights into the changing role of agricultural economists whose work focuses on management issues.

During the pre-industrial stage, which extended into the early 1930's, the availability of labor was the critical determinant of farm firm success. Information networks were simple. Experiences of family and neighbors were primary sources of information. Reliance on products and services provided by agriculturally-related firms was relatively limited, and these firms tended to be small and locally based. Agricultural economists working with both farm and nonfarm firms during this period emphasized basic management skills, such as record keeping and comparative analysis.

The period during which the industrial stage management style evolved roughly corresponds to Cochrane's period of technical revolution. Throughout this period, capital was being substituted for labor, and the adoption of technological innovations was a key determinant of success. Information networks expanded rapidly, as extension agents, farm media, input suppliers, and lenders became increasingly important sources of information. Thus, the importance of agriculturally-related firms increased as farm managers became more dependent upon them. These firms grew rapidly in both size and scope, and their managers began to face a new set of problems associated with planning and control in large organizations and marketing over a wide geographical area. Agricultural economists played an increasingly important role during this period. Working with both farm and nonfarm firms, they emphasized technical and economic efficiency and enjoyed considerable success. Their research and outreach activities were important in the development and implementation of new technological inputs and new management strategies. Because of the often clear-cut dominance of the new technologies and the relative stability of the operating environment, recommendations based on static production economic analyses were often both widely applicable and quite durable.

As the agricultural sector entered Cochrane's period of world integration, instability and uncertainty, the information stage of management practices began to emerge. In the face of rapid structural change; increased instability; and rising costs for labor, capital equipment, and energy, the effective use of information has become a key to success for both farm and agriculturally-related firms. Facilitated by developments in information technology and by new market linkages with firms outside of the traditional agricultural sector, farmers' information networks are continuing to grow. They now include on-line data services, financial service firms, and production consultants, as well as extension agents, lenders, input suppliers, and the farm press. The demand for more comprehensive and complex internal information systems is intensifying as flexible management strategies that allow for repeated reevaluation of plans as the decision environment changes come into more widespread use. Such strategies rely on information to document and/or predict changing conditions. In the midst of these changes, managers of agriculturally-related firms face a number of new challenges associated with managing still larger, more geographically dispersed organizations and with innovating into new markets and product areas. For these firms, too, effective information management is a major determinant of success.

Agricultural economists also face a new set of challenges. In part, this stems from the fact that the transition from industrial to information stage management processes is a gradual one. Therefore, the needs of both farm and nonfarm client groups are and will continue to be quite diverse. In addition, instability and rapid change in the environment increase the need for flexible management strategies based on dynamic analyses, while structural changes in both farm and nonfarm firms are creating new problems related to organizational design and human resource management. In the sections which follow, these new problems and issues are described in greater detail, and future directions for management research, teaching, and extension are explored.

KEY ISSUES AND PROBLEMS FOR MANAGERS OF RURAL FIRMS

In an environment characterized by instability and rapid change, the particular issues and problems that confront managers may differ considerably across firms and from one year to the next. In general, however, we believe the following five broad problem areas will demand increased attention from the future managers of both farms and agriculturally-related firms:

1. managing innovation and change
2. managing risk
3. organizational design
4. information system design
5. human resource management

In this section, critical dimensions of these problem areas are explored and major challenges for the agricultural economics profession are identified.

Managing Innovation and Change

As agriculture moves into the last years of this century, the increased rate of technical, economic, and institutional change makes it important for rural firms to innovate and evolve if they are to perform successfully and survive. This need is not unique to rural firms. Drawing on his experience with large

industrial corporations, Ansoff notes an increase in managerial preoccupation with the need to adapt and change in a turbulent environment. More recently, managing innovation and change has been a central theme of books such as In Search of Excellence by Peters and Waterman and The Change Masters by Kanter. From a market rather than a managerial perspective, innovation has also been a central theme in works by Arrow, Kamien and Schwartz, Mansfield, and Ruttan.

Based on a cross industry study of innovation, Van de Ven has identified four central problems in the management of innovation:

1. the human problem of managing attention
2. the process problem of managing ideas into good currency
3. the structural problem of managing part-whole relationships
4. the strategic problem of institutional leadership

Regarding the first of these problems, it is human nature to make activities routine--to ignore fluctuations in the environment until conditions have changed dramatically. Often this tendency puts managers in the position of being forced to react to crises when they should be developing emerging opportunities. To overcome this, managers need to improve their ability to scan the environment--to distinguish between significant trends and short term changes. This issue is critical for the managers of both farm and agriculturally-related firms.

Gaining acceptance for innovative ideas--managing ideas into good currency--is a second central problem in the management of innovation. Managers must evaluate new ideas when organizational goals are complex, relevant data are costly or nonexistent, and resources for doing feasibility analyses are scarce. In addition, as organizational structures in both farm and nonfarm firms become increasingly complex, managers must often overcome considerable internal resistance to change. This can be an important problem for a farming operation managed by several members of the same family as well as for a large regional cooperative or an equipment manufacturing company.

Managing transitions in production technology, markets served, and organizational structures is an often overlooked problem that is closely related to Van de Ven's final two central problems. It is, for example, a key issue for agricultural managers responding to the problems and opportunities created by the current financial crisis in agriculture. Managers must determine an appropriate path along which to move their organization from its existing state to that which is desired in the future, and they must deal with the task of integrating new people and processes into an existing system.

This set of problems poses a number of challenges for agricultural economists working on management issues. First it points to the importance of efforts to understand and predict structural changes in the sector and in the overall economy, as exemplified in the USDA report on Structure Issues of American Agriculture and the Project 1995 study by the Farm Credit System. Understanding the forces that drive change is, however, only one aspect of managing change. Delineating the methods managers actually use and the difficulties they encounter as innovations are introduced is also essential. This requires research on less familiar issues, such as the design of more effective environmental monitoring systems and incentive structures that encourage and channel innovative activity.

Managing Risk

The forces leading to increased environmental turbulence have exposed the agricultural sector to increasing levels of market, financial, and institutional risk. At the same time, the range of risk management options available to managers of both farm and nonfarm firms has expanded dramatically. Risk transfer mechanisms such as contractural marketing arrangements, commodity options and futures instruments, and new more widely available forms of insurance, combined with choices about the pattern of internal resource allocation, give firms the opportunity to substantially alter their risk exposure.

Managers can also respond to uncertainty by working actively to overcome it (Hirschleifer and Riley). On the one hand, resources may be allocated to learning more about the system being managed and about future environmental conditions. Investments in irrigation scheduling, crop scouting, and commodity market forecasting services are examples of actions which combine information and flexible management strategies to overcome risk. Alternatively, risk management strategies may incorporate efforts designed to influence future environmental conditions. The organization of farmer bargaining cooperatives and the merger of agribusiness firms to gain increased market power are two examples of this type of active risk management strategy.

Managers face two broad sets of problems as they analyze risk management alternatives. First, while risks should, ideally, be assessed globally for the organization, actual decisions are usually made one at a time in piecemeal fashion (Cohen, March, and Olsen). Farm level production and marketing decisions, for example, appear to be made separately, despite considerable theoretical and empirical evidence for the importance of making them jointly. One response to this problem is to make larger, more comprehensive models for analyzing managerial decisions. Given the limited information processing capacity of human problem solvers (Miller; Newell and Simon), however, it may be more fruitful to identify conditions under which decisions can be decomposed (March and Simon) and to formulate models that are robust even when key features of the choice problem are misspecified (Cohen and Axelrod).

A second set of problems arises as flexibility and more extensive use of frequently updated information become more widely recognized as key features of risk management strategies. Although the more intensive use of information can improve performance dramatically (e.g., King and Lybecker), this improvement comes at a cost. Managers must attempt to balance the benefits of more intensive information use against these costs. This problem has long been recognized among agricultural economists working on management-oriented problems (e.g., Johnson and Lard). Despite some noticeable recent progress in this area (e.g., Bosch; Chavas and Pope; Antonwitz and Roe), however, workable tools for analyzing investments in information and information processing capacity are almost nonexistent.

Looking to the future, both of these broad sets of problems suggest that the challenge for agricultural economists will be to develop analytical methods that are both usable and effective. Considerable progress has been made in this area over the past decade, but few of the tools and techniques developed are widely used. Advances in information technology are rapidly making widespread use of risk management models technically feasible, but it is not clear these models actually meet the needs of the managers.

Organizational Design

Profound structural changes in the agricultural sector are having an impact on the organizational structure of both farm and nonfarm firms. Farm firms are growing larger and often involve multiple families. New financing arrangements involving outside equity interests differ considerably from the traditional relationship between an owner-operator and a lender. Among nonfarm firms, deregulation of the financial industry, consolidation and mergers in both the farm supply and grain marketing sectors, changes in the farm machinery industry, and new information technology based products are all straining existing organizational structures. Changes in the sector and its environment are changing our view of the organizational boundaries of rural firms.

In essence, the problem of organizational design is one of deciding how work and decision making responsibilities will be divided and how information will flow within an organization. This view of the problem emphasizes the managerial aspects of organizational design rather than the legal and tax implications associated with the alternative organizational structures. Although important, legal and tax issues have received considerably more attention and are less broadly applicable across firms, locales, and time than are managerial issues related to organizational design.

The emergence of larger, multiple family production units and the increased complexity of both production and managerial tasks in farming are creating a number of new organizational design problems. The adoption of specialized roles and responsibilities can be an effective response to increased size and complexity of operation. For the manager of a farm operation, however, specialization means giving up direct monitoring and control of factors that may have a key impact on overall business performance. These problems are compounded when no individual has clear decision making authority for the firm as a whole. A further complication arises when nonfarm individuals share some of the decision making responsibility. Managers facing these problems need insights about the design of organizational structures that promote communication, provide appropriate incentives and responsibility bearing, and encourage effective group decision making in a family setting. Simply borrowing organizational structures from corporate settings is not likely to provide adequate solutions to this problem. Rather, synthesis of concepts from areas as diverse as organization theory, family social science, and behavioral decision theory is needed.

For agriculturally-related firms, choosing an appropriate level of centralized authority and decision making is becoming an increasingly important organizational design issue. Mergers, acquisitions and consolidations are increasing the size and geographic scope of farm supply and grain marketing firms. Financial deregulation is allowing large urban banks to compete with, and in some cases gain control over, rural banks. These changes seem to encourage an increase in the centralization of authority and decision making. Other factors, such as the need to respond quickly to an unstable economic environment that may vary considerably across locales, and the need to innovate, may make decentralized organizational structures more efficient, however. In the future, information technology is likely to have important impacts on the organizational structures these firms choose, and design strategies may need to allow for a relatively flexible mix of centralization and decentralization in decision making. Galbraith's information processing approach to organizational design, for example, allows for decentralization and reduction in the need for

information processing through the creation of slack resources and self-contained tasks. At the same time, he notes that centralized control and the ability to process information across units are facilitated through investments in vertical information systems and the creation of more extensive lateral relations. Although a firm need not adopt all of these strategies, they are by no means mutually exclusive.

In the area of organizational design, perhaps the most important challenge for our profession will be to extend our view of decision making beyond an almost exclusive focus on the individual. Throughout the sector, in both farm and nonfarm firms, decision making will increasingly be a shared activity. In this setting, research and educational activities will be useful if they provide an improved understanding of group decision processes and of the economic issues and options open to managers as they design and manage larger, more complex operations.

Information System Design

Recent advances in computer hardware and software and in telecommunications technology have made it feasible for even relatively small rural firms to have computer-based information systems (Holt). At the same time, changes in the economic environment are making it increasingly important for managers to use information effectively. Despite lower costs and apparently greater need, however, the adoption rate of computer-based information systems has been much slower than expected. Important shortcomings in information system design may be making it difficult for managers to fully exploit the potential of this new management technology.

A management information system (MIS) serves three important functions in an organization. First, it is a mechanism for collecting, organizing, storing, and retrieving data about the firm and its environment. Second, it is a medium for communication and the facilitation of information flows within and across organizational units. Finally, it provides support for the decision making activities of managers. Problems associated with information system design for rural firms can be explored in relation to these three functions.

Recent advances in storage technology and database management software are making it easier and less costly to capture, organize, and use data. These developments make it possible for data to be managed as a separate resource (King, 1985). As Everest notes, sharing data resources across users and applications and cooperating in the maintenance of these shared resources are key features of the "database approach." Despite these technical and conceptual advances, data collection and entry continue to be costly activities for small rural firms. Furthermore, considerable expertise is needed to organize a firm's database so that data can be easily retrieved and used. Most accounting and record systems available to small farm and nonfarm firms are designed to generate standard statements and reports rather than to create a data resource for managerial use. As a result, managers often lack reliable data about their own firms. In contrast, data about the physical, economic, and political environment in which rural firms operate are becoming much more readily available through on-line data services. In this regard, managers face the problem of deciding how much to invest in and how to most effectively use this data resource.

In addition to being a mechanism for data capture, storage, and retrieval, an MIS is also a medium for communication within an organization. As rural firms become larger and more complex, the problem of matching information system and organizational design is likely to increase in importance. The key issues involve determining what information should flow within and across units of an organization. In a family farm operation in which specialized roles follow functional lines, for example, it is essential to determine what the person in charge of commodity marketing needs to know about production and financial activities within the business. If all information is shared, a major benefit of specialization is lost. If no information is shared, serious coordination problems may arise. The importance of the MIS as a mechanism for communication is still greater for farm supply, commodity marketing, and banking firms that have local outlets spread over a wide geographic area. For these firms, the flow of information can be influenced as strongly by changes in the rural telecommunications systems as by choices regarding organizational design.

Finally, from a managerial perspective, the support of analysis for planning and control is perhaps the most important function of a MIS. Often, however, formal MIS provide little actual support for these key managerial tasks. As Mintzberg notes, this stems, in part, from the way managers work. Managerial activity is typically characterized by brevity, variety, and fragmentation, and managers are oriented toward action rather than reflection and analysis. They typically rely on verbal communication and ad hoc queries for information and analysis rather than on the regularly updated, aggregated information provided by most formal MIS. Mintzberg further states that focusing attention on key issues and making effective use of analytic inputs represent a major challenge for managers.

The effective support of managerial work is the central theme of the emerging literature on decision support systems (DSS). Sprague and Carlson (p. 4) define DSS as "interactive, computer-based systems that help decision makers use data and models to solve unstructured problems." An ideal DSS provides a flexible, easily used set of tools and data resources that a decision maker can use to identify problems and explore the consequences of potential solutions. The emphasis is on support of decision making rather than its automation. Effective DSS design often requires a synthesis of insights and tools from operations research, statistics, economic theory and behavioral decision theory.

Rural businesses that provide products and services to farmers are also faced with difficult strategic decisions related to the design and provision of information technology based products and services. Markets for on-line data services, accounting and management software, and computer supported consulting services appear to have considerable potential (King, 1984). These are also highly uncertain markets, however, that are drawing in new competitors and are blurring distinctions between public and private sector activity. In the area of on-line data services, for example, competing products are being offered by banks, farm supply cooperatives, publishing companies, land grant universities, farm organizations, and communications companies.

For agricultural economists, the primary challenge will be to extend our understanding of the decision making process and our ability to design workable tools to support managerial activities. Understanding the processes by which managers make decisions will be necessary and will require a synthesis of insights from the economic and behavioral sciences. Efforts to rigorously value information as it is used by agricultural managers must also be part of the process (Chavas and Pope; Sonka, 1985a).

Human Resource Management

Economic, social and political changes in rural areas are having an impact on the human resource pool from which rural firms draw labor and management services. Reduction in farm numbers and the demise of many "main street" businesses in rural areas has resulted in significant reductions in job opportunities and an attendant loss of skilled members of the workforce. Conversely, trends toward exurban migration and the location of nonagricultural businesses in rural areas that began in the 1970's seem likely to remain a factor, especially near urban centers. Overall, the impacts of demographic and structural changes are difficult to predict. Regardless of the direction of these shifts, however, it seems likely that rural and urban labor markets will become more thoroughly integrated and that the managers of agriculturally-related firms will be challenged to develop effective compensation schemes to attract and retain skilled personnel.

At the same time these structural changes are effecting the size and composition of the rural labor force, the increased rate of technological change in agriculture is posing a second broad challenge to agricultural managers. The use of more complex and specialized technology that changes rapidly over time requires more effective strategies for continuing training and education. This is a difficult problem if training and education programs are delivered by traditional means, because geographic dispersion of participants makes programs requiring direct contact considerably more expensive to deliver in rural areas. Just as information technology is changing the economics of firm location, however, it is also changing the economics of educational program delivery. In the future, more of these programs are likely to be delivered through media such as interactive video, video disk, and computer assisted instruction.

More effective strategies for training and education are not the only response to the problems posed by increased rates of technological change and more specialization. Often small firms, both farm and nonfarm, are not large enough to internalize certain types of specialized expertise. For example, it may be economically infeasible for the manager of a farm firm to invest the time and funds required to develop technical expertise in integrated pest management or financial planning. Markets for specialized consulting services are developing rapidly, however. In the future, agricultural managers will need to address the strategic problem of deciding when to internalize expertise and when to make use of consultants. The need to evaluate consultation services delivered partly or totally through computerized means--e.g. through expert systems--may be a particularly unusual challenge.

A final human resource problem stems from the fact that more farm enterprises are relying on off-farm work as a supplemental source of income. If the labor market for seasonal, part-time work is to function effectively, the managers of both farm and nonfarm firms may need to adjust patterns of labor utilization so that overall labor demands are relatively stable. This is by no means a new problem, nor is it one confined to the United States. As the agricultural sector undergoes major structural changes, however, these are issues that will demand renewed and continuing attention.

For agricultural economists, the challenges posed by these human resource management problems are two-fold. First, we need to continue to improve our understanding of the structure of rural labor markets and of effective managerial responses to human resource issues. Efforts to design responses to

changes in the human resource base must be closely related to organizational design issues, because the solutions to many human resource management problems are manifested in the boundaries and structure of the organization. Second, but equally important, we need to contribute further to the development of training and education programs that meet the needs of agricultural managers and their employees and the needs of the growing number of consultants who provide services to rural firms. This will be a difficult but exciting challenge as both the needs of program participants and the economics of program delivery evolve.

IMPLICATIONS FOR FUTURE DIRECTIONS IN MANAGEMENT RESEARCH, EXTENSION AND TEACHING

As Jenson notes there was a major shift in management research, extension, and teaching efforts by agricultural economists during the years following World War II. Largely inspired by Heady's (1948, 1952) writings, farm management work shifted away from the empirical, comparative focus of the pre-war years to an emphasis on results and models drawn from static neoclassical production theory. This new focus was well suited for the environmental conditions of the period--a time of relatively stable markets and steady technological change. It was made possible by significant developments in microeconomic theory, econometrics and statistics, and operations research. The development of computer technology was also instrumental in making the shift possible and agricultural economists were leaders in the early use of computers as tools for the analysis of economic and managerial problems. This paradigm shift made work on management problems more analytical and more disciplinary. Although this has resulted in important progress in basic knowledge, it has also shifted the focus of management research, teaching, and extension away from an emphasis on problem solving and from the concerns of general managers (Johnson, 1963; Schuh).

If management scholarship will experience another paradigm shift in the next few years, in what direction will it take us? First, it is likely to be shaped by the new problems and concerns managers face in the more complex economic, social, and political environment. New knowledge and theories in disciplines related to management--dynamic economic theory, strategic management, organization theory, cognitive psychology, artificial intelligence, and management information systems--will also shape the direction of change. A key feature of these changes is likely to be an increase in work with other disciplines--not only with other agricultural disciplines, but also with scholars in the behavioral sciences and in business schools. In addition, researchers will need to work more directly with agricultural managers, whose problems should be the focus of management research. Finally, just as the availability mainframe computers had an important influence on management work from the late 1950's through the 1970's, advances in information technology are likely to have an important impact on future management scholarship. In the following sections, the implications of these changes for research, extension, and teaching are explored.

Management Research

If the impacts of a possible paradigm shift in management research in the agricultural economics profession are to be examined, the domain of management research must first be defined. Since the early 1950's, farm management and production economics research, on the one hand, and nonfarm firm management and marketing research, on the other hand, have come to be closely associated in the

agricultural economics profession. This development has helped focus attention on some key problems and has channeled insights from two areas of economic theory into management research. However, this trend also may have created a false dichotomy in management research and contributed to a lack of emphasis on research related to the emerging managerial problems identified in the preceeding section.

Under a more integrated view of management research, which takes the manager and management problems as its starting point rather than production technology and market structure, three general areas of focus emerge. First, management research may be directed toward gaining a better understanding of managerial behavior. This is useful for identifying problems managers face and opportunities for improving managerial performance. Cross sectional surveys designed to identify management practices, longitudinal case studies, studies of organizational behavior, and efforts to measure risk preferences are all examples of research of this type. Except in the area of risk preference measurement, however, relatively little work of this kind has been done since the Interstate Managerial Study (Johnson, et. al.).

The development of analytical tools and problem solving procedures designed to support managerial work is a second general area of focus for management research. Analytical tools, often computer based, may be designed to organize, process, and summarize data and information--e.g., accounting and management control systems--or they may be designed to assist in the evaluation of alternatives--e.g., optimization and simulation models. Research on organizational design, competitive strategy formulation, and processes for managing innovation and change are also included in this category, because they are directed toward the development of general methods for solving managerial problems.

A third area of focus for management research is on the generation of information used by managers. For example, market forecasts, analyses of market structure, and estimation of industry financial and production performance standards are all examples of research activities directed toward the generation of management information. Efforts in this area are usually guided by analytical models and general problem solving procedures.

Finally, representative firm and econometric studies designed to improve understanding of sector performance and to analyze the impacts of policy changes are often classified as management research. Research of this kind may influence policy decisions that have a major impact on the environment rural firms face. Although such efforts have recently become increasingly prevalent in the professional literature, their results do not focus directly on managerial problems and activities. Therefore, these efforts will not be considered further in this discussion.

In recent years, research in each of these areas has become increasingly disciplinary. This is not unique to the agricultural economics profession. Referring to professional schools in engineering, medicine, and business, for example, Simon (p. 130) notes an increased emphasis on disciplinary research:

> In terms of the prevailing norms, academic respectability calls for subject matter that is intellectually tough, analytic, formalizable, and teachable. In the past much, if not most, of what we knew about design and about the artificial sciences was intellectually soft, intuitive,

> informal, and cookbooky. Why would anyone in a university stoop to teach or learn about designing machines or planning market strategies when he could concern himself with solid-state physics? The answer has been clear: he usually wouldn't.

In Simon's terminology, the sciences of the artificial focus on designing tools--be they objects, methods or institutions--to help people achieve desired ends. This should be, of course, a central focus of management research. For management researchers, a key question is whether our increased emphasis on disciplinary work has moved us away from or closer to an effective science of design.

One of the positive results of the emphasis on management research rooted in neoclassical theory is that increasingly powerful tools for designing optimal management strategies have been developed. At the same time, this research has helped identify and organize the data and information needed to support these strategies. The emphasis on deductive methods and optimizing models has also had adverse consequences, however. First, it has led to a deemphasis on work with decision makers. Models and methods tend to be tested either by logical argument or through simulation. The reliability of such tests is highly sensitive to the validity of underlying assumptions. Therefore, the focus of empirical research relating to managerial behavior has shifted to an emphasis on verifying assumptions for populations rather than on describing the behavior of individuals and identifying key problems they face. Second, the cost of information and analysis has often been ignored in model building and testing efforts. As a result, many seemingly optimal strategies are actually unworkable. Finally, managerial research has often been model driven rather than user driven. Therefore, managers often find the information generated difficult to use.

This may be an overly critical view of the shortcomings of discipline oriented management research. Nevertheless, these arguments are at the root of the perception that management research has lost its problem solving focus (Johnson, 1984; Swanson, 1984). If, in the future, management research returns to that focus, what will be the likely characteristics of that research?

Considering research methods first, a broader range of modes of inquiry will be needed and direct interaction with managers will be increased. For example, case study methods will allow for more direct contact with managers and organizations. Prototyping is also likely to be used more widely in testing new analytical tools and institutional designs. Although sometimes not considered as research, prototyping can be an effective, highly interactive mode of inquiry, well suited for helping users formulate and articulate their needs (Keen and Gambino; Moore and Chang). Finally, experimental methods, often based on computer gaming models, are also likely to be used more widely in the future. This broadening of research methods is consistent with the pluralism advocated in contemporary views of the philosophy of science (e.g., Rorty, Caldwell). It will encourage increased attention to the normative and prescriptive knowledge that are necessary complements to positive knowledge in problem solving research (Johnson, 1984).

In addition to relying more reliance on methods that encourage interaction with managers and organizations, agricultural economists are also likely to broaden the scope of their efforts by working more with other disciplines. Bioeconomic modeling projects are promoting increased collaborative research involving

agricultural economists and agricultural production scientists (e.g., Mapp and Eidman; Boggess and Amerling). In parallel fashion, research in the emerging area of expert systems may facilitate interdisiciplinary work with computer scientists and cognitive psychologists (Brachman, et. al.). Interdisciplinary research need not always center around computer models, however. Work with other disciplines will also be beneficial in studies of organizational design, strategic management, and information system design. Such a reemergence of interdisciplinary efforts is quite consistent with the historic orientation of management research in agricultural economics. Here, however, interaction with a broader set of disciplines is proposed.

Finally, there will continue to be an important place for disciplinary efforts in future management research. New developments in organization theory, information economics, and game theory, for example, are likely to have important management applications. Similarly, continued development of quantitative methods will be needed. Advances in computing capabilities will change the economics of information acquisition and analysis, and may make currently unworkable models feasible in the future.

As the mode of inquiry, scope, and disciplinary content of management research change, one of the most challenging problems for the profession will be to define and recognize "good science" in a problem solving context. The reliance on economics as the sole behavioral discipline will be questioned. This questioning will challenge researchers trained primarily in economics. This problem will be resolved, in part, through debates about research methods and the philosophy of science. More importantly, we will also learn by doing. We believe a science of design is both possible and worth pursuing. In fact, it is essential if research is to contribute to solving the problems of agricultural managers.

A second, equally important, challenge for the future of management research is that of ensuring adequate funding. There is a trend in agricultural economics research toward increased reliance on competitive grants rather than on formula funding. At the same time, it appears that the USDA is placing less emphasis on funding management research. The small scale of farms and many agriculturally-related firms makes it unlikely that needed research can be funded directly by the private sector. These trends suggest a decline in funds and associated professional emphasis for such research at a time when additional work on new issues and problems is critically needed.

Extension Activities

Implementation of results from this new research agenda will require transmission of findings to decision makers. A strong focus on preparing future managers through resident instruction and on updating and expanding the skills of current managers through extension programs is essential to an efficient and dynamic agriculture. Particularly in the management area, the successful conduct of these educational activities is every bit as challenging as are research investigations.

Current management-related extension efforts can be grouped in many ways. However, three broad categories are:

1. The generation of information defining the current and future status of the operating environment. Efforts include programs on new technologies, likely policy or legislative actions, and supply/demand conditions for the coming year.

2. Educational thrusts relating to use of management tools. Efforts to improve managers' capability to analyze alternatives are a major contribution. Tools presented in these efforts include budgeting, financial statements, and investment analysis. Recently major emphasis has been focused on utilizing computerized versions of these tools.

3. Problem diagnosis and evalution of alternatives. Agricultural managers have often relied on extension specialists to aid in identifying and solving problems. In some cases, a publication with an illustrative example has been sufficient to clarify outcomes and justify general recommendations. Analysis of government program participation is an example. Alternatively, producers may desire firm-specific evalutions. Clarification of key issues as a second generation enters the firm and, recently, individual review for financially stressed producers are examples of such activities.

Extension activities in each of these areas have been valued in the past, and they will continue to be desired in the future. The following remarks will focus on the implications of the emerging trends identified earlier on activities and delivery mechanisms in extension education. Implicit throughout this discussion is the recognition that difficult choices of emphasis will continually be forced by resource constraints. The challenge is to continue and to initiate those activities that utilize the unique strengths of the public sector.

If change and decision making in an environment of surprise are concerns of the future, how can extension management specialists have the opportunity to make essential educational contributions related to these concerns. Many of the important events affecting the agricultural manager in the last 15 years have occurred outside the agricultural arena. Decisions relating to domestic and international monetary policy, international relations, and artificially induced resource shortages have greatly affected agriculture. Extension educators often have responded to these events with effective analyses of the impact of specific events on producers in general. In the future, there will be a need for educational programs that teach individual managers the skills needed to identify and interpret these impacts relative to their individual circumstances. Included in such efforts would be basic education on general economic forces and their interrelation with agriculture. Also needed is instruction in concepts of strategic planning and the formulation of flexible organizational structures.

Organizational design and information system design were identified previously as key future problem areas. Both topics are unfamiliar to agricultural producers and managers of small nonfarm firms. A challenge to extension educators will be to develop programs that are beneficial even though solutions to these problems tend to be highly firm specific. Programs that discuss these problems and general types of solutions have value in heightening manager awareness. Delivery mechanisms and tools which aid managers in better evaluating their individual situations will have considerably greater value.

Much has been written about the effects of computers on decision making and on the delivery of information to agricultural managers. Although computer literacy, both for managers and extension educators, is important as new management styles emerge, it is not the most critical management skill needed to exploit computer and information use. Instead, the basic management skills of goal formation, problem recognition, analysis, and decision making will continue to be key elements of successful management. The new information technologies, however, should allow extension educators to more successfully provide instruction and should help managers to more efficiently implement those skills.

How might the ongoing advances in computer technology affect extension delivery systems? The likely answer is that this technology will be implemented in diverse ways based on the resources and opportunities of individual states. A number of electronic communication systems will allow direct access by managers. The development of microcomputer based software will continue. Some of these programs will be designed for end user application and supported by public institutions. Others will be generated to illustrate concepts. Although possibly available for end user application, such concept oriented efforts can have significant impacts through their effect on private sector efforts.

The computer revolution should allow significant strides to be made in extension education for agricultural managers. Possibilities include:

1. Allowing producers to test risk response strategies or to experience the effect of new technologies for a range of economic conditions.

2. Synthesis of knowledge from multiple disciplines in a decision relevant form. In a sense, the manager is the ultimate multidisciplinary researcher and, as noted by Swanson (1979), quantitative models are an effective means to integrate multidisciplinary knowledge. Bioeconomic simulation models can be particularly useful as educational tools.

3. Availability of expert systems which deliver sophisticated expertise to the firm manager in the form of consultation for specific problems.

4. Delivery of data which can be directly analyzed through complex quantitative algorithms and then reported in manager usable terms.

5. Provision of time sensitive data such as prices or weather-related pest infestations.

The developmental role of agricultural economists will be vital in the first three possibilities noted. Model building, for the development of tools that will become integral parts of larger educational thrusts, should be an exciting opportunity for the extension educator. For the latter two possibilities, extension specialists have much to contribute to the definition of needed data items and their form.

The one hour to one-half day lecture and written publications have been vital components of the extension delivery system. Although these delivery mechanisms are likely to persist, sole reliance on these methods is unlikely to be effective if managers are to truly assimilate many of the educational topics noted above. Instead, experiences which are more like educational courses will

be needed. For many of these, student access to computers will allow simulation techniques and interaction with expert systems to be implemented. Management oriented courses, if effective, can be a means for agricultural managers to accomplish the continual retraining that is likely to be needed in tomorrow's agriculture.

In this paper's first section, it was suggested that new management styles are emerging in agriculture. The distinguishing attribute noted was the orientation towards flexible, information-based strategies versus more rigid, recommendation-oriented approaches. The development and likely coexistence of these management approaches further complicates the extension educator's problem of serving a diverse management clientele. No easy solution presents itself and a multiplicity of responses is likely to evolve. Probably the most important point is the recognition that this new source of audience diversity exists and that no single extension product or delivery mechanism will satisfy the system's farm and nonfarm clientele.

An issue related to the development of a diverse audience is the emergence of private sector providers of management consultation and/or education. One attitude is to view such private sector initiatives as strictly competitive to public sector efforts. Another view is to consider private sector efforts as a means to enhance the level of expertise available to agricultural managers. Historically, extension educators have had positive impacts through interactions with lenders, legal professionals, and government officials. Management consultants may well be another means to provide expertise to agricultural managers, particularly given the limited resources available relative to the needs that will exist.

Resident Instruction Activities

The implications of the emerging trends and key problem areas defined previously for resident instruction are similar to those just discussed for extension activities. Therefore, only a brief discussion of these topics will be provided. An area of significant similarity is that much of what is currently done in resident instruction relating to management is useful. These efforts have, in general, contributed to improvements in economic efficiency by agricultural managers.

For many students, introductory farm management courses are valued because they present the farm firm as a single entity rather than as a set of individual physical processes. As students take additional coursework, instruction tends to divide the business management process into specialized activities, such as marketing, accounting, labor management, and operational and strategic planning. An unfortunate result may be that students lose sight of management as a holistic process and the interrelations of the individual firm with the larger economic system. An area that needs strengthening in management-related resident instruction is the concept of the agricultural firm, both farm and nonfarm, as it operates within a larger system.

An increased emphasis on strategic management, particularly in upper level courses, would serve to counteract the tendencies just noted. The orientation of such efforts should include strategic thinking as well as numeric analysis and calculations. Concentrating on the questions an agricultural manager needs to ask to anticipate surprises can often be more useful than instruction on how to calculate quantitative solutions. Stressing problem formulation and information sources will be of significant value even though students may tend

to appreciate precise formulas and rules amenable to memorization. In addition, curricula which encourage students to gain an appreciation of broader national and international forces will lead to a better understanding of the future workplace.

As noted for extension activities, the enhanced capabilities and expanded availability of computer resources should alter the resident instruction process. Computer models can enable students to experience a range of economic situations. Agriculture's experiences of the last 15 years provides ample illustrations of a wide array of economic situations. Embedding those relationships (in current dollars) into interactive firm models will encourage student users to "experience" and test differing management strategies.

The range of computer applications available for management instruction is exciting not because powerful technology is being used, but because it poses a challenging opportunity for students to better identify causal forces and interrelationships affecting firm performance. Several applications appear promising, including relatively simplistic operational and strategic planning tools, sophisticated expert systems, bioeconomic simulators, and computerized programs for internal control.

SUMMARY

The managerial problems of farm and agriculturally-related firms are likely to intensify and change in character in the future. The environment within which these firms operate is likely to be one characterized by uncertainty and the potential for marked and sudden change. The continued evolution of commercial farms and the firms that serve them implies the need for increasingly complex organizational structures, information utilization, and human resource management.

Faced with these changes, the approaches and tools of management scholars must also evolve. Research efforts focused on the role of the manager as an integrator of information and a decision maker will be required. To realistically model the decision making process, input from several disciplines will be essential. Those efforts should lead to an improved understanding of the manner in which various types of information affect manager behavior. Research results will need to be transmitted to agricultural managers. Extension and resident instruction activities will need to illustrate the manager's integrative function and improve the abilities of current and future decision makers in agriculture.

In several respects, the prospects are extremely promising for researchers and educators to understand the improve the agricultural management process. This opportunity appears potentially as rewarding as was the introduction of production economics into farm management shortly after World War II.

Future scholarly efforts should place greater emphasis on the integrative role of the manager. An uncertain agricultural environment, interdependent with the national and international economies, and the increasing complexity of the agricultural firm imply a need for significant improvements in management procedures and strategies. In addition, advances in the computer technologies available to researchers and managers are occurring at the same time that substantial strides are being made in several of the sciences related to decision making. Finally increasing our understanding of the manager's integrative role will require much less reliance on secondary rather than

primary data and the recognition that economic theory is only one of the tools necessary for effective investigations in this area.

The effective use of information will become more important in determining the success of agricultural managers. The rigid management approach of industrial stage farms was predicated on the availability of inexpensive raw materials and energy inputs. The role of information in the management process will evolve as more flexible management strategies, which strive to continually reevaluate plans as the decision environment changes, are developed. The role of the management scholar is critical in developing more flexible strategies, as well as in serving as a vital link in the information network available to the agricultural manager.

Five key problem areas are likely to be increasingly important to managers of farms and agricultural firms. This list is not all-inclusive, but the areas listed are likely to be common to a broad range of managers. The five areas are:

1. managing innovation and change
2. managing risk
3. organizational design
4. information system design
5. human resource management

Consideration of the issues relating to each of these problem areas suggests an exciting agenda of activities for agricultural economists concerned with management problems. This agenda includes major contributions in each of the functional areas of research, extension and resident instruction.

REFERENCES

Ansoff, I. "The Changing Shape of the Strategic Problem." Strategic Management, D. Schendel and C. Hofer, eds., Boston: Little-Brown, 1979, pp. 30-43.

Antonovitz, F. and T. Roe. "The Value of a Rational Expectations Forecast in a Risky Market: A Theoretical and Empirical Approach." Amer. J. Agr. Econ. 66(1984):717-23.

Arrow, K. J. "Innovation in Large and Small Firms." Entrepreneurship. J. Roren, ed., Lexington, Massachusetts: Lexington Books, pp. 15-28.

Boggess, W. G. and C. B. Amerling. "A Bioeconomic Simulation Analysis of Irrigation Investments." South. J. Agr. Econ. 15(1983):85-92.

Bosch, D. J. The Value of Soil Water and Weather Information in Increasing Irrigation Efficiency. Ph.D. Dissertation, Department of Agricultural and Applied Economics, University of Minnesota, 1984.

Brachman, R. J., S. Amarel, C. Engelman, R. S. Engelmore, E. A. Feigenbaum, and D. E. Wilkins. "What is an Expert System?" Building Expert Systems, F. Hayes-Roth, D. A. Waterman, and D. B. Lenat, eds., Reading, Massachusetts: Addison-Wesley Publishing Company, 1985, pp. 31-57.

Caldwell, Bruce. Beyond Positivism: Economic Methodology in the Twentieth Century. London: George Allen & Unwin, 1982.

Chavas, J. P. and R. D. Pope. "Information: Its Measurement and Valuation." Amer. J. Agr. Econ. 66(1984):705-10.

Cochrane, W. W. The Development of American Agriculture: A Historical Analysis. Minneapolis, Minnesota: University of Minnesota Press, 1979.

_____. Agricultural Economics at the University of Minnesota 1886-1979. Minneapolis, Minnesota: Department of Agricultural and Applied Economics, University of Minnesota, Misc. Pub. 21-1983, 1983.

Cohen, M. D., J. G. March, and J. P. Olsen. "A Garbage Can Model of Organizational Choice." Admin. Sci. Quart. 17(1972):1-25.

Cohen, M. D. and R. Axelrod. "Coping With Complexity: The Adaptive Value of Changing Utility." Amer. Econ. Rev. 74(1984):30-42.

Dahl, D. C. "Structure of Input Supplying Industries and Techniques of Analysis." Amer. J. Agr. Econ. 51(1969):1046-54.

Dorner, P. "Agriculture Within the U.S. Economy: Integration and Interdependence." Farm Structure. Washington, D.C.: U.S. Senate Committee on Agriculture, Nutrition, and Forestry, 1980. pp. 51-61.

Everest, G. C., "Database Management Systems Tutorial." Fifth Annual Midwest AIDS Conference Proceedings. Volume 1, pp. A1-A12, 1972.

Farm Credit System. Project 1995. Denver, Colorado: Farmbank Services, 1984.

Firch, R. "Sources of Commodity Market Instability in U.S. Agriculture." Amer. J. Agr. Econ. 59(1977):164-69.

Galbraith, J. R. "Organization Design: An Information Processing View." TIMS Interfaces. 4(1974):28-36.

Hamm, L. G. "Farm Inputs Industries and Farm Structure." Structure Issues in American Agriculture. Washington,D.C.: U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, Agr. Econ. Rep. No. 438,1979, pp. 218-25.

Heady, E. O. Economics of Agricultural Production and Resource Use. Englewood Cliffs, New Jersey: Prentice-Hall, 1952.

_____. "Elementary Models in Farm Production Economics Research." J. Farm Econ. 30(1948):201-25.

Holt, D. A. "Computers in Production Agriculture." Science. 228(1985):422-7.

Hirschleifer, J. and J. G. Riley, "The Analytics of Uncertainty and Information--An Expository Survey." J. Econ. Lit. 17(1979):1375-1421.

Jenson, H. F. "Farm Management and Production Economics." A Survey of Agricultural Economics Literature, Volume 1, L. R. Martin, ed., Minneapolis, Minnesota: University of Minnesota Press, 1977. pp. 1-89.

Johnson, G. L. Academia Needs a New Covenant for Serving Agriculture. Mississippi State, Mississippi: Mississippi Agricultural & Foresty Experiment Station, Special Publication, 1984.

_____. "Stress on Production Economics." Australian J. Agri. Econ. 7(1963):12-27.

Johnson, G. L., A. N. Halter, H. R. Jensen, and D. W. Thomas, eds. A Study of Managerial Processes of Midwestern Farmers. Ames, Iowa: The Iowa State University Press, 1961.

Johnson, G. L. and C. F. Lard. "Knowledge Situations". A Study of Managerial Processes of Midwestern Farmers, G. L. Johnson, A. N. Halter, H. R. Jenson and D. W. Thomas, eds., Ames, Iowa: The Iowa State University Press, 1961, pp. 41-54.

Johnson, G. L. and S. H,. Witter. Agricultural Technology Until 2030: Prospects, Priorities, and Policies. East Lansing, Michigan: Michigan State University Special Report 12, 1984.

Kamien, M. I. and N. L. Schwartz. Market Structure and Innovation. Cambridge: Cambridge University Press, 1982.

Kanter, R. M. The Change Masters. New York: Simon and Schuster, Inc., 1983.

Keen, P. G. W. and T. J. Gambino. "Building a Decision Support System: The Mythical Man-Month Revisited." Building Decision Support Systems, ed. J. L. Bennett. Reading, Massachusetts: Addison-Wesley Publishing Company, 1983, pp. 133-72.

King, R. P. "Farm Information Systems: Needs, Methods, and Responsibilities." Paper presented at the North Central Farm Management Extension Workshop, Urbana, Illinois, May 7-9, 1985.

_____. "Technical and Institutional Innovation in North American Grain Production: The New Information Technology," Discussion Paper 16, Strategic Management Research Center, University of Minnesota, August 1984.

King, R. P. and D. W. Lybecker. "Flexible, Risk-Oriented Marketing Strategies for Pinto Bean Producers." West. J. Agr. Econ. 58(1976):124-33.

Mansfield, E. "R&D and Innovation: Some Empirical Findings." R&D, Patents, and Productivity, Z. Griliches, ed., Chicago: University of Chicago Press, 1984, 127-48.

Mapp, H. P. and V. R. Eidman. "A Bioeconomic Simulation Analysis of Regulatory Groundwater Irrigation." Amer. J Agr. Econ. 58(1976):391-402.

March, J. G. and H. A. Simon. Organizations. New York: John Wiley & Sons, 1958.

Miller, G. A. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing, Information." Psych. Rev. 63(1956):81-97.

Minden, A. J. "Changing Structure of the Farm Input Industry: Organization, Scale, Ownership. Amer. J. Agr. Econ. 52(1970):678-86.

Mintzberg, H. "The Manager's Job: Folklore and Fact." Harvard Business Rev. July-August 1975, pp. 49-61.

Moore, J. H. and M. G. Chang. "Meta-Design Considerations in Building DSS." Building Decision Support Systems, J. L. Bennett, ed., Reading, Massachusetts: Addison-Wesley Publishing Company, 1983, 173-204.

National Defense University. Climate Change to the Year 2000. Joint Study of the U.S. Department of Agriculture, the Defense Advanced Research Project Agency, the National Oceanic and Atmospheric Administration, and the Institute for the Future. Washington, D.C., 1978.

Newell, A. and H. A. Simon. Human Problem Solving. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.

Office of Technology Assessment. Technology, Public Policy and the Changing Structure of American Agriculture. Washington, D.C.: Congress of the United States, OTA-F-272, 1985.

Oram, P. A. "Sensitivity of Agricultural Production to Climate Change." Climatic Change. 7(1985):129-51.

Parry, M. L. and T. R. Carter. "The Effect of Climatic Variations on Agricultural Risk." Climatic Change. 7(1985):95-110.

Peters, R. J. and R. H. Waterman, Jr. In Search of Excellence. New York: Harper & Row, Publishers, 1982.

Rorty, R. Consequences of Pragmatism. Minneapolis, Minnesota: University of Minnesota Press, 1982.

Ruttan, V. W. "Social Science Knowledge and Institutional Change." Amer. J. Agr. Econ., 66(1984):549-559.

Schertz, L. P., ed. Another Revolution in U.S. Farming? Washington, D.C.: USDA Agricultural Economics Report 441, 1979.

Schuh, G. E. "Revitalizing The Land Grant University," Discussion Paper 36, Strategic Management Research Center, University of Minnesota, September 1984.

Simon, H. A. The Sciences of the Artificial. Second Edition. Cambridge, Massachusetts: The MIT Press, 1981.

Sonka, S. T. "Computer-Aided Farm Management Systems: Will the Promise be Fulfilled?." Paper to be presented at the XIX International Conference of Agricultural Economists, Malaga, Spain. 1985a.

_____. "Information Management in Farm Production." J. Computers and Electronics in Agr. Forthcoming, 1986.

Sonka, S. T. and G. F. Patrick. Risk Management in Agriculture, P. J. Barry, ed., Ames, Iowa: The Iowa State University Press, 1984, pp. 95-115.

Sprague, R. J. and E. D. Carlson. Building Effective Decision Support Systems, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1982.

Swanson, E. R. "Working With Other Disciplines." Amer. J. Agr. Econ. 61(1979):849-59.

_____. "The Mainstream in Agricultural Economics Research." Amer. J. Agr. Econ. 66(1984):782-791.

Swanson, E. R. and S. T. Sonka. "Technology and the Structure of U.S. Agriculture." Farm Structure. Washington, D.C.: U.S. Senate Committee on Agriculture, Nutrition, and Forestry, 1980. pp. 62-73.

Tweeten, L. "Economic Instability in Agriculture: The Contributions of Prices, Government Programs and Exports." Amer. J. Agr. Econ. 65(1983):922-31.

_____. Causes and Consequences of Structural Change in the Farming Industry. Washington, D.C.: National Planning Report #2, 1984.

U.S. Department of Agriculture. Structure Issues of American Agriculture. Washington, D.C.: Economics, Statistics, and Cooperatives Service, Agr. Econ. Rep. No. 438, 1979.

U.S. Senate. Farm Structure. Washington, D.C.: Committee on Agriculture, Nutrition, and Forestry, 1980.

Van de Ven, A. H. "Central Problems in the Management of Innovation," Manage. Sci. Forthcoming 1985.

INSTITUTIONS AND AGRICULTURAL ECONOMICS IN THE TWENTY-FIRST CENTURY

by Paul W. Barkley*

Although variously defined, institutions are generally thought of as sanctioned, well ordered, and reasonably stable relationships that affect people's behavior. They are brought into being by problems that grow beyond the point of being mere hindrances. They appear in all environments and range from trivial to complicated and controversial. Putting the dinner fork to the left of the plate, local leasing arrangements, and the rules of property are each institutions because they are agreed upon and somewhat venerable ways of determining how people will behave.

This last feature makes institutions a proper and necessary part of economic inquiry. Lionel Robbins, in writing that economics deals with the allocation of scarce resources among alternative and competing ends, insured that economists must consider institutions because institutions not only define resource collections, but frequently place upper and lower bounds on how resources can be used. Institutions as well as

---

*Paul W. Barkley is professor of agricultural economics at Washington State University. The scope and content of this paper has benefitted immensely from discussions or comments from Philip Raup, Ted Alter, Ron Powers, and Philip Wandschneider. Remaining errors in fact and interpretation reside with the author.

prices are allocators of land, labor, capital, and entrepreneurial skill.

Since they affect the allocation of resources, any institutional change, regardless of how trivial or complex, reorders benefits and costs, benefactors and beneficiaries, and the distribution of compensated and uncompensated effects of human endeavor. Put another way, a change in institutions reorders behavioral and economic relationships in such a way as to have an impact on efficiency, distribution, Pareto solutions, and the dimensions of unconstrained bliss. Given the potential and often real pervasiveness of these possible consequences, it is surprising that economists have spent so little time in the systematic study of the formation of institutions and institutional change. It is especially surprising that agricultural economists have been so recalcitrant about this since few productive enterprises or contemporary industries have been the object of more institutions and institutionalized interventions than agriculture.

It is unlikely that this will change.[1] Most agricultural economists will continue to research problems as if the

---

[1]In all fairness, it must be noted that the number of agricultural economists showing interest in institutions seems to be increasing. The inability of classical and neo-classical economics to cope with or explain the problems of the post World War II industrial world and the inability of all economists to bridge the gap between microeconomics and macroeconomics brought foment among a group of young economists in the 1960s. The group evolved into the Association for Evolutionary Economists. Few issues of its quarterly

(Footnote Continued)

problems existed in a given and fixed institutional framework. Those who do inquire into changes in institutions will likely work on limited themes--the change in a taxing scheme, a change in the loan rate for a specified crop, or a move toward strict enforcement of the Reclamation Laws.

This paper argues that agricultural economists cannot continue to ignore the changing institutions that impinge upon farming and rural areas. It starts with a modest list of some aspects of agriculture and some institutions that are likely to change demonstrably as the 21st Century approaches. It then moves to some analytic devices that may be useful in inquiring into the causes and effects of the growth and decline of institutions. The paper ends where it well could have started: a discussion of Institutionalism, an ungraceful corner in the history of economic thought.

Some Contemporary Institutional Issues Affecting Agriculture

Lists are efficient ways of conveying information. Unfortunately, they often become mindless and encyclopedic, thus losing any usefulness they may have for either writer or reader. The following list is, therefore, extremely limited insofar as the number of themes it includes. Each item is expanded slightly, however, so that its breadth, depth, and

---

(Footnote Continued)
publication, the Journal of Economic Issues, are devoid of articles by agricultural economists.

importance can be appreciated. The list is presented in no particular order.

1. The structure of factor and product markets faced by farm operators is changing so that the invisible hand, atomistic competition, and the ceteris paribus assumptions so frequently invoked by researchers are no longer effective in providing a stop-frame picture of reality. This results from the constant change in technology, institutions, relative prices, and organizational forms within the industry. Vertical integration continues to transfer decision making rights from production firms to processing firms. Farmer-owned cooperatives transfer a variety of decision making opportunities in the opposite direction. Each of these changes in structure means that the industry is less one of firms in competition and more one of oligopoly and monopolistic competition--both areas where economic theory becomes weak in its ability to either describe or predict.
2. The traditional "bundle of rights" approach to the exclusive ownership of land and other natural resources will continue to be broken, disaggregated, and scattered. The sale of development rights and hunting rights, and the acceptance of terms dictated by use-value taxation schemes dilutes the decision making power of the farmer and adds limits or imperfections to land titles. This institutional evolution could be carried to an extreme in which markets develop for very particular kinds of rights in

production or in use. For example, a farmer may begin in 1990 to search for land on which to grow oats in 1992.

3. Institutions surrounding water rights and water use will increase in complexity and number. With well-known exceptions, water law is state law but water problems are interstate problems. With equally well-known exceptions, natural watercourses--surface, underground, and atmospheric--are notable for their contemptuous treatment of political boundaries. Market institutions may provide the best (most efficient in a Pareto sense) allocative devices in local areas, but some supra-market, large-area entity is certainly needed to generate the most desirable wide area and perhaps national approach to the proper relationships among water, populations, and the conduct of economic activity.

4. The current bent toward deregulation is surely precursor to an era of re-regulation. While the market is still an honored device for its ability to make nearly automatic and continuous corrections to misallocations, society is learning from the re-marketization of the airlines, trucking, rails, telecommunications, and banking, that instability and uncertainty is the incalculable cost of allowing some industries to operate without non-market rules. This is an especially important topic for agricultural economists since there is currently more than the usual amount of talk in favor of abandoning many of the traditional regulations on farming.

5. Even though the population of many rural areas continues to grow, farmers continue to diminish as a proportion of the rural population. Rural non-farm residents will increase their interest in the way agricultural resources are used and will have the political power to invoke sanctions on farmers. In some cases, the sanctions will give rise to increased costs of production for farm products. In the end, the results may bring conflict among at least three groups--producers, rural non-farm residents who consume both agricultural products and rural amenities, and the strictly urban population that is interested primarily in low food costs.

6. Rural communities will face rapidly escalating public costs and a diminishing non-land tax base. Rural communities are in a perilous circumstance. Their collections of public capital have deteriorated and their ability to provide services has diminished. If their populations grow, they have no choice but to revitalize (to state and federal specifications!) their schools, hospitals, water systems, and waste disposal systems. If population continues to decline, an already decrepit and inadequate infrastructure will continue to deteriorate, perhaps to the point of speeding the demise of the community. Regardless, the pressure for public revenue will be on agriculture and agricultural resources as federal revenue sharing is phased out and states, facing their own financial traumas, can do little to help.

7. Technical change will continue to lower the relative unit price and expand output per acre of many agricultural commodities. This, coupled with inelastic demand for products and the vagaries of international markets will put downward pressure on farm incomes. Farmers and their families will have, in the absence of governmental largesse, little opportunity to maintain their total family income without turning to non-farm sources of income. Institutions such as re-training, grants for acquiring saleable skills, flex-time, and job-sharing in the labor market will have to be introduced in rural areas. The profession's attitude about income from non-farm sources will have to change.

8. The process of parcelization will continue to change the structure of land ownership. More agricultural land will be held by non-farmers. Whole farms that remain whole will become the exception rather than the rule. In consequence, farmers will have to spend an increasing amount of time gathering information on land to rent and lease. A small farmstead may be the headquarters for a large farm, but the large farm may change in location, size, and number of parcels from year to year. Moreover, the non-farming owners--individuals, corporations, banks, cousins, and the like--may take a more active role in managing their properties by dictating what can and cannot be grown on a particular parcel.

9. The methods of making transfers of land and non-land agricultural resources will continue to change. Various tax reforms at the state and federal levels have made new organizational forms popular and profitable among farm families. It is not clear that these kinds of changes have ended. Until they do, the ownership pattern of land and other durable resources will be clouded and will lend a degree of inflexibility to farm adjustments.

10. It is increasingly clear to most observers that there is redundancy among all classes of inputs in agriculture. Although attempts to remove some resources from the industry have been in place and institutionalized for fifty years or more, these efforts have been offset by equally institutionalized efforts to increase the number of resources in agriculture (through the reclamation program, the REA, and the farm credit system) and to increase the productivity of resources already in the industry (through research, improved information, and the Land Grant System). It appears that agricultural overproduction will continue through the professional lives of most living and trained agricultural economists. If this is so, more inventive genius will need to be devoted to perfecting institutions that remove resources from the industry.

11. Rapid changes in a number of forces that impinge upon agriculture have caused the price of land to become uncertain if not volatile. Since equity in land is the basis for the majority of farm borrowing, this volatility has

had drastic and deleterious effects on farming and has led to the financial stress currently being felt by the production industry and its supporting service sectors. One way out of this price-equity-debt problem is for the industry to divest itself of the offending resource--land. U.S. agriculture, long based on the ideal of owner operatorship, could avoid some instability by selling land and renting it back from its new owners to be used for productive purposes. This theme is, of course, related to item eight listed above. Given creative (that is, new and perfected) leasing instruments, there is no reason to believe that the absolute size or the stability of the food supply would be jeopardized by such a change.

These eleven represent only the short list of all possible examples. Any others among us would have selected a different eleven and perhaps been bold enough to establish a hierarchy among them. Nonetheless, the list does indicate that agriculture is surrounded by institutions on the factor side, on the product side, and in the production process. Moreover, there is no sub-area, specialty, division, or region within agriculture or agricultural economics that is exempt from institutions or institutional change. If institutions were collectively regarded as a factor of production in the same fashion as land, labor, capital, and entrepreneurial skill, there would be drastic shifts in factor combinations as the relative scarcity of institutions changed from time to time and from aspect to

aspect within the industry. Changes of this kind are defined here as being related to the demand and supply of institutions--a theme that is elaborated in the following section.

The Demand and Supply of Institutions

Institutions--those ordered, regular, and sanctioned artifacts that impinge upon man's behavior--are created. The creation can be swift. A Supreme Court decision that strikes down a regular or traditional mode of behavior is a swiftly arranged or rearranged institution. Institution building can also be very slow. The gradual evolution of the land tenure system in the United States provides an example. Regardless of the rate of formation, institutions come in response to pressure, agitation, or need. These attributes are familiar in the literature of economics because they are the attributes that cause disequilibrium and change in any market. Market prices and the quantities exchanged change in response to relative changes in pressure, agitation, and/or need. Since each of these attributes can appear on either the demand side or the supply side of the market, the traditional supply and demand mechanism of microeconomics can be reconstructed with slight modifications to show under what circumstances institutions may be formed and when they may disappear.[2]

---

[2]The disappearance of institutions is a moot point. While a specific rule or institution may be summarily stricken from the books, the gap left by its going is quickly filled with new
(Footnote Continued)

Figure 1 is a familiar diagram that needs no explanation as long as the context is a world of prices and quantities. The world under discussion, however, is broader. It includes non-price ways of affecting the price and/or quantity exchanged of goods and services. The whole of Figure 1 is given over to a representation of the supply and demand for institutions.

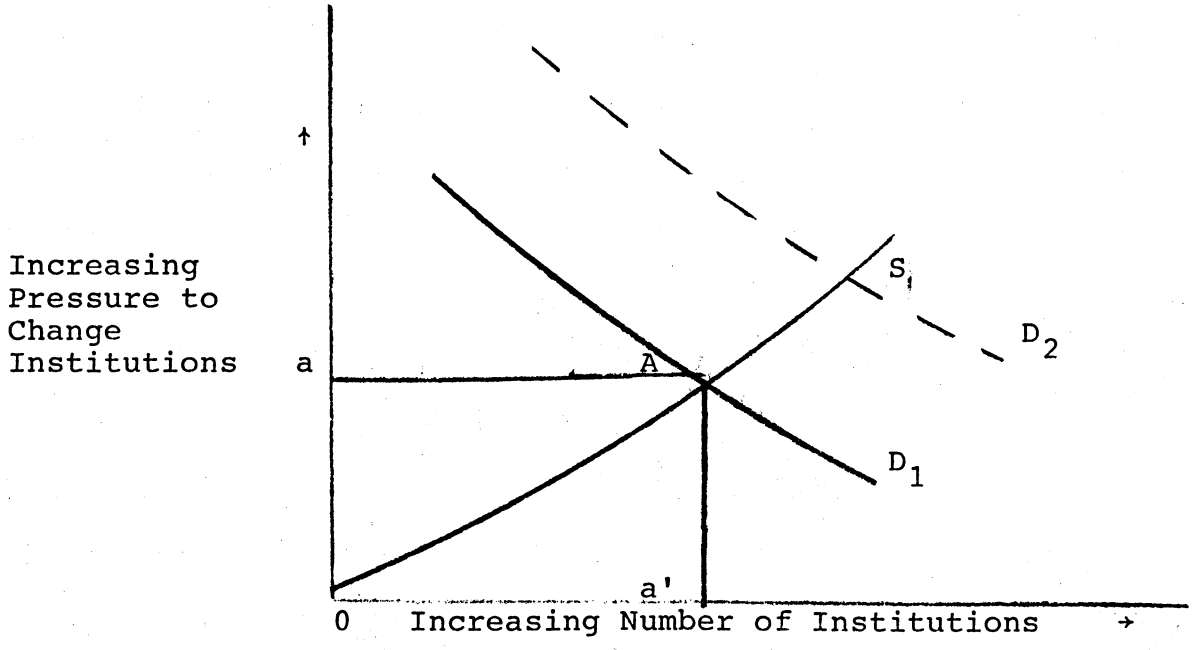


Figure 1. The Supply and Demand for Institutions.

The axes are similar to, but not quite the same as, those in the more familiar supply and demand diagram. The horizontal axis in Figure 1 is a complex measure of the quantity or numbers of institutions. Since many rules, habits, and

---

(Footnote Continued)
sets of rules--themselves institutions. Deregulation, for example, is a major effort aimed at eliminating institutions. The institutuions that have been cast aside, however, are quickly replaced by the un-regulated price mechanism. Has there been a decrease or an increase in institutions? No one can say for sure.

conventions that constitute institutions are not additive, this axis is not merely a counting device. It is better described as a scale of the intensity with which institutions, regardless of number, affect human affairs.

The vertical axis must be treated similarly. There is no scale to measure "pressure," especially when it is unclear whether the pressure is on an economic entity such as a corporation, a political body, an informal organization, or the public as a whole. It is known that increased restlessness, more sophisticated lobbying, a surge in righteous indignation, or a new morality puts noticeable pressure on whatever group is in charge of a particular set of institutions. This axis reflects the generation and notice of increased pressure.[3]

The supply curve SS shows how those who create or formalize institutions will respond to pressures that are brought against them. Response is shown as a positively sloped curve indicating that as pressure for institutions increases, the creating body will be more and more likely to respond with new sets of rules in a struggle to eradicate or lessen the pressure that is being placed on it. The demand curves D_1 and D_2 have an analogous interpretation. As the number or intensity of rules increases, the pressure for more diminishes.

---

[3]Two reviewers of an early draft suggested that Figure 1 be modified so that the vertical axis measures the supply and/or demand of institutions while the horizontal axis measures the rate of change in institutional formation (destruction). This formulation has merit but was rejected in
(Footnote Continued)

Only at point A is the system in a kind of equilibrium where no new institutions are being created and (apparently) no old ones are being destroyed. It is crucial to note that this equilibrium does not remove dissatisfaction or the pressure to change. At this point, Oa pressure remains, but is insufficient to force the governing body to add to the stock of rules. Put another way, the system is not necessarily happy with itself, but the dissatisfaction is diffuse or harbored only among those without sufficient power to effect a change.

Once point A has been achieved, the society or polity has a given stock (Oa') of institutions. These, in conjunction with the price mechanism, determine how resources will be allocated and how factor rewards and rents will be distributed. There is no way to tell, however, whether efficiency and equity are best served with this stock of institutions, or whether a change in Oa' would bring an improvement. Oa' is merely a position on a scale of less and more.

Movements from Oa' bring a number of interpretations. As distance (quantity) Oa' shortens, the rule makers are less responsive to their constituents' desires. In the vertical axis where the stock of institutions has been reduced to zero, the pressure for change and for rules may be very high but no one is acting on this pressure. This no-institution limit might be a perverse sort of egalitarian anarchy in which all

---

(Footnote Continued)
order to keep the diagram consistent and symmetrical with familiar supply/demand/equilibrium diagrams.

persons are equal, each makes his own rules, and none can compel others to follow any example.

To the right of Oa', the supply of institutions, rules, and duties is immense, but the deprivation or disorganization of the populace is so severe as to diffuse any attempt to generate pressure for change. This or a similar circumstance may have been the case in Europe prior to the Enclosures.

The combinations and possibilities that stem from Figure 1 are almost endless. Discussion should not end, however, before demand shifters and supply shifters have been brought into the discussions. Just as a change in income will cause the demand curve for a commodity or product to shift and twist, so will a change in social cognition cause the demand curve for institutions to change, shift, move, or acquire a new shape. The Great Depression of the 1930s brought such economic chaos that the government was asked to intercede into the workings of the price system. This was nothing more than a major shift in the demand for institutions--one shown by the upward movement of the demand curve to D_2 in Figure 1. The more recent mood of deregulation is more difficult to depict since it is not clear whether deregulation is a demand side phenomenon in which the public has diminished the intensity of its desire for institutions or a supply side phenomenon in which the rule-making groups have decided not to respond to pressure for institutions that help certain industries circumvent the price mechanism.

One thing is sure: the quantity (or intensity) of institutions changes constantly. No one can predict how the

quantity will change, but the suspicion is that more institutions are required as an economic society matures and becomes more complex. The development (creation) of institutions was essentially halted during the Dark Ages, but emerged with the Enlightenment during which the price system was perfected with new rules on coinage, contracts, and the control of money. It was also during this time that the institutions surrounding private property began to take forms that are recognizable today.

The pace of institution creation has seemed to increase in the 19th and 20th centuries. Admittedly, western society has divested itself of the huge overburden of institutions that stemmed from the Roman Empire and the Roman Church. It has also selectively replaced many of the older institutions of feudalism with new rules related to civil rights and market allocations of most resources. One senses, however, that in the progression of Western society through the Dark Ages, the Enlightenment, the Renaissance, and more contemporary eras, men have sought to increase the extent of group interventions into actions of individuals. This has been part of a continual struggle to reallocate resources and redistribute rewards so as to eliminate negative externalities, capture unearned rents for public use, and make the total behavior of society fit more

closely with the utilitarian's impossible goal of "the greatest good for the greatest number over the longest period of time."[4]

The press for more institutions continues. The pseudo-demand curve of Figure 1 apparently continues to shift out, and the suppliers of group rules and conventions continue to oblige society with new ways to organize old processes. Agriculture will certainly feel pressures to expand or change many kinds of institutions. The industry has always expended vast quantities of resources trying to shift either the demand curve or the supply curve for institutions to the right. The degree of success has been notable but changes in the structure of the industry may cause the search for institutional advantage to change its dimensions.

In the time between the present and the start of the 21st Century, agriculture will become increasingly diverse and will continue to lose in its ability to generate pressure for change. Agricultural economists will be well served to attempt to measure the pressure or degree of agitation that is developing in the industry so that they will be in an improved

---

[4]Georgescu-Roegen, and others, have used an analogy to make this point. They have argued that Spain could not make "progress" in her colonial empire because she encountered great difficulty in colonizing Central and South America where highly sophisticated civilizations already had elaborate institutional systems already in place. The countries of Northern Europe had a much easier time colonizing North America because the diffuse tribal system of the native North Americans did not yield extensive networks or institutions. England, Holland, and France had only to get a toe-hold and install their own institutions. The result, from the vantage of three centuries, is quite demonstrable.

position to predict the occurrence of changes. Ideally this should be done with respect to individual commodities, individual factors, and for the industry as a whole.

Institutions and National Product

In 1984, the GNP of the United States was $3.8 trillion.[5] This sum has increased quite steadily over the last century with decreases of major proportion coming only after cataclysmic events--usually worldwide in cause and/or effect. In 1984, the productive resources of the United States were allocated by a unique combination of choices that resulted from individuals interacting in marketplaces and observing the incentives and limits placed on them by institutions.[6] Market price incentives coupled with a peculiar set of institutions led agriculture to use too many resources and produce too many products. At the same time, institutional limitations and the New Federalism of the Reagan administration caused too few resources to be devoted to unemployment benefits, poverty programs, and urban renewal--an imbalance that did not escape the notice of

---

[5]Gross National Product is used here only for convenience. Any measure of aggregate product could be used to make the argument.

[6]This wording is, by necessity, ambiguous. Institutions sometimes substitute for the price mechanism, sometimes act to enhance the price mechanism, and sometimes act to inhibit the more flagrant behavior of the price mechanism. Providing examples and explanations of each case is beyond the bounds of this paper.

the contemporary institutionalist and sometimes agricultural economist, John Kenneth Galbraith.[7]

Regardless of accompanying circumstances, the size of GNP at any moment is functionally related to the number and/or intensity of extant institutions. This can be shown in stylized fashion in Figure 2. The vertical axis shows the size of GNP (or any other measure of aggregate product); the horizontal axis shows the number or intensity of institutions that are in place and affecting economic affairs. The horizontal axis suffers the same ambiguities noted in conjunction with Figure 1: There does not appear to be a meaningful way of accounting for the pervasiveness or intensity of a particular collection of rules, regulations, or habits.

---

[7]Late in the Spring of 1985, Galbraith carried this concern to its logical end by noting with sardonic humor that the U.S. society must be a peculiar place since its customs, habits, and mores (institutions, all!) intermixed to provide an incentive system that encouraged the very rich to work even harder at the same time it encouraged the very poor to work not at all.

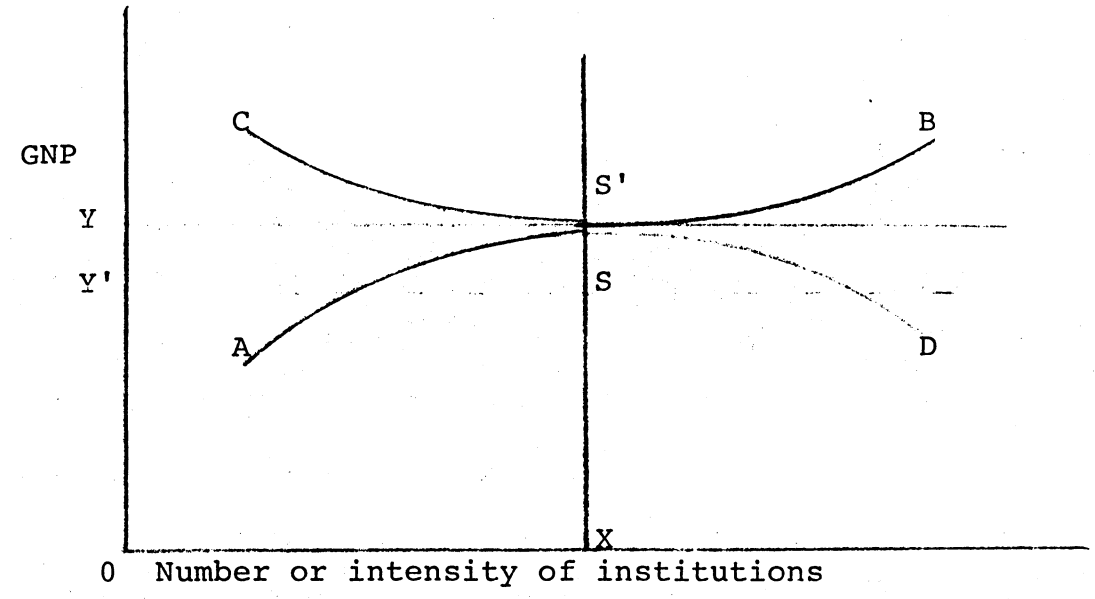


Figure 2. Hypothetical relationship between GNP and Institutions.

The exercise starts with a given GNP, OY, and a given number of institutions, OX. It is assumed that the OX institutions permit or encourage the production of some part of GNP. The remainder is produced without strong reference to any except the most fundamental institutions--the price system, the laws of contract, private property, and the like. The division of GNP into institution-induced and market-induced is made arbitrarily at point S along the vertical line segment XSS' meaning that GNP equal to XS is assumed to come through ordinary market channels, while SS' stems from rules that have an important influence on resource allocation and productivity.

An important question arises immediately: What would happen to GNP if the magnitude OX were changed? By assumption, nothing would happen to volume XS so long as a small, basic set

of institutions remained intact. Note that this assumption requires the further assumption that there is a hierarchy among institutions. Beyond this, it is not at all clear whether GNP would rise or fall with a change in the volume or intensity of rules. Several possibilities exist.

(1) One can assume that OX is the optimal quantity and quality (intensity) of institutions. If this is so (and if GNP is the appropriate maximand), then deviation from OX will cause a reduction in GNP and institutional change will cause the path of GNP to be described by the inverted U along AS'D.

(2) OX may be sub-optimal in such a way as to yield increases in GNP if the number of institutions is increased, but reductions in GNP if the number is reduced. GNP would then follow the path AS'B. This might occur in an enlightened, developing economy that is embarking on a well-conceived land reform. It might also occur in an advanced economy like the United States in which more institutions are needed to cope with vast numbers of output-reducing externalities.

(3) The CS'B path shows a society that has paid dearly for its present collection of institutions. These have been a drain on society, but committing additional resources to institutions would have a positive payoff. China in the few years after revolution may have followed path CS'. Surely, though, China is

now increasing her GNP and the formation of rules by which economic activities take place has increased as well. China's future may unfold along S'B.

(4) The CS'D path is easily conceptualized but applied only with some discomfort. It is a case where institutions have stymied productivity and any increase in rules will further reduce the output of the economy. A possible example comes from the occupied nations of Eastern Europe in the early years of WWII. The impositions of the National Socialists impinged upon incentives to such a degree that the output of the occupied economies was reduced. Perhaps being colonized forces a nation into this trap. If so, the lesson is clear for the next generation of USAID experts.

Figure 2 provides entree into a guessing game. The relationship between institutions and output is not well known, but it is likely a researchable issue whose importance will be felt only with careful examination of the institutions that may affect agriculture and agricultural output. Agricultural economists in the 21st Century have a large task in this identification and quantification problem.

Institutions, Institutionalism, and Agricultural Economics

Institutions have been present since the Creation, when it was decreed that the seventh day was to be used for rest. In

spite of this, the tone of this paper suggests that institutions are new phenomena that have been completely ignored by economists as they bend their attention to agriculture. Such is not the case. Many within this profession have studied institutions, and some have made a career of the study. The typical agricultural economist is, however, content to study other aspects of the farm economy within a context that assumes most institutional aspects to be fixed. The same can be said for most of economics--our parent profession.

It has always been this way even though there is a sub-set of economists whose members claim to be "Institutionalists." The books that deal with the history of economic thought invariably include a chapter on institutionalism as a school of thought. The school of thought never coalesced. If it is taught at all in contemporary graduate curricula, it is taught through biography rather than analytics, and it is often considered to be an amusing diversion from the main thrust of microeconomics, quantitative methods, and the exacting study of agricultural production economics. A brief excursion into the origins of institutionalism is useful in the present context.

Circumstances Leading to the School. Classical and neo-classical economics have roots in the beginning of industrial society where man was living close to the land, the world of exchange was very simple, and increased product (output) of any good or service added to the well-being of mankind. Early interventions into the economic system were designed to encourage the good and discourage the bad that could come from the price system.

In the latter years of the 19th Century, a small number of well trained economists began to question the ability of received doctrine to explain the structure of the nation's economy and the performance of the economy as it had unfolded in the years following the American Civil War. Rather than attempting to expand existing theory so that its explanatory power was somewhat greater, they decried the narrowness of the field and sought answers to economic problems in a much broader context. Chief among the dissenters were Thorstein B. Veblen (1857-1929), Wesley Clair Mitchell (1874-1948), and John R. Commons (1862-1945). These three and their intellectual descendants formed the basis of the loose affiliation that came to be called "The Institutional School" of economic thought. The sobriquet is not apt since there is only one common theme to which they all ascribed. The theme centered on the inability of Ricardian economics to explain the economic phenomena that these economists were studying and observing.

They reacted to this apparent limitation to economic theory in different ways. Veblen--by far the most fascinating personality of the three--is sometimes swept under the economist's rug by being called a social philosopher, sociologist, or cultural anthropologist--all appellations to which the man himself would heartily agree. He spent a professional lifetime chastising economic theory, hoping for a broader view, and asking how society affected economics as well as how economics affected society. Commons was more disciplined. His concern centered on the multiple influences that impinge upon a

transaction. He championed collective action and the way in which tastes, demands, and concerns of an individual are eventually subjugated to the concerns of a group. His wish was that the old Ricardian rules, even as synthesized and expanded by Marshall, could be adequate to the task of studying group subjugation and/or group choice. His writing is difficult and sometimes contradictory, but he attracted a wide following and had an important influence on agricultural economics--especially the group that was growing in size and stature at the University of Wisconsin in the 1920s and 1930s.[8]

Wesley Clair Mitchell abjured the deductive logic of price theory. His rhetoric is more disciplined than that of either Veblen or Commons, but he simply could not accept the basic deductive requirements of hedonism or the utilitarians. His views on the logic of pleasure and pain can be simply put: individuals have good, broad ideas of what constitutes a marginal contribution to their own well being, but they cannot translate the broad notion into reasoning that allows tightly defined, rational choice in the supermarket. Alternatively, the broad thrusts of consumers are perfectly understandable; the fine adjustments to choice are beyond the pale of economics and economists ought not to bother with them.

---

[8]Commons is one of the few "institutionalists" who touched on methods or on the way economists should form problems. His interest and depth of knowledge of collective bargaining led him to conclude that one should study the transactions conducted in the bi-lateral monopolies when a powerful union

(Footnote Continued)

These three were, of course, joined by others. The others shared the view that the main body of neo-classical economic theory and its analytical apparatus was not sufficient to explain the economic occurrences of a modern, industrial era. Beyond that, there is little to make the institutionalists into a school of thought. There was Commons, always advocating or making new rules that made the economy run in a slightly different way. There was Veblen, with his acerbic moods and turgid prose, standing to the side commenting on rules and institutions that were in place or ought to be in place. And there was Mitchell who looked, gave up, and went his own way. Although Mitchell went on to make a noteworthy and lasting contribution to economic theory and practice, his contribution was general and holds no meaning that is unique to agricultural economists.[9] Concern, then, turns to Veblen and Commons.

Contributions of Veblen and Commons. Thorstein B. Veblen is best known for painfully elaborating the veracity of such catchy phrases as "conspicuous consumption" and "the theory of the leisure class." His elaborations have not fallen on deaf

---

(Footnote Continued)
bargains with a powerful industry. This, rather than the unfettered supply and demand forces in (say) the wheat market, would provide instruction on a "pure transaction."

[9]This is quite different from saying that Mitchell's work is not especially useful or important to agricultrual economists. Quite the reverse is true. Mitchell's work on business fluctuations, the measurement of national product, and the size distribution of income seems exceedingly important, especially as the profession turns toward an increased concern with macroeconomics.

ears. Indeed, they have been appropriated by all who wish to criticize the effectiveness or reliability of the conventional patterns of economic theory and research. Leaving the catchwords aside, though, there is a major theme that runs through Veblen's writings. He saw the United States as a technological society that was condemned to social and economic disequilibrium because the pace of technological change would always be such as to outstrip the society's ability to adjust to the newly produced technology.

Nowhere is this more evident than in agriculture. Since 1883, the year the original Hatch Act was passed, the federal government has maintained institutionalized support for improved agriculture. The reasons for the passage of the Hatch Act were sound and federal dollars joined an even larger sum of private dollars in finding ways to expand agricultural production through improved inputs, improved ways of combining inputs, and the more effective use of information. The improvements have been astounding. Since the turn of the century, agricultural productivity has consistently outstripped domestic demand. Frequently, it has outstripped both domestic and foreign demand. Even in the face of chronic overproduction, neither agriculture nor society have been able to adjust and bring the industry into equilibrium. Veblen's observations about the relationship between technology and the adjustment to it have proved to be correct. The demand curve for institutions has shifted upward and to the right. This demand was first accommodated by an activist federal administration that,

in the 1920s and 1930s changed many of the rules that governed the conduct of agriculture.

John R. Commons provided a different approach. His concern was the transaction and, as has been mentioned, he believed that the transaction--the act of exchange--was the key fixture in economic analysis.[10] Commons reasoned that many market and non-market forces impinged upon a transaction. He was consistent with Veblen in admitting that transactions have cultural antecedents, but he went much beyond this. The law, customs, regulations, local habits, and scores of other influences help determine when a transaction will be consummated.

Commons turned the force of his intellectual genius toward labor transactions, labor relations, and industrial organization. If the labor market was not behaving well, Commons suggested remedies. He was an activist in the economic affairs of his times. If his interest had been agriculture and if he had been so situated, he would have been invited into the policy deliberations held by Rexford Tugwell, John D. Black, G.F. Warren and others, in the 1920s and 1930s. If this had taken place, it is possible that the whole structure of agricultural policy might have been different today. The man's pragmatism and eclecticism have become important attribute in the descriptions of the "American (Institutional) School of Economic Thought."

---

[10]This is in contrast to many others, especially Boulding, (Footnote Continued)

The Economic Analysis of Institutions. Institutionalism per se does not provide entree to the systematic study of individual institutions, rules, or behaviors. Nor do many of the practitioners of this kind of study. This is unfortunate because the time has come when it appears essential that this profession say more about these sanctioned and well ordered relationships that help define resources, determine the way resources are allocated, and have impacts on both efficiency and income distributions. Explicitly, economists need to know:

(1) What are the forces that cause changes in institutions?

(2) What effects do individual institutions have on people?

(3) Can measures be developed to aid in predicting when institutional change will occur?

(4) How can these aspects of institutional research be superimposed upon or rationalized with the kinds of things that agricultural economists are ordinarily trained to do?

Answering these questions will require data. This is not new because research economists working on agricultural problems have always been large-scale consumers of data. Regardless of

---

(Footnote Continued)
who, in The Skills of the Economist made a great deal over the notion that the commodity (or the thing that is traded) is the focal point of the discipline.

school of thought, training, or disposition, the real headway in the profession has always come when the logical positivists have empiricized the models of the rationalists. Sadly, this kind of headway cannot be made in the present case because the data needed by the institutionalists or by those who study institutions do not resemble the data required for other empirical work in the profession. Moreover, two first rate, empirically oriented economists, one following the path broken by Veblen; the second working at Commons' involvement in the creation of rules, laws, and the like, would require data of two different types. The institutionalists, then, are separated from the main body of theorists and researchers by ideas, approaches, and evidence (or facts).

Research and Teaching for the Twenty-First Century. There is little evidence to say that the pace of technical change and economic activity will slow in the next few decades. There is every evidence to show that the structure of economic activity, the division of the product of economic activity, and the broad relationships among natural and sub-national economies will continue to change at (probably) an accelerated rate. This means that conducting research in agricultural economics and training others to be agricultural economists will become a changing task.

It seems untoward to suggest that more institutionalist-analysts be trained because the question arises: how will their training differ from that received by the present generation of analysts? There is no "other paradigm" because

there is no paradigm at all. It does not seem untoward to ask that more research resources (or a greater proportion of a given quantity of research resources) be given over to investigating problems of the type mentioned in this paper. For some, that will mean investigating the potential effects of tax reform on the structure and profitability of the agricultural industry. For others, that will mean outlining legislation that will allow rural schools to produce superior students who will have a competitive advantage in this increasingly urban or urban-driven economy. For still others it will mean collaboration with scientists from other disciplines to ferret out or anticipate where economic anxiety is high enough or where resource owner depression is intense enough to warrant the creation of new sets of institutions that will reallocate or redistribute in such a fashion as to relieve the offending pressures.

The problem in teaching is perhaps more severe. There are scores of books that are devoted wholly or in part to the discipline's most prominent institutionalists--Veblen, Mitchell, Commons, Ayres, Gruchy, Galbraith, Wantrup, Boulding, Parsons, Schmid, Gaffney, and others. There are hundreds of articles written about themes that these economists and their students studied. There are few books, but several good articles, that demonstrate the differences between classical, neo-classical, and institutional economics. There is not, nor can there ever be a definitive treatment of the Institutional School that begins on page one and continues to the end and in

doing so tells the reader how to be an institutionalist and what good being an institutionalist can do.

Training must take a form different from training in agricultural marketing or farm management. It should be more than just a jocular corner in the history of economic thought, but it must be something different from a drill in quantitative methods. It should be an exercise that teaches about personalities, their thought processes, and why they found the mainstream of economic thought to be inadequate, constraining, or irrelevant. Such training should allow this generation of students to capture the feeling of Veblen as he objected to the lack of fit between theory and reality. Similarly, the training should instill some part of Commons' inclination to become involved by not just analyzing and describing, but also by forming prototype institutions to solve emerging problems.

Summary and Discussion

In many ways, this has been an impossible task. Any ten agricultural economists asked to comment on the institutions likely to affect us in the 21st Century could have approached the problem in at least ten different ways. The present way has been to talk about some institutions and institutional changes affecting agriculture, to comment on how institutions are formed, and to mention briefly institutionalism as a school of economic thought. The task was only partially done. Some other problems are now facing agriculture. Among them are the redundancy of agricultural labor, the (informal) institution

called the family farm, the historical importance of inflation as a means of coping with farm indebtedness, the inability of the social safety net to reach farm and rural people, the (false) idea that the world cannot in the short run feed its populations, and the increasing number of international institutions designed to cope with the increasing complexity of foreign trade in agricultural commodities . . . all these and dozens more could fill additional papers, pamphlets, and books with stories that tie agricultural economics to institutions and to the ghost of institutional economics.

It seems appropriate now to return one more time to the beginnings of institutionalism: Thorstein B. Veblen and John R. Commons. Although both were products of the nation's agricultural heartland, neither spent a great deal of time attempting to unravel the problems of agriculture. This is easily explained. When they were at the heights of their intellectual genius, very few economists gave direct and continued concern to the agricultural industry and its problems. In spite of this, each has a lesson for contemporary agricultural economics.

Veblen built many of his most important arguments around the notion that society is very ingenious in advancing technology but inept in adjusting to it. There are high private rewards for firms that invent transistors, triple by-pass surgery, and selective weed killers. The incentive is always to develop more and more of these rent-producing technologies. There are similarly high public rewards for drought resistart

crops, feed-efficient broilers, and social security systems. And these things have come. But the price has been in human terms. Agricultural labor and rural household capital has not been able to adjust to the continuing stream of new seeds, fertilizers and machines, so the industry remains out of equilibrium earning sub-normal rents, and supplementing its incomes through off-farm labor incomes and public and private transfer payments. To be sure, this circumstance is not confined to agriculture. The automobile industry has installed high-technology robots to replace over one-fourth of its laborers--laborers who cannot adjust and will spend the rest of their lives living on some form of transfer incomes. Similar observations can come from printing and publishing, small manufacturing, and many other capital intensive industries.

Agricultural economists must not ignore this source of Veblen's caustic observations about industrial society. Indeed, these ideas should become as central to our instructional programs as the present disposition regarding the propriety of market allocations and Pareto optimality.

Similarly with John R. Commons. In their own way, the writings of Commons are as complex and obscure as those of Veblen. Each knew the language and technical requirements of economics, but each stumbled over his own feet in exposition--Veblen in long, convoluted sentences and paragraphs; Commons by jumping theme-to-theme in an eclectic fashion that went beyond the bounds of pragmatism. But Commons saw that markets were the stuff of which transactions are made and the relative

weighting of forces in transactions provided--good or bad--an allocation of resources that gave rise to the collection of goods asked for by those playing in the market. The market was not a sympathetic or compassionate device in satisfying the needs of its constituents so it had to be imposed upon. The imposition came through ordered relationships, group actions, and law--all of which are institutions.

Commons went well beyond this in the area of labor relations. He was an advocate of group action. The negotiated price or allocation might be superior for all involved and in some cases, it was. Commons made things happen and in doing so he made his own niche in economics.

The agricultural economists in our graduate programs today will reach the peak of their intellectual inventiveness and output in the decade that will run 1995-2005. We are currently training them to be rationalists who argue from a priori positions or as logical positivists who deduce conclusions from observations of the real (existing) world. We do little in our training to tell these students about the changing institutional structure in which problems are generated and solved. As a result, we play into Veblen's trap: We know the world is changing, but we are ill-prepared to work with the continuing process of adjustment. We continue to hide in a world defined by ceteris paribus assumptions and until this stops, our professional talents and efforts will be directed toward only partial solutions of increasingly complex and increasingly pervasive problems.

THE MACROECONOMICS OF AGRICULTURE AND RURAL AMERICA

G. Edward Schuh and David Orden*

ABSTRACT

Flexible exchange rates and the emergence of a well-integrated international capital market have created a new world for U.S. agriculture with its increased dependence on trade. This results from a shift of the burden of adjustment to macroeconomic policy onto trade sectors, with the exchange rate the primary transmission mechanism. Substantial evidence of exchange rate impacts on agriculture has accumulated and the linkage of these impacts to monetary and fiscal policies is increasingly well documented. Nevertheless, contemporary analysis of these impacts raises difficult theoretical and econometric issues, and economic policy remains misguided. There is critical need for institutional reform consistent with the international economic integration that has occurred. High on the agenda are reform of domestic agricultural commodity programs and of international monetary arrangements.

INTRODUCTION

This paper addresses some challenges we face as we seek to understand the development of U.S. agriculture in an increasingly interdependent world economy, and as we seek to formulate appropriate policies for this sector. These are challenges in the macroeconomics of agriculture. Our interests extend as well to related macroeconomic effects on rural communities.

As we undertake the task of addressing these challenges, it has become commonplace at the University where we recently resided to argue that macroeconomics occupies an interesting chapter in the history of economic doctrine, but is of little value beyond that. From this perspective, what matter are the microeconomics of markets, the theory of the business cycle, and/or the theory of money. For the senior author, this cycle has gone full term. When he was a graduate student at the University of Chicago, he too studied microeconomics and the theory of money, wrote a preliminary examination in each field, and diligently studied The General Theory by Keynes in order to know why Mr. Keynes got it wrong. Keynesian economics, of course, is what in this lexicon is macroeconomics.

We have kept the concept "macroeconomics" in our title for two rather simple reasons. First, there is still considerable debate about whether neo-Keynesian macroeconomics is in fact discredited. Second, we want to give the concept a more general, and not so uncommon, interpretation to refer to the aggregate aspects

---

*Director, Agriculture and Rural Development, The World Bank, Washington, D.C., and Assistant Professor of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, respectively. The authors wish to thank their reviewers for comments on an earlier draft of this paper.

of the economy. As our point of departure, we take agriculture as a whole and think about it in the context of the economy as a whole, with the emphasis on how such things as monetary, fiscal, exchange rate, and trade policy affect the sector.

A major challenge facing our profession is that contemporary thinking on these issues is in a state of considerable flux. Moreover, much of the new classical or rational expectations perspective that is central to this discussion has not yet penetrated either the thinking about U.S. agriculture or the empirical work on the agricultural sector.1/ We have tried to resolve the many dilemmas that arise in addressing the macroeconomics of agriculture under these circumstances by examining the pragmatic implications of recent changes in the international economy and the institutional challenges posed by its management without ignoring some of the theoretical and econometric controversies that arise in contemporary analysis of these issues.

The general outline of our paper is as follows. First, we provide a general equilibrium perspective on agriculture and discuss some of its obvious implications. Second, we discuss the rather dramatic integration that has taken place in the world economy over the past twenty years and the role of the U.S. in the economic setting that has emerged. This is followed by a brief discussion of modern macroeconomic theory and of some controversial issues in the evaluation of macroeconomic policy. We then posit a conceptual analysis of the effects of macroeconomic policy on trade sectors in an integrated world economy, and review recent empirical work on these impacts on agriculture. This takes us to the last section, wherein we consider some policy issues and needed institutional reforms. As we proceed, we attempt to identify some of the challenges raised for our profession by the issues that are addressed.

A GENERAL EQUILIBRIUM PERSPECTIVE ON AGRICULTURE

The agricultural economics literature is replete with studies of this important sector of the U.S. economy. Unfortunately, a disappointingly large share of these studies are cast in a partial equilibrium, closed economy model. Such a perspective was probably not all that inappropriate so long as trade was not very important to agriculture or to the economy as a whole and so long as an international capital market was also relatively insignificant. In today's world, however, where trade is important to both agriculture and the rest of the economy, and where there have been other changes in how the U.S. relates to the international economy, that perspective can be dangerously misleading. Changes in the world economy and agriculture's role in it have greatly enhanced the relevance of general equilibrium considerations when evaluating the agricultural sector.

Relative Protection

Perhaps the best way to gain insight into the consequences of these two different perspectives is to consider a number of important issues where the distinction between partial and general equilibrium analysis is important. An obviously relevant issue in contemporary policy is whether policy is protective of agriculture or discriminatory towards it. If agriculture, or a subsector of it, constitutes a traded good sector, a useful way to analyze this question is to evaluate the protection that is provided. A naive approach to this analysis would consider the nominal "protection" created by either tariffs or direct subsidies.

A more sophisticated perspective, which would take account of some general equilibrium implications, would recognize the need to study effective protection and take into account the impacts of tariffs and taxes (both positive and negative) on inputs as well as the product market. Distortions in the value of the nation's currency would also be taken into consideration.

For many analysts, measurement of effective protection would convey the full policy impact on agriculture. But by focusing on only one sector even this more sophisticated perspective tells only one part of the story. In general, there will be some degree of protection or taxation of other sectors in the economy as well. And, the relative protection or taxation is what matters in the final analysis, not the protection or taxation of one sector alone. It is the relative protection that determines relative social profitability. Thus, even though there is positive effective protection of the agricultural sector, the relative social profitability of agriculture may be weak, if the rest of the economy has an even greater level of protection. It is relative social profitability that determines relative prosperity among sectors and the direction of investment flows.

Such issues are implicit in contemporary discussions of farm policies, but are seldom brought out.2/ These issues come to the fore when the theory of second best is applied. The naive perspective is that establishing a free market policy for U.S. agriculture would lead to a more efficient allocation of resources in the aggregate compared to the present distorted situation. This is piece-meal policy analysis, and, in general, the recommended policy is wrong. As long as there are other distortions in the economy, the second-best policy may be to provide agriculture with the same degree of "protection" as prevails elsewhere. Since agriculture is an export sector and there is apparently net tariff protection of about 10 percent on the rest of the U.S. economy, the ideal policy for agriculture, at least from the perspective of national resource allocation, may be an equivalent export subsidy.3/

This reasoning points to other general equilibrium dimensions of agricultural policy. In particular, an overvalued currency is both an export tax and an import subsidy and thus discriminates against trade sectors. When one recognizes that the U.S. dollar was overvalued during most of the 1950s and 1960s, the interpretation of the past history of U.S. agriculture and its policy is quite different from generally accepted versions.4/ In general, contemporary discussions of U.S. agriculture have been misguided for their failure to recognize this important issue.

Still another sense in which a general equilibrium perspective contributes to a more enlightened policy discussion is in terms of the measurement of relative social profitability. The index used historically to evaluate the relative economic condition of U.S. agriculture is the agricultural parity index: the ratio of product prices to input prices. Among the many deficiencies associated with this concept, a serious problem is that it is based on a partial equilibrium, sectoral perspective and thus is too narrow. More relevant are the domestic terms of trade; namely, the price of agricultural goods and services relative to the prices of all other final products and services in the economy. In general, the domestic terms of trade may be quite different from the parity index.

Output and Factor Markets

A general equilibrium approach centers policy considerations on linkages of the agricultural sector to other sectors of the economy. Perhaps the most important of these linkages is addressed by the notion of food as a wage good. As a wage good, the price of food is an important determinant of real wage rates. Real wage rates, in turn, are an important determinant of the relative profitability of nonfarm sectors of the economy. If the price of food declines steadily, wage earners can experience a rise in their real wage with no rise in the nominal wage. This will enable export sectors to compete more effectively in international markets, other things being equal. It will also influence relative profitability among nonfarm sectors depending on the relative intensity with which they use labor. In addition, as a wage good, the price of food can be quite a sensitive political issue, as experience has demonstrated time and again.

To fully appreciate the significance of the intersectoral wage-good linkage one need only to go back to the commodity price boom of the early 1970s. The significance of food as a wage good became readily apparent at that time and macroeconomists and general policy makers became excited about the price of food after a long period of neglect. Their concern was briefly translated into an export embargo and later into a concern with whether increased agricultural exports were good or bad for the economy as a whole (e.g. Doering, Schmitz, and Miranowski).

In the U.S., the expansion of the food stamp program probably attenuated some of the wage-good effects of food prices during the 1970s. However, as support for the food stamp program declines, if food prices rise sharply these issues may surface again, especially in light of the general increase in U.S. dependence on trade.

The implicit wage-good effect also probably explains why there was such strong support for agricultural research from almost all sectors of the economy so long as U.S. agricultural exports were relatively small and agriculture was essentially a closed economy. It may also explain why there has been a decline in support for such research as agriculture has become increasingly dependent on trade. With dependence on trade, a larger share of the benefits of agricultural research are passed on to foreign consumers or captured by producers as economic rents, either to the relatively fixed supply of land or to entrepreneurial-innovative skills in limited supply.

A second important linkage between agriculture and other sectors of the economy arises among factor markets. This linkage works two ways and again a general equilibrium approach provides an interesting perspective. In one direction, wage rates, nonfarm employment opportunities, the cost of borrowing and of using capital, and the cost of purchased inputs are important determinants of resource use in agriculture and the composition and level of output from the sector. A broad array of monetary, tax, fiscal, trade, and industrial policies impact on agriculture through their effects on these factors. In the other direction, agriculture provides resources for other sectors and agricultural policy is an important determinant of this resource flow. Production control programs provide an interesting case in point. These programs release land, labor, and other resources to the nonfarm sector, thereby lowering the price of these factors in the general economy.5/ This tendency reinforces the wage-good effect. Again, this may have contributed to the willingness of the nonfarm sector to accept such programs in the past. The absence of effective production controls in recent

years, together with relatively high target and loan levels for export crops, is working in the opposite direction. One consequence may be erosion of the political support for agriculture.

CHANGES IN THE INTERNATIONAL ECONOMY AND HOW THE UNITED STATES RELATES TO IT

The international economy and the way that individual economies relate to it have undergone drastic changes in the last twenty years. These changes have dramatically altered the economics of agriculture and how one must think about the agricultural sector.

Increased Dependence on Trade

Contrary to the trade-pessimistic mentality that prevailed at the end of World War II, since the war international trade has grown at a faster rate than world GNP in all but three years. The growth trend in world trade accelerated in the 1970s and the U.S. became increasingly related to the rest of the world through trade. The dependence of U.S. agriculture on exports doubled during the decade, as did the dependence on trade of many other sectors of the economy. By the 1980s, the American economy was essentially as open to trade as the economies of Western Europe as a whole or Japan.6/

The economy becoming more open has important policy implications for both the general economy of the U.S. and its agricultural sector. Perhaps of most significance is that the domestic economy becomes increasingly beyond the reach of domestic policies. This has been a major source of frustration in the U.S. where policy makers and the public both expect much more direct control. In the case of agriculture, it is not that the government hasn't been doing anything. The problem is that the impacts of policies designed for the domestic economy are literally swamped by forces from the international economy.

Emergence of a Well-integrated International Capital Market

At the end of World War II, there was virtually no such thing as an international capital market. There were transfers of capital from one country to another, but these were largely on a government-to-government basis in the form of foreign aid.

By the early 1960s an international capital market began to emerge. A Eurodollar market developed as European banks discovered they could loan the dollars they had on deposit. This market grew very rapidly, eventually expanding into a Eurocurrency market as the banks discovered they could lend other currencies as well. The international capital market continued to expand through the 1960s, then it was propelled forward by the OPEC-induced petroleum crisis of 1973 which generated petrodollars in huge amounts. We seem to forget today that the banking community in the 1970s was enjoined to recycle these dollars to keep the international economy from collapsing. This they did to a fault, to the current chagrin of the banks and of many less developed countries that are now burdened with excessive debt.

The important fact about the Eurocurrency market is that it is now absolutely huge. Although some disagreement exists about the numbers, a widely accepted estimate is that the total amount of credit this market had outstanding at the

beginning of the 1980s was about $1.7 trillion. That is approximately commensurate with the total annual value of international trade at that time.

Since 1980, the international capital market has continued to burgeon. The total amount of international financial flows were on the order of $40 trillion by 1984, while the total value of international trade was on the order of $2 trillion. Moreover, almost all countries use the international capital market in one form or another. Hence, the international capital market has become as important in tying the economies of the world together as international trade itself. In addition, as we will describe below, it ties economic policies together in ways they were not tied together before.

The Shift to Flexible Exchange Rates

At the Bretton Woods meeting after World War II it was agreed that countries would fix the value of their currencies in terms of currencies of other countries and change them only under dire circumstances. The objective of this agreement was to keep individual countries from "dumping" their domestic problems abroad. The expectation was that disequilibrium in the external accounts, or problems of unemployment, would be managed by changes in domestic monetary and fiscal policy, not by competitive devaluations.

This system of fixed exchange rates served the industrialized countries reasonably well for almost 30 years. For a variety of reasons, including inappropriate U.S. monetary and fiscal policies, this system came under a great deal of stress in the late 1960s and early 1970s. President Nixon devalued the dollar in 1971 to alleviate this stress, then devalued again in 1973, eventually letting the dollar float to an exchange value determined in international markets.

The flexible exchange rate monetary system that has emerged since 1973 is essentially a system of bloc-floating. Many individual countries tie the value of their currency to the value of a major currency such as the U.S. dollar, the British pound,the French franc, or the German Deutsch Mark. While this may give the appearance of a great deal of fixity in the system, as the major currencies float against one another most countries experience realignment of their currency values. Recent estimates suggest that approximately 85 percent of international trade takes place across such flexible exchange rates. This shift to an essentially flexible exchange rate regime is de facto recognition that in light of the large volume of international trade and financial flows, governments can no longer fix the value of national currencies.

Increased Monetary Instability

International monetary conditions were quite stable during the 1950s and 1960s. Starting in about 1968, however, this desirable situation changed, for reasons that no one seems to fully understand. Monetary policy in the U.S., in particular, has been quite unstable in this period, being variously classified as stop and go, erratic, zig-zag, and so forth. Monetary instability in the U.S. has been exacerbated by conditions in other countries, with the result that fluctuations in world monetary aggregates have been quite large.

The significance of increased monetary instability for the agricultural sector is that it has occurred at the time when agriculture has become vulnerable to changes in monetary conditions. As a result, an important part of the instability

of U.S. agriculture over the 1970s and 1980s has been due to monetary instability, and not to the weather as is frequently argued.

THEORETICAL ISSUES IN MACROECONOMICS

In addition to changes in the international economy, there are some controversies in macroeconomic theory and practice that are also central to our concerns with the macroeconomics of agriculture and rural America. In this section we discuss three issues: (1) the modern classical view of macroeconomics; (2) the Keynesian fixed-flex price model; (3) the modern definition and interpretation of economic policy.

The Modern Classical View of Macroeconomics: The Crucial Role of Expectations

Recognizing the role of expectations in determining the outcomes of specific real shocks or government actions has been a critical insight of modern macroeconomics. That is, the effects of government policy are seen to arise in a fluid context, with the public responding to policy measures in a fashion determined by its own optimizing logic, rather than as application of policy measures to a passive public. As a result, the public's perceptions affect policy impacts.

To consider this issue, suppose we want to evaluate the effects of anticipated versus unanticipated movements in policy variables. One approach to this evaluation is to consider a stochastic equilibrium model in which participants in different markets have imperfect information about economy-wide variables (e.g., Lucas, 1972; Barro, 1976; Cukierman).7/ Briefly, the policy implications of such an equilibrium model arise as follows. Anticipated changes in money supply have known effects on nominal income and proportionate effects on individual prices and the general price level, hence real economic activity is not affected--the traditional classical assertion. An unanticipated monetary shock, in contrast, is partly confused with shifts in relative demand and induces output responses. Further, if price elasticities of supply and demand differ across markets, a monetary shock may affect relative prices and have very different impacts among sectors.

The distinction between anticipated and unanticipated monetary policy in the stochastic equilibrium model plays a crucial role in the modern classical view of macroeconomics. This distinction provides a basis on which to reconcile the "monetarist" view that monetary policy has no real effects (i.e. when it is anticipated), with the "monetarist" view that changes in money supply have been the principal cause of fluctuations in output levels historically (i.e. when these changes are unanticipated). Further, the stochastic equilibrium model provides a modern foundation for the recommendation that a stable money growth rate is the optimal monetary policy.8/

The proposition that only unanticipated monetary policy has real effects has substantive implications as well for evaluation of macroeconomic impacts on agriculture. The proposition that systematically "tight" monetary growth dampens agricultural exports must rest upon real impacts of anticipated policy, or on such a policy embedding a sequence of realized monetary growth rates below expectations. If only unanticipated shocks matter, then the stability of monetary policy

is of concern to agriculture, but the level at which stability is attained is of less consequence.

Equivalent questions can also be raised with respect to fiscal policy: Does the public respond to anticipated government deficits with offsetting increases in private savings so that the level and composition of real output remain constant, while unanticipated fiscal shocks augment real demand, raise real interest rates, and shift the makeup of output? In the case of fiscal policy the outcome depends not on whether nominal and relative price signals are confused, but rather on whether private agents optimize with respect to anticipated government dissaving with neutralizing increases in private savings.9/

More generally, consideration of the public's expectations blurs the distinction between monetary and fiscal policy as private agents recognize that government expenditures must be paid for by taxes, borrowing, or creation of money. Recognizing this simple identity leads the public to question the permanence of incompatible monetary and fiscal policies. For example, a large deficit might lead to inflationary expectations despite temporarily constant money supply. If this induces high real interest rates for some interim period (a real effect), whether one attributed this effect to unanticipated monetary policy (not as inflationary as expected during this period) or to fiscal policy would be quite arbitrary.

The Keynesian Fixed-flex Price Model

The policy inferences derived from stochastic equilibrium models may be moderated, without abandoning the expectations concept, when price stickiness, varying costs of price adjustment, or staggered multiperiod contracting among markets are assumed (e.g. Dornbusch; Mussa; Phelps and Taylor). In these latter cases less than perfect price flexibility is realized in some markets for some medium-length time horizon and both anticipated policy and policy shocks may affect relative prices and real output.10/ In the fixed-flex price model, these impacts exist only as interim effects. Over time, as fixed prices adjust, prices and output are assumed to return to long-term equilibrium. Consequently, in the fixed-flex price model the distinction between the short-run and the long-run is crucial.

In the analysis of macroeconomic issues in U.S. agriculture, the application of fixed-flex price models has been pioneered by Gordon Rausser and his colleagues at the University of California, Berkeley (Frankel; Rausser; Stamoulis, Chalfant and Rausser; Rausser, Chalfant and Stamoulis). The basis of their perspective is that asset markets and some sectors of the economy, in particular agriculture, have flexible prices, while other sectors have fixed or sticky prices. Such a dichotomy leads to price overshooting among flex-price sectors when the economy experiences shocks since the bulk of the shocks have to be absorbed in these sectors.11/ This results in nonneutrality of monetary policy. Rausser and his colleagues thus link monetary disturbances to commodity markets. Monetary policy results in overshooting of currency exchange rates, and leads to overshooting in agricultural commodity markets as well. Hence, monetary policy affects relative prices. This is a source of macroeconomic externalities in the short-run. Expansionary monetary policy creates a subsidy for flex-price sectors; contractionary policy creates a tax.

The Definition and Interpretation of Policy

Closely related to the issue of the impact of anticipated versus unanticipated policy are questions about the appropriate definition of a policy action. In an influential paper, Lucas (1976) has argued that traditional econometric models do not provide a valid basis for evaluating the impact of government policy alternatives. Underlying his critique is the assertion that the parameters of "fixed, well understood, relatively permanent rules" of government behavior comprise part of the environment in which economic decisions are made by rational participants in an uncertain and dynamic world. The decision rules of private agents--that is, such behavioral equations as supply and demand functions--depend on the parameters of the government's policy. As a result, the effects of a change in policy cannot be computed simply as the impact of an exogenous change given fixed behavioral coefficients--essentially the usual econometric approach. Rather, to assess the impact of a change in government policy, the impact of the policy change on the parameters of private agents' decision rules themselves must be evaluated.

Usual econometric analysis of the effects of alternative government policies has also been questioned on the basis that such analysis imposes "incredible" restrictions on the magnitude and, more importantly, the causal direction of relationships among economic variables (Sims). The alternative, this reasoning holds, is to capture the essential stochastic characteristics of the economy in loosely structured time-series representations. Once coefficients of these representations are estimated, impacts on the economy of unanticipated shocks to each variable can be evaluated. The merit of alternative theories may then be tested as restrictions on the unstructured model. Vector autoregressive econometric models come into their own when this perspective is taken.

At first glance, it may appear that the Lucas and Sims critiques raise similar questions about policy inferences derived from the coefficients of standard econometric models. But, in fact, the two critiques are quite distinct. The Lucas critique places emphasis on well-defined policy rules. In this context, meaningful policy analysis can be applied only to changes in such rules. Of course, such rules have a stochastic element, but effects of specific shocks (i.e. unanticipated realized outcomes given a particular rule) do not have a well-posed interpretation for policy. The choice of the policy maker is among rules, not to specify one rule and then consistently affect the economy by following deviations from that rule.

Loosely structured representation of the stochastic characteristics of the economy takes quite a different approach than the Lucas critique. The emphasis in this case is precisely on the impacts of the type of shocks that Lucas asserts have no policy interpretation. That is, unanticipated government decisions--such as an intervention decision arising from a contentious meeting at the Federal Reserve--are government policy. In this context, to pursue the example, the challenge the loosely structured approach raises is to determine, first, what characteristics of the evolution of the economy led to such a meeting and, second, how and in what order policy decisions at such a meeting are reflected as stochastic shocks in various economic variables. If these questions are resolved--clearly no small task--then policy analysis may proceed without reference to changes in fixed policy-rules.

That differences in basic perceptions of the nature of the aggregate economy between the classical and fixed-flex price models continue to underlie differences in macroeconomic analysis does not imply that nothing has been learned from past management of the economy or the policy debates it has generated. To the contrary, a great deal has been learned. To illustrate, recognition of the importance of inflation expectations--as they might shift the Phillips curve, for example--now precludes acceptance of a naive assessment of expansionary effects of short-run monetary policy. Likewise, the critical lesson from the oil shocks and stagflation of the 1970s has been that governments can do little good with a monetary response to real shocks.

Despite these "lessons", a traditional classical view--that no government actions have real impacts as private agents anticipate effects of changes in the money supply and offset government fiscal actions with their own countervailing savings decisions--seems inconsistent with the recession and recovery, and the overwhelming appreciation of the dollar, that have accompanied monetary and fiscal policy in the U.S. and elsewhere over the past four years. More consistent with these observations is either an explanation that unexpected tight monetary policy and expansionary fiscal policy have had real effects or that rigidities in the economy have caused even anticipated policies to have real impacts. In either case, the changes in the world economy as described above, as well as how policy changes are measured, have important implications for the magnitude and incidence of macroeconomic policy impacts.

Of particular importance in this regard is that the shift to flexible exchange rates be understood in the context of the emergence of integrated world capital markets. For example, under a system of fixed exchange rates and an absence of international capital flows, the impact of monetary policy is widely diffused in the economy. Agriculture, in particular, may be almost completely isolated from changes in monetary and fiscal policy, especially if agricultural credit markets are insulated from monetary impacts. That, of course, was the historical, post-World War II experience of U.S. agriculture through the end of the 1960s. Except for the sensitivity of labor outmigration to the aggregate level of unemployment, changes in macroeconomic policy, in particular monetary policy, had very little impact on agriculture. In part, of course, this was due to the fact that monetary and fiscal policies were relatively stable in this period.

With a well-integrated international capital market and flexible exchange rates, however, the situation is changed dramatically.12/ When the Federal Reserve adopts a restrictive monetary stance, tight monetary policy (i.e., an unanticipated reduction in the rate of growth of money in the stochastic equilibrium framework) induces an incipient rise in the domestic interest rate together with reduced aggregate demand. Downward price movement reduces overall output. The potential increase in interest rates also attracts foreign investment. As a result, the value of the dollar rises, inhibiting exports and stimulating imports. The resulting trade deficit provides foreigners with the revenue to sustain their investment decisions.

The important point to recognize is that international capital mobility releases upward pressure on domestic interest rates arising from tight monetary policy and shifts some of the adjustment burden from interest-rate sensitive industries to

trade sectors. Hence, the impact of such a monetary policy falls heavily on these latter industries. Under this circumstance, the problems of U.S. agriculture and of many of its traditional manufacturing sectors are cut from the same cloth, as has been the case in the 1980s. Of course, the converse also applies. Easy monetary policies stimulate output and induce lower interest rates, a capital outflow, and an improvement in the trade account. Again, the "burden" falls largely on export and import-competing industries, but in this case policy favors these sectors.

A capital inflow induced by restrictive monetary policy (and/or expansionary fiscal policy) also shifts the relative burden of that policy from dampening aggregate consumption to dampening aggregate production. International borrowing reduces the increase in the interest rate necessary in equilibrium and allows short-term consumption within the domestic economy to temporarily exceed income.

If expansionary fiscal policy accompanies monetary restraint, then upward pressure on interest rates is exacerbated and an even greater influx of foreign capital is induced. Again the burden is shifted to trade sectors. Tight monetary and expansionary fiscal policies are not compatible in the long-term. By shifting the burden of adjustment from interest-sensitive activities and consumption to trade sectors, the impact of these policies is concentrated on a narrower component of the economy, allowing some latitude to policy makers and postponing the point at which reconciliation of policy inconsistencies becomes necessary.

Thus, when fiscal as well as monetary policy is considered, the emergence of international capital markets and the shift to flexible exchange rates again have important implications for U.S. agriculture and agricultural policy. The crucial point is that U.S. agriculture has shifted from a situation in which it was almost totally isolated from the effects of monetary and fiscal policies, to a situation in which it bears the burden of adjustment to changes in such policies. A key conduit of these impacts is the exchange rate. This is quite likely the most important sense in which changes in the international economy have changed the economics of U.S. agriculture.

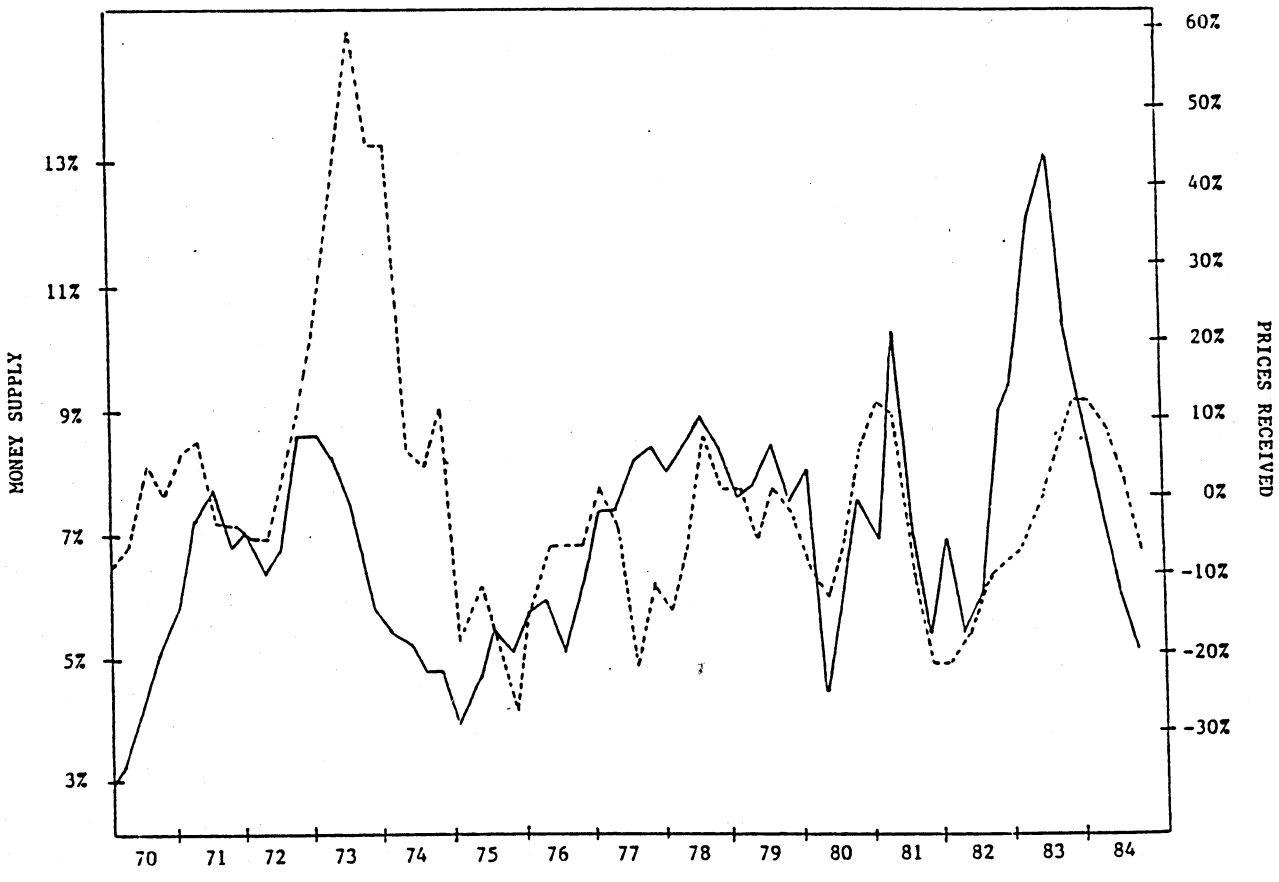
THE MAGNITUDE OF MACROECONOMIC IMPACTS ON U.S. AGRICULTURE

Substantial evidence of macroeconomic impacts on agriculture has accumulated since the move to flexible exchange rates in 1973.

Prima Facie Evidence of Macroeconomic Impacts on Agriculture

Central to our conceptual model of macroeconomic effects on agriculture is the impact of monetary instability on agricultural commodity markets. Some evidence suggestive of the destabilizing price-effects of monetary policy is shown in Figure 1. Movements in farm prices (measured by the rate of change in the index of crop prices received by U.S. farmers deflated by the consumer price index) and movements in the U.S. money supply (measured by the rate of change in M1) are shown.13/ These variables show a clear correlation. Moreover, since prices are expressed in real terms, the observed relationship between the money and price variables reflects nonneutral monetary impacts on the agricultural sector. Of course, not all price movements are associated with changes in money growth rates. Deviations from a close association of these variables are explained by the other factors that affect agricultural prices.

Figure 1--Trends in the U.S. money supply and the real prices of agricultural commodities,* 1970-1984 (percentage change from corresponding quarter of previous year)



——— Money supply

------ Prices received

*Respectively, the seasonally adjusted U.S. money supply (M1) and the index of crop prices received by farmers deflated by the Consumer Price Index. These series were computed from Department of Commerce, Federal Reserve Bank, and Department of Agriculture data.

Further prima facie evidence of the importance to agriculture of macroeconomic factors is derived from the historic time-paths of realized real interest rates, the real value of the dollar, and the real value of U.S. agricultural exports, as shown in Figure 2. Expressed in real terms, these variables account for the effects of inflation on nominal interest rates and the value of exports, and for the effects on exchange rates of inflation differentials among countries.14/

During the 1972-1980 period, real interest rates fell below their average over previous years and tended to be negative. The value of the dollar was also generally low and agricultural exports increased throughout the period. The value of the dollar fell sharply in 1971-72 and again in 1977-78. Large increases in the value of agricultural exports accompanied both of these sharp currency declines: in 1972-73 the value of agricultural exports rose 76.8 percent in real terms, while in 1977-79 the real value of agricultural exports rose 22.9 percent.

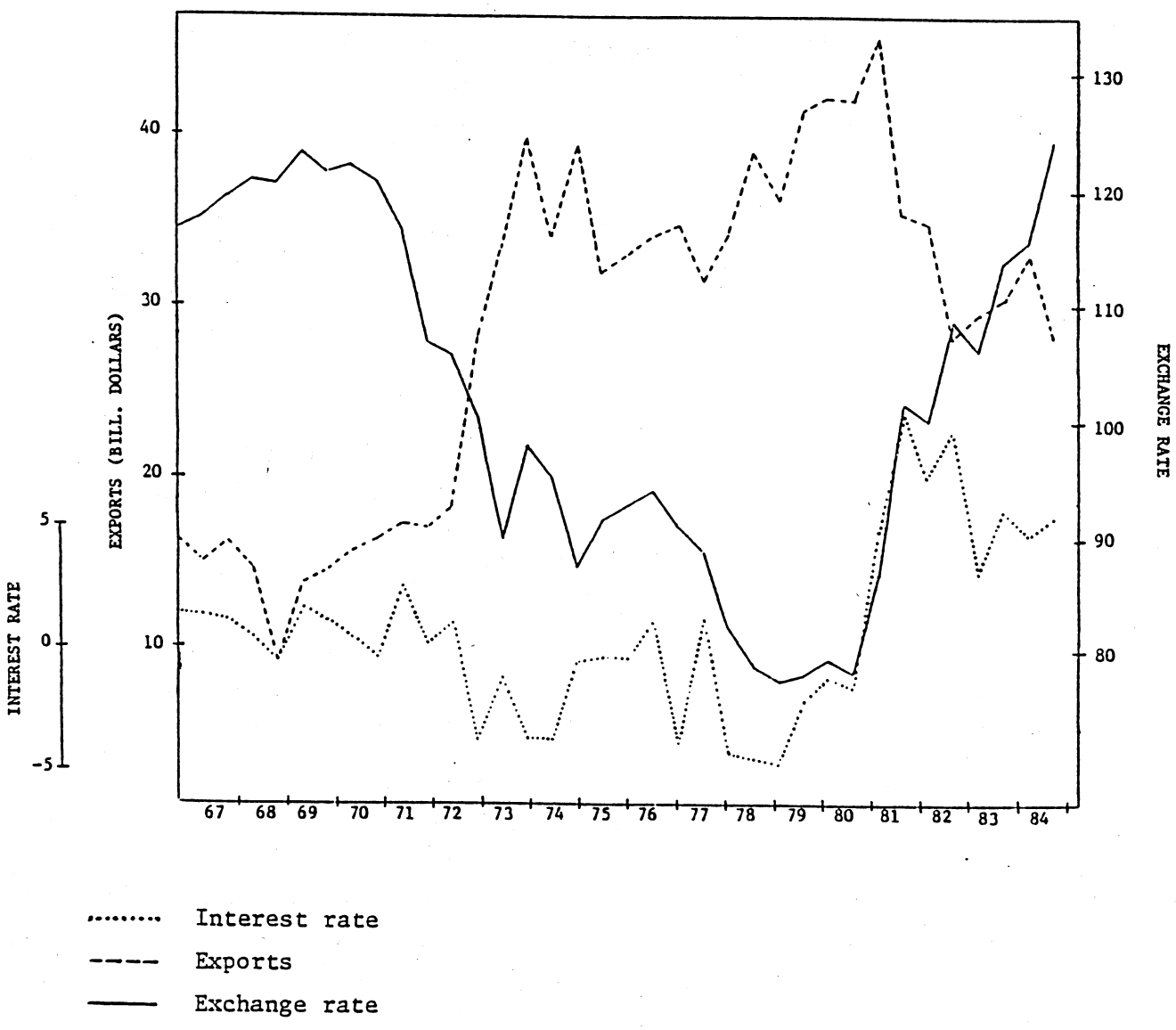
Since 1980, the conditions of the 1970s have reversed, but the pattern of comovements among the interest rate, the exchange rate, and the value of agricultural exports has remained the same. Real interest rates have risen to unusually high levels and the U.S. dollar has appreciated rapidly. The real value of agricultural exports which peaked in 1980 fell 27.2 percent by 1984, from $41.2 billion to $30.0 billion (in 1980-dollars).

The relationships observed between the interest rate, the value of the dollar and the value of agricultural exports are quite remarkable when one considers the myriad of factors that influence each of these highly volatile market variables. These relationships are strongly suggestive of the importance of macroeconomic factors to agriculture, so much so that the burden of further proof would seem to fall most heavily on those who assign a small or inconsequential role to these factors.

Another aspect of the prima facie evidence of macroeconomic impacts on agriculture arises when the growth of U.S. agricultural and nonagricultural exports are compared. Changes in these broad categories follow quite similar patterns, as shown in Table 1. Similarity of these patterns would be expected to the extent that macroeconomic phenomena impinge on both sectors, less so to the extent that exports of each sector are influenced primarily by sector-specific factors.

A final aspect of the prime facie evidence of the importance of macroeconomic factors to agriculture arises in the increased proportion of world agricultural trade that involves middle-income developing countries. These countries accounted for fully 45 percent of the increased value of U.S. agricultural exports from 1976 to 1981. They also accounted for almost half of the decline in agricultural exports the following year.15/ There is a substantial macroeconomic dimension to these fluctuations. When world credit conditions are easy, the monetary and fiscal policies adopted by many of these countries induce capital inflows, so that consumption is expanded through a deficit in goods and services trade. When world credit conditions tighten, trade-deficit inducing macroeconomic policies are less viable and imports are constrained.

Figure 2--Trends in the realized real interest rate, the real exchange value of the dollar, and the real value of U.S. agricultural exports,* 1967-1984



*Respectively, the nominal yield on three-month treasury bills less actual inflation, the trade-weighted value of the dollar against ten foreign currencies adjusted for inflation differentials, and the nominal value of U.S. agricultural exports deflated by the Consumer Price Index. These series were computed from Department of Commerce, Federal Reserve Bank, and Department of Agriculture data.

Table 1--Trends in the value of U.S. exports, 1970-1984

	Agricultural	Nonagricultural
	(percentage change in nominal value)	
1970-1980	+468.0	+396.0
1980-1981	+5.1	+5.8
1981-1982	-15.5	-18.2
1982-1983	-1.4	-6.3
1983-1984	+4.7	+8.9

Source: Computed from data reported in U.S. Department of Agriculture, Foreign Agricultural Trade Statistical Report (Washington, D.C., 1984).

Empirical Studies of Macroeconomic Impacts

Exchange Rate Impacts on Prices and Exports

Our analysis of the impacts of monetary and fiscal policy suggests that under flexible exchange rates currency realignments play a crucial role in shifting the burden of policy adjustment onto trade sectors of the economy. Similar reasoning has caused many analyses of macroeconomic impacts on agriculture to focus on the impact of the exchange rate on agricultural exports and prices. This is an important dimension to the evaluation of macroeconomic effects.16/

Among sectoral economists, and by no means limited to agricultural economists, empirical evaluations of exchange rate impacts have been based largely on partial equilibrium analysis. In these studies, the effects of an exogenous change in the exchange rate on the price and traded-quantity of one product, or at most several closely related products, are evaluated.

Along this line, the effects of appreciation of the dollar from 1980 through 1982 on prices, exports and stocks of wheat, corn and soybeans were evaluated in a recent simulation study of U.S. agriculture by Longmire and Morey. Domestic and foreign supply responses were carefully considered under various assumptions about price expectations. The impacts of cross-price effects among the three commodities and the possibility of less than perfect transmission to foreign prices of changes in dollar prices or exchange rates were also taken into account.

Longmire and Morey conclude that real appreciation of the dollar of approximately 20 percent during 1980-82 caused the real value of U.S. wheat, corn and soybean exports to drop by about $3 billion (or 16 percent). This exchange rate effect accounted for close to 70 percent of the total decline in the value of exports

of these commodities that occurred during this period --a rather sizable exchange rate impact.

The Longmire and Morey study also demonstrates an important interrelationship between exchange rate fluctuations and U.S. farm commodity programs. Loan rates were approximately stable in real terms during 1980-82, setting a floor under dollar prices of supported commodities. With appreciation of the dollar, the stable loan rates caused world prices of these commodities to be higher than they would otherwise have been. Foreign demand for U.S. grains was choked-off while other countries were given an incentive to increase their grain supply. As a direct consequence, an estimated 20 million tons of grain entered U.S. farm program stocks at a program cost of some $2 billion. Total increases in these stocks were 80.8 million tons.

Though the preceding study (and others like it) are useful, measurement of exchange-rate impacts in a partial equilibrium framework raises a number of concerns. First, such studies depend on imposed partial elasticities of foreign demand with respect to prices and the exchange rate. Unfortunately, the state of our knowledge about these critical parameters can only be described as still somewhat muddled.

A second concern is that our conceptual model suggests that fiscal and monetary policies induce an association of the real exchange rate and capital flows that shifts consumption expenditures from countries with a trade surplus to those with a trade deficit. The impact of these income transfers on the prices and trade of specific commodities are not considered in a partial equilibrium analysis. When these income transfers are taken into account, exchange rate effects can exceed constraints imposed by focusing only on a small group of closely substitutable goods.17/

A third concern arises from the linkages among commodity markets and other asset markets. These linkages are not incorporated in static equilibrium analysis (either partial or general) and remain poorly understood. Yet, there are reasons to expect asset substitution to affect markets for storable farm products. Of central concern in this respect is substitution between money and assets such as gold and other primary commodities. That monetary phenomena cause exaggerated short-run movements in some of these flexible asset prices (price overshooting) has been illustrated in the fixed-flex price models discussed above. In the model of Rausser and his colleagues, the effects of monetary and fiscal policies are significant, and the linkages from macroeconomic policy to the agricultural markets are by means of the exchange rate and financial markets. Evidence of overshooting of agricultural prices in response to monetary policy is also reported by Lawrence and Lawrence, and Frankel and Hardouvelis.

A final concern raised by studies such as Longmire and Morey's arises from the comparison of impacts attributed to the exchange rate to actual observations. The observed differences may be explained by a variety of factors. If these factors have had counteracting effects, the magnitude of the exchange rate impact relative to that of other factors could easily be obscured.

Some of our own historical analysis provides insights into the magnitude of these concerns (Orden, 1984a). Using the moving average representation of a 12-variable autoregressive model, we have investigated reasons for divergence between forecast and realized values of U.S. corn exports and prices for the 1970-80 period.

In our analysis, these differences are attributed to the dynamic effects of shocks to each of the variables in the model. Aggregating the effects of shocks to individual variables into exchange rate effects, income transfer effects, domestic income effects, and corn sector effects, we find that for the entire 11-year period exchange rate shocks explain 19.8 percent of the differences (in absolute value) between forecast and realized export quantities, compared to 24.6 percent for income transfer shocks, 14.6 percent for domestic income shocks, and 33.6 percent for shocks specific to the corn sector. Effects of the exchange rate on corn prices are more dominant, explaining 33.6 percent of the differences between forecast and actual values, compared to 24.6, 14.6, and 27.2 percent, respectively, for the other variables. These results suggest macroeconomic factors have been a major source of instability in the world corn market. That income transfers associated with real exchange rate realignment may have substantial impacts is also implied, while the price volatility associated with exchange rate shocks is consistent with the monetary overshooting hypothesis.18/

Interest Rates and Other Effects

Though empirical studies of macroeconomic impacts on agriculture have focused largely on the exchange rate, our conceptual model associates macroeconomic policy with simultaneous impacts on the exchange rate and the real interest rate. Agriculture bears both adjustment burdens--being an export industry with a high value of physical capital and land investment per worker and unit of output. This explains why, squeezed between the effects of declining exports and rising interest rates, real net farm income has declined to historically low levels since 1981. This decline has continued through a recession and, more recently, a period of quite rapid growth of the aggregate domestic economy.

Though we are not familiar with empirical studies that have carefully traced the net implications of a rise in the interest rate through its impacts on production costs, supply and storage decisions, prices, income, and farm asset values, one can estimate crudely the potential impacts. With farm debt over $200 billion, each one-percent rise in the real interest rate, if applied to the entire debt, would raise interest costs by over $2 billion. With real net farm income just under $8 billion last year, the interest rate impacts are clearly substantial.

In this respect, it is important to recognize that blaming the high value of the dollar on high interest rates is not quite appropriate. Were it not for the high value of the dollar, and the associated trade deficit and investment by foreigners in dollar-denominated assets, real interest rates in the United States would be even higher than they are, in order to reduce credit demand and induce more domestic savings. Policies to lower the value of the dollar without changing underlying credit conditions would have to suppress foreign investment and would cause real interest rates to rise. It is not clear that this would be to the advantage of agriculture.

The emergence of a well-integrated international capital market should cause interest rates to be more stable, with the response to monetary and fiscal policy reflected in capital flows rather than changes in interest rates. However, monetary disturbances have been so large under the flexible exchange rate system that such conditions have not yet prevailed. Moreover, there is an inherent relationship between the exchange rate and interest rates, reflected in uncovered interest rate parity.

So long as interest rates vary, then traditional impacts on agriculture will occur. These include significant impacts on livestock sectors because of the effects of the interest rate on the cost of carrying livestock inventories and on the demand value of long-lived assets. There are similar effects on land values, the cost of production, and the cost of carrying grain stocks.19/

Nevertheless, so long as the international economy and the U.S. role in it stay in their present configuration, it is our view that the major effects of monetary and fiscal policy on agriculture will be reflected in their impacts on foreign demand, with the principle transmission being through the exchange rate. In this kind of world, the foreign demand becomes a key determinant of what happens to the income of those subsectors of agriculture that depend on exports, and thus of agriculture as a whole.

More generally, there is also a wide range of related impacts of macroeconomic factors that are not measured directly by the exchange rate or the interest rate. Often it is incorrectly argued that these interrelated factors do not reflect macroeconomic policy. For example, the effects of the exchange rate on U.S. exports have been contrasted in a reduced-form equation with the effect of changes in national incomes, as if the former but not the latter carried implications of macroeconomic influences (Batten and Belongia).

Finally, and though it is somewhat off the theme of our paper, there are other effects of fiscal policy as it is reflected as tax, rather than spending, policy. An important macroeconomic effect is associated with accelerated depreciation for agricultural machinery and livestock herds which builds excess capacity in agriculture and causes the sector to be more capital intensive than it would otherwise be, to the disadvantage of agricultural labor. Tax policy also has important microeconomic effects. Hanson and Eidman have shown, for example, that U.S. tax policy is not size neutral; it benefits large farms relative to small farms.

Interpretation of "Exchange Rate" and Other Impacts

Studies that focus on a reduced-form conveying the impact of the exchange rate, the interest rate, or some other variable are adequate as measures of macroeconomic impacts on agriculture only if we treat as "macroeconomic" any movement in such economy-wide variables. The more focused interpretation suggested by our conceptual model, however, would center on the impacts of government's monetary and fiscal policies. To address these policy questions, empirical models treating the exchange rate (or the interest rate) as exogenous provide only part of the requisite information. In addition, it is necessary to identify policy-induced versus autonomous movements in these variables.

One approach to such an evaluation is based on large-scale econometric models with a substantial focus on agriculture. We have already discussed the fixed-flex price model developed by Rausser and his colleagues. Another large-scale econometric model, one that focuses on financial flows and balances, is the COMGEM model of Texas A&M University and Texas Tech University. Using COMGEM, Hughes and Penson have considered the likely impacts on agriculture through 1990 of three alternative macroeconomic policy scenarios: a real government budget deficit continuing at about $100 billion with monetary policy that brings the inflation rate to zero; a real deficit continuing at about $100 billion with monetary policy that causes the rate of inflation to rise by one percent each year; and a 15-percent budget deficit reduction each year with a policy of modest monetary

growth. Over the 1984-1990 period, aggregate GNP growth forecast under these three scenarios are a recession followed by annual real growth of less than 3 percent; no recession and 4-6 percent annual real growth; and no recession and 3-4 percent annual real growth, respectively. The real interest rate and value of the dollar rise under the first scenario and fall under the third, while under the second scenario they fall briefly then rise. Agriculture fares best with reduction of the government budget deficit. Real net farm income rises to $14 billion and farm asset values climb steadily under the third scenario. Real farm income remains under $10 billion and asset values decline steadily under either of the high-deficit scenarios, with faster growth of the money supply leading to higher income in the short run.

While the preceding exercise provides some interesting estimates, if one is wary of the large-scale econometric models--and we believe we have raised some econometric concerns and unresolved theoretical controversies that would suggest some caution--there are alternative approaches to evaluating the policy linkages to variables such as the interest or the exchange rate. These studies focus more narrowly on development of the theory, such as that of exchange rate determination. The literature is truely enormous. We have already noted the controversy in the economics literature conserning the aggregate impacts of anticipated versus unanticipated monetary policy, a controversy that is now spilling over into assessment of monetary impacts on agriculture.20/ Similar controversies surround theories of interest rate and exchange rate determination and the empirical evidence brought to bear to resolve these theoretical issues.21/ 22/

Finally, it should be noted that the strong dollar of the 1980s is not just a consequence of U.S. monetary and fiscal policies, misguided as they might be. Whereas the U.S. has been pursuing a highly stimulative fiscal policy and a restrictive monetary policy, European countries have collectively been pursuing a restrictive fiscal policy and an expansionary monetary policy. The net effect has been a sluggish European economy and relatively low European interest rates. The flow of capital into the U.S. that would have been induced by U.S. policy has been exacerbated by policies of the Europeans. This suggests that looking at U.S. macroeconomic policies alone is not adequate as a basis for assessing macroeconomic impacts on agriculture. Rather, the policies of U.S. trade partners also have to be taken into account.

Macroeconomics and Rural America

A somewhat different dimension to our concerns with the identification and measurement of macroeconomic impacts involves extending our analysis from agriculture per se to rural communities more generally. We have purposefully kept the phrase "and Rural America" in our title in order to focus attention on this issue. This concern is shared by our colleagues Deaton and Weber who, in their paper, identify internationalization of the economy as one of the principal forces shaping the future of rural areas.

From a theoretical perspective, the issues with respect to the macroeconomics of rural areas are similar to those we have raised with respect to agriculture. These center on the relative protection provided to rural economies and the effects of narrowing of the burden of adjustment to changes in monetary and fiscal policy onto trade sectors.

A number of issues arise. First, rural America is based in large part on agriculture. A depressed agriculture contributes to a depressed rural America; small towns in the corn belt are linked directly to the international economy through the impact of monetary and fiscal policy on trade sectors. The fact that many of the traditional smokestack industries are also located in "agricultural" states, and are affected by the same policy linkages as agriculture, has exacerbated the adjustment problems of both agriculture and rural areas. Adjustment through nonfarm employment for agricultural operators is not easy in these cases since the very industries where such employment might be found are depressed as well.

Second, the massive decline in asset values in agriculture due to the combination of high interest rates and low commodity prices has seriously weakened rural banks and the private and public capital base of many rural communities. If macroeconomic policy should reverse direction, the effects on rural area would reverse as well. There might be significant "overshooting" in resource adjustment since import-competing industries that have expelled workers with the 1980s policy configuration would have to attract them back if they are to recover.

Third, not all rural areas are primarily dependent on agriculture. For these non-agriculturally dependent areas mining, forestry, manufacturing or transfer payments undergird the local economy. Macroeconomic impacts on these sources of income will have important local implications.

At a national level, nonagricultural macroeconomic impacts--both in agricultural areas and others--may noticeably affect the sensitivity of rural areas to macroeconomic factors. Certain rural areas, particularly largely agricultural areas, are certainly highly disprotected and susceptible to macroeconomic impacts. But when rural areas overall are compared to urban areas, we have little evidence about the relative protection each receives. Similarly, at this juncture we have little evidence about the average impacts of monetary or fiscal policies on rural versus urban areas, though one might anticipate that social adjustment costs may well be higher when the impacts are borne by rural communities. These are important issues with local and national implications. Yet, we simply do not have the empirical evidence we need to address these questions.

The Challenge for Theoretical and Empirical Research

Concerning the evaluation of macroeconomic impacts, our profession now stands in somewhat of a quandary. Our theories by and large are consistent with real impacts of some, at least unanticipated, policy actions, and prima facie evidence seems to conform to such a perspective. Yet, as our brief review of theoretical and econometric controversies suggests, efforts to clarify theoretical differences or explain past economic observations raise difficult analytic and statistical issues and provide ambiguous outcomes that seem regrettably specification specific. To illustrate, as far as we can judge, and as remarkable as it may seem, the economics profession simply cannot stand behind a definitive explanation for the recent persistent appreciation of the dollar, despite its vast array of implications.

In our view, therein lies the challenge facing our profession, at least with respect to understanding the effects of macroeconomic forces on agriculture and rural communities. There are two aspects to this challenge. The first challenge is to stay abreast of theoretical developments and empirical analysis emerging

from the broad fields of macroeconomics and international economics, making contributions to theory and empirical analysis of macroeconomic relationships where we can. The second challenge is to model the impact of macroeconomic factors on the agricultural sector and other rural industries, and to quantify these impacts in a cohesive empirical framework.23/ This work is really still in its infancy. Economic policy, as a consequence, continues to be ineffective and misguided.

POLICY ISSUES AND INSTITUTIONAL REFORM

It should now be apparent that changes in the international economy, in the U.S. economy, and in how the U.S. relates to the international economy have changed the way we have to think about U.S. agriculture. Thinking about the sector as a closed economy and using a partial equilibrium framework to consider narrow sectoral issues is no longer relevant. Instead, it is imperative that we take an international perspective to agriculture, and view it through the prism of an open economy model. When we do that, of course, it then becomes necessary to consider a far wider policy agenda: an agenda that includes monetary, fiscal, exchange rate, and trade policy. Moreover, agricultural commodity policy also has to be viewed from a quite different perspective.

The Dual Constraints on National Policy

The general failure to recognize the significance of international capital markets has caused us to think about international economic relations primarily in terms of real trade. We tend to think about the balance of payments in terms of the balance of trade and to assume that is our primary external constraint. Perhaps the best example of the popularity of such a perspective is the frequency with which observers of the contemporary scene expect each new report on the U.S. trade deficit to bring the dollar crashing down.

In point of fact, each country has both a trade account and a capital account. In today's world, the capital account tends to be dominant. To understand what has been driving exchange rates one need not look to international trade flows as much as to international capital flows. Thus, the U.S. has a large trade deficit <u>because</u> the dollar is strong. And the dollar is strong because of events happening on the capital account. The dollar may eventually also fall because of what happens on the capital account.

These dual accounts impose a dual constraint on both the economy and on what policy makers can do. It seldom seems to be recognized in contemporary discussions of economic policy, but these dual constraints are imposing very real limitations on the choices policy makers face in today's world.

Consider simultaneously the developing countries of the world (LDCs), with their large foreign debt, and the developed countries of the world, such as the United States, which have extended them that credit. To a certain level, the LDCs could go on borrowing additional capital if their economies are growing, and the developed countries can go on lending to them. If such a situation prevails, the borrowing countries will need to run a trade deficit--the parallel of being a net capital importer--and the developed countries will need to run a trade surplus--the parallel of their net export of capital.

Suppose instead that the developing countries need to scale back their net borrowing from abroad. To service this debt and to amortize part of it, they will

have to become net exporters on the trade account. But a net exporter requires somebody else who will be a net importer. Typically that role must fall on those countries that loaned capital in the first place: hence, a country like the U.S. would need to be a net importer, as it has been recently. But that also means the U.S. is a net importer of capital. The developing countries may view this outcome as sucking much needed investment funds away from them. Yet it is just the obverse of their need to have a trade surplus. The constraints on U.S. policy in this situation are no less real than those on the developing countries, with the caveat that the U.S. has a special role in the international economy due to the size of its own domestic economy and the unique role it plays as essentially the central banker for the world.

The dual constraints arising from the symmetry of the balance of trade and capital accounts explain a great deal about current pressures for trade, trade access, and the need for international finance. One of the important aspects of the international scene today is the pressure for the debtor countries to become export-oriented. In fact, both the United States and international agencies, such as the World Bank, often press hard on the debtor countries to change their policies to favor the export objective. Less often is any question raised about who is going to take those exports. Burden sharing and symmetry require that the United States and other creditor countries remain open to exports from the debtor nations. If they do not, policy-induced inconsistencies are inevitable, and the developing countries may find cause to resent international "meddling" in their affairs.

It turns out that in today's world there are considerable vested interests in favor of trade liberalization that come about, for the first time, through the international capital market. Bankers in the U.S., for example, know full well that if the loans they have extended to the developing countries are to be serviced and repaid, the U.S. will have to accept an ever-growing flow of imports. Hence, their lobbying efforts--and they are not insignificant--lean against protectionist measures.

Because of the perversity of its macroeconomic policies in recent years, the U.S. may face an even more severe shock and challenge in the years ahead. Because it has borrowed so much abroad it has now become a net debtor nation. By the end of this year it is expected to become the world's largest debtor nation, and is now importing capital at an annual rate of about $100 billion. At some point, it too may have to repay some of that debt--just as the developing countries are at present. That would require that it shift from its large trade deficit to a trade surplus. The fall in the value of the dollar required to bring that about would be quite large. Such a fall would provide a large stimulus to agriculture, but it would also require another massive reallocation of labor in the rest of the economy, as well as a reduction of consumption relative to output. One wonders how long such major adjustments can be imposed on the populace without major political dissatisfaction.

Macroeconomic Policy and Competitive Advantage

It is just such pressures as those described above that have caused major realignments of economic policy in many developing countries. Brazil is an important example. From having one of the most closed economies in the world a few short years ago, Brazil has turned outward and launched a major export drive. To do that, it has undertaken a draconian realignment in the value of its currency.

The result is that its latent comparative advantage in crops such as soybeans has been brought to the fore as a competitive advantage, after many years in which policy discriminated against potential export crops. If Brazil persists with current policy it may well take away the U.S. soybean market, and may even have the potential to export soybeans to the United States.

The point this example underscores is that the implications of international capital flows for agricultural trade are great. Policies of the U.S. are not the only policies that affect U.S. export potential; nor are the exports of any other country determined solely by its own policies. Rather, competitive advantage, and hence trade flows, will be determined by the joint effects of each country's policies on one another. Again it is the dual nature of the capital and trade accounts that is relevant.

Domestic Commodity Programs

Commodity programs that operated by intervening in domestic markets could be sustained in a world of fixed exchange rates and no international capital market. In today's world, however, that no longer seems possible. Monetary and fiscal policies, as well as conditions in international financial markets, can cause those programs to be counterproductive and costly.

Consider again the recent experience with U.S. commodity programs. The dramatic rise in the value of the dollar in the early 1980s translated international prices to the domestic economy at lower and lower levels. At some point U.S. market prices settled on the support rates provided by farm programs, and they could decline no further. As the value of the dollar continued to rise, U.S. prices were translated abroad as increasingly higher foreign-currency prices. Thus, rigid U.S. loan rates provided an underpinning to the world market, with the result that we could easily be undersold by foreign competitors. If we had set out to design a policy to lose market shares, we couldn't have designed a better policy.

With present program arrangements, excess U.S. production is diverted into government program stocks or reserves. When these reserves burgeoned out of control in 1982 and 1983, the result was the costly PIK program. The final costs of PIK are still not tallied up. Furthermore, it appears likely that farm support costs at unprecedented levels will continue to be incurred if current programs are maintained.

Therefore, it is questionable whether commodity programs as we have known them in the past can be sustained under present economic arrangements. They will be very costly while doing little to improve the welfare of farmers. A great deal of flexibility is now needed in domestic farm programs, since agriculture has to adjust to changes in both the international economy and domestic monetary and fiscal policy. Failure to adjust can be very costly both to agriculture and the economy as a whole.

Similar comments apply, incidentally, to the potential for international commodity agreements. The problem is that realignments in exchange rates bring about implicit changes in relative domestic prices. Hence, fixing prices in nominal terms will bring about significant pressures for an agreement to break down. To fix them in any other way would appear to be an impossible task.

Savings Rates and U.S. Competitiveness Abroad

By international standards, U.S. savings rates are notoriously low. That may give rise to a new version of the Dutch disease.24/ If the U.S. has a highly productive economy, the marginal productivity of capital will be high. Under certain circumstances that will cause the real rate of return on capital and the demand for investment to also be high. If U.S. savings rates are too low to provide the aggregate level of savings needed to fill investment demand, a net inflow of capital will be induced. That in turn will cause the value of the dollar to rise, and that will make U.S. export goods less competitive abroad.

By way of contrast, consider the case of Japan, which has one of the highest savings rates in the world. It consequently finds itself in the position of being a capital exporter. This acts to keep the yen weak, other things being equal, which is an incentive to a strong export performance.

Hence, one of the serious contradictions the United States faces is that its investments in research and development together with its relatively unregulated economy may give it a higher productivity on capital investment than many, if not most, other countries of the world, but it has a savings rate that is not consistent with that high productivity economy. Consequently, the U.S. may have shifted into a capital importing status for the longer term. This can be a chronic problem unless something is done to raise the savings rate. There are things that can be done. Such measures as greater use of consumption taxes, reduction in fiscal incentives to borrow for consumption goods, and stronger incentives to save could be among the measures used to raise the U.S. savings rate and reduce pressures attracting foreign capital inflows. These are options the nation has. In the meantime, however, the low savings rate will continue being a factor affecting export and import performance.

Trade Distortions in a Flexible Exchange Rate System

Current thinking about the effects of tariffs, export subsidies, and other trade interventions in the U.S. is heavily influenced by past experience under a fixed exchange rate system. Under such a system many of the potential second-order or general equilibrium effects could be ignored. Moreover, many domestic problems could be "dumped" abroad, despite the original expectations that a fixed exchange rate system would make that less likely.

These issues need considerable rethinking. For example, by keeping imports to a lower level, tariffs may cause the value of the nation's currency to rise. This makes all imports enter at a lower price, so the tariff's effects are spread across the economy. Clearly, there may well still be some relief to the immediate sector, but other trade sectors bear more of a burden than under fixed exchange rates.

Export subsidies have similar counterproductive second-order effects. By increasing exports, such policies also increase the value of the national currency, other things being equal, and thus again spread the effects of the subsidy through the economy, to the detriment of other sectors. Political leaders interested in promoting trade liberalization can and should capitalize on these distributional effects of trade intervention, and on the fact that the cost effectiveness of such interventions in today's world is probably in general quite low.

The Need for Reform of International Monetary and Trade Institutions

Existing international institutional arrangements, such as the GATT, the International Monetary Fund (IMF), and other institutions, were designed on the premise that a fixed exchange rate system would prevail in the post-World War II period. There was little perception that technological developments in the communication and information sectors would make possible the kind of international capital market we now have. Given the changes that have taken place in the international economy, the existing institutions are largely irrelevant. We need to rethink these institutions and help to put a new system in place.

Unfortunately, the U.S. seems to have little stomach for taking on this arduous task and, paradoxically, appears to be retreating from an international involvement at the very time that our economy is becoming increasingly internationalized. Nothing could be more counterproductive to our own best interests.

We need to recognize that many present problems of agriculture and the rest of the economy are rooted in deficiencies in the international system. We also need to recognize that as our economy becomes increasingly open, it is increasingly beyond the reach of domestic policies. Wishing it to be otherwise will not cause it to be so, and is to fail to be realistic.

High on the agenda for institutional reform should be our international monetary arrangements. Many Bretton Woods' conventions were swept away when the world moved to a system of bloc-floating exchange rates in 1973. But nothing has been put in their place, so we limp along, handling each crisis on an ad hoc basis. Failure to deal with the problems of international monetary instability is giving rise to strong protectionist pressures and creating disillusionment among those who were originally supportive of a flexible exchange rate system. Failure to take action in this area can cause us to slip back into a destructive spiral of declining trade and negative economic growth approximating that of the 1930s.

The paradoxes in the international monetary arena are legion. For example, the U.S. and other industrialized countries have starved the IMF for resources almost since its original creation. The reason for this is that these countries feared the IMF would go on an inflationary binge. But when the international capital market emerged and petrodollars flowed rapidly, it was the commercial banks that went on a lending binge, as the experience of the last decade documents. Moreover, the commercial banks were unable to impose any conditionality which the IMF would have attached to its lending program. As a result we have the worst of all possible worlds.

Similarly, the United States is essentially the central banker for the world since the world is for all intents and purposes on a dollar standard.25/ But it refuses to accept this unique role, while at the same time opposing any initiative either to strengthen the IMF or to create a new institution. Instead of the U.S. managing its money supply as if it were central banker for the world, it manages its money supply primarily as if only domestic conditions were relevant. The exception, of course, is when there is a crisis such as Brazil and Mexico experienced in 1982. In those crisis situations, the Federal Reserve has acted like a banker of last resort.

Reform of international monetary arrangements should be at the top of our agricultural policy agenda. We are playing Russian roulette with an issue that is

of the greatest importance to this nation. A continuation of the instability of the last decade, with wide swings in currency values and large shocks to trade conditions, will cause a loss of confidence in the system and a breakdown of both international trade and international monetary arrangements. It is better to work to strengthen the existing system before we see its collapse.

The United States has two options before it in attempting to reform the system. First, it can accept its responsibilities as international banker and manage its money supply accordingly. That is a feasible approach, and certainly would be an improvement over present arrangements. The problem with this option is that U.S. trade sectors, including agriculture, would remain quite vulnerable to monetary disturbances, although probably less so than in recent years.

Alternatively, the United States can work to reform and strengthen the IMF. This can be done on a gradual basis.26/ The first step would be to strengthen the Standard Drawing Right (SDR) so that it becomes a more attractive reserve asset to hold. This could be done by providing for a market-determined rate of interest. Then, the IMF should be given a mandate to create new SDRs and, consistent with the notion of stable monetary policy being optimal, a mandate to keep the stock of SDRs growing at a constant rate commensurate with the growth in international trade and finance. Such modest reforms would see the SDR gradually replace the U.S. dollar as an international reserve asset. At the same time, these reforms would free U.S. monetary policy to be managed primarily on domestic considerations. The dollar would be free to circulate or to be held in reserve, and all nations would retain their domestic currencies and be free to manage their domestic monetary policy independently.

CONCLUDING COMMENTS

In this paper we have argued that in today's world, U.S. agriculture and agricultural policy must be viewed through the prism of an open economy model. From this perspective, the macroeconomics of agriculture encompass the relative degree of protection provided to the sector and a shift of the burden of adjustment to monetary and fiscal policy onto trade sectors. This shift results from the emergence of a large international capital market that ties national economic policies to one another in a world of flexible currency exchange rates.

It is now clear that the opening of the U.S. economy, and of its agricultural sector in particular, has created a new setting for agriculture. An important challenge to emerge for our profession is to quantify the net impact of macroeconomic factors on agriculture and other rural industries in an open economy. The dilemmas we face in addressing this challenge arise in part as a consequence of the considerable debate within contemporary economics over the theoretical and econometric foundations upon which the assessment of these impacts should rest.

Despite such analytic issues, the extent to which our international economic integration has proceeded remains the outstanding characteristic of today's economy. Indeed, our economic integration has far outpaced our social and political integration. Economically, we are in each others hair at every twist and turn. But the institutional and political means to deal with that growing economic integration are deteriorating rather than improving. This is potentially a very explosive situation with serious consequences a real possibility. This nation needs to address these issues, and to collaborate with other nations in

strengthening existing institutional arrangements and in designing new ones. Our profession has a role to play in this pressing task. Meaningful empirical analysis, after all, serves a higher purpose.

As the economics of agriculture have changed, so too the basis for agricultural policy should have changed. Unfortunately, our institutional arrangements on the domestic side are as out of date as they are on the international scene. Herein lies part of the challenge we face. In today's world it is monetary, fiscal, exchange rate, and trade policy that really matter for agriculture. However, our domestic political arrangements link agriculture to House and Senate agricultural committees that have little or no responsibility, or perhaps even understanding, of these broader policies. The consequence is that we will continue to tinker around with domestic commodity programs that have little potential to do anything for agriculture, despite its serious plight. Out of such conditions there arises a political disillusionment, and a general lack of confidence in political arrangements. This nation desperately needs to get its domestic political arrangements up to speed with the kind of economy we now have, and to work for a strengthening of international institutions consistent with the increasingly well-integrated international economy that has emerged.

FOOTNOTES

1/ Among the recent exceptions are Eckstein, Brian Fischer, Goodwin and Sheffrin, Huntzinger, and Todd. While these studies model agricultural supply in a rational expectations framework none utilize that framework to address macroeconomic issues.

2/ For further discussion of the measurement of relative protection and its policy implications, see Schuh (1984).

3/ Strictly speaking, this argument requires that a uniform level of protection applies to all sectors so that no relative prices are distorted. If tariff levels vary among sectors, raising the protection afforded to any one sector to the average among sectors will not necessarily improve resource allocation. The argument for uniform protection also ignores any gains the U.S. might acquire by adoption of optimal tariff policies, and the negative effects of export subsidies on world prices. Identifying these impacts may be problematic in a multisector economy, but there is little doubt that any gains would come at the expense of export sectors such as agriculture.

4/ See Schuh (1974) for a preliminary attempt to reinterpret the post-World War II history of U.S. agriculture and agricultural policy in light of distortions in the value of the dollar.

5/ This analysis is developed further by Rodgers.

6/ For the period 1980-82, for example, the proportion of GDP attributed to trade (an average of exports and imports as a percentage of GDP) was 8.5 percent for the United States, compared to 12.8 percent for Japan.

7/ To illustrate the stochastic equilibrium model, consider a case in which supply and demand functions in the jth market at time t be given, in log-linear form, by

$$(1)\quad y_t^s(j) = a(j)(p_t(j) - E(P_t|I_t(j))) + e_t^s(j)$$

$$(2)\quad y_t^d(j) = -b(j)(p_t(j) - E(P_t|I_t(j))) + c(Y_t - E(Y_t|I_t(j))) + e_t^d(j)$$

where, at time t, $y_t^s(j)$, $y_t^d(j)$, $e_t^s(j)$ and $e_t^d(j)$ are, respectively, quantities supplied and demanded in market j and random market-specific shocks to supply and demand, $p_t(j)$ is the price in market j, P_t is the general price level, Y_t is nominal income, and $I_t(j)$ is the information available to participants in the jth market. The notation E is the expectations operator. The coefficients a(j) and b(j) measure the impact on supply and demand, respectively, of the price of the jth good relative to the expected overall price level, and the coefficient c measures the impact on demand of actual nominal income relative to expected income.

In the above model, information discrepancies arise when it is assumed that participants in a particular market observe the current price in their market ($p_t(j)$) but only observe the general price level with a one period lag (i.e. $I_t(j)$ includes P_{t-1} but not P_t). Price determination arises from setting supply and demand in equilibrium:

$$(3)\quad p_t(j) = E(P_t|I_t(j)) + (c/(a(j) + b(j)))(Y_t - E(Y_t|I_t(j))) + (1/(a(j) + b(j)))(e_t^d - e_t^s)$$

If nominal income is equal to expected nominal income plus an error term, say e_t^y, and is driven by monetary policy, then actual price in market j depends on the expected price level and an error term that includes both market-specific shocks and an aggregate demand shock. An observation on $p_t(j)$ carries information on a linear combination of these shocks, thus affecting $E(P_t|I_t(j))$ and leading to some confusion between relative and aggregate phenomena.

Deriving an equilibrium solution to the model (1)-(3) entails solving simultaneously for market price, $p_t(j)$, and the price level, P_t, assuming agents forecast rationally given the information available to them. For brevity, this solution is not pursued herein. The general method of solution is discussed in Cukierman. Stochastic equilibrium models may also be extended to consideration of intertemporal problems, in which case the real interest rate becomes an important relative price. For one such approach, see Barro (1981b).

8/ Given the confusion element associated with unanticipated monetary shocks, it can be shown that a perfectly anticipated monetary policy is optimal in the above model, in the sense that the variance of economic output around its full information level is minimized by such a policy. The full information output level is derived from optimizing decisions of agents whose information set includes observation of the current price level so confusion between relative and nominal price changes is avoided. In a stochastic environment this does not mean output is constant, rather prices and outputs in the economy respond naturally to real supply and demand disturbances.

9/ For alternative views, see Barro (1981a) and Feldstein.

10/ Differences among theoretical models on the basis of whether anticipated versus unanticipated macroeconomic policies have real effects has generated an extensive, but not conclusive, empirical literature. This literature has focused on testing the proposition that only unanticipated monetary policy affects aggregate output or employment. Barro (1977, 1978), Barro and Rush, and Leiderman find evidence favoring these propositions. Mishkin, on the other hand, finds evidence that monetary shocks have real impacts while anticipated monetary policy does not, only in models that constrain monetary impacts to short lags. Over longer lag-periods (up to twenty quarters) the evidence suggests that impacts of

anticipated monetary growth exceed those of unanticipated monetary shocks. McGee and Stasiak also report evidence favoring real impacts of both anticipated and unanticipated money growth.

11/ Price overshooting may also arise in equilibrium models that do not impose the fixed-flex price distinction. For an illustration in which changes in portfolio preferences induce transitory overshooting even when all prices are flexible, see Lawrence and Lawrence.

12/ Reasoning that monetary policy has important implications for U.S. agriculture under a regime of flexible exchange rates and well-integrated international capital markets has been pursued consistently by Schuh (e.g. 1976, 1981, 1983, National Agricultural Forum).

13/ Evaluation of monetary impacts on agriculture in terms of world money supply and international prices, rather than U.S. money and price variables, may be more appropriate. Analysts at the Australian Bureau of Agricultural Economics (BAE) have compiled evidence of a remarkably strong correlation of movements in OECD money growth and an index of world commodity prices during recent years (1975-81). These results are reported in Rae.

14/ The results displayed in Figure 2 are invariant to a simple respecification of the real interest rate variable as the nominal interest rate less inflation that is anticipated on the basis of a univariate autoregressive equation. Since the evidence in the figure is only suggestive, we did not pursue more sophisticated specification of inflation expectations.

15/ Agricultural exports to the developing countries rebounded in 1983 and have continued to increase modestly, while agricultural exports to the developed countries have continued to decline. In part, the recovery of agricultural exports to the developing countries despite macroeconomic conditions is due to a variety of direct and credit subsidies--nonagricultural exports to these countries have continued to fall badly.

16/ The studies we review do not address the critique of econometric analysis posed by Lucas. While we recognize that Lucas's concern with policy variance of economic decision rules may be quite important (particularly when the impacts of "large" changes in policy are being considered), we believe that in many cases much can be learned from empirical analysis of how the economy reponds to specific monetary and fiscal shocks. Policy rules are not, and perhaps cannot, be so well known that the economy does not respond to modifications of policy implementation.

17/ For further discussion of general equilibrium exchange rate effects, see Orden (1984b). In particular, in a general equilibrium analysis the percentage change in equilibrium price need not be less than the percentage change in the exchange rate. Further, even if foreign price of an agricultural commodity is constant, the income transfer associated with a real appreciation of the dollar may contract foreign demand. Assuming constant foreign supply, U.S. exports then fall.

18/ Sources of commodity price instability are also examined in Stanley Fischer and Stockton, as well as in the references to "overshooting" cited in the text.

19/ See Rausser for a great deal of detail on the effects of the interest rate among subsectors of agriculture.

20/ To date, there has been little research to differentiate between the impact on agriculture of anticipated versus unanticipated money, and those few studies that have been undertaken vary widely in methodology and focus. Bond, Vlastuin and Crowley find evidence that both anticipated world money supply and monetary shocks have positive effects on the relative price of traded food commodities over the period from first quarter 1975 through third quarter 1982. Enders and Falk, using a distinction between anticipated and unanticipated money attributed to Barro and Rush, present evidence that only monetary shocks affect pork output. Belongia also reports preliminary estimates suggesting no effect of anticipated money growth on the relative price of farm products and only very brief impacts of monetary surprises. Azzam and Pagoulatos find the Enders and Falk results quite sensitive to the sampling period. Rausser and his colleagues also make a distinction between anticipated and unanticipated changes in monetary aggregates.

21/ The literature is narrowed somewhat by focusing solely on papers addressing the high level of real interest rates or the value of the dollar in the 1980s. Clearly, a model such as COMGEM works upon real impacts of fiscal policy, but there remains a diversity of opinion: see Evans, and Blanchard and Summers.

22/ One of the problems with many of these latter studies is that regression estimates of one or several essentially reduced-form equations--with a few macroeconomic variables treated as dependent while a group of others are treated as independent--seem less than convincing, since the right-hand-side variables are clearly not necessarily independent or exogenous. The vector autoregressive (VAR) models offer an alternative approach. Association of interest-rate shocks with changes in the value of the dollar are quite robust in such unstructured time-series representations, but often neither of these variables appears responsive to money supply or fiscal variables. Based on statistical tests using restricted and unrestricted VAR models, Litterman and Weiss go so far as to suggest that one cannot reject exogeneity of the real interest rate in a four-variable system with money, prices, and income.

23/ A research problem one has in discriminating between the classical and fixed-flex price models, especially when trade sectors are crucial, is that there has not been sufficient history with a flex-price system to distinguish empirically between them. The exchange rate became flexible in nominal terms only in 1973, and the nominal interest rate became flexible only in 1979. The resulting data series are thus quite short under the flex-price regime if an analysis is based on nominal terms. In real terms, of course, adjustments in the exchange rate and interest rate have always been possible. See Schuh et al. for a comprehensive evaluation of the new open-economy situation of U.S. agriculture and a careful look at the research priorities that have emerged.

24/ Traditionally, the term Dutch disease has described the phenomena of a new and productive export sector (such as oil) causing a country's currency to appreciate thus crowding out sales from its traditional export sectors.

25/ The extent to which the world economy operates on a dollar standard and some implications of this situation for macroeconomic policy are discussed in McKinnon. See also, Blanchard and Summers.

26/ Strengthening the IMF to reduce world dependence on the U.S. dollar is discussed by Schuh (National Planning Association, forthcoming).

REFERENCES

Azzam, Azzaddine and Emilio Pagoulatos. "Unanticipated Money Growth and Agricultural Supply Decisions," mimeo, Department of Agricultural Economics, University of Nebraska, March 1985.

Barro, Robert J. "Rational Expectations and the Role of Monetary Policy," Journal of Monetary Economics 2 (1976): 1-32.

_____. "Unanticipated Money Growth and Unemployment in the United States," American Economic Review 67 (1977): 101-115.

_____. Unanticipated Money, Output, and the Price Level in the United States," Journal of Political Economy 86 (1978): 549-580.

_____. "Output Effects of Government Purchases," Journal of Political Economy 89 (1981a): 1086-121.

_____. "International Substitution in the Business Cycle," in Supply Shocks, Incentives and National Wealth (K. Brunner and A. H. Meltzer, editors) Amsterdam: North Holland Publishing Co., 1981b.

_____ and Mark Rush. "Unanticipated Money and Economic Activity," in Rational Expectations and Economic Policy (S. Fischer, editor) Chicago, Illinois: University of Chicago Press, 1980.

Batten, Dallas S. and Michael T. Belongia. "The Recent Decline in Agricultural Exports: Is the Exchange Rate the Culprit," Review, The Federal Reserve Bank of St. Louis, 66 (1984): 5-14.

Belongia, Michael. "Relative Farm Prices and the Long-Run Neutrality of Monetary 'Surprises'," mimeo, Federal Reserve Bank of St. Louis, February 1985.

Blanchard, Oliver, J. and Lawrence H. Summers. "Perspectives on High World Real Interest Rates," Brookings Papers on Economic Activity (1984): 273-324.

Bond, Gary, Chris Vlastuin and Peter Crowley. "Money and Primary Commodity Prices: A Global Perspective," presented at a conference of the Economics Society of Australia, August 1983.

Cukierman, Alex. Inflation, Stagflation, Relative Prices, and Imperfect Information, New York, NY: Cambridge University Press, 1984.

Doering, Otto, Andrew Schmitz and John Miranowski. "The Full Cost of Farm Exports," Giannini Foundation Working Paper No. 206, University of California, Berkeley, 1982.

Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics," Journal of Political Economy 84 (1976): 1161-1176.

Eckstein, Zvi. "A Rational Expectations Model of Agricultural Supply," Journal of Political Economy 92 (1984): 1-19.

Enders, Walter and Barry Falk. "A Microeconomic Test of Money Neutrality," Review of Economics and Statistics 66 (1984): 666-669.

Evans, Paul. "Do Large Deficits Produce High Interest Rates?", American Economic Review 75 (1985): 68-87.

Feldstein, Martin. "Government Deficits and Aggregate Demand," Journal of Monetary Economics 9 (1982): 1-20.

Fischer, Brian S. "Rational Expectations in Agricultural Economics Research and Policy Analysis," Amer. J. Agr. Econ. 64 (1982): 260-265.

Fischer, Stanley. "Relative Shocks, Relative Price Variability, and Inflation," Brookings Papers on Economic Activity (1981): 381-441.

Frankel, Jeffrey A. "Commodity Prices and Money: Lessons from International Finance," Amer. J. Agr. Econ. 66 (1984): 560-566.

_____ and Gikas A. Hardouvelis. "Commodity Prices, Overshooting, Money Surprises, and Fed Credibility," NBER Working Paper No. 1121, 1984.

Goodwin, Thomas H. and Steven M. Sheffrin. "Testing the Rational Expectations Hypothesis in an Agricultural Market." The Review of Economics and Statistics (1982): 658-667.

Hanson, Gregory D. and Vernon R. Eidman. "Agricultural Income Tax Expenditures--A Microeconomic Analysis," Amer. J. Agr. Econ. 67 (1985): 271-278.

Hughes, Dean W. and John B. Penson, Jr. "Effects of Selected Macroeconomic Policies on Agriculture: 1984-1990," Agricultural Financial Review, forthcoming.

Huntzinger, R. LaVar. "Market Analysis with Rational Expectations," Journal of Econometrics 10 (1979): 127-145.

Lawrence, Colin and Robert Z. Lawrence. "Global Commodity Prices and Financial Markets: Theory and Evidence," mimeo, Department of Economics, Columbia University, 1981.

Leiderman, Leonardo. "Macroeconometric Testing of the Rational Expectations and Structural Neutrality Hypotheses for the United States," Journal of Monetary Economics 6 (1980): 69-82.

Litterman, Robert B. and Laurence M. Weiss. "Money, Real Interest Rates and Output: A Reinterpretation of Postwar U.S. Data," Staff Report 89, Federal Reserve Bank of Minneapolis, 1984.

Longmire, Jim and Art Morey. "Strong Dollar Dampens Demand for U.S. Farm Exports," Foreign Agricultural Economics Report No. 193, Economic Research Service, United States Department of Agriculture, 1983.

Lucas, Robert E., Jr. "Expectations and the Neutrality of Money," Journal of Economic Theory 4 (1972): 103-24.

_____. "Econometric Policy Evaluation: A Critique," in The Phillips Curve and Labor Markets (K. Brunner and A. H. Meltzer, editors), Amsterdam: North Holland Publishing Co., 1976.

McGee, Robert T. and Richard T. Stasiak. "Does Anticipated Monetary Policy Matter? Another Look," Journal of Money, Credit and Banking 17 (1985): 16-27.

McKinnon, Ronald J. "Currency Substitution and Instability in the World Dollar Standard," American Economic Review 72 (1982): 320-333.

Mishkin, Frederic S. A Rational Expectations Approach to Macroeconometrics, Chicago, Illinois: University of Chicago Press, 1983.

Mussa, Michael. "Sticky Prices and Disequilibrium Adjustment in a Rational Model of the Inflationary Process," American Economic Review 71 (1981): 1020-27.

Orden, David. "The Exchange Rate and the International Corn Market," presented at the AAEA Short-Courses on the Macroeconomics of Agriculture, Cornell University, August 1984a.

_____. "The Exchange Rate and Agricultural Commodity Markets: A General Equilibrium Perspective" mimeo, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, 1984b.

Phelps, Edmund S. and John B. Taylor. "Stabilizing Powers of Monetary Policy Under Rational Expectations," Journal of Political Economy 85 (1977): 164-190.

Rae, Jeffrey. "Major Impacts on Agricultural Trade: A View From the South," presented at the Annual Outlook Conference, United States Department of Agriculture, December 1984.

Rausser, Gordon C. "Macroeconomics and U.S. Agricultural Policy," Working Paper No. 385, Giannini Foundation of Agricultural Economics, University of California, Berkeley, March 1985 (prepared for the American Enterprise Institute).

_____, James A. Chalfant and Kostas Stamoulis. "Instability in Agricultural Markets: The U.S. Experience," Working Paper (unnumbered), Giannini Foundation of Agricultural Economics, University of California, Berkeley, March 1985 (to be presented at the meeting of the International Association of Agricultural Economics, August 1985).

Rodgers, Joan. "General Equilibrium Effects of an Agricultural Land Retirement Scheme in a Large, Open Economy," P85-16, Department of Agricultural and Applied Economics, University of Minnesota, April 1985.

Schuh, G. Edward. "The Exchange Rate and U.S. Agriculture, "Amer. J. of Agr. Econ. 56 (1974): 1-13.

_____. "The New Macroeconomics of Agriculture," Amer. J. Agr. Econ. 58 (1976): 802-811.

_____. "Floating Exchange Rates, International Interdependence, and Agricultural Policy," in Rural Change: The Challenges for Agricultural Economists (D. G. Johnson and A. Maunder, editors) Westmead, England: Grover, 1981.

_____. "U.S. Agricultural Policy in an Open World Economy," testimony presented before the Joint Economic Committee of the U.S. Congress, Washington, D.C., May, 1983.

_____. "Trade and Macroeconomic Dimensions of Agricultural Policies," in Alternative Agricultural and Food Policies and the 1985 Farm Bill (G. C. Rausser and K. R. Farrell, editors) Giannini Foundation of Agricultural Economics, University of California, Berkeley, 1984.

_____. Policy Options for Improving the Trade Performance of U.S. Agriculture, prepared for the Trade Policy Task Force of the National Agricultural Forum, forthcoming.

_____. The U.S. and the Developing countries, prepared for the National Planning Association, forthcoming.

_____ et. al. Research and Agricultural Trade, Washington D.C.: ESCOP, USDA, 1984.

Sims, Christopher A. "Macroeconomics and Reality," Econometrica 48 (1980): 1-48.

Stamoulis, Kostas, James A. Chalfant and Gordon C. Rausser. "Monetary Policy and the Overshooting of Flexible Prices: Implications for Agricultural Policy," Working Paper (unnumbered), Giannini Foundation of Agricultural Economics, University of California, Berkeley (to be presented at the meeting of the American Agricultural Economics Association, August 1985).

Stockton, David. "Relative Price Dispersion and Aggregate Price Movement," Unpublished Ph.D. dissertation, Yale University, 1983.

Todd, Richard M. "A Dynamic Equilibrium Model of Seasonal and Cyclical Fluctuations in the Corn-Soybeans-Hog Sector," Unpublished Ph.D. dissertation, University of Minnesota, 1983.

ECONOMICS OF RURAL AREAS

Brady J. Deaton and Bruce A. Weber*

ABSTRACT

Rural economies are being affected by internationalization of the economy, changing economic and demographic structures, government decentralization and deregulation, changing social norms and neomercentilist national and local policy initiatives. Issues needing more attention include (1) farm nonfarm interactions, (2) private and public sector roles in capital formation and (3) poverty and income distribution. Rural economic research ought to build on neoclassical, structuralist, regional and institutionalist theoretical foundations, and recognize the analytical limits of existing theoretical paradigms and their ethical presuppositions. Extension should focus on explaining the complex economic environment, providing analytic and leadership skills, and helping define research needs. Teaching should stress development economics, macroeconomics, trade, economic history and philosophy of science.

> It is ... the social enthusiasm which revolts from the sordidness of mean streets and the joylessness of withered lives, that is the beginning of economic science. Here, if in no other field, Comte's great phrase holds good: "It is for the heart to suggest our problems; it is for the intellect to solve them..." [A.C. Pigou, The Economics of Welfare, 1950, (1st Ed., 1920)]

INTRODUCTION

Since the founding of the discipline, agricultural economists have been concerned with the interrelationships between the agricultural economy and the communities affected by agricultural and other natural resource economic bases.

The purpose of this paper is to analyze critical issues that either emerge from or impinge directly on these interrelationships and to assess the theoretical and analytical foundations which the profession will require to effectively address these issues. The first section summarizes six social and economic trends that are shaping the rural economic environment. The second section provides an interpretation of the changing policy context in order to establish a framework for interpreting the trends, the issues, and the professional role of agricultural economists. A third section of the paper addresses three

---

*The authors are Professor of Agricultural Economics at Virginia Polytechnic Institute and State University, and Professor of Agricultural and Resource Economics at Oregon State University, respectively. We are indebted to Tom Hady, Paxton Marshall, Wes Musser and Dave Orden for reviewing an early draft of this paper and providing some very insightful suggestions.

selected issues. The first issue is the interrelationship between farm and nonfarm economic activity in rural areas. Particular emphasis is given to the effect of expanding nonfarm employment opportunities on farmers' perceptions of risk and thereby, the choice of products, techniques of production, and capital intensity of farming.

The second issue regards the functioning of rural capital markets in a deregulated financial environment. It is hypothesized that the demand for capital in rural areas stimulates new institutional change to provide capital to both the public and private sectors of rural areas.

The third issue is the continued high levels of poverty and inequality in rural areas and the rural poverty consequences of current social and economic forces. The inadequacy of our information base and our theories in this area for providing useful policy guidence is stressed.

A final section of the paper provides interpretation of the implications of these issues for the research, teaching, and extension missions of our profession.

TRENDS AFFECTING RURAL AMERICA

The principal forces that we see shaping the social, political, and economic framework are encompassed in the following six trends:

Internationalization of the Economy

Growing global interdependence in patterns of trade is now having major impacts on the domestic economy. One quarter of our GNP is now attributable to our international trade and our borrowing from abroad has reached an annual rate of $80-100 billion. (Schuh, 1984) Foreign capital investments are currently the principal source of manufacturing investment for some states (South Carolina, for example) and are becoming more dominant in a number of other states and regions of the U.S. At the same time a "product cycle" unfettered by national boundaries is partly responsible for a significant number of manufacturing jobs moving abroad. That is, as the production process for goods becomes routinized, firms will move to areas where labor is relatively unskilled and inexpensive. In the absence of strong restrictions, some firms move to low wage regions of the world. Combined with relatively more centralized capital markets and international aid, there has been a massive restructuring of world economic interrelationships.

Changing Demographic Structure

Four major demographic changes have shaped and will continue to affect rural areas in this country: (1) migration from the North to the South and West and between metropolitan and nonmetropolitan areas, (2) the changing age structure of the population, (3) increases in single parent families and single person households, and (4) increases in female labor force participation.

Migration to seek employment, to search out more acceptable living environments, and to return to home culture, all continue to reshape rural society, invigorating some communities and depressing others. While migration to the South and West is a continuation of a decades-old trend, metro-nonmetro shifts

are in a state of flux. Rural areas grew much more rapidly than metro areas in the 1970s, a sharp reversal of earlier trends. Data from the early 1980s, however, suggest a return to the earlier pattern of relatively greater metropolitan growth. (Weber and Deaton)

Increasing life expectancy has resulted in both relative and absolute growth in the elderly population. Bureau of the Census projections suggest that one in five Americans will be 65 years of age or older by the year 2030. Improved health, greater mobility, and a willingness of the elderly to live apart from their adult children are factors that have helped create a greater proportion of elderly population in rural areas. The elderly are more concentrated in the South and their numbers are growing there disproportionately due principally to growth in retirement-related communities.

Although the increase in the "over 65" population during the 1980's will be large, the age cohort which will increase the most is the early middle aged (35-44) population. This group will account for three fifths of the net increase in population during the current decade. Expected female labor force participation of this and the younger cohorts combined with their large numerical increases will keep the labor force growing faster than population.

Household composition is also expected to change dramatically. Nonfamily-households (mostly single-person households) and single parent families are expected to be the fastest growing household types accounting for almost two-thirds of the increase in households over the 1980's. This change has implications for the distribution of income and demands for public and private goods and services.

Changing Economic Structure

Differences in income, employment and cultures between the city and the country in past years have been altered by technological advances in communications and transportation and by the increasing integration of these different areas. Yet, the continuing heterogeneity of rural America has been well documented by Deavers and Brown and even their attempt to find some common groupings underscores the persistence of diversity, a point that contains important economic ramifications. The terms rural and urban are now end-points on a continuum rather than separable categories, and rural and urban areas are interlinked in a pattern of spatial interactions which require the simultaneous consideration of activities in both areas. Yet, their cultural heritages, their spatial relationships, and their institutional characteristics make rural communities the continuing subject of literary and scientific inquiry.

Rural economies are more complex today than in the past. Four aspects of the changing economic structure merit attention: (1) the increased dependence of farm households on off-farm income and the implications of this for the farm sector; (2) the sectoral employment shifts; (3) the shift in income structure from earnings to transfer and investment incomes; and (4) changes in the size distribution of income and poverty.

The agricultural sector has been moved by technological advances, market forces and government policy toward greater interdependence with both the global economy and the local nonfarm sector. For farms in value-of-sales classes below $40,000 (representing three quarters of farms in the U.S.) net farm income was negative in 1981; nonfarm income provided all the family income and subsidized

farm losses in the aggregate. Nonfarm income was 69 percent of family income for the $40-99,000 sales groups, and dropped to 17 percent for farms in the $100,000 and above category.

The structural changes in the nonfarm sector have been even more pronounced. Service sector employment is of growing importance nationally and now represents an essential part of the export base of rural communities. This reflects improvements in transportation and communications that have altered spatial interdependencies. A massive shift, by historical standards, has occurred in the spatial distribution of manufacturing locations over the past two and a half decades. The relative contribution of manufacturing to total employment has grown most rapidly in the South and West while declining in the Northeast and Northcentral states. Smaller towns and rural areas have experienced a disproprotionate share of this growth, except in the South-west where metropolitan areas have remained predominant. Most rural communities are now linked strategically to urban centers in terms of the job market and service dependency. In this sense rural communities have become more differentiated, specialized, and autonomous.

Between 1962 and 1982 transfer payments nearly doubled as a percent of total personal income, increasing from 7.7 to 14.6 percent. At the same time, investment incomes increased their share from 13.5 to 18.8 percent. The relative increase in transfer payment and investment incomes and the relative decrease in earnings (labor and proprietor income) represent a major shift in our income structure, reflecting both changes in age structure and government policy decisions affecting transfers (principally Social Security) and interest rates.

Trends in poverty and the structure of income distribution are not so clear. Poverty incidence in both metro and non-metro areas declined between 1959 and 1979 rather steadily. With the severe post 1980 downturn in the economy, poverty incidence increased and remains in the mid-80's at higher than late 1970 levels. Income distribution patterns are much more stable in the post-WWII period and appear not to have changed much between 1950-70 (Reynolds and Smolesky, 1977). Recent census data not withstanding, there is some dispute about whether there has been a major shift in income distribution over the past five years.

Decentralization of Government

The authority and fiscal responsibility for governmental functions is shifting from the national to the state level under New Federalism. In turn, state governments have thrust greater responsibility back to local units of government. In fact, perhaps the major realignments are occurring between state and local governments as a new sense of local autonomy creates new demands for redefining local taxing and spending authority. Economic development activities at the local level have increased as a consequence of new demands for job provision being placed on rural, local governments.

Government deconcentration,or devolution, is occurring thoughout the Western democracies and has been characterized as a fundamental realignment in governmental power by Jecquier. The pervasiveness of the trend suggests fundamental causes that have not been well established by any research. Dissatisfaction with the ability of central governments to manage local affairs appears to be a contributing factor.

Deregulation of Key Economic Sectors

Spatial linkages between certain rural communities and urban centers have been affected by changes in rail and airline regulations. Population centers may not be as well-served in the aftermath due to the lack of effective demand and the absence of competitive suppliers of services, airlines in particular. To some degree, potential economic disadvantages are offset by expanded interstate highway systems and by improved communication links.

A more pervasive set of changes may come from deregulation of the banking system and other financial institutions. Consolidated banking operation within states, interstate banking, the expansion of bank-like activities by retail stores and credit card suppliers have altered the spatial flows of capital. While the net level and rate of capital flows from these changes have not been determined, it is clear that for any given rural community capital flows can be altered rapidly in either direction.

Capital flight from rural areas has been a foundation of modernization processes around the world. Ultimately, however, both agriculture and rural communities most depend on reinvestment for survival. Current deregulations appear to have reduced support for long-term fixed investments in rural areas (Markley, Barkley, 1984b). Whether rural business and industry and rural governments will be able to take advantage of a more complex world financial market in order to sustain their economic growth must still be determined.

Evolving Conception of Justice and Human Rights

A society's sense of justice is to some extent embodied in its laws and other institutions. As society's norms change and become embodied in legal institutions, markets adapt to the new rules of the game. Since Brown vs. Board of Education in 1954 and the Civil Rights Act of 1964, our society has undergone significant social change that has realigned expectations for economic opportunity among almost every segment of American life. Perceptions of the likelihood of obtaining a given job are altered, potential mobility is reconsidered, and a broader view of family labor force participation emerges with multiple job holders in each family unit. OSHA regulations and environmental protection activities further constrain the forces of business and industry vis-a-vis more broadly conceived human needs.

Public education is particularly affected by these changes. Its responsibilities are continually being redefined, and its support broadened as the public shapes the foundations of its own future by creating the human capital and basic values deemed essential to society (Deaton, 1983). Through a myriad of equalization rules at the state level, combined with federal support, access to a publicly prescribed minimum level of education is being guaranteed. Minimum wage legislation as well as movements such as that associated with "comparable worth" attests to the conviction held by broad segments of the population that labor markets are simply inadequate and/or unacceptable for establishing wage rates. Many such rules already in place represent society's attempt to modify the rate of social change created by market forces.

These changes do not affect all areas of the country evenly. The adjustments to these changing social norms maybe more disruptive in rural areas than in urban areas to the extent that rural demographic and job mixes and culture are

different.

THE CHANGING POLICY CONTEXT

Rural communities are shaped by both exogenous and endogenous forces and interactions among them. The past few decades of economic change have resulted in the ascendancy of the exogenous forces as compared to the endogenous ones. Among the former, particular attention is called to the growing internationalization of the rural economy and the rapid penetration of technological change into rural communities because of enhanced communications networks and deregulations of important economic sectors. National and state economic policies contribute significantly to the evolution of economic affairs. This section briefly summarizes three important eras of policy and discusses their significance to rural economic change.

Rural Economies in a Neo-Mercantilist Age

The sectoral and spatial structures of rural economies respond to corresponding evolutionary changes in national policy. From this perspective, it is instructive to interpret changes in rural economies within the context of national economic policy orientations as they have evolved since 1950. The current rural scene is reminiscent of an earlier age of mercantilism under which nation-states sought to reorganize their internal economies in order to enable the economy of the nation to compete most effectively in the international arena. Building and preserving national power were principal objectives. Internal social structures that impeded the accumulation of national wealth were modified or eliminated in the process. The enclosure movement that displaced rural residents and created an ownership pattern that maximized the flow of raw materials into the national and, subsequently, international market is perhaps the clearest illustration. The social costs of displacing rural residents were realized only as an after-thought (Polanyi).

Today, international competition is marked by the pursuit of national economic and political power. The political and economic enterprises of some national economies are so intermeshed that they are almost indistinguishable, as in the cases of Japan, and both Eastern and Western Europe. Similarly, in the U.S. public policy is called on to engage in sufficient tax and subsidy action so as to match the mercantilist tendencies of our competitors. Yet, financial, transportation, and communication deregulations are pursued in attempts to realign local economies to enhance national competiveness. And, once again, the social costs of the growing social instability generated in this process are being relegated to a state of secondary consideration.

The evolution of neo-mercantilism can be seen most clearly by interpreting post-war policy changes. The post-war period can be divided into roughly three time periods of relatively different structural adjustments. These periods can be characterized as: (a) Technological Ascendency - 1950-1960; (b) Balanced Growth - 1960-72; (c) New Internationalism - 1972-present.

Each period will be briefly discussed in order to establish the roots of the current structural conditions in rural America. The influence of public policy toward rural areas, including the role of agricultural policy, will be assessed in each period.

Technological Ascendency and Unanticipated Policy Outcomes: The 1950's

Through the 1950s, the rural economy was shaped principally by the final flourish of an industrial revolution that began in the previous century and which culminated in the agricultural transformation of this century. The scientific and technological achievements of the twentieth century came into full bloom in the 1950s, particularly in the form of a cost-reducing technological treadmill that displaced for several years over a million people a year from U.S. farm production. The major active policies toward rural areas were the farm programs. The implication that such programs geared to commodities would alleviate low income conditions among a sizable portion of the farm sector was a misleading aspect of the policy debate during the 1950's and 1960's. In fact, these policies created sufficient stability of expected income to provide incentives for the rapid adoption of cost-saving machinery, which, in turn, displaced labor from the farm sector in greater numbers than would have occurred in the absence of farm programs. Smaller-sized farms were particularly affected by these changes, although their rate of demise may have been slower under the minimal income floors provided by price and income support programs. Small farm operators tended to survive more effectively than farm laborers, per se. Fortunately, strong kinship ties in urban centers and income floors provided by commodity programs enabled rural residents to search for better jobs and higher incomes at a more leisurely pace than would be possible in later time periods.

Many changes in the structure and function of rural communities occurred over the 1940-1970 period due to technology, marketing, economies of size, and competitive factors unique to each sector of the economy. In spite of the massive exodus of people from rural communities and a 70 percent decline in farm employment, the total population of rural communities and small towns remained more or less constant (Jordan and Hady). To some extent then, increased employment in both the private and public sector helped offset reduced employment on the farm.

During this period, the business sector of rural communities realized a degree of benefit from the stable flow of funds derived from commodity programs. For both agriculturally linked and consumer-oriented businesses, orderly adjustments were possible. Both the relative stability of farm income which increased the rate of mechanization and the greater intensity of inputs that substituted for land such as fertilizers, seeds, pesticides, and insecticides led to a thriving agribusiness sector through the 1960's.

By the end of the decade, the seeds of fundamental change had been sown. The dislocation of such large numbers of rural workers during the 1950's undoubtedly contributed to the urban crises of the 1960's, the growing disaffection with life in our major metropolitan areas, and the so-called "population turnaround" of the 1970's. The rural-urban migration process was related directly to the mechanization of American agriculture. In turn, the urban-to-rural movement of people and industry of the 1970's was made easier to some degree by the residual strength of the rural economy which had been buoyed up by a combination of farm commodity programs and transfer payments to the disproportionate numbers of the rural poor and elderly.

Balanced Growth and Policy Conflicts: 1960-72

The distinctive aspect of this period was the policy attention given to "balanced" economic growth and a societal focus on distributive justice. These

themes characterized major policy initiatives on both the domestic and international front. Significant steps were taken through the Kennedy Round of GATT negotiations to significantly reduce trade barriers. Domestically, attention focused on some of the most severely depressed areas of the country and innovative programs were launched to address the problems of poverty, malnutrition, and regional growth. For example, the Economic Development Administration was initiated in 1965, and regional programs such as the Appalachian Regional Commission and the Title V regional commissions, as well as a renewed regional development focus within TVA also appeared during this time period. Unfortunately, the targeted approaches for addressing many critical issues became diverted later in the period as political interests forced more widespread distribution, blurring the intent of many programs.

Efforts at the state and local level followed the federal lead in establishing institutional mechanisms to encourage economic growth in relatively depressed rural areas and to encourage job creation designed to employ the unemployed. Also, tax concessions given to industry by local authorities reached new highs and were estimated to be as much as $50 million annually by Dillman and Mulkey. How effective these policies were in altering the settlement patterns of the U.S. is not clear. A number of major factors contributed to the changes.

The decentralization of manufacturing was accentuated in the 1960's in part due to the abundance of relatively cheap labor in small towns and rural areas. The labor market adjustments out of rural areas that were predicted by standard general equilibrium theory appeared to lag so severely as to bring the theory itself into question. An unexpectedly high elasticity of labor supply in many rural areas kept wages relatively low. The labor supply response increased as a result of growing participation of women in the work force, return migrants from urban centers, and expanding commuter fields made possible by improved transportation and communication systems.

Farm programs of price and income supports in the 1960s changed in form but continued to be based on an overriding concern for commercial farmers. Their effects on the structure of rural areas continued to be secondary considerations. On the other hand, urban social costs were a frightening reality that commanded public attention.

New Internationalism: 1972-Present

Rural communities experienced significant structural changes in the decade of the 1970s as consequences of both the rapid outmigration of the 1950s and the balanced growth focus of the 1960s. While these structural changes were first observed in the 1970s and associated with a historical reversal in population trends, the so-called population turnaround, the rural economy was already under the influence of more powerful international forces. These forces were accentuated as a result of the Russian Wheat Deal of 1972 and the OPEC embargo of 1973. A gradual opening-up of the rural economy to international market influences has characterized our policy orientation since 1972. Our purpose is to call attention to the pervasive penetration of the international economy into the rural economies of the U.S., both in agriculture and manufacturing. The choice of which sectors to expose to international competition remains very much a national policy decision. Rural areas have suffered because their economic base is largely agricultural, mining, and low-wage manufacturing. These sectors face stiff competition in international markets and/or are inordinately affected by the overvalued U.S. currency, particularly in the case of major

export sectors such as agriculture.

International competition in both manufacturing and agriculture has varying consequences for the rural economies of different regions of the country depending on their sectoral composition of enterprises. The international linkages may either compound or offset cyclical economic changes driven by domestic competition, capital investment, and monetary and fiscal policies. Almost all facets of rural economies have become acutely aware of the strength of international forces. Low wage industries, particularly shoe and textile manufacturing, face stiff competition from abroad. Many low-wage firms have moved to Third World countries. Small-town banks engage regularly in international transactions, and the strength of the U.S. dollar has become the subject of their daily discourse. In addition, direct foreign investment in the U.S. is now a major source of new job creation for some states. Neither agricultural nor general economic policy has addressed the unique consequences of these uneven impacts.

SELECTED CRITICAL ISSUES

The above trends and policy orientations have significantly altered the sectoral and spatial organization of rural economies. Yet, the secondary effects of this internationalism have been essentially ignored by public policy. Among the many reasons behind ineffectual public policy, the slow response of research and education programs must bear some blame. For example, there has been almost no research linking international factors with domestic changes outside their effects on commodity prices and trade flows. Research and education programs must be aware of the positive and negative consequences of such changes and help design policies to preserve the social advantages and offset the social disadvantages. Public policy simply has not had an appropriate knowledge base for dealing with some of these critical issues.

Farm and Nonfarm Interactions

The importance of nonfarm income sources for farm families was described above under "Changing Economic Structure." Nonfarm employment helps determine family income in important ways and further influences economic development through its impacts on both capital and labor markets, by reducing family income risk, generating savings, and through services provided by rural communities to the farm population. These interrelationships have not been given the research attention deserved by an issue which is so significantly shaping resource allocation in rural economies. Two aspects of this issue will be briefly discussed: (a) the farm-level implications posed by the changing risk environment created by growing nonfarm employment; and (b) the rationale for public sector involvement in shaping the level and pattern of nonfarm job creation in rural areas.

Nonfarm Employment and Risk

By drawing on concepts of risk analysis, farm/nonfarm interactions provide an important example of the need to re-think basic approaches about interpreting sectoral interaction. Agricultural economists have almost exclusively addressed the issue of farm risk from the perspective of the farmer as an entrepreneur whose principal focus is on farm markets, farm prices, credit and technologies.

A recent analysis by Just and Zilberman classified farmers on the basis of "several important regimes of behavior" in order to interpret their risk-oriented behavior (p.4). They argued that small and part-time farmers may tend to fall into a group of technologically lagging farms that do not readily adopt new technologies. Young, expanding farmers were expected to be highly leveraged but to lack sufficient capital for needed farm investments. Older, large farms were more likely to be risk diversifiers, and large aggressive operators or corporate farms were expected to be the risk takers.

Their classification scheme was used to illustrate the distributional implications of agricultural policies between producers and consumers. The response of supply to increased price supports, the stability of consumer prices and government costs, and the income distribution effects will vary by the relative structure of the agricultural sector. They argue that policies designed to simultaneously achieve growth and equity must be based on the joint distribution of farm size, risk preferences, and credit availability.

Our intent is not to argue with these essential aspects of their classification, but to recognize their limitations for a wide spectrum of farm families where one or more members of the household works off the farm. Risk analysis must recognize household labor allocation between the farm and nonfarm sectors. Farm size, risk preferences, and farm credit availability almost certainly alter the household members' desires to participate in nonfarm employment. For example, risk averse farmers may be more likely to participate in nonfarm employment. They create a more elastic labor supply for the nonfarm sector at relatively low wages. Risk analysis ought to focus also on farm household capital allocation between farm and nonfarm sectors. Nonfarm investments of farm families are also affected by farm size, risk preference and credit availability. Risk averse farmers may be more likely to make off-farm investments, once size economies in farming operations have been exploited.

At the same time, a more secure nonfarm income stream should create a more conducive environment for adopting relatively more capital intensive on-farm technologies. This could be particularly important for the roughly 80 percent of the U.S. farmers in sales classes below $100,000 who depend on non-farm income to a very significant degree. In the face of growing uncertainties facing agriculture and growing nonfarm employment opportunities, greater diversity of farming technologies is likely to emerge in the farming sector. Farm families will be more innovative in exploring new cropping systems. Specifically, it is more likely that transitions from traditional to alternative technological enterprises are occurring more rapidly and smoothly in those parts of the country where non-farm job opportunities are more prevalent.

Extension Implications

The emerging structural changes in agriculture pose some difficult choices for Extension with regard to program emphasis. On the one hand, Extension could emphasize highly sophisticated technology to serve a relatively few, commercial farms, most of whom probably do not need much extension help, because they are already in constant touch with private sector technology producers. On the other hand, and more in keeping with the historical mission of Extension, Extension could emphasize assistance to the majority of American farmers, who will be making significant economic adjustments in both farm and nonfarm enterprises. It is our opinion that technical support from research and extension services should emphasize assistance to the latter group. Broad-based

research and extension support from our Land Grant colleges and universities should be directed to developing multi-pronged programs addressing infrastructure and financial support for small businesses and industry as well as agricultural production and marketing strategies. The transition into new crops which may provide more optimal resource use may be impeded unless non-farm opportunities are available to reduce the income risk associated with the new farm practices, marketing systems, and technologies that will be involved.

Extension programs must be broad enough to address household needs. Farm household units will depend increasingly on nonfarm jobs for employment. Their farming operations will be modified to meet the new demands for less intensive labor inputs and more capital intensive technologies. The income security provided by nonfarm jobs will lead to a more innovative, experimental approach to agricultural production. Agriculture will become even more information-based. The distinction between farm and nonfarm extension programs will become increasingly blurred, and the appropriate technologies for most farms will not be the same as those for the largest commercial farm operations.

Extension programs should be coordinated with state programs of economic development. Their common clientele are the many small towns and rural communities that require balanced economic growth based on entrepreneurship, venture capital, and interdependencies between farm and nonfarm sectors. Rural-based economic development will draw on the same information bases that drive the larger economy. Rural people will be "left behind" only if extension programs and the policies of federal and state governments fail to recognize that their needs require immediate, concerted attention.

Balanced Economic Growth and the Public Sector Role

Public sector subsidies, grants, loans and administrative regulations have been used as tools for addressing the needs of low income families and for stimulating lagging economic regions of the country. The expansion of occupational choice through strategies of economic diversification helps provide ladders of opportunity for rural residents. It also creates a broader "safety net" that draws on a wider range of job skills, thereby reducing the probability of being unemployed. Public participation can also help guarantee that low income families and minorities are targeted for job training and that their communities benefit from public investment decisions that stimulate job creation. These objectives cannot be readily achieved unless public policy encourages spatially balanced job opportunities. Most likely such a strategy will result in the development of value-added industries which strengthen the farm sector as well.

Continuing research must be devoted to the relative effectiveness of alternative public sector approaches such as infrastructure investments, capital subsidies, and other economic development incentives. Adam Smith notwithstanding, our empirical knowledge of public sector investment provides no basis for asserting that they are any less productive than private sector investments. In fact, the high rates of agricultural return on publicly funded agricultural research (Ruttan) and public education (Becker) are greater than the average private sector investments. Empirical attempts to separate public from private sector influences may miss the more important synergistic affects of the interaction between sectors.

Empirical research on the rates of return to local infrastructure investments

has been limited. Convincing evidence has accumulated that infrastructure investments such as water, sewerage, education, and fire and police protection, and others have statistically significant relationships with new manufacturing locations and employment expansions. Barrows and Bromley found that EDA investments had the most significant employment effect in the smallest population centers and in the communities farthest from SMSAs, implying that these investments compensated for other locational disadvantages. Likewise, Smith, Deaton and Kelch reported that even the most locationally disadvantaged communities could overcome their disadvantages by undertaking significant investments in industrial sites. Kriesel's work further supported this observation.

Research to determine an optimal mix of infrastructure investments has not been undertaken. A great deal of conceptual attention is needed to develop operational measures of public sector output in a manner that would enable rates of return to be calculated for alternative investment patterns. The lagged nature of the benefits derived from public investments and the importance of local leadership, social structure, and perceptions of private business investors make this a knotty set of issues.

The effects of capital subsidies on business location and expansion have been analyzed more thoroughly by Stober and Falk, Moes, Bridges, Dewar, and Heckman. While these results are mixed, most point to the effectiveness of capital subsidies in guiding the location of manufacturing plants. Research on a wider variety of service oriented firms has not been undertaken, though they have become critical components of the export base of rural communities.

The research on the question of the relative effectiveness of public sector activity suffers from a number of problems:

1. The influence of exogenous factors such as foreign competition, the international transfer of technology, and windfall gains due to market-windows opening up either domestically or internationally have not been included in most analyses.

2. Changes in the rate of job creation due to the business cycle, product cycles of specific types of industry, and the interrelationships between these cycles and international competition have not been well documented.

3. Endogenous influences that vary by geographic region are not well-understood. Chief among these are the issues of variation in efficiency wages (money wages adjusted for productivity differentials), and the effects of economies of size and agglomeration economies.

Capital Formation

Understanding the process of capital formation is essential to understanding how rural economies work. Both public and private sector processes and the interaction between the two must be recognized. Our intent here is to emphasize the changing nature of capital formation in an international capital market. International market forces and deregulations reduce local control over capital flows. State and local governments have been forced to respond in unprecedented

fashion to reassert an element of social control over the market. A classic illustration of an historical struggle is being re-enacted. It presents a new environment for rural economic affairs. The institutional bases of capital formation are being affected by the economic forces delineated earlier in the paper.

Kendrick estimates that U.S. capital stock is roughly one-fourth in the form of government capital, one-fourth in the form of business capital, and one-half in the form of individually owned capital, both human and tangible (Stinson, 1985). In order to understand the economics of rural areas, it is essential that the relative productivity of each type of capital be known, its rate of accumulation, complementaries among types, and factors that determine variation in the growth and utilization of each type. Unfortunately, this task is severely impeded by both our conceptual approach and data availability.

Public Capital Investments

Stinson has advanced a life-cycle theory of household savings to help interpret infrastructure investment decisions in rural areas. Drawing on the work of Ghez and Becker, he suggests that time paths of market wage rates and consumption preferences produce a pattern of net borrowing, then net saving, followed by dissaving in the elderly life stage. Such life-cycle behavior by the post-war baby boom generation may be sufficiently strong to explain the current lag in rural infrastructure investments. That is, the current outcry about deteriorating public infrastructure may simply reflect utility maximizing behavior on the part of a dominant cohort of younger voters who are now emphasizing current consumption until peak earning years are reached. A later period where this dominant cohort enters the net investor stage should result in renewed support for public investments in infrastructure, as well as greater private investment.

Additional insight into rural capital formation is provided by Stinson's introduction of risk concepts into both private and public investment decisions. For example, he defines "community risk" as "a systematic risk" attached only to the public sector investments in each community caused by unanticipated population changes" (p. 12). Sudden decreases in population common to boom towns near energy developments, such as the historical cycles in the Appalachian coal fields, may reduce local public revenues, driving up per capita costs, and reducing the value of the claims on local public services for any given individual. Such local risks drive up the capital return required by local investors in public sector capital (p. 13).

Uncertainty associated with international market fluctuations interact with public and private sector investments to add complexity to Stinson's arguments. More risky public sector investments drive up the risk for private investments for both businesses and households. Reduced value of claims on local public services will result in relatively less investment in fixed capital by homeowners and by businesses. If these processes persist in given regions of the country or in particular communities that are affected by sudden shifts in population, then conditions of downward-spiraling levels of public and private investments may occur in such communities.

This argument could help explain the reduced levels of housing investments for given income levels in such regions as the central Appalachian coal-fields where mobile homes have constituted over 90 percent of new housing starts for the past

decade. Reduced private and public investments feed on each other creating the setting for intergenerational deterioration of public and private capital. This may be particularly onerous for low-income groups who may be less able to migrate out of the region or commute long distances to other communities. Human capital would deteriorate as well as under these conditions as the local emphasis on school expenditures would decline due to the greater risk factor and the reduced certainty of reaping local returns on human capital investments because of outmigration.

Attempts on the part of local taxpayers to reduce community risk most likely explain efforts to establish industrial parks and to provide incentives to attract new private investment. This may be a major rationale behind what has been labeled as wasteful local spending in what is a near zero-sum game from the national perspective. The analogy with national mercantilist policies is inescapable. Actions that may maximize local social welfare may be wasteful from a national perspective.

A more recent study of the cost-effectiveness of economic development incentives argued that "Industrial Revenue Bonds are a highly efficient way to subsidize loans from a state's perspective but are, by far, the least efficient method when the costs of the state and federal governments are combined" (Rasmussen, et al., p. 25). This latter study concluded that direct grants should be made from the federal to the state level and that subsequent programs at the state and local levels be directed toward loan guarantees, equity investments and limited land acquisition assistance (p. 28).

Private Capital Investment

The banking system has traditionally played a significant role in channeling local savings into support for residentiary businesses that enhance the equity position of local investors and entrepreneurs. Banks have also been the princpal purchasers of local revenue bonds. With the rapid deregulation of the banking system, relatively larger capital funds can be drawn on to support a given community's bond issue, though the aggregate funds available may have diminished with the growth of international market transactions. Offsetting capital infusions from abroad compensate to some extent for reduced local savings and capital outflows, but these accrue primarily to the private sector.

Research is needed to analyze the net effects of these flows on rural economies. The relative slowdown in manufacturing movement into rural areas may portend a weaker position for rural economies. Markley's analysis of rural banks concludes that the effects of banking deregulations may vary significantly even among sub-regions of a state depending on the composition of the local economy and the behavior of the particular bank's decision-makers. Markley argues that institutional innovations occur in response to the marginal gains to be derived by the principal action group. As she points out:

> "Institutional change will likely create costs and/or benefits in rural areas that are external to the decision-making process of the primary action group and represent a source of externality" (p. 692).

The differential impact of institutional change on rural areas is generally recognized ex post and haphazardly. Institutional change generally, and banking

deregulation specifically, hold both promise and pitfalls for rural economies. Whenever such changes are generated by national and international principal actors, reactionary elements may arise at the state and local level. Following the basic institutional change model of Davis and North and the modifications suggested by Markley provide insight into changes in the capital formation process of the past three and a half decades.

Capital Formation Under Balanced Growth Policies

The period 1960-72 was characterized by an active pursuit of alternative organizational approaches to channeling capital into rural economies. The capital flows through organizations such as ARC, EDA, SBA, FmHA, and undoubtedly contributed to the infrastructure that undergirded the movement of manufacturing and business into small towns and rural areas during the next decade. Many of local community efforts were initiated in order to take advantage of federal largesse; most of these were stimulated by federal activity. A mix of local public and private capital was usually marshalled through non-profit or limited profit local development corporations to attract private capital investment principally from outside the local economy. The locally generated capital was basically sold to outside bidders who then controlled the equity of local firms and, if successful, increased the value of their equity through the public largesse at all levels. This model is still the rule.

A great deal of organizational and intellectual effort was given to reshaping the institutional base of capital in rural and urban areas (Deaton et al.). A major aim was to broaden the base of capital ownership through equity accumulation by individuals and by community organizations. Supported by a national commitment to address the special needs of the rural poor, these activities attempted to alter the institutional form of savings generation and capital channeling. The Special Impact Program of the Office of Economic opportunity and the Community Action Agencies stimulated the development of cooperatives and community development corporations that promised a new grip on life for many depressed rural areas. They resulted in relatively few significant alterations, though some projects have continued to be quite successful. The limited success appears to stem from their failure to marshall the support of primary action groups that controlled the financial network undergirding local development efforts. The capital resources and political power of this group at either the state or local level simply overwhelmed the meager funds provided through the Special Impact Program, private foundations, churches, and individuals. The major thrust of federal activity was to alter the spatial pattern of investments through credit provisions that served to strengthen the equity position of the principal action group.

Capital Formation Under New Internationalism

Changes in state and local activity in response to the openness of rural economies and financial deregulations stand in sharp contrast to earlier periods. As private financial capital has become more concentrated nationally, political power has become less concentrated. The New Federalism has served notice to state and local governments that their actions will become the primary factors guiding future public investment activity. Rural areas are receiving far less special attention in this period as primary concern has focused on the ability of the states to develop new partnership arrangements with the private sector, on the one hand, in order to maintain a competitive flow of private capital into the state. On the other hand, states have been caught up with the

process of re-designing the rules and regulations governing their relationships with local governments. Because of the greater openness of the local economies, state governments can shrug off demands from local governments while simultaneously eliciting broad public support to address state public policy matters, particularly state economic policy.

As this process has evolved, alternative approaches to capital formation are emerging, mostly in the form of credit subsidies to industry with relatively greater emphasis on high technology industries. Several states have also provided stronger incentives for private venture capital funds. Tax credits to private investors and access to state retirement funds to support equity capital investments have been initiated in Illinois, Michigan, and a few other states. Relatively less attention has been paid to directing these capital formation efforts toward rural communities, though Iowa, Alaska, and Virginia have initiated legislation with this expressed intent (Deaton, et al.).

The major shift that has occurred as compared to previous time periods is that primary action groups at the state level have coalesced to take advantage of a more open financial market and to protect their accrued position from eroding under the more powerful influences of international market forces. In other words, new forms of state controls over financial markets are being created using creative incentive programs and public subsidies. These state reactions may be much stronger than expected and may ultimately re-shape national institutions to afford relatively more protection against international influences. This is now being seen in the protectionist arguments being posited by a number of special interest groups and principal Congressional committees. Whether or not rural areas receive net gains in this process remains to be determined.

Implications

Each of these latter time periods stand in sharp contrast to the 1950s when capital formation at the local level was determined principally by local savings and manufacturing locations driven by technological adjustments. Bosworth recently concluded that increased savings can no longer be "relied upon to increase domestic capital formation" (p. 317). The international flow of capital renders obsolete the view that domestic savings serve as a major constraint on domestic investment (Bosworth, p. 317). Banking deregulations establish the basis for similar conclusions regarding the contribution of household savings in rural communities to local capital formation. They simply may not matter either in agriculture or in business and industry. On the other hand, local savings can matter a great deal if capital institutions are consciously designed to achieve public objectives.

At the same time rural communities face a far more competitive environment for maintaining an appropriate mix of capital investment at the local level. National and international factors may serve to draw local savings away without compensating reinvestment. Technological change and the product cycle create greater uncertainty for rural areas. The uncertainty drives up the necessary rate of return to elicit private and public investments. Local banks may no longer support local bond issues for public capital investments. The future appears to be far more uncertain.

Successful rural communities will be those which : (a) design institutions to marshall and channel capital in support of local investments, (b) successfully

broaden the base of equity participation in the local economy, (c) create effective partnerships with state governments and with the broader private sector of the state, and (d) effectively use traditional industrial incentives to broaden their economic base. At the same time, attention to increasing the local share of human capital will significantly alter the competitiveness of rural areas in the information-based economy toward which the U.S. is moving (Black). Research attention should shift toward the macro-perspective provided by Stinson in order to determine the strength of demographic changes, risk and public/private complementaries in determining the rate and level of capital formation.

Increasingly, rural economies will be caught up in cyclical changes that stem from international and national forces. Determinations should be made of the importance of economic diversity, local factor productivity, and local and state institutions in protecting rural economies against the vicissitudes of such uncontrollable events. This would appear to be a significant future challenge for rural leaders, researchers, and educators alike.

Poverty and Income Distribution

The notion that poverty and income distribution are central to the study of economics has been around a long time. Alfred Marshall, in the introductory chapter of his famous Principles of Economics, asserts that it is elimination of "the pains of poverty and the stagnating influences of excessive mechanical toil" that "gives to economic studies their chief and their highest interest."

Yet several forces have kept the study of this question from occupying a central place in agricultural economics research.

First, while the neoclassical paradigm that has served as a foundation for our disciplinary research explains the distribution of income among factors of production, it does not yield insights into income distribution among income classes. We have tended to avoid areas of research in which we have no strong theoretical foundation. Second, economists are faced with serious conceptual and measurement issues in the study of income distribution and poverty. (See, for example, A.B. Atkinson; and U.S. Department of Health, Education and Welfare). Thirdly, data which describe relevant distributions of income or poverty populations are often difficult to obtain (Danzinger and Gottschalk). Finally, given the observed improvement in living standards of the vast majority of people in this country during the twentieth century as the nation's economy grew, there was some basis for a belief that poverty could be most effectively reduced by merely ensuring continued economic growth.

Several things happened during the 1950's and 60's which changed the focus of agricultural economics research toward increased attention to personal income distribution issues. First there was an increased awareness about poverty in the midst of plenty in the early 1960's, which riveted the attention of policy makers and economists on the plight of the poor and the rural poor. (President's National Advisory Commission on Rural Poverty). This awareness was complemented by a growing skepticism within the economics profession about the effectiveness of growth in reducing poverty. "The most certain thing about modern poverty," observed John Kenneth Galbraith in 1958, "is that it is not efficiently remedied by a general and tolerably well-distributed advance in income." The development of a poverty index by Molly Orshansky in 1965 allowed the collection of empirical data which could be used to track progress in the

war on poverty in both rural and urban areas, and to test various hypotheses about factors affecting poverty incidence.

These factors led to a period of intense research on poverty related issues in both rural and urban America in the 1960's and early 1970's. Although this concern and the funding support for it dropped off in the late 70's, we sense a renewed interest in this question in the 1980's (although no new funding) as a result of both the 1982 recession and the current problems experienced by the farm sector.

More recent trends identified above suggest the need to refocus attention on poverty and inequality issues in agricultural economics. The internationalization of the economy, the neomercantilist response of the federal government and the resultant shifts in employment structure, have major implications for poverty and income distribution. While the evidence is not conclusive, some have suggested the emergence of a "two-tier" economy, with low wage jobs expanding faster than high wage jobs. The overall effects of the changing job structure on poverty and income distribution will depend in part on how labor demand shifts interact with increases in the labor supply caused by the maturing of the baby boom and projected increases in female labor force participation. Poverty trends will also depend on household composition, i.e. the extent to which rapid growth in single parent families and single person households continues. The "decentralization" of government, with attendant cuts in certain social programs, has increased poverty incidence particularly among the young.

On the other hand increases in social security payments (and investment incomes) have led to a decrease in poverty incidence among the increasing elderly population. Since transfer payments tend to equalize and investment incomes disequalize the overall income distribution the net effect of this change in income structure on the overall income distribution is unclear.

A major recent shift in social perceptions about economic justice could dramatically alter poverty and income distribution. Equal opportunity concerns of the 1960's focused on inequalities among races, and between urban and rural areas. Attention has shifted to inequalities between women and men. The idea that this shift is warranted is strengthened by the recognition that there is a large area of overlap between income-class inequalities and male-female inequalities; the poor are disproportionately female. The implications of this changed social perception for social policy, and ultimately, income distribution warrant further research attention.

Explaining Poverty and Income Distribution

Economists have tended to approach the study of rural poverty and income distribution by drawing from both neoclassical economic theory (Schuh) and structuralist hypotheses such as Kuznet's "inverted U" hypothesis about intersectoral employment shifts and income distribution and Anderson's "trickle down" hypothesis about aggregate growth and poverty incidence.

As economists formulated and tested models of poverty incidence and income distribution, they looked at four different sets of variables to explain these phenomena: (1) aggregate income and income growth (in an attempt to test the "trickle down" hypothesis); (2) variables related to the structure of the economy, particularly the export base of the region; (3) characteristics of household members, particularly those associated with human capital, such as age or

education; and (4) characteristics of the community or region within which the individual lived, particularly those identified as critical in central place and location theory. Empirical studies either examine the effects of these variables on aggregate measures of poverty and income distribution or focus on changes in income and poverty status of families and individuals with household data. Examples of a rural-oriented study which focused on aggregate measures are West and McGranahan. Examples of the latter kind of study are Weber, and Deaton and Landes.

Implications

Major economic and social changes in the coming decades will affect the extent of poverty and inequality in urban and rural areas of this country, and the policy response to these changes. At least four types of research would help us to monitor and understand poverty and inequality changes and to design effective policy.

(1) First, we need to continue to monitor how rural families earn their income and receive unearned income in the form of transfer payments and investment income. While aggregate data are useful for describing overall trends in the distribution of income and in the sources of income, it is generally not adequate for answering specific questions about factors which affect changes in family income, movement out of poverty, and a family's place in the overall income distribution. This requires household survey data of the very basic kind that has long been part of the tradition of agricultural economics. With survey data, for example, we can learn the extent to which transfer incomes equalize the overall income distribution, or the affect of farm income on the overall income distribution of farm families. It appears, for example, that between 1968 and 1982, farm income may have become a more disequalizing force in the farm family income distribution (Saupe and Weber; Shaffer, Salant and Saupe).

Perhaps more importantly, answering questions about income dynamics requires the kind of panel data on income dynamics which has been collected at the University of Michigan Institute for Social Research (Duncan). We have known for a long time that a large share of families and individuals who are poor one year have incomes above the poverty line the next year (Smith and Morgan). Yet without panel data, we cannot distinguish the "persistant poor" from the "transitory poor" and cannot design policy appropriate for their respective needs. With panel data we could better understand the dynamics of poverty in rural areas: What proportion of poor families and individuals is persistently poor (in poverty for extended periods) and what are the characteristics of this population and their environment? It could permit us not only to understand movements of families and individuals within the income distribution and into and out of poverty, but also to relate those movements to changes in personal characteristics, community characteristics, and health of the overall economy.

(2) After twenty years of debate about the definition of poverty, some progress has been made. Poverty can be defined as "the condition of having insufficient income to meet ones basic needs." Yet, there is no accepted standard of "basic needs." The University of Wisconsin Institute for Research on Poverty recently undertook a study in Wisconsin which attempted to define basic needs and estimate income levels necessary to purchase these basic needs. This kind of research can take us a long way in terms of both measuring the extent of poverty and assessing the extent to which our transfer programs provide for basic needs. Replication of this kind of research in other places would allow us to answer the questions about

whether basic needs are different in different parts of the country, and whether it costs more to provide for basic needs in a small town than in a large city. We do not presently know this.

(3) We do not merely need information, however, about the sources of income for families in different situations and about the definition of poverty. We also need models that help us understand what affects poverty and income changes in ways that are helpful to policy makers. Several kinds of research could be useful in helping policymakers in the design of poverty-reducing strategies. At the aggregate level, following the lead of Gottschalk and Danziger (1985) we could profit from models that enable us to separate the effects of changes in employment and earnings on poverty from changes in transfer payments. It is only in this way that we will be able to separate out the effects of macroeconomic policies on poverty incidence from those of strictly transfer payments policies. It would be interesting to use this framework to analyze possible differences between regions and between urban and rural areas in their responsiveness to these different kinds of policies.

Williamson and Lindert analyze long term trends in inequality in this country in a neoclassical general equilibrium framework. They attempt to explain patterns of inequality over time in terms of capital accumulation, growth in labor supply and sector-specific technological progress. While they conclude that government policy has not been a major factor in historical trends in inequality, their analysis does not cover the period of major growth in transfer payments. It would be useful to expand their framework both by incorporating more recent data on earnings and on investment and transfer incomes, and by looking for rural-urban or regional differences in patterns. Such regional disaggregation would allow the dramatic differences in settlement patterns, natural resources, and cultural history to emerge as explanatory factors.

Williamson and Lindert claim that their neoclassical general equilibrium framework gives them access to certain insights which would not be available without that model. It is also possible, however, that the restrictive neoclassical model precludes consideration of important factors identified in alternative models.

The development economics literature provides some alternatives such as models of "cumulative causation" which draw on ideas of Myrdal and Kaldor. These models, which formalize the idea that increasing returns activities will concentrate geographically to the benefit of certain regions and the detriment of others, can be expanded to address poverty and income distribution concerns (Weber and Deaton).

"Rural" and "urban" are increasingly viewed as a "continuous, integrated system, rather than as a sharp dichotomy" (Hoch, p. 959). This implies that the study of rural economies must deal with the spatial location and position in the urban hierarchy, issues central to the theoretical foundations of regional economics (location theory, central-place theory, export base theory). Although it has become standard procedure for agricultural economists to call for the integration of spatial relationships into our rural models (see, for example, Edwards, 1979, p.71), a satisfactory way of doing this has not been forthcoming. We may be able to learn something about this in designing rural growth models by looking at the approach of Richardson and (for a rather unorthodox view) of Dunn. Neither of them is attempting to explain poverty or distribution of income. Incorporation of spatial dimensions into the study of poverty incidence and inequality would allow the study of regional and rural-urban differences in

poverty associated with location and position in the central place hierarchy.

As global economic interdependence becomes more of a reality, our search for factors explaining domestic income distributions will need to include international factors. The outlines of a conceptual framework proposed by Schuh (1981) can guide the selection of these factors. In addition to studies of aggregate behavior, we need to study behavior of individual economic units. Particularly important is the need to pursue the understanding of the dynamics of poverty over the life cycle and between generations and the effect of changing incentive structures on economic participation of low income people.

(4) With this understanding, it would be possible to do better policy research, to better analyze the effects of alternative policies on the extent of poverty and inequality in this country and for specific areas and demographic groups. It would be possible not only to assess the impacts of transfer payments or employment creation strategies, but also the effects of macroeconomic fiscal and monetary policies and trade policies on poverty and inequality as well. By being better able to anticipate negative distributional consequences of international economic forces and domestic policy, it would be possible to determine the need for and general outlines of institutional innovations to modify any socially unacceptable outcomes.

CHALLENGES FOR RURAL ECONOMISTS

As we look to the challenges facing the discipline as we approach the twenty-first century, it is important also to look at our history. In this concluding section of the paper, we will examine the historical roots of our discipline, reflect briefly on some elements of the tradition we should seek to recapture and conclude with some challenges to the profession growing out of our history and out of the emerging social and economic context.

Historical Context of Agricultural Economics

Agricultural economics developed during a period when higher education was in transition from the dominant model of the college to that of the research university. (Bellah et al.) The American college of the nineteenth century did not emphasize disciplinary divisions. Higher learning was assumed to be a "single unified culture" encompassing literature, the arts and science and unified by moral philosophy. In the late ninteenth century the research university (with graduate education, research and specialized departments) came into ascendency and the "unity and ethical meaning" of higher education was obscured. This transition affected the development of the early social sciences.

> While they [the early social sciences] were concerned with establishing professional specialities providing useful knowledge about an increasingly complex society, many social scientists still felt the older obligations of moral philosophy to speak to the major ethical questions of the society as a whole. This tradition has never died, but it has been driven to the periphery by an ever more specialized social science. (Bellah et al., p. 299)

Agricultural economics departments also developed within Land Grant universities, which had an orientation to applied problem solving. As Schuh reminds us,

> "In addition to the notion of providing mass education for society, the essence of the Land Grant university was traditionally a strong institutional mission orientation. The idea was that the university had a major responsibility to address the problems of society and to apply the tools of science and technology to the solution of those problems." (1984,p.3)

Both this mission orientation and the emergence of the science-oriented research university greatly shaped the discipline of agricultural economics as it evolved in the first two decades of the twentieth century.

Some idea of what the founders of agricultural economics had as their vision of the discipline can be obtained by looking at an early report of a committee which was charged with defining the boundaries of the discipline. Shortly after the founding of the American Farm Management Association (forerunner of the American Agricultural Economics Association) in 1910, the Committee on Instruction in Agriculture of the American Association of Agricultural Colleges and Experiment Stations created a Subcommittee on Rural Economics and Farm Management to "study the relationship between rural economics and farm management and, if possible, to define the subjects and determine their lines of cleavage" (Taylor and Taylor, p. 90). In its report the committee presented its rationale for recommending that the term "rural economics" be used as the general reference for the profession:

> Rural economics is preferable to agicultural economics because the former term indicates that the affairs of the community, as well as of the individual farmer, are to be considered under this head. Rural economics or economy has for a long time been used in this sense in this country and abroad.
>
> Your committee is deeply impressed with the importance of developing strong courses in rural economics and sociology and the other subjects just referred to. These all involve the human element in agriculture and country life. They tend to raise the college courses in agriculture above the materialistic plane, to emplasize broadly the human interest that properly inheres in agricultural studies, and thus to inspire both faculties and students in our agricultural colleges with a higher sense of the wide responsibilities attaching to leadership in agricultural affairs. Pedagogically they serve to show that agriculture, when broadly treated, is to be enrolled among the humanities, as well as the sciences; ethically, they point out the vital connection between agricultural science and the welfare of rural people and even of all mankind." (Report of the Committee on Instruction in Agriculture, 1911" U.S. Department of Agriculture, Office of Experiment Stations, Circular 115, Washington D.C., 1912, pp. 12-14, quoted in Taylor and Taylor 1952, p. 95.)

An important thing to note here is the breadth of scope of what they called "rural economics," placing the discipline among the humanities and viewing it as having major ethical concerns. It is interesting to note also that the founders of the discipline recommended using the term rural economics rather than agricultural economics in order to highlight that the discipline encompassed "the affairs of the community, as well as of the individual farmer."

A major overall challenge facing agricultural economics (and indeed all the social sciences) as we adapt our discipline to the changing economic and policy context is to hold in creative tension both the focus on problem solving, model building and institution building and concern for the ethical dimensions of our pursuit.

Challenges in Research, Extension and Teaching

Early in the paper we noted some fundamental changes affecting rural areas as we approach the twenty-first century. Foremost among these were the neo-mercantilist orientation to the internationalization of the economy, the changing demographic and economic structure of the United States, and the new philosophical cross currents in social ethics. These changes viewed in the context of the intellectual tradition of agricultural economics pose some challenges to the profession. We are challenged by these trends and traditions to redirect our professional energies in research, Extension and teaching.

Research: Toward a Rural Development Paradigm?

Paul Barkley, (1984a) has recently suggested that the "total social product of the profession could be increased by increasing the amount of time spent in formulating problems, generating hypotheses, and selecting appropriate theories (page 798). He argues that our facility with quantitative techniques may have blurred our ability to recognize problems and reassemble our research results in a meaningful way (page 801). What Barkley views as critical for the entire agricultural economic discipline, we view as particularly important for rural development economics. Perhaps this problem is accentuated for rural development research since such problems have broad social consquences, but the supporting theoretical paradigms are severly limited in scope.

Recent attempts to identify the conceptual or theoretical bases of rural development economics have drawn eclectically from various theoretical paradigms. If the purposes of economic study are to understand, to predict, and to shape economic events, then a discussion of the theoretical basis of rural development economics ought to be placed in the context of a framework which is useful for all three purposes. Such a framework exists in Jan Tinbergen's "Theory of Economic Policy" applied most recently to rural development questions by Glenn Nelson. One can use this framework to examine the relationship between policy instruments and policy target variables after specifying links between instruments, the structure of the economy and target variables. In this framework target variables are selected with reference to some notion of society's goals. Development economists focusing on international development often do this explicitly. Todaro, for example, borrowing from Goulet, bases his definition of development on three explicit core values "life-sustenance, self-esteem and freedom from servitude representing common goals sought by all individuals and societies" (p.70). Using these values as guidelines, he

identifies the target variables of development economics as the level and growth of income, and the levels of unemployment, poverty and inequality in the distribution of income (p.68).

Domestic rural development studies have tended to focus on changes in income or employment and implicitly define development in these terms.[1] Recently, there have been attempts to ground the selection of target variables in explicit ethical systems. Nelson used Rawl's Theory of Justice as the basis for his arguments that the most important target variable for rural development studies is poverty and that, in addition to poverty, economists ought to study income levels and distribution, employment, and public sector "productivity." For us these variables ought to be supplemented with target variables relating to level of unemployment (requiring attention to labor force participation as well as jobs) and income stability.

Agricultural economists have devoted a fair amount of attention to policy-oriented research in rural development. Policy research has been oriented towards those policies affecting growth of income and employment. (Smith, Deaton and Kelch, Kriesel) Analysts have looked at, for example, the effect of industrial parks, extension of water and sewer lines, the level of support for public education, taxes, and other variables on industrial location. Much, if not most, of this work is oriented towards local policy instruments. With regard to poverty incidence, there was some important work done on national policy alternatives for reducing poverty in rural areas in the early '70s.

The lack of an underlying comprehensive conceptual model for rural development which links policy instruments and target variables has been a source of frustration for economists for a number of years. (See for example, Edwards, 1976, 1979, 1981; Nelson). There have been three attempts in recent years to identify the components of a comprehensive framework for rural development research (Edwards, 1981; Jansma et al.; Schuh, 1981).[2] While these reviews have focused generally on growth and did not attempt to incorporate within a single framework elements that would explain growth, unemployment, poverty and income stability, many of the elements used in models of growth almost certainly have relevance for the understanding of these other target variables as well.

Four bodies of theory were identified in these three papers as bases for a comprehensive framework for rural development: supply-oriented neoclassical theory and its developmental variants dealing with human capital and the Baumol hypothesis; demand oriented export base and trade theory, including the insights of Keynes and the "Structuralists;" regional economics and central place theory, to incorporate spatial dimensions of rural development; and institutional economics to capture the interrelationships between institutions (laws, working rules, etc) and economic activity. Schuh would include within this latter category theories of induced institutional innovation and theories of endogenous government behavior drawing on the work of Downs, O'Connor, and Stigler. We would add and emphasize the important theoretical developments of Olson.

While arguing that these four bodies of theory will provide the elements upon which a "theory of rural development" can draw, we also note that each of these bodies has its limitations. The foundations of neoclassical economics, for example, have been challenged by three ideas which came into prominence in the 1960s: the concept of uncertainty, the theory of the second best and theories of social choice. (Fusfeld) Uncertainty, for example, seems to be playing a larger role in the economic affairs of rural areas. This uncertainty, generated by the

internationalization of the world economy, deregulation, and technological change calls into question conclusions about optimal resource allocation out of general equilibrium theory. And Breimyer, discussing rail and trucking deregulation impacts on rural areas, notes the inconclusive nature of analysis based on neoclassical assumptions: "In an imperfect world, in which all solutions are second best, we can no longer claim that the results obtained from the free operations of self-adjusting markets are necessarily desireable. We just don't know." (p.152) These challenges imply that, in our attempts to draw from neoclassical theory and the other bodies of theory, we need to give more explicit attention to the limits of the theories and not extend them beyond their limits.

How important a prerequisite for relevant research is an integrated paradigm for rural development? Nelson makes the strongest case for the need for an integrated framework for rural development. Without an understanding of the structural relationships between target variables and policy instruments, he argues, agricultural economists are not able to provide rural policy analysts with information to help them design appropriate public policies. An underlying paradigm, Nelson argues, would help us determine what data to collect and what relationships to analyze in a way that would help our information to be more relevant to policy makers.

A second reason for attempting to develop a rural development paradigm is that it would increase the intellectual excitement of those working in the area by giving researchers a sense of "contributing to a larger whole or of attacking a critical gap in understanding." (Nelson, p. 695)

Others do not argue so strongly for the development of the comprehensive framework, although they view it as a desireable goal. Edwards, for example, sees the incorporation of his five bases for growth into a single rural growth model as "a challenge which we as a profession need to work on" (1979, p. 972). We see some value in attempts to develop a model of rural development which integrates the four bodies of theory into a comprehensive framework. Shaffer's observation summarizes our view quite well.

> It may be that we need to remind people of the uses and limitations of our theories and caution them about the conditions that make their use appropriate or inappropriate. The synthesis of a comprehensive theory can remain as our long-run goal, and more appropriate use of existing theories and tools remain a legitimate short-run goal. (p. 976)

However, even the development of an adequate conceptual model for rural development would not insure the relevance of our research without attention to what Bonnen has called "operationalization and measurement issues." Jansma and Goode offer some suggestions about how this operationalization and measurement of relevant concepts in rural development might proceed.

Extension

"Extension was launched to deliver new applied knowledge to farm and rural people in the United States and to transmit their interests to the land grant university research community" (Hildreth and Armbruster, p.893). The challenge to agricultural economists in extension is to adapt this role to fit a new environment in which the demands for information and education are changing,

the resources for program delivery are shrinking, and the technology for extending information is changing, while at the same time applying the traditional principles of extension programming identified by Hildreth and Armbruster: "involving students in program development, presenting education in an informal setting, and focusing on practical information" (p.854).

The trends identified earlier provide some indicators of new demands for informal education as we approach the 21st century.As the age structure "greys" and the family structure and labor force participation patterns of men and women change, we are seeing an increasing demand for education over the life span. Education is not something which ceases at high school and college graduation, as the tremendous growth in community college nondegree programs attests. While much of this demand is for leisure skills and mid-career and career change education, there is also a desire to better understand the increasingly complex world within which we live and to more effectively participate in public affairs.

The decentralization of governmental authority provides the opportunity for more effective participation by citizens in local affairs and consequently a potential demand for information that enables people to understand the complex issues and for leadership skills to make their input more effective.

Internationalization, deregulation and the changing economic structure are dramatically affecting the conduct of business in rural areas. Local business leaders and local government officials often do not have time to keep up with the trends and think through their implications for local economies or local business opportunities. Extension can take advantage of the opportunity by both explaining the larger social and economic trends and by showing community leaders and citizens how local community changes either reflect or can take advantage of these trends.

The same forces that affect nonfarm businesses also affect farms and farm families. Perhaps the most important thing for agricultural economists to do is to recognize in their extension programs the increasing interdependence of farm and nonfarm economic activities. Rural development specialists need to pay more attention to "farm" issues and farm management specialists need to pay more attention to the off-farm economic activities and opportunities of farm households in analyzing farm enterprise decisions.

Extension can also keep new opportunities and trends in perspective by providing information on the local and national social costs of economic change. While extension has done this in the past for local areas in its impact modelling, it has often not put the local and national perspectives together.

As the program needs and potential clientele for Extension education change, so also may the needed delivery mechanisms. Some demographic trends like the aging of the population allows some people to have more time for education. Other trends,like the trend toward two-earner families, decreases the amount of leisure time for education. These shifts may dramatically affect the kinds of educational formats demanded. These may be less demand for public meetings by the family audiences and more demand for written materials, correspondence courses, video casettes and computer-assisted learning packages that can be used at home. This suggests a need to better target education programs about rural development issues and to involve these target audiences in the traditional program design mechanisms to insure effectiveness.

Teaching

A major challenge is to broaden the students' conception of social science to enable them to cross the boundaries between economics and the humanities and to help them understand the value implications embedded in the selection of research and Extension projects. To this end we see the importance particularly of reorienting graduate instruction to include more emphasis on the history of economic thought and on the philosophy of science. We would echo Barkley's (1984a) call for more training in "problem recognition", and Wunderlich's call for more attention to the ethical underpinnings of economic analyses in our graduate teaching programs. Adequate preparation for analyzing economic events in an increasingly interdependent world will also require more attention in training all agricultural economists to international development economics, international trade, macroeconomics and income distribution.

Following Arthur Lewis we also believe that more attention to economic history would give students a better appreciation of the evolution of the market system and of the economic institutions which exist today. This is particularly important in development because of the long term and dynamic processes which development economists study.

We believe that teaching has a critical role in the development of a comprehensive rural development framework. Because our work in research and to a lesser extent Extension tends to be rather narrowly focused, and because the only time many of us are forced to attempt a comprehensive view of the rural economy is in the classroom, it is our opinion that the outlines of a comprehensive rural development economic s framework are most likely to be developed in teaching development economics in a classroom. We are particularly impressed with the potential of development models spawned in a third world context to provide the intellectual groundwork for advances in domestic rural development models.

SUMMARY

We are guardedly optimistic as we approach the twenty-first century. We see the world undergoing fundamental change, and we see a discipline of agricultural economics with broad philosophical base and a deep concern for relevance to public issues and the role of public institutions in shaping the economic context. We understand some of the incredible complexity in the economic and social systems, and we are aware of the narrow professional social science orientation which has tended to dominate our discipline. We sense, however, a reawakening of interest in broad issues of social ethics, and their economic dimensions, and we see active interests in the relationship between institutional change and economic behavior. We are confident that by appropriating out of our own and other traditions that which is useful, and by maintaining dialogue with society about issues of common concern, agricultural economists will be able to match the discipline's greatest strengths with society's greatest needs.

FOOTNOTES

1/ Indeed, in the 1976 session of the American Agricultural Economics Association meetings entitled "Rural Development, Poverty, and Regional Growth," poverty was mentioned only once in passing in one of the four papers. (Edwards, 1976, p.914)

2/ Schuh's paper is actually an attempt to develop a conceptual framework to help us to understand the world economic system and "to design more orderly, efficient and equitable international economic system" (p. 767). Because of the increasing importance of international economic developments to rural America and because of the richness of Schuh's discussion, we have included it here.

REFERENCES

Anderson, W.H. Locke "Trickling Down: The Relationship Between Economic Growth and the Extent of Poverty Among American Families." Quarterly Journal of Economics, 78(1964)511-524.

Atkinson, A. B. The Economics of Inequality. Oxford: Oxford University Press, 1975.

Barkley, Paul W. "Rethinking the Mainstream: Discussion." Amer. J. Agr. Econ. 66(1984a):798-802.

_____. "Using Policy to Increase Access to Capital Services in Rural Areas." Restructuring Policy for Agriculture: Some Alternatives, papers from College of Agricultural and Life Sciences, VPI & SU, S.S. Batie and J.P. Marshall, eds., 84(1984b):23-40.

Barrows, Richard L. and Daniel W. Bromley. "Employment Impacts of the Economic Development Administration's Public Works Program." Amer. J. Agr. Econ. 57(1975):46-54.

Baumol, William J. "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis." Amer. Econ. Rev. 57(1067):415-26.

Becker, Gary. Human Capital, New York: Columbia University Press, 1975.

Bellah, Robert, et al. Habits of the Heart, Berkeley: University of California Press, 1985.

Black, Sena Hoosenally. "From the Industrial to the Information Economy Policy Implications for the South." Paper prepared for the 1985 Committee on Southern Trends, Southern Growth Policies Board, Research Triangle Park, N.C.

Bonnen, James T. "Improving Information on Agriculture and Rural Life." Amer. J. Agr. Econ. 57(1975):753-64.

Bosworth, Barry P. Capital Formation and Economic Policy." Brookings Papers on Economic Activity, pp. 273-326. Washington D.C: The Brookings Institution, 1982.

Breimyer, Harold F. "Consequences of Transportation Regulatory Reform on Agriculture and Rural Areas: Discussion. Amer. J. Agr. Econ. 66(1984):663-665.

Bridges, Benjamin Jr. "State and Local Inducements for Industry: Part I." National Tax Journal, 18(1965):1-14.

Danziger, Sheldon and Peter Gottschalk. "The Measurement of Poverty: Implications for Antipoverty Policy," American Behavioral Scientist. 26(1983):739-56.

Davis, L.E. and D.C. North. Institutional Change and American Economic Growth, Cambridge: Cambridge University Press, 1971.

Deaton, Brady J. "CDCs: A Development Alternative for Rural America." Growth and Change, Vol 6, No.1.

_____. "New Institutional Arrangements for Supplying Local Public

Services Under New Federalism with Special Reference to Education." Amer. J. Agr. Econ. 65(1983):1124-30.

_____. "Rural Employment and Rural-Urban Population Shifts: Discussion." Amer. J. Agr. Econ. 61(1979):973-75

_____, Thomas G. Johnson, Berkwood Farmer and Patricia Schwarts. "Rural Virginia Development Foundation: The Making of an Institution." Virginia Cooperative Extension Service, Publication 302-002, 1985.

_____ and Maurice R. Landes. "Rural Industrialization and the Changing Distribution of Family Incomes." Amer. J. Agr. Econ. 60(1978):950-54.

Deavers, Kenneth L., and David L. Brown. "Sociodemographic and Economic Changes in Rural America." Rural Development, Poverty and Natural Resources Workshop Paper Series, Washington, D.C.: Resources for the Future, Inc., 1983.

Dewar, Margaret E. "The Usefulness of Industrial Revenue Bond Programs for State Economic Development: Some Evidence from Massachusetts." New England Journal of Business & Economics, 7(1981):23-34.

Downs, Anthony. An Economic Theory of Democracy. New York: Harper & Row, 1957.

Duncan, Greg J. Years of Poverty, Years of Plenty, Ann Arbor: University of Michigan, Institute for Social Research, 1984.

Dunn, Edgar S. Jr. The Development of the U.S. Urban System Volume 1: Concepts, Structures, Regional Shifts, Baltimore: Johns Hopkins University Press, 1980.

Edwards, Clark. "The Bases for Regional Growth: A Review." A Survey of Agricultural Economics Literature Vol.3, Lee K. Martin, ed., pp.159-284. Minneapolis: University of Minnesota Press, 1981.

_____. "The Political Economy of Rural Development: Theoretical Perspectives." Amer. J. Agr. Econ. 58(1976):914-922.

_____. "Modeling Rural Growth." Amer. J. Agr. Econ. 61(1979):967-73.

Fusfeld, Daniel R. Age of the Economist, Glenview: Scott, Foresman, 1982.

Galbraith, John Kenneth. The Affluent Society, New York: The New American Library of World Literature, Inc., 1958.

Ghez, G.R. and G.S. Becker. The Allocation of Time and Goods Over the Life Cycle, New York: Columbia University Press, 1975.

Gottschalk, Peter and Sheldon Danziger. "A Framework for Evaluating the Effects of Economic Growth and Transfers on Poverty." Amer. Econ. Rev. 75(1985):153-61.

Heckman, John. "What Are Businesses Looking For?" Economic Review, Federal Reserve Bank of Atlanta, pp. 6-19, 1982.

Hildreth, R.J. and Walter J. Armbruster. "Extension Program-Past, Present, and Future: An Overview." Amer. J. Agr. Econ. 63(1981):853-59.

Hoch, Irving. "Settlement Size, Real Income, and the Rural Turnaround." Amer. J. Agr. Econ. 61(1979):953-59.

Jansma, J. Dean and Frank M. Goode. "Rural Development Research: Conceptualizing and Measuring Key Concepts." Amer. J. Agr. Econ. 58(1976):922-28.

_____, Hays B. Gamble, J. Patrick Madden, and Rex H. Warland. "Rural Development: A Review of Conceptual and Empirical Studies." A Survey of Agricultural Economics Literature Vol.3, Lee K. Martin, ed., pp. 285-392. Minneapolis: University of Minnesota Press, 1981.

Jequier, Nicolas. "Appropriate Technology for Rural Governments." Theme Paper No.3, Co-operative Action Programme, Local Leadership and Rural Development, Organization for Economic Co-operation and Development

(OECD), Washington, D.C. and Williamsburg, Virginia 16-20, 1984.
Jordan, Max and Tom Hady. "Agriculture and the Changing Structure of the Rural Economy." Structural Issues of American Agriculture, Washington, D.C.: U.S. Department of Agriculture, ESCS, Agr. Econ. Report 438, 1979.
Just, Richard and David Zilberman. "Risk Aversion, Technology Choice, and Equity Effects of Agricultural Policy." California Agricultural Experiment Station, Giannini Foundation of Agricultural Economics, 1984.
Kaldor, N. "The Case for Regional Policies." Scottish Journal of Political Economy, 17(1970):337-348.
Kendrick, J.W. The Formation and Stocks of Total Capital, New York: Columbia University Press, 1976.
Klindt, Thomas H., Maurice R. Landes and Brady J. Deaton. "Impact of New Manufacturing Plants In Rural Areas of Tennessee on Employee Family Income Distribution." Bulletin 603, University of Tennessee Agricultural Experiment Station, Knoxville, July 1981.
Kriesel, Warren. "The Estimation of Benefits, Costs, and Probabilities of Manufacturing Plant Location in Rural Virginia." unpublished M.S. thesis Department of Agricultural Economics, Virginia Polytechnic Institute and State University, 1984.
Kuznets, S.S. "Economic Growth and Income Inequality." Amer. Econ. Rev. XLV(1955).
Lewis, W. Arthur. "The State of Development Theory." Amer. Econ. Rev., 74(1984):1-10.
Markley, Deborah M. "The Impact of Institutional Change in the Financial Services Industry on Capital Markets in Rural Virginia." Amer. J. Agr. Econ. 66(1984):686-693.
Marshall, Alfred. Principles of Economics, 8th Edition, London: MacMillan and Co., 1925.
McGranahan, David A. "The Spatial Structure of Income Distribution in Rural Regions." American Sociological Review, 45(1980):313-24.
Moes, John E. "The Subsidization of Industry by Local Communities in the South." Southern Economic Journal, (1961):187-193.
Myrdal, G. Economic Theory and the Underdeveloped Regions, London: Duckworth, 1957.
Nelson, Glenn L. "Elements of a Paradigm for Rural Development." Amer. J. Agr. Econ. 66(1984):694-701.
O'Connor, J. The Fiscal Crisis of the State. New York: St. Martin's Press, 1973.
Olson, Mancur. The Logic of Collective Action. Cambridge: Harvard University Press, 1965.
Polanyi, Karl. The Great Transformation, Boston: Beacon Press, 1944.
President's National Advisory Commission on Rural Poverty. Rural Poverty in the United States, Washington, D.C., May 1968.
Report of the Joint Subcommittee studying the Development of a Rural Virginia Development Foundation, Senate Document No. 12, Commonwealth of Virginia, Richmond, 1984.
Reynolds, Morgan and Eugene Smolensky. "Post-Fisc Distributions of Income in 1950, 1961, and 1970." Public Finance Quarterly, 5(1977):419-38.
Richardson, Harry W. Regional Growth Theory, London: The Macmillan Press, Ltd., 1973.
Rasmussen, D.W., M. Bendick, Jr. and L.C. Ledebur "The Cost-Effectiveness of Economic Development Incentives." Washington, D.C.: The Urban Institute, 1982.
Saupe, William E., and Bruce Weber. "Rural Family Income in Wisconsin." Research Report R2634, Madison: University of Wisconsin, June 1974.

Schuh, G. Edward. "Economics and International Relations: A Conceptual Framework." Amer. J. Agr. Econ. 63(1981):767-79.

_____. "Neoclassical Economic Theory, Poverty, and Income Distribution." Rural Poverty and the Policy Crisis, Robert O. Coppedge and Carlton G. Davis, eds., pp. 87-113. Ames: The Iowa State University Press, 1977.

_____. "Revitalizing the Land Grant University." Presented at Colloquim, Strategic Management Research Center, University of Minnesota, September 28, 1984.

Shaffer, Ron E. "Rural Employment and Rural-Urban Population Shifts: Discussion." Amer. J. Agr. Econ. 61(1979):975-77.

Shaffer, Ron, Priscilla Salant and William Saupe. "Rural Economics and Farming: A Synergistic Link." Paper presented at North Central Regional Conference "Interdependences of Agriculture and Rural Communities in the 21st Century," February 12-14, 1985, Zion, Illinois.

Smith, James D. and James N. Morgan. "Variability of Economic Well-being and Its Determinants." American Economic Review, 60(1970):286-95.

Stigler, George J. "The Theory of Economic Regulation." Bell J. Econ. 2(1971):3-21.

Stinson, Thomas F. "Life Cycle Behavior, Uncertainty, and the Demand for Infrastructure." Paper presented to the National Symposium on Local Infrastructure Investment Decisions, Arlington, VA April 17-19, 1985.

Stober, William J. and Laurence H. Falk. "Property Tax Exemption: An Inefficient Subsidy to Industry." National Tax Journal, (1967):386-394.

Taylor, Henry C. and Anne Dewees Taylor. The Story of Agricultural Economics in the United States, 1840-1932, Ames: The Iowa State College Press, 1952.

Todaro, Michael P. Economic Development in the Third World: Second Edition, New York: Longman Inc., 1977.

U.S. Department of Health, Education and Welfare. "The Measure of Poverty." A Report to Congress as Mandated by the Education Amendments of 1974, April 1976.

Weber, Bruce A. "Trickling Down: Are Rural and Rural Poor Family Incomes Responsive to Regional Economic Growth?" Contributed paper at annual meetings of the American Agricultural Economics Association, College Station, Texas, August 1974.

Weber, Bruce A. and Brady Deaton. "U.S. Regional and Rural-Urban Growth Differentials: An Examination of the Cumulative Causation Hypothesis." Agricultural Economics Staff Paper SB-85-1, Virginia Polytechnic Institute and State University, November 1984.

West, Jerry G. "Consequences of Rural Industrialization in Terms of Income Distribution." Growth and Change, 9(1978):15-21.

Williamson, J.C. and Peter H. Lindert. American Inequality, New York: Academic Press, 1980.

Wunderlich, Gene. "Fairness in Land Ownership." Amer. J. Agr. Econ. 66(1984):802-7.

HUMAN CAPITAL FOR AGRICULTURE

By Wallace E. Huffman*

ABSTRACT

This paper focuses on human capital aspects of four topics in agriculture: farmers' decision making; off-farm income; farm labor; and food, nutrition, and health. For each topic, a summary of new events and current research is first presented and then important unresolved issues are identified.

INTRODUCTION

Agriculture, the food system, and rural communities face a rapidly changing array of problems. The profession may be able to establish a set of priorities that helps society understand and adjust to these changes. The objective of this paper is to help define issues and priorities for the subject of human capital for agriculture.

The human capital field owes a major debt to T. W. Schultz and Gary Becker. The rapid recovery of Europe and Japan after World War II impressed upon Schultz that expenditures on education, health, and information were investments in people rather than consumption expenditures. In his 1960 address to the American Economics Association, Schultz (1961) put forth the bold propositions that people deliberately invest in skills, knowledge, health and human migration; that this is a form of human capital, and that these investments in human capital account for much of the rise in real earnings per worker over time. Gary Becker (1964) formalized the basic framework for considering investments in human capital. Advances in theories of human time allocation (Becker 1965; Michael and Becker) and the new home economics (Nerlove; Becker 1981) have been complementary to the rapidly expanding human capital literature.

From the myriad of topics that could be emphasized in this paper, I have chosen four. They are (1) farmers' decision making, (2) off-farm income, (3) farm labor, and (4) food, nutrition, and health. For each topic, I describe significant new events, summarize the state of current research, and suggest important unresolved issues.[1/] The final section of the paper concludes with a few critical remarks.

FARMERS' DECISION MAKING

The markets and technologies facing agriculture promise to be dynamic in the future. Likely sources of changes in market prices include changes in international exchange rates, world markets for agricultural products, U.S. price and income programs for agriculture, and domestic business cycles (Schuh 1984). Likely sources of new technologies include biotechnology which greatly

---

*The author is professor of economics, Iowa State University. Robert Emerson, Loren Ihnen, Glenn Nelson, William Saupe, T. W. Schultz, and Marta Tienda provided helpful comments on an earlier draft of this paper. Journal Paper No. J of the Iowa Agriculture and Home Economics Experiment Station. Project No. 2738.

expands the genetic potential of plants and animals, robotics which use computer technology for advanced mechanization (and control) of agriculture, and micro-computers which have dramatically reduced the cost of information storage and analyses (Johnson and Wittner). Thus, farmers and agri-businessmen can expect to continue to need skills to operate in a dynamic agricultural environment.

Some Concepts

The ability to adapt efficiently to an economic environment that has been altered in a specific way may be a scarce resource in agriculture (Schultz 1975; Huffman 1985). In particular, adaptive ability may be scarce relative to the ability to produce maximum output from a bundle of inputs. The setting is one in which farmers face uncertainty about the future course of events--production, technologies, prices, and governmental policies--and production is dynamic. A large share of inputs is purchased from the nonfarm sector, and a significant share of output is exported. Information is available, but acquiring, storing, and analysing information is costly. Farmers are assumed to differ in their adaptive ability, which is viewed as a form of human capital.

Adaptive ability seems unlikely to be important when the processes generating the variables, which farmers take as exogenous, are stationary and unaltered. However, when these processes undergo structural change, adaptive ability is expected to affect the quality of production, marketing and investment decisions.[2/] Farmers who have superior adaptive skills are expected on average to make and implement better decisions. Furthermore, successfully adapting to structural change seems to be selective. Farmers possessing poor adaptive skills can be expected to comprise a relatively large share of the persons forced to seek alternative employment or retirement, provided governmental intervention does not completely neutralize this selection process.[3/]

Previous Findings

Farmers' schooling and agricultural extension have been shown to increase the efficiency or productivity of agriculture. Previous empirical studies have found it useful to distinguish between technical and allocative effects (Welch 1970, 1978). A firm is technically efficient if it is on the production possibility frontier or transformation function. Technical inefficiency occurs when the firm faces the opportunity of, but does not choose, an activity vector containing more of some outputs and less of some inputs, holding other quantities unchanged. A firm is allocatively efficient if it is technically efficient and if it meets all the marginal conditions for optimization, say profit maximization. Thus, the appropriate mix of inputs and outputs must be chosen in order to be allocatively efficient.

Farmers' schooling and information may enhance both the technical and allocative efficiency of agricultural production. The potential efficiency gains are conditioned by the nature of the economic environment. A dynamic technical environment, created by the introduction of new technologies, provides greater potential than a static environment.

A considerable amount of evidence has accumulated on the contribution of education to agricultural production since Griliches' early studies (1963, 1964). Much of this later evidence has been compiled and summarized by Schultz 1975; Welch 1978; and Jamison and Lau 1982. Their summaries indicate that a number of different methodological approaches within a production framework have been applied.

Griliches' and some of the other early researchers have fitted aggregate production functions to state or county level data. For U.S. data, this procedure has been quite successful in the sense of finding positive and statist ically significant effects of farmers' schooling on farm sales or agricultural productivity (e.g., Griliches 1963, 1964; Fane 1974; Khaldi 1975; Huffman 1976). Although these might be taken as estimates of technical efficiency effects of schooling (and extension), they most likely include technical and allocative efficiency effects.

New and creative approaches have been developed for direct tests of allocative efficiency. Khaldi (1975) and Fane (1975) investigate allocative efficiency by contrasting minimum hypothetical cost of realized output with actual cost. Each finds, using aggregate average data for U.S. farms, that the proportional difference between actual cost and minimum cost declines as farmers' average schooling level increases. Huffman (1974, 1977) and Petzel (1976) consider allocative efficiency in a different way by focusing on the rate of adjustment over time by farmers to new technology and changes in relative prices. Both find that farmers adjust their resource use faster as their average schooling level increases. Huffman's studies also show a positive effect of agricultural extension on allocative efficiency. Wozniak (1984) and Rahm and Huffman (1984), using micro or farm level data, also find a positive effect of farmers' schooling on the adoption of new technology.

Jamison and Lau (1982) have summarized much of the evidence for developing countries. They reached the conclusion that farmers' schooling enhanced the efficiency of agricultural production when there was a technically dynamic environment. Several studies cited by them suggest that a threshold number of years of schooling (4-6 years) must be attained before farmers' education has a consistent, persistent, and statistically significant effect on agricultural production.

Unresolved Issues

The markets and technologies facing agriculture promise to be dynamic in the future. A major challenge for agricultural researchers is to identify types of human capital that enhance adaptive ability of farmers (and agri-businessmen). This includes the relative importance of formal schooling (of different types), experience (O-J-T), information processing ability, and extension and other types of information. We know very little about how the content of education and extension translates into human capital that affects the probability of surviving in agriculture. The government sector is reducing real expenditures on data collection and distribution, but is this a socially beneficial change? What should be the relative role of private and public sector information collection of United States and world business conditions?

For the dynamic agriculture of the future, farmers (and agri-businessmen)

seem likely to need additional training in biological sciences, business-economics-finance, and personal computer use. At what level of technical sophistication is this training needed? How will the private sector firms and public educational institutions (universities, community colleges, high schools, extension service) share these training needs? How should public programs be organized or what groups should be targeted to have the largest social benefit? What role should the extension service have in supplying information?

More research is needed on the economics of occupational entry to and exit from farming, including the retirement decisions of farmers. How is human capital accumulation related to these decisions? What role does human capital play in the greater specialization within agriculture? When individuals leave farming for other occupations, which skills are most useful?

OFF-FARM INCOME

The nonfarm income of U.S. farm operator families has exceeded their net farm income during every year since 1969, except for 1973 and 1975. More than 70 percent of this income is off-farm wage and salary income (U.S. Department of Agriculture, 1984). Off-farm wage income is a result of dual jobholding by farm operators and nonfarm labor force participation of their wives. Off-farm income is a relatively more important source of income for families operating small and medium sized farms than for families operating very large farms.[4/]

The size distribution of farms seems to be taking a bimodel shape in the United States. The relative frequency of small and large farms is increasing at the expense of medium-sized farms (U.S. Department of Agriculture, 1984). For the large number of small farms, off-farm employment of household members is generally the primary source of income. For some of these households, the negative net farm income is the price of a lifestyle that they desire to consume. If the families that operate these small farms do not have off-farm income, poverty is almost assured.

Some Concepts

The human resource endowment of farm families, especially of adults, and its allocation among farm, off-farm, and household work are important determinants of family income and welfare. Off-farm labor-supply decisions of farm household members can be viewed as the result of household utility maximization subject to constraints on human time, income, and farm technology (Rosenzweig 1980; Huffman 1980; Sumner 1982). Adults are permitted to have dual employment, on-farm and off-farm. Household members' welfare is assumed to be summarized in a single household utility function and to depend on a vector of members' home or leisure time and goods purchased for direct (or indirect consumption).[5/] The household is assumed to face constraints. First, a vector of human time endowments of members is allocated between farm work, off-farm work, and leisure or home time. To simplify the analysis, the time allocation of only one (or two) adult household members (e.g., husband and wife) is considered. Because men and women generally acquire different skills, their time is indexed separately. Second, households receive income from members' off-farm wage work, net-farm income, and other sources, and they spend this income (largely) on goods for consumption. (Because these are one

period models, saving does not generally have a key role.)[6/] Third, the transformation of farm inputs into farm outputs is restricted by the technology. Farm output is produced by a vector of labor inputs, a vector of purchased inputs, and environmental inputs.

In this model, the off-farm labor supply decisions are made jointly with household consumption and farm production decisions. Thus, the off-farm labor supply functions have as determinants the off-farm wage rate, prices of purchased consumption goods, prices of variable farm inputs, price of farm output(s), and environmental variables, including the schooling level of adult household members. The expected marginal effects of these variables on off-farm labor supply are, however, generally indeterminant.

The off-farm labor demand or wage-offer equations of adult household members are assumed to depend on their marketable human capital, local labor market characteristics, and possibly job characteristics (Rosenzweig 1980; Sumner 1982). Marketable skills may be proxied by the amount of formal schooling, vocational training, and experience of an individual, and each of these variables is expected to increase the wage. Local labor-market conditions are expected to affect labor demand functions when workers and firms are immobile and when local labor markets for particular skills are thin. Land rental and ownership opportunities, location of cities and towns and tied spouses are expected to be a source of reduced labor mobility in rural labor markets. Thin labor markets are due to a small local labor market for many specialized skills in non-metropolitan areas. As a simplification, the wage rate faced by individuals is generally assumed to be independent of hours of off-farm work.

Within this framework of off-farm labor supply and labor demand functions, which has been derived from modern labor economics, the effects of human capital variables on off-farm hours can be investigated. Although the conceptual model suggests that all household consumption and farm production decisions should be considered jointly, data availability considerations have generally caused these studies to consider off-farm hours in isolation from other decisions on production and consumption. Sometimes production decisions are separable from consumption decisions (Barnum and Squires).

Previous Results

Empirical studies of off-farm work have focused almost exclusively upon farmers. This includes Ph.D. dissertations by Barros, Schaub, and Sexton, and articles by Huffman (1980) and Sumner (1982). Exceptions are Lange; Huffman and Lange; Rosenzweig; and Evenson where decisions of males and females are considered.

For U.S. farmers, off-farm wage rates have been shown to increase with farmers' schooling and age (or experience). The effect of age (experience) is quadratic (inverted U). Vocational training has, however, frequently had a negative effect on off-farm wage rates (Sumner 1982; Huffman and Lange 1984). The reason for this surprising result is that completing vocational training apparently represents an adjustment for an individual's ability. Individuals who have obtained vocational training may be less able and earn a lower wage, other things equal.[7/]

Off-farm work decisions include participation and hours components. In reduced form equations, farmers' schooling and nonfarm vocational training tend to increase the probability of their participating in off-farm work. Being farm raised or past farming experience reduces the probability of off-farm work among farmers.

In quasi-structural off-farm hours equations fitted to data for off-farm work participants (those with zeros are excluded), the coefficient of the farmers' wage rate is sometimes positive (e.g., Sumner 1982) and sometimes negative (e.g., Huffman and Lange 1984). Being farm raised or past farming experience reduces off-farm hours supplied. Farmers' schooling has had mixed effects on their hours of off-farm work.

Unresolved Issues

With large structural changes in agriculture, changes in rural communities, and changes in family composition, many of the researchable issues associated with off-farm employment of farm household members are unexplored. We know very little about the life-cycle aspects of dual jobholding at farm and off-farm work and how this relates to farm investment decisions. Also, to what extent is off-farm participation affected by business and farm income cycles? How are husband's and wife's off-farm work decisions interrelated? How serious are tied-spouse and thin labor-market effects on wage rates and on off-farm participation? How have diffused rural development strategies of the 1960s and 1970s affected off-farm participation rates and income levels of farm household members (Marshall, pp. 73-76)? What skills provide the highest expected return for dual jobholders? Skills that have a dual purpose of raising the productivity of time at both farm and off-farm work promise higher returns than other skills. This may be general as opposed to vocational schooling.

For households that operate small farms, the theory of the household as a combined producing and consuming unit is a promising framework for evaluating their welfare. Time spent working on their farm and home produced food may be a significant direct source of household utility. This should be taken into account in considering the distribution of income of households.

FARM LABOR

Farm work is done by farmers, their spouses and children and hired (non-family) workers. The total amount of labor input and average labor intensity of agricultural production have shown long term declines since about 1910 because of the rising value of human time and mechanization. Fruit, vegetable, and nursery crop production continue to be labor intensive relative to other agricultural products because of significant hand labor, especially at harvest time. Overall, hired and contract farm labor expenses make up about 13 percent of all production expenses, but they average about 56 percent of all production expenses on fruit, vegetable and nursery crop farms (Coltrane, p. 11). Although these vegetable and horticultural crop farms comprise about 6.4 percent of all farms, they incur about 35 percent of all expenses on hired and contract labor (Coltrane, p. 14). Geographically, these expenses are highly concentrated in two states, California and Florida. Currently, most hired farm workers are relatively young (less than 25 years of age) and work only a few weeks on average per year. Immigrant farm laborers are concen-

trated in the labor intensive fruit and vegetable production areas (Coltrane).

Important human capital topics associated with farm labor are the low economic returns to schooling and worker mobility, including migration and immigration. Except for farm operators, formal schooling levels of farm workers are on average low. The U.S. Department of Labor has, however, sponsored training programs that are targeted to seasonal farm workers (Rochin; Martin 1985).

Models and Previous Results

Much of the farm labor research has focused upon aggregate labor supply and demand, aggregate labor demand, and disaggregate laobr demand. The aggregate farm labor market analyses by Schuh (1962) and Tyrchniewicz and Schuh (1966, 1969) are well know. Schuh (1962) considers a two-equation simultaneous equation model of the national market for hired farm labor, where labor is defined as the number of workers. The quantity supplied of hired labor is considered to be a function of the agricultural wage rate, expected nonfarm income foregone, and the size of the civilian labor force. The quantity demanded of hired labor is a function of the price of farm labor, the price of other farm inputs, and the price of farm output. The equations have a partial adjustment mechanism of the Nerlovian type. For the national labor market fitted (1927-57), Schuh obtains estimates of supply elasticity of .25 for the short run and .76 for the long run. The estimates of the demand elasticities were -.12 for the short run and -.40 for the long run. When Tyrchiewicz and Schuh (1969) expanded the farm labor market model by adding four equations for the demand and supply functions of operator labor and family labor, the size of the estimates of the supply elasticities for hired farm labor more than doubled.

The aggregate demand for farm labor has been considered within a multiple-input production framework where the labor demand function is one of several input demand functions. These equations have been fitted to U.S. data for a national aggregate (Antle) and state aggregates for pooled states (Binswanger) and one or two states (Shumway; Weaver). In these studies, all types of labor are aggregated together and generally labor is adjusted for quality by employing some type of schooling index. Although all of these studies report estimates of the elasticity of demand for farm labor, I am focusing on Antle's results obtained for the period 1910-1978. His results show (suggest) that the wage elasticity of farm labor demand is much smaller in the post-World War II than in the pre-war years. The estimate of the wage elasticity of labor demand is -1.31 for the years 1910-46, but it is near zero (-.008) for the years 1947-78. This suggests that the demand for farm labor, where all components are aggregated together, is not currently wage responsive.

The labor demand functions that individual hired farm workers face are undoubtedly affected by a number of economic and other factors. For example, a small share of the hired farm workers (perhaps 5 percent) are migratory and others are illegal aliens. For individuals employed at nonfarm jobs, hedonic wage equations have been fairly successful in explaining wage rates (e.g., DaVanzo et al.). For hired farm workers, earnings functions have been fitted by Emerson and Matta (1984) that include human capital variables. Emerson

(1984), using a 1970-71 sample of male Florida hired farm workers found that for nonmigrants, one year of schooling increases earning by 1.9 percent and one year of experience increased earnings by 1.5 percent. (In obtaining these estimates, the share of time allocated to different occupational categories and total weeks worked are being held constant.) Matta (1984), using hired farm working force micro data for 1975, has also fitted earnings functions. For male hired farm workers, who worked primarily on farms, one year of schooling increased earnings by 1.6 percent and age had a positive but diminishing marginal effect on earnings. Earnings seem to peak at age 24, holding days worked constant. These results suggest that schooling of farm workers may affect their wage, but the size of this coefficient is smaller than estimates obtained for males that are employed at nonfarm jobs (DaVanzo et al.).

Wage rates for seasonal field workers are frequently set on a piece rate basis. Martin (1985) indicates that the employer sometimes records individual's accomplishments and in others a work crew (of 20-40 individuals) divides a piece-rate wage. In both cases, the daily rate of pay is determined by the speed per hour and number of hours worked per day. When individuals share a piece-rate, the crew can be expected to consist of individuals who work at a similar, generally fast, pace.[8/] Formal schooling seems unlikely to be important for determining a workers' daily wage in a piece-rate system, but experience, physical endurance, and strength seem likely to be quite important. Martin (1985) indicates that daily earnings of piece-rate workers tend to peak when they are relatively young. This is common when little formal training is required and physical strength and endurance peak at a relatively young age. Earnings peak close to the age of peak physical endurance.

Although concerns have been expressed about wage rates and employee benefits paid by U.S. employers of seasonal farm labor, these employers are frequently engaged in intense international competition, e.g., fresh fruit and vegetable producers. Because labor, especially harvest labor, is a relatively large share of the cost of production, producers may try to find lower cost mechanization or labor (Coltrane). Martin (1985) describes labor-saving harvest mechanization and labor-using field packing that have been adopted in California to reduce labor costs. Immigrant farm labor is frequently a lower cost source of field workers than domestic workers. Some of these workers have been admitted under special work permits (e.g., H-2 Temporary Foreign Worker Program), but since the end of the Bracero program in 1964, a large majority of the immigrant workers in U.S. agriculture are illegal Mexican aliens (Coltrane).

Most of the aliens come to the United States because wage employment opportunities are much better here than in their home country. For example, the daily wage rate for low-skilled agricultural labor in the United States is more than five times higher than in Mexico. Analyses of the effects of illegal aliens on farm labor market (and other labor markets) are impeded by the absence of statistical information on the number of illegal aliens employed in U.S. agriculture, the amount of time they work, and the location of their work. Torok and Huffman have, however, made some progress. New and stricter immigration legislation may change significantly the supply of immigrant labor to agriculture in the future.

Unresolved Issues

The labor intensity of agricultural production seems likely to continue to decline in the future. Biogenic research has the potential for developing new fruit and vegetable varieties that ripen uniformly, and robotic type technology has the potential for the development of new fruit and vegetable harvesting technology. Computer technology can also control and monitor machinery, crop irrigation, and livestock feeding systems.

Many of the unsettled issues associated with farm labor seem to be associated with immigrant labor. What effect do illegal immigrants have on wage rates for agricultural labor and availability of dependable harvest labor? To what extent would a strict immigrant labor program shift the comparative advantage of fruit and vegetable production to foreign producers and away from U.S. producers? How price responsive is the development of new labor-saving technologies for fruit and vegetable production? Can computer information systems be employed to help the seasonal farm labor market function more efficiently?[9/]

U.S. Department of Labor CETA 303 and JTPA 402 programs are specifically targeted to migratory and seasonal farm workers. These are primarily training programs to enhance job skills of farm workers, either for farm work, especially in machinery machanics and welding, or for nonfarm jobs, mainly clerical. Given the substantial funding of these programs, they need to be evaluated for impact. Have they been a good social investment? Recently these programs have promoted skills for full-time employment of workers in agriculture rather than leaving agriculture for nonfarm jobs. Have they had a significant effect on the supply (total or specific skills) of farm labor?

New personnel management programs have been suggested for employers of significant numbers of farm workers. The basic idea is that employers can increase worker productivity by providing improved work conditions and worker benefits. The key question is whether workers and employers can both be made better off by altering the total compensation package to include a larger share of nonwage benefits. These programs need careful evaluation, because in our highly competitive agriculture, firms are likely to have small margins for adjusting employees' total compensation.

Much of the general research and extension activities dealing with farm labor are impeded by an absence of good quality and regularly collected data on hours worked and wage rates. A higher priority should be placed on obtaining and preserving this data.

FOOD, NUTRITION AND HEALTH

Significant increases in the life-spans of people in developed and developing countries have occurred during the past 30 years (Fuchs; Ram and Schultz; Schultz 1984). These changes are unmistakably linked to the production of good health and are important for how households allocate their resources over a lifetime. Agricultural economists have made their main contribution to this area through consumer demand studies, which have a long history. These include the estimates of income and price effects and food program effects on households' demand for food and nutrients. The demand for food and nutrients are derived from the demand for good health, a form of

human capital, and other considerations.[10/]

Some Concepts

The new home economics provides a rich new framework for considering the production and consumption of good health by households. The early theories of consumer choice, however, considered the household to be a pure consuming unit. Goods purchased in the market were considered to be direct sources of welfare (utility). Furthermore, households purchased these consumption goods from exogenously determined income. Thus, the quantity demanded of goods depended on their prices and household income. Unfortunately, this methodology is being perpetuated in a number of studies today.

First, these studies ignore the basic labor supply decision, which in most households is made jointly with consumption decisions (Keeley; Barnum and Squires). In its simplest form, leisure of adult household members is a consumption good. Leisure and purchased goods enter the household utility function. Households also face a time constraint on adult household members' time. Their time is allocated between leisure and work for a wage (and possibly farm work). The household receives income from wage work and assets (and possibly a farm business). When households choose the quantity of labor and market goods that maximizes utility subject to the human time and income constraints, the demand functions for purchased goods are altered. They now include the prices of the purchased goods and the wage rate. The wage rate is the price of leisure. Also, asset income enters these demand functions rather than total household income. Earnings from work are the product of hours of work, which is endogenous, and the wage rate, which is the price of leisure. Thus, different sources of income are expected to have different effects on household choices on food, nutrients, and other goods.

Second, food and nutrients are not really an end in themselves. They are one input into the production of (good) health and other commodities (e.g., life styles) that the household members consumes. Household production is an innovation of the "new home economics". (See Becker 1981; Michael and Becker 1973; Nerlove 1974; Becker 1965.) In this model, the inputs of human time of one or more household members, food, other inputs are transformed by the technology of household production into commodities for final consumption (e.g., good health, life style, children, meals, vacations) or to energy and skills. Environmental variables (genetic potential, education and age of household members, availability of health facilities ingredient and nutrient labeling of food, hazardous substances) may affect the efficiency of household production. A key relationship is how food and nutrients map into health (and work).

Third, individuals' participation in food programs, e.g., school lunch and health programs, is the result of a joint set of food and other household choices (Heckman).

Previous Findings

Much of the recent research on household demand for food and nutrients in U.S. households is summarized in a paper by Davis. He points out that the useful implications of the new home economics have been ignored in most studies. Nutrient demand studies have considered "available" nutrients in food, based upon standard nutrient-food tables, rather than actual nutrients

consumed. Households can be expected to differ in their efficiency of converting available nutrients into consumed nutrients. Nutrients may be lost in the storage and preparation of food and the amount of this loss may be related to education and information. He also shows that most studies have not made a distinction between asset and labor income or included a wage variable in food or nutrient demand functions.

Studies by Adrian and Daniel and by Price, et al. are examples of U.S. demand studies for nutrients. Adrian and Daniel consider the annual intake of eight nutrients. Their income variable is annual disposable household income, and they find a positive but diminishing marginal income effect on all nutrients, except for carbohydrates. They employ the suspect practice of including a dummy variable for wife's employment.

Price, et al. considers the demand for food nutrients by school children and participation in school food programs. The per child demand for total energy and 11 food nutrients is assumed to depend on a fairly large set of variables. Some of these variables are really jointly determined with nutrient intake, e.g., frequency of participation in school lunch programs, frequency with which particular types of food are served at home. In four of the ten nutrient demand equations, assets (liquid or total) have a positive effect on nutrient consumption. No wage variable is, however, included in the demand functions. Although the coefficients of dummy variables for participation in school food programs have positive signs, this is an unsatisfactory modeling strategy.

For farm households in developing countries, Strauss and Pitt and Rosenzweig have investigated the effects of better nutrition. Strauss, using data for farm households in Sierra Leone, finds that calories consumed have a positive marginal product in an estimated farm production function. Pitt and Rosenzweig, using a productive household model and Indonesian data on individual nutrients and health, investigate how changes in commodity prices and health program interventions alter household nutrient intake and health status of individuals and how changes in the composition of nutrients directly alters health.

Unresolved Issues

We know relatively little about the life-span revolution. It does, however, seem to be the result of long term processes of health production that are centered in the household and affected by the environment. Preventive health or health maintenance seems to be much more important than acute or emergency medical care (Fuchs). We need more research on the link between food or nutrient consumption and good health, including energy, work-days, and life expectancy.[11] Also, how is the production of good health being affected by the generally rising value of human time over time, by increased labor force participation of women, by nutrient education programs, and by food programs? What is the relationship between good health, life expectancy, and education? These are largely unresolved but researchable issues.

Although there have been a relative abundance of household foods and nutrient demand studies, we do not have very good estimates of the pure income and wage effects. Agricultural economists should incorporate the recent advances in modeling pioneered in labor economics and the new home economics.

Useful consumer information is a form of human capital. Both public and private sectors are engaged in distributing food and nutrient information relating to good health. Consumer groups have been influential in adding ingredient and nutrient labels to food. What have been the effects on food demand and good health of these labels? The extension service has a long history of supplying food and nutrient information. What effect have these programs had on food demand and good health? Have the content and emphasis of extension food and nutrition programs been changed due to activities of farm commodity pressure groups? If they have, how might we alter our institutional framework to protect the social good?

CONCLUDING REMARKS

The view that I have presented is one where investments in human capital make an individual more productive. An alternative view is the screening or signaling hypothesis. It is most closely tied to the relationship between schooling and wage rates, when information on workers' potential performance is imperfect. According to this view, schooling has no direct effect on workers' useful skills. Schooling is a certification system used to identify pre-existing (might be innate) skills. Completion of a certain level of schooling is a signal to employers that workers have certain desirable characteristics for which the employer is willing to pay a particular wage. If schooling was primarily a screening device, cheaper screening methods seem likely to have been developed and to have replaced it. Also, schooling as a screen has no meaningful role in self-employed occupations.

In the human capital framework, investments in useful skills increase a workers' productivity. The value of these skills as a source of income is, however, determined largely by market conditions. In a system of well functioning labor markets that are in equilibrium, compensating differentials for higher levels of training would be expected to provide a normal rate of return. Labor market conditions sometimes change or are different than expected, and wage rates may become depressed for particular labor services, until individuals can make adjustments. With tied spouses and thin labor markets for many skills in rural areas and small towns, some skills may not be fully employed or may not increase wage rates much over those received for skills requiring less training.

References

Adrian, J. and R. Daniel. "Impact of Socioeconomic Factors on Consumption of Selected Food Nutrients in the United States," Am. J. Agr. Econ. 58 (1976):31-38.

Antle, John J. "The Structure of U.S. Agricultural Technology, 1910-78," Am. J. Agr. Econ. 66 (1984):414-421.

Barnum, H. N. and L. Squire. "An Econometric Application of the Theory of Farm Household," J. of Dev. Econ. 6 (1979):79-102.

Barros, G.S.D.C. "Asking Wages, Market Wages, and the Off-Farm Labor Supply by Farm Operators." Ph.D. dissertation, North Carolina State University, 1976.

Becker, Gary S. "A Theory of the Allocation of Time," Econ. J. 75 (1965):493-517.

Becker, Gary S. Human Capital, 2nd ed., National Bureau of Economic Research, New York, 1975.

Becker, Gary S. A Treatise on the Family. Cambridge, Mass.: Harvard University Press, 1981.

Binswanger, H. P. "The Measurement of Technical Change Biases with Many Factors of Production," Am. Econ. Rev. 64 (1974):964-76.

Coltrane, Robert. Immigration Reform and Agricultural Labor. U.S. Dept. of Agr., Econ. Res. Serv., Agricultural Economic Report No. 510, April 1984.

DaVanzo, J., D.N. DeTray, D. H. Greenberg. "The Sensitivity of Male Labor Supply Estimates to Choice of Assumptions." Rev. Econ. and Statist. 58 (1976):313-325.

Davis, C. G. "Linkages Between Socioeconomic Characteristics, Food Expenditure Patterns, and Nutritional Status of Low Income Households: A Critical Review," Am. J. Agr. Econ. 64 (1982):1017-1025.

Emerson, Robert D. "Migration in Farm Labor Markets," in R. D. Emerson, ed., Seasonal Agricultural Labor Markets in the United States. Ames, IA: The Iowa State University Press, 1984, pp. 104-135.

Evenson, R. E. "Time Allocation in Rural Philippine Households," Am. J. Agr. Econ. 60 (1978):322-330.

Fane, George. "Education and the Managerial Efficiency of Farmers," Rev. of Econ. and Statist. 57 (Nov. 1975):452-461.

Fuchs, Victor R. "The Economics of Health in a Post-Industrial Society," The Public Interest 59 (1979):3-20.

Griliches, Zvi. "The Sources of Measured Productivity Growth: United States Agriculture, 1940-1960," J. of Polit. Econ. 71 (Aug. 1963):331-346.

Griliches, Zvi. "Research Expenditures, Education, and the Aggregate Agricultural Production Function," Am. Econ. Rev. 54 (Dec. 1964):961-974.

Heckman, James J. "Sample Selection Bias as a Specification Error," Econometrica 47 (1979):153-162.

Huffman, Wallace E. "Decision Making: The Role of Education," Am. J. of Agri. Econ. 56 (Feb. 1974):85-97.

Huffman, Wallace E. "Productive Value of Human Time in U.S. Agriculture," Am. J. Agr. Econ. 58 (1976):672-683.

Huffman, Wallace E. "Allocative Efficiency: The Role of Human Capital," Quart. J. of Econ. 91 (Feb. 1977):59-77.

Huffman, Wallace E. "Farm and Off-Farm Work Decisions: The Role of Human Capital," Rev. Econ. Statist. 62 (1980):14-23.

Huffman, Wallace E. "International Trade in Labor versus Commodities: U.S.-Mexican Agriculture," Am. J. Agr. Econ. 64 (1982):989-998.

Huffman, Wallace E. and M. D. Lange. "Off-Farm Work Decisions of Husbands and Wives: Joint Decision Making." Unpublished paper, Iowa State University, April 1984.

Huffman, Wallace E. "Human Capital, Adaptive Ability, and the Distributional Implications of Agricultural Policy," Am. J. Agr. Econ. 67 (1985) forthcoming.

Jamison, Dean T. and L. J. Lau. Farmer Education and Farm Efficiency. Baltimore: The Johns Hopkins University Press, 1982.

Johnson, Glenn L. and S. H. Wittner, Agricultural Technology Until 2030: Prospects, Priorities and Policy. Michigan State University, Agricultural Experiment Station Special Report 12, July 1984.

Keeley, Michael C. Labor Supply and Public Policy. New York: Academic Press, 1981.

Khaldi, Nabil. "Education and Allocative Efficiency in U.S. Agriculture," Amer. J. of Agri. Econ. 57 (Nov. 1975):650-657.

Lange, Mark D. "An Economic Analysis of Time Allocation and Capital Labor Ratios in Household Production of Farm Families in Iowa," Ph.D. dissertation, Iowa State University, 1979.

Marshall, Ray. Rural Workers in Rural Labor Markets. Salt Lake City: Olympus Publishing Co., 1974.

Michael, R. T. and G. S. Becker. "On the New Theory of Consumer Behavior," Swed. J. Econ. 75 (1973):378-396.

Martin, Philip L. "Seasonal Workers in American Agriculture: Background and Issues." Research Report Series RR-85-04, National Commission for Employment Policy, Washington, D.C. March 1985.

Matta, Benjamin N. "The Off-Farm Work of Hired Farm Workers," in R. D. Emerson, ed., Seasonal Agricultural Labor Markets in the United States. Ames, IA: The Iowa State University Press, 1984.

Nerlove, Marc. "Economic Growth and Population: Perspectives of the 'New Home Economics'." Reprint of Agricultural Development Council, New York, Nov. 1974, pp. 1-11.

Petzel, Todd E. "The Role of Education in the Dynamics of Supply," Amer. J. of Agri. Econ. 60 (Aug. 1978):445-451.

Pitt, Mark M. and M. R. Rosenzweig. "Health and Nutrient Consumption Across and Within Farm Households." Rev. Econ. and Statist. 67 (1985):212-223.

Price, David D., D. A. West, G. E. Scheier, and D. Z. Price. "Food Delivery Programs and Other Factors Affecting Nutrient Intake of Children," Am. J. Agr. Econ. 60 (1978):609-618.

Rahm, M. R. and W. E. Huffman. "The Adoption of Reduced Tillage: The Role of Human Capital and Other Variables," Am. J. Agr. Econ. 66 (1984):405-413.

Ram, R. and T. W. Schultz. "Life Span, Health, Saving and Productivity," Econ. Dev. and Cultural Change 27 (1979):399-422.

Rochin, Refugio. "Farm Worker Service and Employment Programs," in R. D. Emerson, ed., Seasonal Agricultural Labor Markets in the United States. Ames, IA: Iowa State University Press, 1984, pp. 412-446.

Rosenzweig, Mark R. "Neoclassical Theory and the Optimizing Peasant: An Econometric Analysis of Market Family Labor Supply in a Developing Country," Quart. J. Econ. 94 (1980):31-56.

Schaub, James O. "A Simultaneous Equations Model of Multiple Job Holding Farmers with Endogenous Farm Inputs." Ph.D. dissertation, North Carolina State University, 1980.

Schuh, G. Edward. "An Econometric Investigation of the Market for Hired Labor in Agriculture," J. Farm Econ. 44 (1962):307-21.

Schuh, G. Edward. "U.S. Agriculture in the World Economy." Farm Policy Perspectives: Setting the Stage for 1985 Agricultural Legislation, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, 98th Congress. Washington, D.C.: U.S. Government Printing Office, April 1984.

Schultz, T. W. "Investments in Human Capital." Am. Econ. Rev. 51 (1961):1-17.

Schultz, T. W. "The Value of the Ability to Deal with Disequilibria," J. of Econ. Lit. 13 (Sept. 1975):827-846.

Schultz, T. W. "The Changing Economy and the Family," Department of Economics, University of Chicago, Human Capital Paper No. 84 (Aug. 1984):3.

Shumway, C. R. "Supply, Demand, and Technology in a Multiproduct Industry: Texas Field Crops," Am. J. Agr. Econ. 65 (1983):748-60.

Sexton, R. N. "Determinants of Multiple Job Holding by Farm operators." Ph.D. dissertation, North Carolina State University, 1975.

Strauss, John. "Does Better Nutrition Raise Farm Production?" Unpublished paper, Yale University, March 1984.

Sumner, D. A. "The Off-Farm Labor Supply of Farmers," Am. J. Agr. Econ. 64 (1982):499-509.

Torok, S. J. and W. E. Huffman. "U.S.-Mexican Trade in Winter Vegetables and Illegal Immigration." Unpublished paper, Iowa State University, June 1985.

Tyrchniewicz, E. W. and G. E. Schuh. "Regional Supply of Hired Labor in Agriculture," J. Farm Econ. 48 (1966):537-56.

Tyrchniewicz, E. W. "Econometric Analysis of the Agricultural Labor Market," Am. J. Agr. Econ. 51 (1969):770-87.

U.S. Department of Agriculture. Economic Indicators of the Farm Sector. U.S. Dept. of Agr., Econ. Res. Serv., 1984.

Weaver, R. D. "Multiple Input, Multiple Output Production Choices and Technology in the U.S. Wheat Region," Am. J. Agr. Econ. 65 (1983):45-56.

Welch, Finis. "Education in Production," J. of Polit. Econ. 78 (1970):35-59.

Welch, Finis. "The Role of Investments in Human Capital in Agriculture," in T. W. Schultz, ed., Distortions of Agricultural Incentives. Bloomington: Indiana University Press (1978):259-281.

Wozniak, Gregory. "The Adoption of Interrelated Innovations: A Human Capital Approach," Rev. of Econ. and Statist. 66 (1984):70-79.

Footnotes

1/ I have undoubtedly excluded some topics and issues that are important to the agricultural economics profession.

2/ At this point, it is useful to think of structural change as being imposed by events that are outside the direct control of farmers. Farmers and others may, however, form interest groups which lobby for governmental policies that affect the size of gains and losses from other structural changes.

3/ Given the random nature of weather, biological, and economic events and heterogeneity of agriculture, some farmers who have considerable ability will also be unsuccessful. Some of the uncertainty associated with farming is, however, insurable.

4/ The number and share of farm households that report off-farm wage income is clearly conditioned by the definition of a farm. The U.S. Department of Agriculture and Census of Agriculture have chosen a farm definition which is not very restrictive, i.e., a place that has annual sales of farm products in excess of $1,000 (after 1974). Under this definition, we would expect a significant amount of off-farm work.

5/ The model can be extended to permit households to receive utility directly from the work of its members.

6/ A multiple-period farm-household model could be used to investigate life-cycle patterns in work, consumption, and investment. In this model type, it may be useful to distinguish between permanent and transitory income. Allocating more time to off-farm work and less time to farm work is one way that farm households can reduce the variance of hosuehold income.

7/ If most of the vocational training is obtained in high school, the negative coefficient could also imply that a year of vocational courses has less effect on wage rates than a year of general schooling.

8/ If the crew consists of a family, more variation in the pace of work by crew members would be expected.

9/ The combination of piece rate wage rates and the labor contractor system, which provides the market coordinating function between employers and workers, seems to function relatively efficiently. Thus, it is not obvious that a computer information system would be superior to existing network that have been built up over time.

10/ Some advances in food production and processing that have lowered the price of food may have also lowered food quality and have implications for good health. During the past 15 years, there have been large increases in easily available nutrient information on food packages and containers in the United States.

11/ As with other human capital concepts, obtaining an adequate measure of good health is difficult.