

FOOD AND AGRICULTURE IN THE 1980s: THE IMPLIED RESEARCH PRIORITIES

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Several factors arose during the post-World War II era and particularly the 1970-1980 decade which had a great impact on the U.S. food and agriculture system—including forestry, fiber, and related activities. They include (1) the increasing interdependence among the basic industries of agriculture and forestry and other sectors of the domestic and world economies, (2) the emergence of a technology highly dependent on petroleum and petrochemicals accompanied by increasing dependence of the U.S. on foreign sources of petroleum, the cartelization of major foreign crude oil suppliers under OPEC, and an increased vulnerability to worldwide political unrest, (3) the rapidly expanding export market for farm food and feed commodities and the reliance on farm commodity exports to help offset a growing deficit in international trade, (4) the rapid commercialization and industrialization of the food and agriculture sector, and (5) the increasing social awareness and demands for improved environmental quality and human health that led to public regulations affecting the food and agriculture system.

These factors increased the extent to which U.S. producers and consumers of food, fiber, and forest products are affected by national and world economic, social, and political conditions. They also provide the basis for heightened concern about many issues and problems confronting U.S. food and agriculture in the decade ahead. Domestic commodity policy issues and federal programs for southern commodities, international trade policies for farm commodity exports, issues involved in formulating a structures policy for food and agriculture, new energy sources for agriculture, fossil-based energy supplies and costs, and natural resource conservation and use have been identified as topics of concern.

Our task is to identify agricultural economics research priorities implied by these factors, problems, and issues confronting U.S. food and agriculture in the 1980s. We do not attempt to cover all research implications and have chosen to focus on research needs in four areas:

1. Structural changes in food and agricultural production-marketing subsectors.
2. Interregional competition and rural economies.
3. International trade in food and agricultural products.
4. Natural resource and environmental constraints.

STRUCTURAL CHANGES IN PRODUCTION-MARKETING SUBSECTORS

Forces on both the domestic and international fronts influence the structure of the food-agricultural system. These forces are technological, economic, social, and political.

The technological forces are the most apparent and easiest to quantify. Mechanization—with its accompanying labor efficiency—is the primary force underlying the trend toward larger and fewer farm producing units. Specialization and an effective exchange system are necessary to provide the capital and cash flow needed for adopting most emerging technologies. The same kinds of forces also are operating in the food fabricating-distribution sector.

The price of food to the U.S. consumer and domestic prices of farm commodities and purchased inputs are influenced by international markets for raw agricultural products and purchased farm inputs. Understanding the international market is essential to analyzing the production and marketing problems confronting U.S. food and agriculture. Increased interdependence of agriculture with other sectors of the U.S. and world economies and the increase in uncertainty that has accompanied this growing interdependence have become dominant themes in a wide range of national and international issues.

Sorenson (p. 5) and Martin (p. 42) have stressed the need for more general macroeconomic models of the food and agricultural, nonagricultural, and international sectors for

empirical analyses. The development and empirical testing of general macroeconomic models will depend on much additional research to identify emerging technologies, estimate their economic, social, and environmental impacts, and evaluate policies and programs to minimize the adverse effects of these emerging technologies. The priority research needs for domestic food and agricultural production-marketing subsectors include the following.

1. Estimation of subproduction functions for more efficient combination of inputs used to produce major food and agricultural commodities. Fossil-based energy and capital intensive technologies traditionally have been substituted for labor and land. Consequently, we have developed an agricultural production technology that is dependent on petroleum. Prospects of the prices of fossil-based energy increasing substantially over the next decade pose uncertainties for agricultural firms, particularly in the ways they are organized and managed. The process of substituting petroleum energy and petrochemicals for land and labor is going to be halted until new sources of energy and petrochemicals or new energy efficient technologies emerge. Both appear to be more than a decade in the future (Lu et al.).

Much of our research involves application of production relations of the 1940s and 1950s vintage to examine the impacts of changes in relative prices of inputs on factor demands and supplies, agricultural output, income, resource use, etc. We need to reexamine the input-output alternatives for producing food and fiber products. We will be required to work more closely with our biological and physical science colleagues in this effort.

2. Analyses of long-range alternatives for organizing agricultural production, including the economics of size and structure in farming and the interrelationships among land, farm labor, energy, machines, and petrochemicals. Much of this information will stem from research on subproduction functions. We also need to assess (1) the economies of large-scale buying and selling and the financing of farming operations, (2) the integration of farms with firms supplying inputs and/or marketing, processing, and retailing functions, and (3) improvements in labor productivity on farms, including the income and competitive position of farms of different sizes.

The analyses must include the effects of alternative production technologies on the competitive position of producing regions and on the associated production, income, and resource use within each region. Alternative public policies and institutions designed to influence the structure of agriculture are also likely to emerge.

3. Estimates of short-run production by

regions under current production technologies and alternative farm policies, product prices, and farm input cost and supply conditions. We have emphasized the need for a longer-run look at agricultural production technologies and the adjustments attendant to those relationships. In the interim, it is important to continue examining production, income, and resource use as related to specific commodity prices, input costs, and government programs. Such analyses should also include the effects of the major economic and policy forces on the competitive position of producing regions.

4. More research on the nature and structure of demand for food and agricultural products. A progressive, dynamic agriculture-food system must be geared to the market—both domestic and international. Many forces, including rising affluence and varying rates of change in world population, will have an impact on the market. Other forces, such as nutrition and health concerns, social structures, and life styles also will affect markets, especially on the domestic front.

Information is needed on regional markets for food and fiber commodities. The energy crunch will require more efficient movement of products from producing areas to consuming areas. Rising costs of transportation also might necessitate some relocation of primary production. At any rate, more information on final consumer markets in spatial detail—both in the domestic and world markets—is needed to address these problems within an interregional-transshipment competition framework. Such information would include the nature of price and income elasticities for most food and fiber products in regional markets, as well as assessment of the longer-term growth potential of these markets.

5. Research to streamline exchange and transportation systems. Exchange (transfer of ownership and price discovery), assembly, and distribution of farm commodities and final consumer products are fundamental components of an efficient food-agricultural system. In fact, an effective exchange system is essential to adoption of the new production technology that accompanies specialization in production.

Modern communications technology has not been fully analyzed in terms of its adaption to commodities exchange systems. Electronic exchange systems could widen the scope of markets available to the primary farm producer, enhance the price discovery mechanism, and provide both buyers and sellers with timely information on prices, quantities, and physical characteristics of products.

Electronic exchange systems could also be integrated with the vast transportation system necessary to assemble and distribute agricultural commodities and food products.

Rising energy and labor costs will necessitate a better coordinated, more efficient transportation system. The potential for increased efficiency through electronic exchange systems has not been thoroughly assessed. Research is needed to provide basic information about an electronic exchange system, especially the capabilities and costs of alternative exchange systems and/or modifications, by simulation and other analytical techniques.

6. Research related to government policies and programs. Policies and programs of the U.S. government and other governments around the globe will have an appreciable impact on the food-agriculture system of the future—including import-export policies. Programs designed to shift part of the risk of agriculture from primary producers to society will become increasingly important. The emergence of international markets, worldwide political unrest, and advancing technologies that require a higher level of purchased inputs are the main forces contributing to increasing risk in production.

Price supports or guarantees in the form of target prices and storage and loan programs, market quotas and acreage restrictions, food stamps and other domestic food programs, and international food programs all will have an impact on the food-agriculture system of the future.

Research is needed on two fronts: (1) the potential impact of current and proposed programs and (2) examination by simulation and other techniques of the impact of alternative policies and programs on the various segments of the food-agriculture sector in the future, including domestic and foreign consumers.

7. More research on risk management. Risk management is a growing concern both on the farm and in the fabricating-distribution sector. Only a part of the risk can be shifted to society through governments. Also, some risk can be shifted to futures markets. However, risk to some degree is inherent in both the production and marketing system.

Research is needed to identify and quantify the nature of risk. It could be approached by simulating cash flows, including estimates of the probability of various magnitudes of negative cash flows, and evaluating financial mechanisms for addressing the problems of variable prices and income flows. A uniform flow of foods through the production-marketing system is in the interest of the greater society in terms of availability and price stability. However, this uniformity is becoming progressively more difficult to achieve with the dominance of the world market. It is important to know more about the social cost of insuring against risk. We need to know more about the costs of risk to various actors in the economic

system in order to judge whether it is more efficient and equitable to let speculators in futures markets and industry bear the costs and frequently reap windfall gains or to impose some national insurance scheme.

The preceding discussion covers some aspects of the agriculture production-marketing subsectors needing increased research attention. Numerous other topics also warrant additional research: (1) the economics of the farm supply industries, (2) the economics of pesticide use, (3) the impacts of weather on production, (4) the financial structure of farming, financial management, and farm firm growth, (5) institutional aspects of farm labor—including wages, work hours, working conditions, and other employment benefits, and (6) appraisal of various segments of the feed-livestock industry. These topics undoubtedly will receive additional research attention by agricultural economists during the 1980s.

INTERREGIONAL COMPETITION AND RURAL ECONOMIES

Interregional competition has a strong influence on structural changes in food and agricultural production-marketing subsectors (Reimund et al.). Further, rising energy costs may influence competitive positions. The relative competitive positions of regions may change as a result of increased input costs. Accessibility to final product markets and transportation requirements are important factors influencing the competitive positions of regions. Commodity and regional characteristics (e.g., growth in demand, price and income elasticities for food and fiber products, transportation practices and systems, climate, production technology, etc.) need to be known to determine impacts of higher energy prices on interregional competition (Havlicek and Capps). We must seek to understand the relative cost efficiencies of alternative transportation practices and systems, including alternatives to interstate highways, rail, and inland water transportation modes. Except for the economic feasibility, the development of new transportation modes perhaps is outside the domain of agricultural economists, but we should be coordinating our efforts with those of researchers in the engineering and technical sciences to pursue these avenues of inquiry.

The agriculture-food sector, as well as other sectors of the economy, contains both rural and urban components. These are closely interrelated, and cannot be separated in either a functional or an analytical context. Much of the input to the farm sector originates in urban areas, and most of the food fabrication and distribution is also located in urban areas.

The major distribution between rural and urban in the present socioeconomic system is in population density and concentration of socioeconomic activities. Rural areas provide space for crops, forests, and raw materials such as minerals and fossil fuels. Rural areas also provide space for persons associated with urban activities.

Much additional research is needed to identify the nature of the linkages between rural and urban areas and to provide for the needs of people regardless of where they live or how they contribute to the socioeconomic system. Rising costs and decreasing availability of petro products can disrupt the vital linkages between the urban and rural components. We need to understand the ways in which these disruptions can and do occur.

INTERNATIONAL TRADE IN AGRICULTURAL PRODUCTS

Policies of the U.S. government and the governments of other trading nations have a significant impact on U.S. agriculture. Government policies, technological development, structural changes, and weather are major factors contributing to instability in agriculture. The evidence provides increasing support for the hypothesis that a national policy for achieving domestic price stability within countries is the most important cause of international price instability and risk to agriculture (Johnson; Menzie; Schuh 1976).

Much of our research on international trade either introduces government policy as an exogenous variable, or leaves it out entirely on the assumption that governmental agencies or policies in the other trading nations are irrational or unresponsive to economic forces. Schuh (1979) and Menzie (p. 3, 5) identify priority areas of research designed to improve knowledge and understanding of international trade structures and strategies—investigations to (1) understand the economic, political, and social forces at work in other trading nations that influence the level and direction of trade, (2) measure the impacts and distribution of impacts of trade policy changes, (3) provide better understanding of the role of multinational corporations in transferring technology and capital, and (4) understand the problems of developing countries.

NATURAL RESOURCE AND ENVIRONMENTAL CONSTRAINTS

Two other issues will demand more thorough economic analysis during the coming decade—the allocation of land and water between agri-

culture and other needs and the impact of agriculture on the quality of the environment.

More land will be required for industry, residences, recreation, and transportation, and land ownership will also be used as a hedge against inflation. Two major forces underlying the increased demand for land are the growth in personal income that makes this demand effective and the investments in land improvements and man-made substitutes for cropland (Schultz). Land has become a major component of the U.S. financial market. The capital-gain-producing capacity of land will continue to induce an inflow of dollars into purchase of land by both citizens and aliens as inflation continues. Thus farming operations and land ownership may become progressively separated. Webb and Duncan indicate that land can be substituted for mechanical and chemical energy, but it is not apparent that such substitutions will be forthcoming under relative increases in real energy prices. At the rural-urban fringes, farmland may become more valuable for nonagricultural uses (including a hedge against inflation) than for agricultural production. And when land values are inflated, it has been as profitable to hold land unworked as to undertake the effort and risk of farming it (Breimyer).

Economic research is needed to understand more fully the nature of the forces influencing the demand for land. Such analyses could contribute substantially to a reduction in the social conflicts that characterize this issue.

We need to understand more fully the factors affecting the demand for water for alternative uses, especially where groundwater mining is done. Availability of water will have an important influence on the future location of agricultural production activities. Additionally, efficiency of water use in irrigated agriculture will be a major consideration in developing alternative subproduction functions in many regions. Economists can contribute appreciably to the understanding of the economic forces involved and thus aid in resolving this social conflict.

A continuing controversial issue during the coming decade will be the conflict of interest pertaining to the impact of agriculture on the quality of the environment. Much of the controversy surrounding agriculture's impact on the environment focuses on the use of commercial fertilizers and chemicals in crop production. The effect on the food supply of abolishing chemicals in crop production is highly conjectural. We also do not understand the nature of the demand for environmental quality, particularly the components that go beyond those observable in market behavior (Schultz). Economists face many difficult tasks in coming to grips with the real demands for

maintaining and improving environmental quality. Economic studies must concentrate on the tradeoffs between environmental quality and food costs to society if they are to contribute to a more orderly resolution of conflicts between agriculture and the goal of maintaining a clean environment.

CONCLUSION

We have indicated only a few of the priority research issues facing agricultural economists in the decade ahead. Many of the issues confronting agriculture on the national and world scene are predominantly economic. The data base required to address these issues is generally not appropriate for the more aggregative types of analyses and does not supply much information on the goals, motives, and other behavioral aspects of the actors in the system (Martin; Schuh 1979).

There seems to be no coordinated effort to develop or acquire the data necessary to conduct these types of analyses. Physical and biological scientists are highly specialized with a narrow focus on problems related to agricultural technology. Major data gaps either preclude or make exceedingly difficult analyses of production-marketing subsectors, the broader agricultural sector in relation to the domestic and world economy, and other interdependency relationships.

Overcoming these deficiencies requires commitment by both researchers and research administrators. It will require more effective ways of linking together the current talent and the new institutions that attempt to do research on the interdependency of U.S. agriculture with the world economy (Schuh 1979). It also requires redirection of present research efforts and further investment by the public in developing knowledge.

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