FACTORS AFFECTING STRUCTURAL CHANGE IN AGRICULTURAL SUBSECTORS: IMPLICATIONS FOR RESEARCH

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INTRODUCTION

The U.S. farm sector has long been dominated by independent firms exemplifying competitive free enterprise norms. Individual farm operators have had considerable freedom in controlling their own operations. Certain government programs and financial limitations have been the major restraints on their decision making.

In about the past two decades, however, a number of production subsectors have become organized or structured along lines more closely resembling industrial sectors of the economy than the traditional agricultural sector. At the same time, other production subsectors have remained virtually unaffected by this industrialization process and have retained their traditional independent form of organization. Concern over industrialization in agriculture relates to the question of who will control agricultural resources. Some believe large industrialized firms may displace many traditional family farms. There is concern about long-term effects of how those who control these resources use their economic power and ultimately how this affects supplies, prices and income distribution at each stage of the production and marketing process.

Although there has been a great deal of concern regarding structural change and its implications to various segments of the economy, surprisingly little is known about the causes or processes of structural change. This paper is concerned with these causes and processes. First, recent work devoted to delineation of important factors affecting changes in the structure of agricultural production subsectors will be summarized, then several major areas for further research on structural change that emerged from this study will be outlined.

SUMMARY OF COMPARATIVE ANALYSIS

The purpose of working on factors affecting structural change was to identify, isolate and analyze factors thought to be associated with structural change in agricultural production subsectors. In this analysis, structure was defined to include both horizontal (number and size of firms) and vertical (interstage relationships) dimensions. Emphasis was placed on vertical dimensions, however. In addition to identifying factors associated with structural change, the primary objective of the analysis was to determine if a common set of structural change factors is applicable across all production subsectors. A secondary objective was to evaluate the hypothesis (or allegation) that given current structural trends in agriculture, all production subsectors will develop a common organizational structure with control vested in large nonfarm corporations.

In order to accomplish these objectives, three commodity subsectors having experienced significant structural changes in production were selected for study. These subsectors are cattle feeding, broilers and processing vegetables. Each subsector was analyzed historically to determine factors associated with or affecting their structural development. Based on these analyses, a list of factors affecting structural change in each of the three subsectors was established and incorporated into a classification scheme encompassing all identified factors.

Each factor was then subjectively evaluated in terms of its importance as a factor affecting structural

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changes in each subsector. Based on these evaluations, the factors were rated as having a strong, moderate or weak influence on structural changes occurring in each subsector. This classification scheme with factor rankings was then used as the basis for comparative analysis of structural change factors in the three subsectors. The individual factor ratings for each commodity subsector are presented in Table 1.

Those factors rated as having a strong or moderate effect on structural change in all three subsectors were designated primary structural change factors (Table 2). Based on analysis of cattle feeding, broilers and processing vegetables, this set of factors appears to be essential to a major structural change occurring in an agricultural production subsector.

These primary structural change factors were further classified into four levels based on their influence on structural changes in the individual subsectors. Factors rated as having a strong effect in all three subsectors were designated as first level primary structural change factors. Factors with a strong effect in two subsectors and a moderate effect in one were designated second level structural change factors; and those with a strong effect in one subsector and a moderate effect in the other two subsectors were designated third level. The fourth, and lowest level of primary structural change factors, consists of those factors having a moderate effect on structural changes in all three of the subsectors.

The first level primary structural change factors were changes in interregional competition, mechanical, biological and organizational technology, pecuniary economies and organizational and contracting strategies to transfer risks. The second, third and fourth level primary structural change factors were mostly factors relating to specific types of risk. The major exception is the second level factor of declining output costs, which is closely related to the first level technological factors.

Factors rated as having a weak effect on structural changes in at least one of the three subsectors studied were labeled secondary structural change factors (Table 3). These were then classified into levels of importance in a manner similar to that used for classifying the primary structural change factors.

While secondary structural change factors may

TABLE 1. IMPORTANCE OF FACTORS AFFECTING CHANGES IN THE STRUCTURE OF THE PROCESSING VEGETABLE, BROILER AND CATTLE FEEDING PRODUCTION SUBSECTORS

Factor	Importance of factor by subsector: Cattle feeding	Broiler	Processing vegetable
INTERREGIONAL COMPETITION			
Shifts in Location	Strong	Strong	Strong
Geographic Concentration	Strong	Strong	Strong
TECHNOLOGICAL CHANGE			
Production Technology			
Mechanical and engineering	Strong	Strong	Strong
Biological	Strong	Strong	Strong
Institutional and Organizational Technology	Strong	Strong	Strong
PECUNIARY ECONOMIES			
GROWTH IN OUTPUT			
Demand Factors			
Income elasticity	Strong	Weak	Moderate
Population growth	Strong	Weak	Moderate
Supply Factors			
Output costs	Strong	Strong	Moderate
Ease of entry and/or exit	Strong	Moderate	Weak
RISKS			
Product Related			
Market price	Strong	Strong	Moderate
Length of produce ownership	Moderate	Moderate	Moderate
Access to markets	Moderate	Strong	Moderate
Investment in new product risk	Weak	Weak	Strong
Control over product characteristics	Weak	Strong	Strong
Input Related			
Price variations[a]	Strong	Moderate	Strong
Access to supply of inputs	Weak	Strong	Strong
Vehicles to Transfer Risks			
Organizational strategies	Strong	Strong	Strong
Contracting	Strong	Strong	Strong
Futures markets	Weak	Weak	Weak
INFORMATION SYSTEMS	Moderate	Moderate	Moderate
GOVERNMENT PROGRAMS AND REGULATIONS			
Commodity Supply Controls	Strong	Strong	Weak
Environmental Quality	Weak	Weak	Weak
Antitrust and FTC	Weak	Weak	Moderate
Consumer Protection	Weak	Moderate	Weak
ENTREPRENEURSHIP IN SUBSECTOR			
Assumption and/or Aversion of Risks	Strong	Strong	Moderate
Innovativeness	Strong	Strong	Moderate
Agressiveness	Strong	Weak	Moderate
Quest for Market Power	Weak	Weak	Weak

[a]Input price variations at feedlot stage for cattle feeding subsector, grow-out and processor stages for broiler subsector and processor stage for processing vegetable subsector.

TABLE 2. PRIMARY STRUCTURAL CHANGE FACTORS[a] CLASSIFIED BY LEVEL OF IMPORTANCE ON STRUCTURAL CHANGES IN PRODUCTION SUBSECTORS

Importance of Change Factor — Classification	Subsector C.F.	B.	P.V.	Factor
First Level (SSS)[b]	S	S	S	Shifts in Location of Production
	S	S	S	Geographic Concentration of Production
	S	S	S	Change in Mechanical Production Technology
	S	S	S	Change in Biological production Technology
	S	S	S	Change in Institutional and Organizational Tech.
	S	S	S	Pecuniary Economies
	S	S	S	Organizational Strategies to Transfer Risks
	S	S	S	Contracting Strategies to Transfer Risks
Second Level (SSM)[c]	S	S	M	Declining Output Costs
	S	S	M	Product Market Price Risks
	S	M	S	Input Price Risks
	S	S	M	Risk Aversion of Entrepreneurs
	S	S	M	Innovativeness of Entrepreneurs
Third Level (SMM)[d]	M	S	M	Access to Product Market Risks
Forth Level (MMM)[e]	M	M	M	Length of Product Ownership Risks
	M	M	M	Information Systems

[a]A primary structural change factor is defined as one that had an important effect (strong or moderate) on structural changes in all three subsectors.

[b]A factor that had a strong effect on structural changes in all three subsectors.

[c]A factor that had a strong effect on structural changes in two subsectors and a moderate effect on structural changes in the other subsector.

[d]A factor that had a strong effect on structural changes in one subsector and a moderate effect on structural changes in the other two subsectors.

[e]A factor that had a moderate effect on structural changes in all three subsectors.

TABLE 3. SECONDARY STRUCTURAL CHANGE FACTORS[a] CLASSIFIED BY LEVEL OF IMPORTANCE ON STRUCTURAL CHANGES IN THE PRODUCTION SUBSECTORS

Classification	Importance of Change Factor: Subsector C.F.	B.	P.V.	Factor
First Level (SSW)[b]	W	S	S	Control Over Production Characteristic Risks
	W	S	S	Access to Supply of Input Risks
	S	S	W	Government Commodity Supply Control Program
Second Level (SMW)[c]	S	W	M	Growth in Output from Income Elasticity of Demand
	S	W	M	Growth in Output from Increase in Demand Due to Population Growth
Third Level (SWW or MMW)[d]	S	M	W	Ease of Entry into Production
	W	W	S	Investment in New Product Risks
Fourth Level (MWW)[e]	W	W	M	Antitrust and FTC Government Regulations
	W	M	W	Consumer Protection Government Regulations
Fifth Level (WWW)[f]	W	W	W	Futures Market as Vehicle to Transfer Risks
	W	W	W	Environmental Quality Government Regulations
	W	W	W	Entrepreneurship Quest for Market Power

[a]A secondary structural change factor is defined as one that had a weak effect on structural changes in one or more of the three subsectors.

[b]A factor that had a strong effect on structural changes in two subsectors and a weak effect on structural changes in the other subsector.

[c]A factor that had a strong effect on structural changes in one subsector, a moderate effect on structural changes in one subsector, and a weak effect on structural changes in the other subsector.

[d]A factor that had a strong effect on structural changes in one subsector and a weak effect on structural changes in the other two subsectors and/or a factor that had a moderate effect on structural changes in two subsectors and a weak effect on structural changes in the other subsector.

[e]A factor that had a moderate effect on structural changes in one subsector and a weak effect on structural changes in the other two subsectors.

[f]A factor that had a weak effect on structural changes in all three subsectors.

have a significant effect on changes in structure or organization of specific individual subsectors, they cannot be considered essential or necessary to the occurrence of a structural change because such changes do occur in their absence.

This raises questions as to the role of the secondary factors, and to their relationship to the primary factors. A tentative hypothesis is that the primary structural change factors, being applicable across all subsectors, define a general set of conditions applicable to any given subsector if structural change is to occur. The secondary structural change factors, being subsector specific, bear on the nature of changes that may occur in the structure of specific subsectors once general conditions for structural change are satisfied.

Analysis of factors affecting structural change in the cattle feeding, broiler and processing vegetable subsectors suggests the following scenario for the process of structural change.

1. New production and institutional technology exists and can be implemented. This new technology must be capable of reducing production costs (economies of size), and it develops new information systems that tend to bypass or supplement the traditional ones. The new institutional technology must cope with new risks associated with new methods of production.
2. Interregional competition tilts in favor of other areas and shifts in the location of production begin to occur. The shift is related to utilization of input resources (including human) which are available in a particular region or area.
3. Innovative entrepreneurs, who are generally new entrants into the subsector, take advantage of the opportunity to adopt and extend the new technology in the new producing areas.
4. Pecuniary economies develop in the new producing area, nourishing further growth and development. Production tends to concentrate in new areas as a result of both this and lower combined production and distribution costs.
5. New growth in the subsector, which is occurring quite rapidly, emphasizes the need for more specific risk aversion strategies and new types of coordination, both in terms of input and product markets. (The new risk strategies and coordinative techniques develop readily in the new production areas, but only slowly in the older traditional production areas)
6. Contracting and other new organizational strategies to transfer or reduce risks emerge as important characteristics of the new production structure.

Key factors in this scenario for structural change are (1) new production technology, (2) new institutional technology, (3) shifts in interregional competition and (4) risk management strategies. Let us briefly examine the role of each in the structural change process.

New production technology, which may be of a mechanical or biological nature, is basically a triggering factor in the structural change process. Technological innovation disrupts the status quo of structural stability in one or both of two ways. First is through the scale increasing effect which has been a major cause of increasing farm size and declining farm numbers. This is the horizontal dimension of structure. The introduction of new technology also can

have a significant impact on the vertical dimensions of structure through increasing the interdependencies between the agricultural production sector and the input supply and marketing sectors. Shifts of some market risks and coordinative functions toward the consumer may occur — partly because stages closer to the final demand sector have better information concerning market and demand conditions. As a consequence, nonfarm sectors shift from a passive to an active role with respect to their influence over and involvement in activities of the farm sector.

New institutional technology has a dual role in the process of structural change. It serves an implementing function with respect to adoption of new production technology. This is of critical importance in relation to the impacts of production technology on vertical structure. The second function of institutional technology in the structural change process relates to risk management. Adoption of new techniques of production and new organizational forms for implementing these techniques leads to a new set of risks unique to the emerging structure. New institutional forms must be developed, or existing ones modified, to minimize, avert or transfer these new risks.

The role of change in interregional competition is probably catalytic as well as direct. Development of new production areas allows both new production and new institutional technology to be implemented at a faster rate than could be accomplished in existing traditional production areas. This follows because new production units of the size and organizational forms compatible with emerging production technology can readily be established in the new production areas. Likewise, the set of institutions through which business is conducted in the new area can readily be tailored to the needs of these new firms. By contrast, existing investment in traditional production technology, existing tenure patterns and vested interests in existing institutional technology all combine to impede structural change in traditional production areas. This does not imply that structural changes do not or cannot occur in the absence of a locational shift, but that such change evolves over a much longer time period than when a shift in location of production is involved.

IMPLICATIONS FOR FURTHER RESEARCH

Comparative analysis of structural change suggests several avenues of research relating to factors affecting structural change in agriculture. The most obvious, of course, is further testing of generated hypotheses. Key structural change factors (production technology, institutional technology, interregional competition and risk management) identified in the previous study need to be analyzed in-depth to determine their actual roles in the structural change process.

The analysis of structural change factors in three subsectors outlined above is only a first step toward identifying and understanding the processes involved in structural change in agriculture. Results of the study do not support the hypothesis that all production subsectors will develop a common organizational structure with control vested in large nonfarm firms. This has several policy implications, most importantly, in a structural sense, agriculture cannot be treated as a homogeneous sector. Although a set of primary or key structural change factors was identified, the presence of which would indicate an imminent structural change for any given agricultural subsector, this set of factors would give little if any clue to the nature of the structure that might emerge. This would depend on secondary structural change factors influencing the subsector. As each subsector has its own unique set of secondary factors, the analysis implies that policies to modify or guide structural change should be developed on a subsector by subsector basis.

On the other hand, the study does support the hypothesis that structural change in production subsectors is a function of specific, identifiable factors. This hypothesis, as now developed, needs a considerable amount of testing and refinement before it can be considered as a model for structural change. As a first step, the study should be replicated on other commodity subsectors to test for presence or absence of factors identified as structural change factors. Such replications should include subsectors having remained relatively stable in a structural sense, as well as additional subsectors having either undergone significant structural shifts or currently undergoing a structural change. The timing and relationship between primary structural change factors within a subsector need to be examined and compared with the timing and relationship between primary structural change factors in other subsectors. Also, secondary structural change factors need to be examined as industry characteristic variables.

Beyond testing and refining the structural change hypotheses, there are a number of important researchable issues and questions surrounding the key structural change factors of production technology, institutional technology, interregional competition and risk management strategies.

PRODUCTION TECHNOLOGY

Changes in both mechanical and biological production technology have clearly been among the

overriding factors changing the structure of American agriculture. A number of studies have dealt with various impacts of changing technology [1, 3, 4, 5, 6, 7]. The important role placed on technological change is illustrated by the fact that a Technology and Innovation Research Program Area has been established in ERS, and an Office of Technology Assessment has been established in Congress.

The comparative analysis revealed that changes in production technology were an important structural change factor and that changing technology in one stage of a subsector had a strong influence on structural changes in other stages of the same subsector. Implications are that research undertaken to estimate the impact of technology on structural changes in agriculture must be conducted within a broad framework. A relevant framework may be an agricultural subsector with a full set of economic units and institutional arrangements that collectively have the function of combining resources and inputs into goods and services to meet the needs of final markets. In other words, structural changes in the production stage of a given subsector may not be anticipated by considering changes in technology in the production stage alone. Thus, the research framework should be couched in terms of the input, producing, processing and distribution stages within an industry or subsector.

When economic units of a subsector have been specified, dynamics of the system must then be considered. The structure of the subsector will change when the technology of a number of firms in any stage changes to such an extent that it becomes economically advantageous for these firms to change their relationships or linkages with other firms in the subsector. The structure may also change when firms outside a subsector find it possible and profitable, through utilization of new technology, to enter into cooperative relationships with firms already a part of the subsector. On the basis of our comparative analysis, this latter condition for structural change may be the more relevant case and is related to another key structural change factor—interregional competition—which will be discussed shortly. The above conditions suggest that structural changes will occur only if a more economically efficient structure can emerge.

Factors impeding competition (restrictions on entry and exit, supply or price restrictions, immobility of resources, lack of knowledge, etc.) allow one to explain why structural changes do not occur when new technology exists but is not employed. The complicating factor in terms of utilizing the above outlined research framework to examine potential structural changes is that the institutional technology, as well as the production technology, must be explicitly specified.

INSTITUTIONAL TECHNOLOGY

Two types of institutional technology that surfaced in the comparative analysis as important structural change factors will be discussed. One type has been classified as organization technology and the other as government programs and policies. A useful distinction is that organization technology, as we define it, has mainly private origins.

Organizational technology includes such things as forms of business arrangements, purchasing and marketing procedures, methods of vertical coordination and integration, financing methods and institutions and information systems. A significant point in terms of defining a relevant research framework for analyzing structural changes is that the relationships or linkages between firms in different stages of a subsector are a function of the organizational technology. In modeling a structure of an agricultural subsector, one may start by specifying a number of different vertical stages. Our research efforts seem to be organized and conducted in such a way that we learn mostly about characteristics and activities and the production technology of a firm within a given stage. We know much less about linkages or relationships between firms in the various stages. This is unfortunate because this organizational technology is as important as any other type of technology in terms of understanding factors that lead to structural changes in agriculture.

Government programs and policies in USDA and a number of different departments of the federal and state governments have implications for the future structure of agriculture. Determining the impact of these programs on structural changes would appear to be a high priority research area because billions of dollars have been spent on programs, but only a small amount on program evaluation. The effect of programs and policies no doubt includes a wide spectrum. A few are specifically directed towards retarding or reversing the trend of larger and fewer farms, while many others tend to increase average firm size, concentrations of production, and may retard and/or encourage shifts in location of production and processing.

Thus, it would seem appropriate to give more emphasis to assessing distributional aspects of policies and programs which do not involve direct payments but rather operate on cost functions of the affected firms or promote a change in the geographic location of production. This includes determining the effect of such a wide diversity of programs and policies as

capital gains, tariff and nontariff restrictions, environmental standards and labor use restrictions which will require intensive study on a program by program basis. One question to be examined in each case will be: What is the effect on slope and position of the long-run average cost curve and revenue curve for affected firms? Once determined, a growth model might be developed by type of farming area which considers changes in these programs as exogenous variables.

Many program and policy variables that affect economic efficiency and social welfare cannot be quantitatively estimated. The research question in these cases is: What kind of information can be made available so relative weights and tradeoffs effects can be best estimated for policy making?

INTERREGIONAL COMPETITION

This factor appeared to have a strong influence on structural changes in each of the three subsectors examined in the comparative analysis. It is well known that agricultural production is location specific due to climate, soils, location of consumers and availability of intermediate inputs. No agricultural commodity is produced uniformly across the conterminous United States. Even basic commodities, such as wheat, corn and milk are produced in areas of concentration and have production technologies, input mixes and quality characteristics which vary by geographic subregions.

Several hypotheses were developed in connection with the functional relationships between shifts in the location of production and structural changes in agriculture. Verification or rejection of these hypotheses would obviously increase our understanding of structural changes and would have important implications for growth and development. Also, if shifts in location are as important as they appear, government programs that are not neutral with respect to location or area will have an effect on the structure of agriculture.

Relocation of production appears to be a strong catalyst for growth and development of new types of production firms and for development of a new infrastructure in an agricultural subsector. The growth and development stimulant may be due to the fact that new production and organizational technology is available and can be adopted as shifts in the location of production occur or as production moves into a new area. Under these conditions, the new firms apparently develop comparative advantages over firms located in the old producing areas. Perhaps a factor is that new firms or producers are not faced with the capital disinvestment problems associated with the old production technology. Or, producers in old production areas may be reluctant to adopt new technology involving changes from traditional production methods, new capital outlays, and capital losses due to obsolescence.

One might argue that the key factor in terms of a shift in the location of production is that a new set of participants enters the subsector. The location change may come to our attention or surface simply because it is the only way new entrance shows up when using secondary data. That is, secondary data indicates that new and larger firms have entered the subsector when production of a given product begins in a new reporting area. A new set of producers with larger firms may also be in the process of growth in the old producing areas, but as a result of using secondary data, may only show up as a slight increase in average farm size because many older and smaller farms still exist in the old producing area.

Whether or not structural changes in an agricultural subsector can occur in the absence of a change in interregional competition is a researchable question. The more relevant question may be, however, whether or not structural changes are in fact a result of "new blood" or new entrepreneurs entering a subsector. While old firms may grow and develop in terms of increasing size of operation for the evolutionary development of a subsector, outside investment and new participants may be required to initiate a significant revolutionary structural change in agricultural subsectors.

RISK MANAGEMENT AND BEHAVIOR RESEARCH

The ultimate goal of research into structural change is to be able, in the next decade, to simulate and project structural configuration of the various commodity subsectors in agriculture.

Since structural change is the aggregation of individual decisions concerning technology, risk, firm growth, entry and exit, and market power over time, increased emphasis should be placed on behavioral research. The old assumption of a profit maximizing entrepreneur operating under perfect knowledge within fixed institutional constraints will no longer suffice.

Work with the three prototype subsectors leads to the conclusion that the individual's response to risk situations plays an important role in explaining how and why structure changes. These authors hypothesize that distribution of attitudes toward risk aversion and risk preference is not uniform across commodities. That is, individual producers tend to produce those commodities where their utility func-

tions are compatible with their perception of the variance—expected returns parameters of the commodities. For example, producers with strong risk preferences (willing to pay a premium to make a fair bet) would tend to specialize in a commodity with a high net income variance and a high expected income. Opportunities for institutional arrangements to transfer or share risk would be limited or, if available, these producers would choose not to use them.

Level of knowledge in this area is so limited that this research topic is placed high on the list of priorities. Some work has been underway in recent years, both theoretical and applied. However, theoretical work is still in its infancy and the inventory of empirical applications is scant. A research project which empirically measures utility functions with respect to risk over a cross-section of commodities, with a sample large enough to be stratified by several socio-economic characteristics, would contribute significantly to understanding of the adjustment process.

Changes in the distribution of numbers and sizes of firms research, especially that using a Markov Chain process, usually makes an assumption of "grow or die, or up or out." This implies growth for most firms remaining in the industry. Much of the firm growth research has relied on simulation techniques with profit maximizing decision rules or linear programming assuming profit maximization and perfect knowledge. Results of these studies are normative (what should be done); however, if it is ever hoped to explain and predict future structural change, what actually took place, i.e., positive analysis, must be emphasized. Such analysis should include not only farm firms, but cooperative and processing firms as well.

Another area important to structural change analysis falls under the heading of how producers and processors formulate price and yield expectations. For years, agricultural economists have used deterministic models with respect to prices and yields. The big breakthrough came with Nerlove's work on distributed lags. With increased adoption of forward contracting between producers and first handlers extending over more than one production cycle, information sources, the amount of noise in the system, and relative weights attached to each source need to be studied. Only by understanding how these expectations are formulated is it possible to model changes in contracting as coordinating devices. Since forward contracting assumes two or more parties involved, it is equally as important to study first handler-processor behavior as it is to study producers behavior. Where bargaining associations are involved, behavior must be understood in this same context.

Study of the formulation of price expectations logically leads to study of what we call the "Information Industry," especially nontechnological information. Types, precision and fineness of public information available to decision makers has changed very little over the past 40 years; whereas need for and value of information has changed probably as much as the structure of the industry itself. Some indication of these changing needs is manifest in the private sector information services now available in some subsectors.

From a policy standpoint, knowledge of the value of information to each class of user, marginal value of increased precision and/or increased fineness of any information bit would contribute to decisions on expansion or contraction of public-supported information services.

We have hypothesized that economies of size in the utilization of information are present. If this hypothesis can be tested and accepted, there would be a strong case for researching the roles of information systems in generating structural change.

IMPACTS OF STRUCTURAL CHANGE

Discussion to this point has concentrated on factors affecting structural change and dynamic processes through which it occurs. Equally important issues are concerned with impacts of structural change. What are its benefits? What are the costs? How are these benefits and costs distributed? These are among researchable questions raised by structural change.

The major benefit attributed to structural change in agriculture, and especially change toward increased interdependence and coordination with the input supply and marketing sectors, is increased efficiency. This includes technical efficiency resulting from adoption of advanced production methods, specialization and larger-sized farming units, as well as efficiencies that may result from closer coordination of farming with factor and product markets. In reality, however, there is very little concrete information concerning relative efficiencies of a system containing an independent, atomistic farm sector versus a system containing an industrialized farm sector whose activities and functions are highly coordinated with the input and marketing sectors. There would appear to be a fertile field for economic research along these lines.

Assuming that structural change does result in a more efficient food and fiber system, much research is needed to determine how benefits of this increased efficiency are distributed. Are they passed backward to the farm sector as increased returns to resources

and higher farm incomes, passed forward to consumers as reduced costs for food and fiber products or captured as oligopoly profits at some other stage of the system?

Regardless of the magnitude or distribution of any benefits that may derive from structural changes in agriculture, certain costs must be accounted for. Foremost among these are capital disinvestment and income distribution problems associated with structural adjustment.

Monetary returns to new technology in agriculture are apparently substantial. These returns, however, are to some degree offset by costs of capital obsolescence and reduced rates of return to existing resources utilizing the replaced technologies. Scant attention has been given to measuring magnitude and distribution of these costs. One problem in our economic system is that the innovator is not related to and does not bear much, if any, of the adjustment costs resulting from the economic changes that occur in response to effects of changing technology. Thus, decision criteria for technology innovation have considered only private costs and returns to the innovator, and have ignored social costs and benefits.

Adjustment problems will always exist; but in the event changes in organization and production technology occur at an increasing rate, as some suggest, adjustment problems in the food and fiber system may have to be more effectively coordinated in the general economy than they have been in the past. David Seckler [7] summarized past history in dealing with adjustment problems of structural change in agriculture by saying that "The American path to agricultural development over thirty years has been both a production success and a social disaster. Neither lesson should be lost on the world, and one cannot but wonder what the future will hold." Seckler's statement may be somewhat strong, but it illustrates the need for increased emphasis on the adverse impacts of structural change.

Directions of structural change in the agricultural sector toward increased firm size and closer vertical coordination of farm and off-farm stages of the food and fiber system have raised issues concerning relationships among the stages of the system. Foremost among these issues is the shift in control over production of some agricultural commodities away from the farm sector to the processing, distribution and input sectors as production contracts and vertical integration have replaced traditional open markets. Some specific problems raised by this shift in control relate to farmers access to markets, price discovery under administered pricing arrangements, and restrictions on total output if control over the production sector is achieved. Relationships between stages of the system are also being affected by increasing concentration at the farm level, brought about by changes in farm sizes and numbers, and through collective action of farmers in dealing with input supply and marketing agencies.

Because of these changing interstage relationships and continuation of the trend toward increased industrialization, it is necessary to reassess market power relationships between the farm and nonfarm stages. Very little is known about the countervailing power of the industrialized segments of the farm sector or how this power is exercised. Also, broader social aspects of structural change should be addressed. Such issues as what are the social costs and benefits of an atomistic versus an industrialized farm sector need addressing. Questions concerning tradeoffs between equity and efficiency are already beginning to emerge and will become more important issues in the near future.

Changes in structure of the agriculture sector pose questions relating to validity of our competitive analytical model. Level of concentration in production of a few commodities, such as fed cattle and certain fruits and vegetables, has already rendered the traditional model all but obsolete in some instances. If, as recent projections suggest, 13 percent of all farms control 70 percent of farm output by 1985, policies founded on the model of pure competition will be quite suspect to say the least. This suggests that a first order of business for our profession is to re-evaluate our basic analytical model. As Ken Farrell aptly stated in his AAEA Presidential Address [2], "In part because of our fixation with neoclassical models of perfect competition, we have embarassingly little to offer on public policy issues centered on concentration of economic power in the food complex and in international trade."

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