Chapter 5

Factors Contributing to Structural Change in Agriculture

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Chapter 5

Factors Contributing to Structural Change in Agriculture

Traditionally, American agriculture has been dominated by farms in which the operators and their families provided most of the labor, made the management decisions, owned part of the resources, accepted most of the production and price risks, bought and sold in the open market, and depended on the farm as their major source of family income. Such farms have been revered since the days when Thomas Jefferson argued for national policies of public land distribution that favored small, independent landholders. In recent years, the dispersed, independent-farm, open-market system has become less dominant in American agriculture. Major questions are whether this system can compete for world markets and whether society should take steps to halt present trends that are *gradually* diminishing this system's prominence. Answering these questions entails viewing the causes of structural change—that is, how farm resources are organized and controlled—through economic and noneconomic perspectives.

THE ECONOMIC PERSPECTIVE

An economic perspective encompasses concentration and vertical integration in agriculture.

Concentration

Concentration refers to the proportion of production controlled by the largest firms. It is an important aspect to consider because the more highly concentrated the market, the greater the potential impact of a firm or group of firms on price.

Concentration of total production in agriculture compared with that in many of the other economic sectors is generally low. As discussed in chapter 4, concentration has occurred to the point where in 1982 about 28,000 very large commercial farms—1.2 percent of all farms—produced a third of the total value of U.S. farm products and accounted for over 60 percent of U.S. farm net income.

However, concentration inland resources is also occurring in agriculture.[1] Trends in the distribution of harvested cropland according to sales class show that these productive acres are rapidly becoming concentrated in the farms in the large and very large sales classes. Table 5-1 shows the percentage of total cropland harvested by the top two sales classes of farms for the census years 1969 and 1982 and projects them linearly to 1990 and 2000. If present trends continue, almost half of all cropland will be harvested by farms in these sales classes by 2000.

The degree of concentration varies by commodity. For example, beef cattle operators with

Table 5.1 .—Historical and Projected Percentages of Cropland Harvested by Farms With Sales in Excess of $200,000

	Year			
Sales class	1969	1982	1990	2000
$200,000-499,000 . .....12.0	25.3	27.0	32.0	
..... 6.0	11.2	12.0	14.0	
Total 18.0	36.5	39.0	46.0	

Projection assumptions:
1. **Growth in total harvested acres is linear, resulting in an increase of 2.4 roll. lion acres per year.**
2. **Growth follows the linear trend for the two sales classes and results in an increase of 2.7 million acres per year for the farms in the $200,000-$499,000 class and of 1 million acres per year for the >$500,000 class.**
3. **The linear projections are based on the acres harvested by sales classes, adjusted for inflation. Inflation in commodity prices tends to move acres from lower to upper sales classes. Since inflation in commodity prices is likely to continue, nominal growth in acreage harvested by these sales classes may be greater than projected.**

SOURCE: Office of Technology Assessment

*Land resources in the agricultural sector can be viewed in the general category of "land in farms, " as defined by the Bureau of the Census, or in the "harvested cropland" category. The acreage of cropland harvested is a more accurate measure of productive agricultural resources than is the general category of land in farms.

sales over *$500,000* per year in 1982 represented only 0.5 percent of all beef cattle operations and accounted for 55 percent of the total value of cattle sales. The 69 largest of these feedlots produced 21 percent of the fed cattle in 1980 (USDA, 1981). The largest cattle feeders were also some of the largest feed manufacturers and grain companies.

Higher levels of concentration exist for broilers (chickens). In 1977 the 16 largest broiler producers and contractors controlled about 50 percent of the production (Brooke, 1980). In vegetable crops, such as lettuce and celery, concentration is comparably high (Brooke, 1980).

On the other hand, concentration is still very low for most crop agriculture. Relative to other American industries, where the market share of the four largest manufacturers frequently exceeds 50 percent, concentration in agriculture, even for cattle feeding, broilers, lettuce, and celery, is low. However, attention is drawn to agriculture because of the rapidity with which certain industries, such as broilers and feed cattle, have gone from a diffused to a concentrated and integrated agriculture (Knutson, et al., 1983).

Concern exists that if extended over a period of time, the increasing concentration of agricultural production could lead to higher food prices (Breimeyer and Barr, 1972). This would result from increased merchandising and marketing costs, potential unionization of agricultural workers, and the lack of effective competition (Rhodes and Kyle, 1973).

Vertical Integration

Firms are vertically integrated when they control two or more levels of the production-marketing system for a product. Such control may be exercised by contract or by ownership.

Contract integration exists when a firm establishes a legal commitment that binds a producer to certain production or marketing practices. At a minimum, contract integration requires that the producer sell the product to the buyer. Additional commitments may bind the farmer to specified production practices and sources of inputs. While all forms of contract integration have created concern, the greatest controversy exists with contracts that control both production and marketing decisions of farmers. In addition, from a legal perspective, the producer may not even own the product being grown (Knutson, et al., 1983).

The extent of contract integration is not well documented. Ronald Knutson estimates that all forms of contract integration represented 32 percent of farm sales in 1981 (Knutson, et al., 1983). He makes the following observations on the extent of contracting:

1. Contracting used to be limited to perishable products; now it has expanded to virtually all commodities.
2. Production contracting appears to be associated with commodities where breeding and control of genetic factors play an important role in either productivity determination or quality control.

Ownermhip *integration* is a single ownership interest extended to two or more levels of the production-marketing system. It may involve either cooperatives or proprietary agribusiness firms. Knutson estimates that proprietary ownership integration accounts for about 6 percent of farm sales. Some proprietary agribusiness firms—such as Cargill (beef); Superior Oil (fruits, vegetables, and nuts); Coca-Cola (oranges and grapefruit); Tysons (broilers and hogs); Tenneco (fruits, vegetables, and nuts); and Ralston Purina (mushrooms)-have made substantial investments in agricultural production. In products such as broilers, eggs, cotton, vegetables, and citrus fruits, ownership integration is over 10 percent of total U.S. production (Knutson, et al., 1983).

Cooperative ownership integration is much more prevalent than proprietary ownership integration, accounting overall for 34 percent of farm sales. However, in only 13 percent of cooperative integration is there a legal commitment by farmers to market their commodities or to purchase inputs from the cooperative.

The economic implications and concern for structural change of vertical integration are debated. A principal problem in agriculture has been the difficulty of coordinating production

with market needs. Vertical integration can make a substantial contribution to satisfying this need. For example, in broilers and turkeys, vertical integration has contributed to the uniform size and quality of poultry sold. It has also contributed to increased efficiency and reduced costs (Schrader and Rogers, 1978).

On the other hand, there are potentially adverse consequences of vertical integration. Contract integration with corporations, and sometimes cooperatives, radically changes the role of the traditional, independent farmer. More often than not, the farmer loses control of, if not legal title to, the commodities grown under a production-integrated arrangement. Payment to the grower is largely on a per-unit or piecewage basis, and not necessarily related to product value.

It has been argued that in the long run, market power in integrated agriculture will become sufficiently highly concentrated that the consumer will pay higher prices for food. However, no definitive conclusion can be made. The above argument fails to take into account efficiency gains from integration. The extent to which these gains could be realized without the development of a vertically integrated system is open to question.

THE SOCIOLOGICAL PERSPECTIVE

Many concerns relating to structural change are of a sociological nature. They revolve around the impact of concentration and integration on the institution of the family farm, on rural communities, and on rural institutions.

Concern has been expressed that continuously increasing the concentration and integration will lead to the demise of the family farm as an institution. The term *family farm* has been associated with the existence of an independent business and social entity that shares responsibilities of ownership, management, labor, and financing. The family farm system leads to dispersion of economic power and has been associated with the perpetuation of basic American values and of the family as an institution. Increased concentration and integration tend to destroy the family farm institution. Very large farms lose many of the characteristics of the traditional family farm because their business and hired labor aspects clearly predominate. Most of the management functions traditionally associated with the family farm institution are removed by integration. With integration the farmer takes on more of the characteristics of a businessman.

Another concern is that concentration and ownership integration reduce the number of farms and make the integrator less dependent on the local community. As a consequence, small rural towns and their social institutions decline or vanish. Recent research conducted in California provides some evidence to substantiate such a relationship. Dean MacCannell (1983) has found that rural communities where a few large and integrated farms dominate are associated with few services, lower quality education, and less community spirit. (This is discussed in greater detail in chapter 11.)

Concerns are also expressed about the impact of structural change on the nature of the U.S. political system. Thomas Jefferson visualized the merits of a decentralized political system where power was highly diffused and where every individual had the opportunist y to participate in public decisions. His philosophy placed a high value on independent farmers and landowners as a means of maintaining a democratic system of government.

Already there has been a marked departure from the decentralized power structure ideal visualized by Jefferson. The question is whether agriculture is basically unique and different from other sectors of U.S. society, as has long been maintained. Are there unique social, cultural, and traditional values in having landownership widely dispersed, or should agriculture join

the mainstream where the other economic sectors have long been? As U.S. agriculture continues along the trends laid out in this report, it will increasingly take on the characteristics of the nonfarm sector. Some people will interpret this trend as progress; others will interpret it as a step backward.

CAUSES OF STRUCTURAL CHANGE

A number of factors have been identified by researchers as causes of structural change. However, there has been no delineation of the relative importance of each factor. One of the objectives of this study is such a delineation. Before moving to that analysis in the following chapters, however, it is important to understand why each of these factors is considered important to structural change.

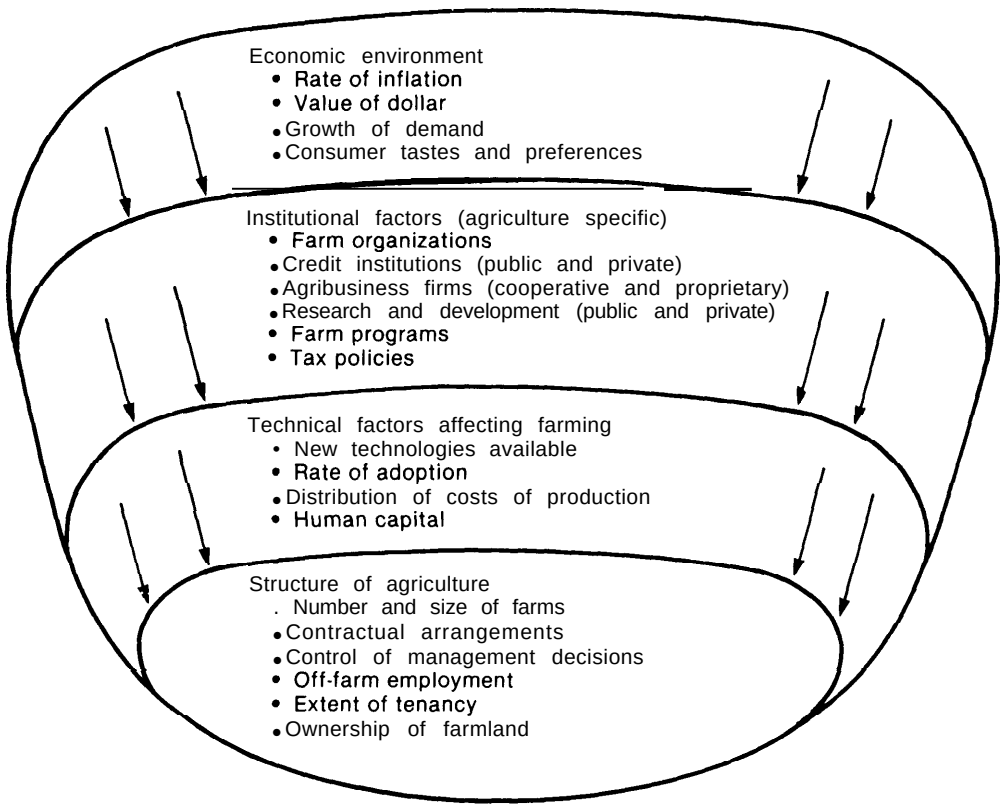
Most observers of structural change cite three main determinants:

1. technology and associated economies of size, specialization, and capital requirements;
2. institutional forces; and
3. economic and political forces (figure 5-1).

Technological Forces

Certain farmers have a strong incentive to adopt new technology rapidly. The early innovator achieves lower per-unit costs and increased profits, at least for a short time, before other farmers follow his lead. For example, in

Figure 5-l.—Factors Influencing the Structure of Agriculture



SOURCE: Office of Technology Assessment

Washington State a winter wheat farmer with *2,500* acres can reduce average machinery costs by 9 percent per acre by replacing a conventional crawler tractor with a four-wheel-drive tractor. If he also expands the size of his farm to *3,900* acres, he can reduce costs by an additional *18* percent (Rodewald and Folwell, 1977). This nearly 60-percent increase in farm size can be made without additional labor. Once the innovative wheat farmer adopts the technology, other crop farmers generally have two options: purchase a four-wheel-drive tractor and expand the size of their farm, or accept a lower net income as market prices for their crops fall. In short, new technology can play an important role in determining acreage and capital requirements. Different farmers have different costs because they use different combinations of inputs, have different management skills, or have a different scale of operation.

Economies of size

The relationship of scale of operation to cost is of particular significance to structure. If costs are relatively the same for all farm sizes, one would expect all farm sizes to have relatively little incentive to increase in size. In addition, with relatively even costs, consumers would clearly not benefit from increases in farm size. If, on the other hand, costs decline sharply as farm size increases, not only would there be strong incentives for farms to grow ***in size,*** but consumers would potentially realize lower prices for food. Of at least equal importance to policy makers, if costs decline sharply as farm size increases, efforts to prevent this change from occurring—e.g., to preserve the family farm–would not only be difficult, but could be counterproductive from a consumer perspective. Smaller farm operators could exist in a cost-declining environment only if they were willing to accept lower returns to contributed labor, capital, and management, and/or had an off-farm job.

Past studies of the relationship between average production costs and farm size support two major conclusions: First, most economies of size are apparently captured by moderate-size farms. Second, while the lowest average cost of production may be attainable on a moderate-size farm, average cost tends to remain relatively constant over a wide range of farm sizes. Thus, farmers have a strong incentive to expand the sizes of their farms in order to increase total profits. (This phenomena is explored in detail in chapters 8 and 9.)

Earlier studies on economies of size have several limitations. External economies gained from buying and selling in large volumes and from access to credit have usually been ignored. Common ownership of related farm and nonfarm activities has not been considered. There is some evidence that inclusion of such pecuniary economies would lower the average production costs for large farm units and would shift the conclusion about the size of the most competitive farm (Smith, et al., 1984).

Specialization

Technology has also influenced specialization and regional production patterns. Cotton production has moved westward, for example, into areas of broad, flat fields where larger machinery can be used to optimum advantage. Specialization in crop production is also due in part to technology, Farmers who once relied on crop rotation and diversification to conserve soil fertility, prevent soil erosion, and control pests have replaced these practices by chemical fertilizers, insecticides, and herbicides, with questionable long-run effects. Such farmers can thus grow one crop exclusively year after year, specializing in commodities that are the most profitable. Similarly, the development of new disease control techniques has given poultry and livestock farmers unprecedented opportunities to specialize. The vertically integrated broiler industry of today would have been impossible without scientific advances in breeding, feeding, housing, and medicine, which have reduced the real cost of broilers by as much as 50 percent over the past 30 years.

These scientific breakthroughs have generally enabled both small and large farmers to specialize more. However, improvements in farm machinery have perhaps been most important in fostering large-scale, specialized operations.

A decision to invest in a specialized piece of equipment means that an operator will emphasize production of the commodity for which the machine is intended, quite likely at the expense of some other commodity. And insofar as a machine is most economical on a particular size of operation, expansion to that size is encouraged. Thus specialization and farm growth occur simultaneously.

Capital Requirements

Agriculture is one of the most capital-intensive industries in the American economy. As a result, the requirements for credit to finance new capital investments, production, or storage are high. Technology has made barriers to entry more formidable. The cost of machinery raises capital requirements for beginning farmers. Technologies that allow individuals to farm increasingly larger acreages have added to the competition for land, resulting in high land prices, the single greatest expense in farming today. The average investment in 1980 in a farming operation with gross sales between $40,000 and $60,000 ranged from $350,000, for fruit and nut farms, to over $800,000, for livestock ranches.

Institutional Forces

Institutional factors have their primary influence on the costs of inputs used in production, the prices of products, and the generation of new technology for agriculture. These institutions may be either in the private or the public sector.

The costs of inputs are primarily a function of competition between private sector agribusiness firms. Input costs do not have to be the same for all farmers. Input suppliers may offer farmers discounts for larger volume purchases of fertilizer or chemicals. Likewise, larger scale farmers may receive higher prices for products marketed through the use of crop contracts or futures markets.

Research and Extension

New technologies are generated in both the public and private sector. Basic agricultural research is primarily a public sector function performed by the U.S. Department of Agriculture (USDA) and the land-grant universities. Applied research functions are shared between the public and private sector, with the private sector dominating development activities. Extension activities assist in evaluating and transferring technological innovations into practice. An integral part of the agricultural research and extension policies involve the generation of higher levels of training and expertise embodied in human capital. The result is more skilled farmers, agribusinessmen, scientists, and agricultural policymakers.

Research and extension have had different impacts on farms, farmworkers, rural communities, and even entire regions, depending on the characteristics and type of technology developed. Some technological innovations, particularly mechanical innovations, have favored and hence fostered larger farms. Technological innovations that could be applied on farms of any size are often first adopted by larger farms (Paarlberg, 1981; Perrin and Winkelman, 1976). By being the first to adopt new technologies, larger farms receive greater benefits than those not adopting the technologies (typically, smaller farms).

A major effort of extension is to disseminate timely information through public meetings. The topics covered in publications and public meetings are heavily influenced by current research results. Any bias toward larger farms that is embodied in research results would most likely be carried over into meetings and publications.

Even though extension personnel make information available to all farmers, those farmers that make the most use of the research results and extension information can generally be characterized as the more innovative, more aggressive, and better managers, usually of larger farms (Paarlberg, 1981). Such farmers are also generally more vocal, providing feedback to research and extension personnel on the usefulness of the information received. Even though no overt effort is made to exclude particular groups, such as operators of small farms, the net result is that many research and extension programs become more oriented toward those

select groups that generally avail themselves of the information (Paarlberg, 1981).

This lack of structural neutrality was recognized in 1979 by Secretary of Agriculture Bergland when he questioned the use of Federal funds for research projects having the objective of producing large-scale, labor-saving technology and set up a special task force to investigate the impact of research and extension on structure. At the same time, Congress earmarked research and extension funds for increased work with small farms and for projects involving direct marketing from farmers and consumers. However, no special programs were developed for moderate-size farms.

The Bergland initiative on research was deemphasized with the change in administration in 1981. It has, however, been rekindled by the announcement of joint initiatives in biotechnology research between private sector companies and universities. Questions have arisen as to whether the primary beneficiaries of the initiatives will be the private sector firms or the initial adopters of the resulting new technology.

Public Policy

Many public policies affect the structure of agriculture by influencing resource use, capital requirements, technology development and adoption, freedom of decisionmaking, exchange arrangements, risks, and costs and profits. Some policies are oriented specifically to the farm sector, such as price and income policy (commodity programs). Others affect agriculture directly but are more broadly oriented, such as tax policy. Still others are general—e.g., national macroeconomic policy—and affect agriculture indirectly,

Public policies offer viable ways to maintain or alter the structure of the agricultural sector. In this section, areas of public policy involvement that affect the structure of agriculture are briefly examined.

Commodity Programs.—Beginning with the Agricultural Adjustment Act of 1933, a series of commodity programs have evolved to deal with price and income problems in farming. These programs have covered such commodities as wheat, feed grains, cotton, wool, sugar, rice, peanuts, tobacco, and dairy products. To stabilize and increase farm prices and incomes, a variety of program tools has been used: price supports, direct payments, acreage allotments, set-asides, conservation reserves, surplus disposal, and stock accumulation.

There is widespread agreement that these programs, in the short run, held farm incomes above the long-run income effects. Price stability from these programs has enabled farmers to adopt new and improved technologies. And logic suggests that the higher the level at which prices are stabilized, the more rapid and widespread will be technological adoption in farming. But it does not follow that high and stable prices necessarily speed resource concentration in farming. The high and stable prices may help the weak and inefficient stay in business. Little is known about how different levels of price and income support affect the rate of resource concentration in farming (Cochrane, 1983). Thus, the question becomes whether policy makers who want to change the rate at which productive resources in farming are concentrated in fewer and fewer hands should support and stabilize product prices at low levels, at high levels, or somewhere in between—or whether they should do something different instead. (The effect of commodity programs on resource concentration is analyzed in chapters 8 and 9.)

Tax Policy.—Tax laws and provisions are widely recognized as being a determinant of agricultural structure. There is, however, no agreement about the relative importance of tax policy because of its interactions with other structural determinants. Some tax laws and provisions can be directly related to structure (i. e., estate and corporate tax law), while others (i.e., investment tax credits, depreciation provisions, capital gains, and cash accounting) are indirectly related and often interact with credit and commodity policies.

In animal agriculture, tax factors such as cash accounting, current deductibility of costs of raising livestock, and capital gains treatment for sales of breeding livestock, together with invest-

ment tax credits and accelerated depreciation, influence livestock investments and can affect structure. Tax policy issues in animal agriculture include tax shelter and nonfarm investments, tax provisions as a factor in economies of size, and the legal structure of agriculture. The cattle sector provides one example.

The income tax advantages of cattle feeding were packaged as limited partnership syndicates in the late 1960s and early 1970s and sold to nonfarm investors. The growth of nonfarm investment in cattle feeding was closely associated with the movement of cattle feeding out of the Midwest and with the growth of large-scale feedlots in the High Plains area. Other factors also played a role, but limited empirical evidence suggests that tax-induced investment in cattle feeding through limited partnerships was related to structural change (Carman, 1983).

For mechanical technology, current tax laws favor the substitution of capital for labor and may speed the adoption of mechanical systems. Two tax factors are at work: payroll taxes, which increase the cost of labor, and provisions for investment tax credit and accelerated depreciation, which decrease the cost of machinery (Carman, 1983).

It is conventional wisdom that tax provisions are an important consideration in the adoption of capital-intensive innovations, since investment tax credit and accelerated depreciation do have a significant impact on after-tax costs. Such innovations include large four-wheel-drive tractors, circle irrigation systems, minimum tillage systems, and large-scale and improved harvesters.

An important implication can be drawn about structural change from the above discussion. Small farms and very large farms have more off-farm interests against which to offset farm losses than do moderate-size farms. This could be a significant factor in accounting for the decline of the moderate farm. (The effect of tax policy on structural change in agriculture is examined in chapters 8 and 9.)

Agricultural Credit Policy.—Public policy directly influences the supply of capital to farmers through the Farmers Home Administration (FmHA) of USDA and the Farm Credit System, which includes the Federal Land Bank, the Production Credit Association, and the Bank for Cooperatives. The original capital for the Farm Credit System was supplied by the Federal Government, but the system is now wholly owned by its borrowers. However, the Farm Credit System is still accorded agency status whereby interest costs on its bonds and discount notes are lowered. The FmHA is a Government agency that has a mandate from Congress to make low interest loans to family farmers who cannot obtain credit elsewhere. The FmHA and the Farm Credit System together account for approximately 40 percent of the total farm debt outstanding (8 and 33 percent, respectively) (Barry, 1983).

The general intent of farm credit policies has been to ensure appropriate capital availability for agriculture. Policies established by these agencies and their attendant programs are thought to have influenced the structure of the farm sector, although the extent of their impact has not been studied thoroughly. (Chapter 7 explores the relationship between credit policy and structural change in agriculture.)

Economic and Political Forces

Agriculture operates in a broader overall economic and political environment. This environment determines the rate of interest, the rate of inflation, and the value of the dollar—all of which influence the costs and prices of farm products. The increased importance of these effects has made macroeconomic policies that influence the overall economic environment within which agriculture operates more important to farmers.

THE DYNAMICS OF STRUCTURAL CHANGE

A study of this type cannot possibly analyze all of the technical, economic, and institutional factors that influence the structure of agriculture. This study therefore concentrates on those factors that appear to be the most critical in affecting structure and that also relate to current farm policy decisions. These factors include:

- the technical factors influencing the costs of production as related to farm size;
- the major farm program elements; and
- the institutions that lead to the development and assimilation of new technology.

These factors interact in a dynamic fashion to influence the structure of farming. New technology continuously infused into agriculture is adopted by the most progressive farmers. While the initial adopters assume increased risk in applying a new technology, they generally also gain substantially higher returns. Farm programs that reduce price risk help assure higher returns.

As more farmers realize the advantages of new technology, the adoption process becomes more general. As this happens, supplies increase, with the tendency to force down market prices. If Government policies prevent market prices from falling, surpluses build up, as they have in the dairy industry or did before the payment-in-kind (PIK) program. If market prices fall, Government payments rise.

Wider adoption of technologies also changes the nature of costs as farm size increases. If larger farms are the first adopters, their costs are substantially lower. The laggers in adoption realize much higher costs. By not adopting, they become, in effect, left behind–eventually being either forced off the farm altogether or forced to take an off-farm job.

These consequences often lead to suggestions of turning off the technological wheels of progress. Such a strategy, however, would have a devastating impact on the competitive position of American farmers in world markets. Instead of just some people being left behind, the whole American farm system would be left behind.

SUMMARY

This chapter has viewed structural change from both an economic and sociological perspective and identified the major forces of this change. These include technological, institutional, economic, and political factors. Technology and associated economies of size, specialization, and capital requirements have had an important influence on structural change in agriculture. Likewise, private and public institutional factors, which include research and extension, credit institutions, farm programs, and tax policies, have played a significant role. And the economic and political environment including the value of the dollar, rate of inflation, growth in demand, and consumer tastes and preferences are becoming even more important factors.

There has been a marked departure from the decentralized power structure ideal visualized by Thomas Jefferson that causes many people to be concerned for a variety of reasons. The question is whether agriculture is basically unique and different from other sectors of U.S. society. Are there unique social, cultural, and traditional values in having landownership widely dispersed, or should agriculture join the mainstream where other U.S. economic sectors have long been? As American agriculture continues along the trends laid out in this report, it will increasingly take on the characteristics of the nonfarm sector, Some people will interpret this as progress; others will interpret it as a step backward.

To help policymakers better understand how and why agricultural structure is changing, this study focuses on the major technical, economic, and institutional factors which influence structural change. They are: 1) technology, 2) major farm program and tax elements, 3) financial institutions, and 4) institutions that lead to the development and assimilation of new technology. In the chapters to follow the impact of each of these factors, as well as the dynamic interactions between them, will be studied.

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