STRUCTURAL CHANGE IN AN ERA OF INCREASED OPENNESS: A BACKGROUND PAPER ON THE STRUCTURE OF U.S. AGRICULTURE

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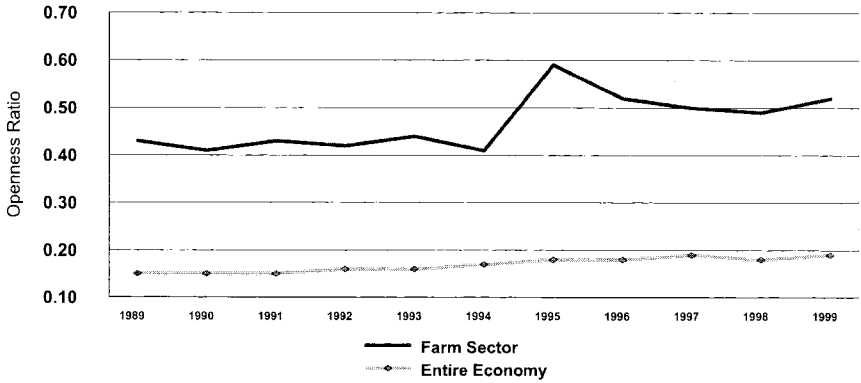
INTRODUCTION

Agriculture is one of the more trade-oriented sectors of the U.S. economy. As measured by the ratio of trade (exports plus imports) to total output, the farm sector in 1999 had an openness ratio of 0.52, compared with 0.19 for the entire economy (Figure 1).[2] This difference is rooted in the fact that a great portion of agricultural output consists of tradeable goods – products that either are traded or have the potential of being traded across international borders.

[1] The authors thank Andy Anderson, John Dunmore, David Harrington, William Kost, Janet Perry, and Kitty Smith for their comments and suggestions.

[2] The trade data used to calculate the openness ratios for the farm sector correspond to the two-digit standard industrial classification (SIC) codes for agricultural products (01) and livestock and livestock products (02). This definition of agricultural trade differs from that used in the U.S. Department of Agriculture's Foreign Agricultural Trade of the United States (FATUS) database. Our departure from convention here is necessary if the industry GDP and trade data are to be matched correctly. FATUS considers as agricultural trade some products that correspond to two-digit SIC codes other than 01 and 02. Examples include agricultural chemicals, manufactured tobacco products, and farm machinery.

Figure 1: Openness of the U.S. Farm Sector and the U.S. Economy, 1989-99.



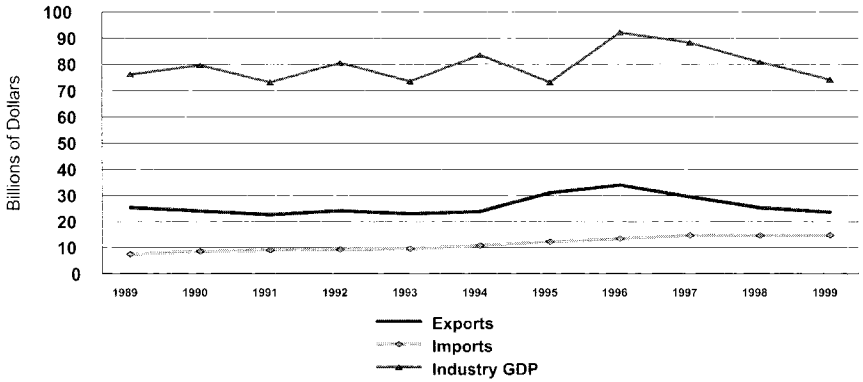
Note: Openness ratio is calculated by dividing the total trade (exports plus imports) of the farm sector by its industry GDP. The farm sector corresponds to the two-digit SIC codes 01 (agricultural products) and 02 (livestock and livestock products).
Sources: Industry GDP data are from U.S. Department of Commerce, Bureau of Economic Analysis (2000). Trade data were obtained directly from U.S. Department of Commerce, Bureau of the Census.

Trade has become more important to U.S. agriculture in recent years, although it remains to be seen whether this is a lasting development. If we ignore 1995, when farm exports reached unusually high levels, and compare the periods 1989-94 and 1996-99, it is evident that the openness ratio of the farm sector has increased. During 1996-99, the ratio averaged 0.51, compared with 0.42 for 1989-94.

An examination of the ratio's components reveals that the numerator increased by a greater proportion than the denominator. In the numerator, the largest change occurred in the imports of farm products, with an increase of 58 percent between 1989-94 and 1996-99. In fact, these imports increased without interruption during the 1990s (Figure 2). In addition, farm exports climbed by 18 percent between 1989-94 and 1996-99. Together, the sum of exports and imports increased by 29 percent across the two periods.

In contrast, the denominator – the gross domestic product (GDP) of the farm sector – experienced slower growth, increasing by only 8 percent between 1989-94 and 1996-99. Moreover, farm GDP experienced many ups and downs during the 1990s. The steady rise of imports during a period of rela-

Figure 2: Key Economic Indicators for the U.S. Farm Sector, 1989-99.



Note: All figures are expressed in current dollars. The farm sector corresponds to the two-digit SIC codes 01 (agricultural products) and 02 (livestock and livestock products).
Sources: Industry GDP data are from U.S. Department of Commerce, Bureau of Economic Analysis (2000). Trade data were obtained directly from U.S. Department of Commerce, Bureau of the Census.

tively slow growth and sharp fluctuations in the farm economy helps to explain why people look to the farm sector's evolving relationship with the domestic and the world economies in order to understand structural developments in U.S. agriculture.

This background paper profiles the structure of U.S. agriculture and highlights some of the primary forces that are driving structural change in the sector. Specifically, six sources of structural change are discussed: trade liberalization, domestic agricultural policy, domestic economic policy, the adoption of new technologies, new commercial relationships, and the relative strength of the non-agricultural economy. Most of these forces originate within the U.S. economy, even though they usually have international dimensions as well.

In addition, the structure of U.S. agriculture is described in further detail using the ERS Farm Typology, a unique conceptual framework developed by the U.S. Department of Agriculture's Economic Research Service (ERS). The ERS Farm Typology divides farms into eight distinct, relatively homogeneous groups, based on the amount of farm sales, type of ownership (family versus non-family), the principal occupation of the farm operator, and whether the economic resources of the farm are limited. This framework allows for a

more in-depth understanding of U.S. agriculture and how the attributes of farms vary across farm types. Throughout the paper, there is a reliance primarily upon research conducted by ERS, which is available on the Agency's web site at <*www.ers.usda.gov*>.

FORCES BEHIND STRUCTURAL CHANGE

Economists have offered many explanations for structural change in agriculture. Perhaps the most comprehensive treatment of this subject in the North American context is a collection of studies published in the *Canadian Journal of Agricultural Economics* (Harrington, et al., 1995). These studies assess and compare the forces and conditions affecting the structure of agriculture in Canada and the United States for the period before the enactment of NAFTA.

Trade Liberalization

The last decade and a half featured several important accomplishments for the United States in the area of agricultural trade liberalization. Within North America, Canada, Mexico, and the United States established a free-trade area through two historic agreements: the Canada-U.S. Free Trade Agreement (CFTA), implemented in 1989, and the North American Free Trade Agreement (NAFTA), which took effect in 1994 and subsumed CFTA. Through these accords, the three countries are eliminating the vast majority of tariff and quota restrictions that formerly governed trade among them. Many of these restrictions already have been lifted in their entirety, and the provisions originally in CFTA are now in full effect.

In the multilateral arena, the Uruguay Round of trade negotiations (1986-94) focused on agricultural issues more closely than any previous round associated with the General Agreement on Tariffs and Trade (GATT). The Uruguay Round culminated in the replacement of the GATT with the World Trade Organization (WTO). This multilateral institution, established in 1995, is responsible for administering the trade rules and disciplines to which its member countries have agreed. These rules include the provisions of the Uruguay Round Agreement on Agriculture (URAA), which requires WTO mem-

Table 1: Estimated Impact of NAFTA on U.S. Trade of Selected Agricultural Commodities.

Commodity	Estimated change in trade volume due solely to NAFTA		Annual Average of Actual Trade Volume (in thousands of specified units)			Value (in millions of U.S. dollars)	
	Direction	Strength	1989-93	1994-98	Units	1989-93	1994-98
Selected exports to Canada							
Beef and veal	Increase	High	72,708	95,236	mt	304	329
Processed tomatoes (1)	Increase	High	64,332	127,431	mt	58	107
Vegetable oils	Increase	Moderate	82,621	200,613	mt	71	166
Cotton	Increase	Moderate	42,092	62,009	mt	61	94
Fresh tomatoes	Increase	Moderate	122,344	127,516	mt	94	103
Selected exports to Mexico							
Cattle and calves	Increase (2)	High	144,543	130,824	no	95	77
Dairy products	Increase (2)	High	—	—	—	162	155
Apples	Increase	High	45,094	93,068	mt	23	50
Pears	Increase (2)	High	29,325	42,068	mt	14	21
Sorghum	Increase	Moderate	3,415,520	2,567,078	mt	377	308
Vegetable oils	Increase	Moderate	123,642	338,149	mt	73	218
Beef and veal	Increase	Moderate	46,425	81,789	mt	135	236
Hogs	Increase	Moderate	100,335	83,143	no	11	8
Pork	Increase	High	26,663	35,107	mt	59	69
Cotton (including linters)	Increase	Moderate	66,940	213,575	mt	85	326

* = Negligible

(1) Trade data for processed tomatoes exclude tomato juice.

(2) Without NAFTA, the volume of trade would have decreased more.

(3) Without NAFTA, the volume of trade would have increased more.

Estimates reflect changes in trade due solely to NAFTA and are based on assessments of ERS analysts:

Increase — High = Volume of trade was more than 15 percent higher during 1994-98 than it would have been without NAFTA.

Increase — Moderate = Volume of trade was 5-15 percent higher.

Decrease — High = Volume of trade was more than 15 percent lower.

Table is adapted from Link and Zahniser (1999). Trade data for peanut imports from Mexico and processed tomato imports from Canada are from HS Imports; all other trade data are from the Foreign Agricultural Trade of the United States database.

Table 1: Estimated Impact of NAFTA on U.S. Trade of Selected Agricultural Commodities (continued).

Commodity	*Estimated change in trade volume due solely to NAFTA*		*Annual Average of Actual Trade Volume (in thousands of specified units)*			*Value (in millions of U.S. dollars)*	
	Direction	*Strength*	*1989-93*	*1994-98*	*Units*	*1989-93*	*1994-98*
Selected imports from Canada							
Beef and veal	Increase	High	106,517	233,637	mt	246	509
Fresh and processed potatoes	Increase	High	360,410	618,015	mt	98	221
Fresh tomatoes	Increase	Moderate	3,604	28,066	mt	5	45
Cattle and calves	Decrease (3)	High	967,742	1,268,483	no	668	908
Seleted imports from Mexico							
Peanuts (shelled and in-shell)	Increase	High	*	4,147	mt	*	3
Sugar	Increase	High	29,664	31,030	mt	8	12
Fresh tomatoes	Increase	Moderate	335,083	609,887	mt	256	477
Processed tomatoes (1)	Increase (2)	Moderate	21	14	mt	16	12
Melons	Increase	Moderate	286,567	358,679	mt	80	108

* = Negligible

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bers to reduce substantially agricultural support and protection in the areas of market access, domestic support, and export subsidies.

NAFTA and the WTO are having a myriad of effects – some profound, others subtle– on the structure of U.S. agriculture. ERS's 1999 NAFTA Report (Link and Zahniser, 1999, 2000) finds that NAFTA generally is exerting a small, positive effect on U.S. agricultural trade with Canada and Mexico. The report places NAFTA in the constellation of other factors affecting this trade, including unusual weather conditions, changes in exchange rates, and the macroeconomic performance of the three countries. However, the report identifies several commodities for which NAFTA has had a dramatic effect on the volume of trade, with an estimated change due solely to NAFTA in excess of 15 percent (Table 1).

The 1999 NAFTA Report also suggests that regional patterns of trade and production have intensified and that new patterns have been established. For instance, pork producers in western Canada tend to export to the U.S. west coast, while U.S. producers tend to export to eastern Canada. Similarly, Mexican ranchers, when confronted with drought, have marketed their cattle for slaughter in the United States. These examples are likely to be the tip of the iceberg with respect to such regional changes in production, processing, and trade.

ERS has not conducted a comparable study about the WTO's impact on U.S. agriculture. However, Normile (1998) identifies a number of the organization's early accomplishments, including reduction in subsidies for agricultural exports, the establishment of new rules for policies governing agricultural imports, and the creation of new multilateral disciplines for sanitary and phytosanitary trade measures.

Domestic Agricultural Policy

The Federal Agriculture Improvement and Reform Act of 1996, commonly referred to as the FAIR Act, the 1996 Farm Act, or "Freedom to Farm," represented perhaps the most ambitious legislative attempt to foster greater market orientation within U.S. agriculture. Broadly speaking, the Act suspended or abolished many long-standing elements of U.S. agricultural policy, includ-

ing price-sensitive deficiency payments and acreage-use restrictions. In their place, the Act created a 7-year program of predetermined direct payments to farmers. The provisions of the Act generally expire in 2002, and the U.S. Congress is already engaged in the process of crafting a replacement Farm Bill.[3]

The 1996 Farm Act took effect at a time of high commodity prices. When these prices plummeted, the U.S. Congress enacted legislation to provide producers with extensive emergency assistance (Appendix 1). Although the emergency assistance does not appear to violate WTO ceilings for domestic agricultural support, it was negatively received by some foreign leaders because of its sheer size and potential influence on world markets.

The impact of the 1996 Farm Act and subsequent emergency-assistance programs is of great interest to agricultural decision-makers. Lin, et al. (2000) concluded that the Act has increased supply responsiveness for major field crops – especially corn, soybeans, and cotton – to changes in their own prices and the prices of competing crops. In addition, the authors found that the Act has not greatly affected regional patterns in the production of these crops.

A crucial dimension of the structural impact of these measures is how the size and type of assistance vary by region, commodity produced, and farm type, and how these differences affect the economic behavior and performance of producers. For instance, government payments could spur additional purchases of farm implements, or they could increase the demand for farmland, driving up rents and land prices. Moreover, they could alter the relative economic rewards to the production of specific crops, thereby influencing the crop mix throughout agriculture. Westcott and Young (2000) indicate that these differential effects are a definite concern, as the major field crops – most notably, corn, soybeans, wheat, and cotton – are associated with nearly all direct government payments, even though they account for only one-fifth of forecasted cash receipts for 2000.

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[3] The 1996 Farm Act contains many other elements, including new and extended programs in the area of conservation. See Nelson and Schertz (1996) for a more complete summary of the Act.

Domestic Economic Policy

Of equal importance in shaping the structure of agriculture is the role of general economic policy, notably macroeconomic and tax policies. Macroeconomic policies affect the availability and terms of credit, exchange rates, inflation, profit expectations, and asset values. Over much of the 1970s, macroeconomic policies were favorable to the accumulation of wealth in agriculture. The macroeconomic adjustments instituted in the 1980s to cool inflation in the general economy created severe adjustment problems for farm families, communities, and agricultural lenders (Duncan and Harrington, 1986). The result was widespread financial stress in the farm sector and losses of wealth for many farm families over the mid- to late 1980s, which agricultural policies were largely unable to correct.

Income tax, property tax, and succession tax policies also play major roles in shaping the structure of agriculture. Differences in the deductibility of farm losses against non-farm income have led to very different distributions of farms by size in Canada and the United States (Freshwater and Reimer, 1995). In the United States, farm losses can be deducted from non-farm income in the calculation of income tax. In Canada, such write-offs of farm losses are severely limited. As a result, the United States has a very large proportion of very small farms that post losses for tax purposes, while Canada has a much smaller proportion of farms in the very small category. Other tax and succession policies affect the structure of agriculture through the market adjustments that farm households make to take advantage of tax preferences. Such adjustment may adversely affect market returns in agriculture, if they increase the supply of agricultural commodities (Harrington and Reinsel, 1995).

Adoption of New Technologies

U.S. farmers and ranchers have a rich history of incorporating mechanical, biological, information, and management technologies into their business operations (Offutt, 1997). As a result, agricultural productivity has increased at an estimated average annual rate of 1.94 percent over the period 1948-94 (Ahearn, et al., 1998).

Producers who are among the first to adopt new technologies typically are perceived as achieving lower costs and increased profits, at least for a short

period of time (U.S. Congress, Office of Technology Assessment, 1985). The concepts of economies of size and the adoption and diffusion of technology have been used to construct models of structural change, with the notion being that the underlying productive relationships and technologies are key determinants of the long-run costs of production (Boehlje, 1992). Some analysts have noted that technology may also influence specialization and the capital requirements of farms and have written about the complex relationships between technology, productivity, and profitability (U.S. Congress, Office of Technology Assessment, 1985; Miranowski, 1986).

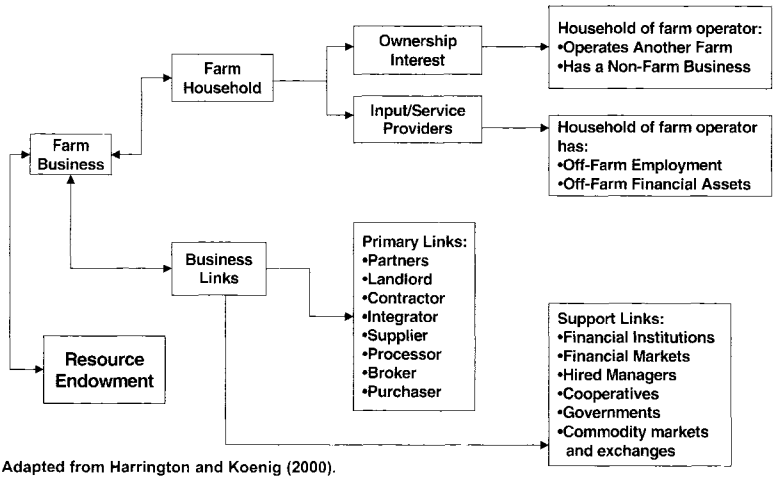
Bio-engineered seed, precision production and harvesting techniques, and high-speed, high-capacity planters and harvesters are examples of recent technological advances in agriculture. Several studies (Daberkow, Fernandez-Cornejo, and McBride, 2000; Daberkow and McBride, 2000; Smith and Heimlich, 2000) indicate that bio-engineered seed and precision farming are being diffused throughout the farm sector. While larger operations are more likely to use these technologies at the present time, more work remains to assess how the adoption of technology affects the costs of production, crop yields, and financial performance of farms under a broad range of conditions and geographic locations.

Application of computer and information technologies to farm decision-making is another example of technology that may influence the selection of inputs and field practices, and of market channels for inputs and outputs. The number of farms with access to the Internet more than doubled between 1997 and 1999, reaching 29 percent in the latter year (Morehart and Hopkins, 2000). Like bio-engineered and precision technologies, the use of computers and the Internet to conduct transactions seems to be positively correlated with farm size. The importance of size differences in the use of emerging information technologies is reflected in potential cost savings of substantial magnitude (Miller, 2000; Smith, 1999).

New Commercial Relationships

In the not too distant past, farm organization tended to exhibit an extremely close relationship between agricultural production and household consumption at a central site – the farm (Heady, Back, and Peterson, 1953). Mem-

Figure 3: A More Current Perspective of Farm Business Linkages, Farm business structure is complex.



Source: Adapted from Harrington and Koenig (2000).

bers of the farm household primarily devoted their labor to agricultural production and the maintenance of the household. In return, the household obtained the lion's share of its income from the sale of farm output, and in many instances, the members of the household directly consumed a portion of that output.

Over time, farmers have adapted their business arrangements to respond to changing economic conditions and to better pursue their personal, household, and business goals. As a result, the business structure of farming is far more complex now than in the past (Figure 3). The current structure features a combination of traditional arrangements and newer innovations in business relationships.

Like their non-farm counterparts, farm households make employment and investment decisions aimed at achieving household financial goals. These decisions often involve off-farm employment. For a majority of farms, the primary occupation of the operator is something other than farming. In these

cases, farming is pursued on a part-time basis for reasons ranging from supplemental income to the enjoyment of nature and outdoor activities.

Off-farm employment is also important to many persons whose primary occupation is farming. Similarly, spouses may be engaged in farm work or hold a wide variety of off-farm occupations. Even on large farms, it is not uncommon for spouses to hold off-farm jobs. In addition to off-farm employment, more than one-tenth of farm households own another farm or a separate non-farm business. While the operator's household has an ownership interest in the farm, it may not be the only household with such an equity position. Two other sets of households – partners and shareholders in corporations – also may hold equity in the farm. But even in the case of proprietorships, outside equity capital may come from other households, as farmers seek additional assets or financing to grow their businesses.

The expanded use of production and marketing contracts is one of the most widely discussed issues in agriculture. A *production contract* is a legal agreement between a farm operator (contractee) and another person or firm (contractor) to produce a specific type, quantity, and quality of agricultural commodity. Usually, the contractor owns the commodity being produced, and the farm receives a service fee for producing the output. Under a *marketing contract*, the contractor buys a known quantity and quality of a commodity from a farm at a negotiated price. The farm owns the commodity while it is being produced and receives a price reflecting the value of the commodity upon its sale. Much discourse has focused on how the expanded use of such contracts may affect the market access of farmers, price transparency, and the farm operator's control of production and marketing decisions. However, it is important to note that substantial use of these contracts, along with concerns about their social and economic ramifications, dates back at least to the 1960s.

While contracts have captured considerable public attention, farmers also have incorporated and pursued other arrangements in order to market their farm output. Among these arrangements are pre-harvest agreements to pool output for marketing, the electronic sale of livestock, participation in farm networks to build and operate common facilities for the production of inputs or the processing of output, and direct sales to consumers and to wholesale and

Table 2: Real GDP by Selected Industry, in Billions of Chained (1996) Dollars.

		Agriculture, forestry, and fishing.		
Year	***Entire economy***	***Subtotal***	***Farms***	***Agricultural services, forestry, and fishing***
1987	6,113.3	110.3	78.8	31.8
1988	6,368.4	101.2	70.2	31.4
1989	6,591.8	111.4	79.5	32.1
1990	6,707.9	118.5	84.2	34.6
1991	6,676.4	121.3	85.6	36.0
1992	6,880.0	130.7	95.7	35.4
1993	7,062.6	122.6	85.8	36.8
1994	7,347.7	135.8	100.3	36.2
1995	7,543.8	123.1	85.5	37.6
1996	7,813.2	130.4	92.2	38.3
1997	8,159.5	143.7	103.6	40.3
1998	8,515.7	144.0	100.2	43.2
1999	8,875.8	150.9	106.3	44.4

Source: U.S. Department of Commerce, Bureau of Economic Analysis (2000)

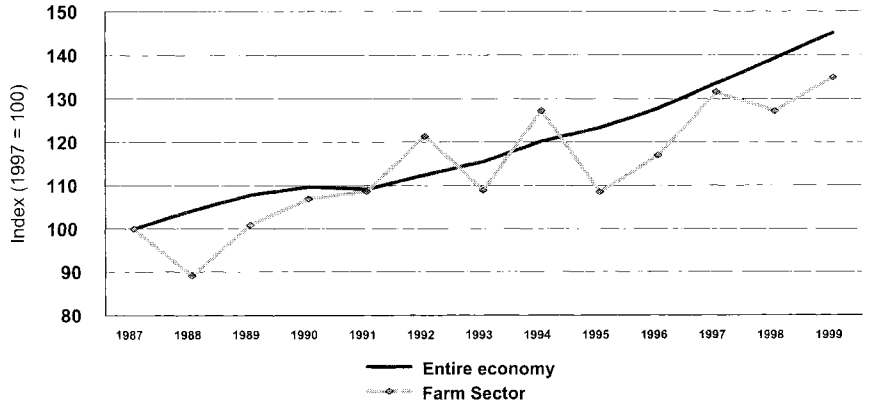
retail outlets. Such direct sales are not yet typical, and thus the growth of such arrangements reflects an important and complex organizational achievement.

New arrangements to procure inputs also are emerging, supplanting purchases from traditional local suppliers. Farmers now band together to purchase big-ticket inputs, participate in buying clubs, and use the Internet to purchase inputs. Operators also lock in the price of inputs before they need them for production and negotiate price discounts with full-service suppliers. Many of these transactions extend well beyond the local community of the farm operator, particularly in the case of larger operations. The same characterization applies to the sale of output. While operators of many small farms still take their output to the local elevator or auction, a substantial percentage of the operators of larger farms opt for different outlets, ranging from dealers and brokers to networks and electronic sales.

Strength of the Non-Agricultural Economy

The structure of U.S. agriculture is also affected by the relative performance of other economic sectors. Agriculture must vie with other industries for entrepreneurial talent, hired labor, investment capital, farmland (which could

Figure 4: Real GDP for the U.S. Economy and the U.S. Farm Sector, 1987-99.



The farm sector corresponds to the two-digit SIC codes 01 (agricultural products) and 02 (livestock and livestock products). Indices were calculated using real GDP data, expressed in chained 1996 dollars.
Source: Calculated using industry GDP data from U.S. Department of Commerce, Bureau of Economic Analysis (2000).

be converted to non-agricultural uses), and a variety of other inputs. In turn, the outcome of this competitive process shapes the size and composition of U.S. agriculture.

Although economic growth has slowed in recent months, the United States continues to enjoy a period of unprecedented economic expansion. Agriculture has shared in this growth, albeit at a slower rate than the economy as a whole. Between 1987 and 1999, real GDP rose steadily from $6.1 trillion to $8.9 trillion (as measured in chained 1996 dollars), an increase of 45 percent (Table 2). Over the same period, real GDP for the farm sector increased 35 percent, from $79 billion to $106 billion. However, farm output experienced a number of wild upswings and downswings during this period (Figure 4).

Perceived differences in the economic rewards to agricultural and non-agricultural activities (and in the risks involved in pursuing those rewards) affect the entry-and-exit decisions of agricultural producers. In recent years, the overall strength of the economy has enabled farmers and ranchers who otherwise would have left agriculture to continue in the sector through non-farm employment. However, the expected differential in economic rewards has en-

ticed many prospective producers, including persons who grew up in farm families, to select a full-time occupation outside agriculture. The decision of these individuals not to enter agriculture is perceived by many farmers as a genuine loss, even though these individuals may receive higher pay in the non-farm economy than they would have in agriculture.

Despite the differing economic performance of agriculture and non-agricultural industries, U.S. agriculture generally is able to secure the inputs necessary for production. For instance, Zahniser and Treviño (2001) conclude that U.S. agriculture is "holding its own" in the market for hired farm labor, securing similar numbers of farm laborers as in previous years and offering real increases in wages. However, they emphasize that crop agriculture relies heavily on foreign-born workers, perhaps more so than in the past, and that many of these workers lack legal authorization to work in the United States.

The continued expansion of human settlements is squeezing agriculture out of some locations, as farmland is sold and then converted to non-agricultural purposes. The sale of farmland does not necessarily reflect the insolvency of the farm operation or some other economic weakness. Some operators liquidate land holdings in order to finance retirement or to transfer wealth to their children. Others utilize receipts from land sales to relocate their farm operations. Also, the conversion of farmland to non-agricultural purposes is sometimes accompanied by efforts to change zoning requirements and other land use regulations that concern the area's remaining farm operations.

Quickly earned gains in non-agricultural industries during the late 1990s may have inspired riskier behavior on the part of some agri-businesses. In at least one instance, this seems to have resulted in a business failure, with adverse consequences for the farm operations that did business with the firm. In January 2000, a major seed firm called AgriBioTech (ABT) filed for bankruptcy protection. Through a series of 34 mergers and acquisitions, ABT had attempted to become a vertically integrated developer, purchaser, and seller of turfgrass and forage seeds. Although the effects of this bankruptcy were localized, the firm's collapse created enormous difficulties for seed producers with ABT contracts.

Defining the ERS Farm Typology

Small Family Farms (sales less than $250,000)

- **Limited-resource farms.** Small farms with sales less than $100,000, farm assets less than $150,000, and total operator household income less than $20,000. Operators may report any major occupation, except hired manager.
- **Retirement farms.** Small farms whose operators report they are retired.*
- **Residential/lifestyle farms.** Small farms whose operators report a major occupation other than farming.*
- **Farming-occupation farms.** Small farms whose operators report farming as their major occupation.*
  - **Lower-sales.** Sales less than $100,000.
  - **Higher-sales.** Sales between $100,000 and $249,999.

*Excludes limited-resource farms whose operators report this occupation.

Other Farms

- **Large family farms.** Sales between $250,000 and $499,999.
- **Very large family farms.** Sales of $500,000 or more.
- **Non-family farms.** Farms organized as nonfamily corporations or cooperatives, as well as farms operated by hired managers.

THE STRUCTURE OF U.S. AGRICULTURE

ERS Farm Typology

In late 1997 and early 1998, ERS developed a typology, or classification system, to categorize U.S. farms into eight mutually exclusive, relatively homogeneous groups (see box entitled "Defining the Farm Typology"). Compared with classification systems based on sales alone, the ERS Farm Typology is far more reflective of operators' expectations from farming, the position of farm operators within the life cycle, and their reliance on agriculture for income. Examining agriculture within the framework of more homogeneous

Table 3. Distribution of farms and farm product sales, by type of farm organization, 1978-97.

Farm organization	Share of farms					Share of farm product sales				
	1978	1982	1987	1992	1997	1978	1982	1987	1992	1997
	Percent									
Individual or family (sole proprietorship)	87.1	86.8	86.7	85.9	86.0	61.6	59.2	56.3	54.1	52.2
Partnership	10.3	10.0	9.6	9.7	8.9	16.1	16.4	17.1	18.0	18.1
Corporation	2.2	2.7	3.2	3.8	4.4	21.6	23.9	25.6	27.2	28.9
Family-held[1]	2.0	2.3	2.9	3.4	4.0	15.1	17.4	19.5	21.1	23.3
Stockholders:										
10 or fewer	1.9	2.3	2.9	3.3	3.9	13.9	15.7	18.0	18.3	20.7
More than 10	0.1	0.1	0.1	0.1	0.1	1.2	1.7	1.5	2.9	2.6
Not family-held	0.3	0.3	0.3	0.4	0.4	6.5	6.5	6.1	6.0	5.6
Stockholders:										
10 or fewer	0.2	0.3	0.3	0.4	0.4	3.6	4.2	4.3	4.0	3.7
More than 10	0.1	0.1	*	0.1	0.1	3.0	2.4	1.8	2.0	1.9
Other (cooperative, estate or trust, institutional, etc.)	0.4	0.5	0.6	0.6	0.8	0.6	0.5	0.9	0.7	0.9

Note: Detail may not add to totals due to rounding.

* = Less than .05 percent.

[1]Family-held corporations have more than 50 percent of their stock owned by people related by blood or marriage.

categories based on several key characteristics enhances our understanding of farm structure and how resources are organized for farm production.

The ERS Farm Typology focuses on the family farm, which is defined as any farm organized as a sole proprietorship, partnership, or family corporation. Family farms exclude farms organized as non-family corporations or cooperatives, as well as operations with hired managers. Contrary to popular belief, agricultural production is not dominated by non-family corporations (Gale and Harrington, 1993). In fact, the share of farms and farm sales corresponding to non-family corporations is small and has been stable for decades.

Nevertheless, significant changes have occurred in the marketing of farm products (Hoppe, 1996). Farmers depend less on terminal markets and spot pricing and rely more on production and marketing contracts. A farm may also coordinate its activities with a vertically integrated firm, where the same company owns several farm-related businesses, such as hatcheries, feed mills, processing plants, and packing facilities. The integrated firm may also own farms or, more likely, contract with farmers. Contracting and vertical integration have become the main modes of production and marketing in the broiler, turkey, egg, milk, and certain specialty crop markets.

Distribution of Farms, Production, and Assets

Although the vast majority of U.S. farms are small family farms, agricultural production is highly concentrated in large and very large family farms (Table 4). In 1998, large and very large family farms made up only 8 percent of all farms, but they accounted for 53 percent of the total value of agricultural production. This large share of production is a reflection of the growing concentration of agricultural production over the past century (Figure 5).

Small family farms, which constituted 91 percent of all farms in 1998, accounted for only 33 percent of agricultural output. Most of this production was concentrated in the high-sales group (17 percent of the total value of production) and the low-sales group (8 percent). However, small family farms produced a large share of certain commodities. Prominent examples include hay (62 percent of the total value of production), tobacco (54 percent), soybeans (49 percent), wheat (47 percent), corn (47 percent), and beef (40 per-

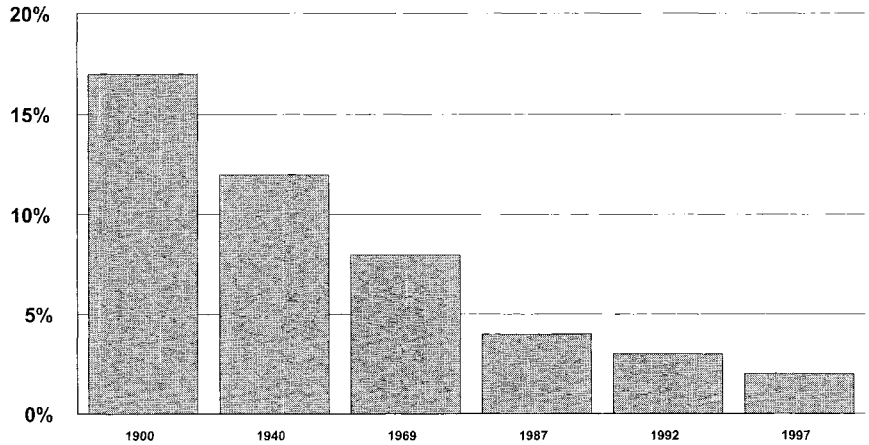
Table 4: Selected structural characteristics of farms, by farm typology group, 1998.

	Farm typology group								
	Limited Resources	*Retirement*	*Residential/ lifestyle*	*Farming-occupation, low-sales*	*Farming-occupation, high-sales*	*Large*	*Very large*	*Non-family*	*All farms*
					Number				
Total number of farms	150,268	290,938	834,321	422,205	171,469	91,939	61,273	42,296	2,064,709
					Percent				
Distribution of:									
Farms	7.3	14.1	40.4	20.4	8.3	4.5	3.0	2.0	100.0
Value of production	0.6	1.4	6.1	7.8	17.1	16.8	36.7	13.6	100.0
Area owned	1.2	10.2	15.7	24.4	16.8	11.2	10.0	10.5	100.0
Farms with sales less than $10,000	79.8	75.5	70.2	34.6	0.0	0.0	0.0	31.1	52.5
Distribution of CRP and WRP area	3.8	28.9	20.6	17.5	13.5	8.2	3.9	3.5	100.0
Positive net cash income	35.2	39.6	31.6	49.5	81.7	87.1	91.7	55.9	45.6
Type of farm:									
Cash grain	*10.0	7.1	14.0	22.6	42.8	44.1	20.3	25.0	18.6
Other field crops	22.1	31.6	24.5	15.9	10.7	12.6	13.5	21.9	21.5
High value crops	d	*7.4	7.8	6.6	4.9	7.3	14.0	20.5	7.7
Beef	40.6	39.0	32.4	36.6	13.0	9.7	8.8	14.7	31.1
Hogs	d	d	d	2.3	4.2	4.7	5.9	d	2.5
Dairy	d	d	d	6.4	20.4	15.6	14.0	d	4.5
Other livestock	*15.7	*14.5	18.0	9.5	4.0	6.0	23.5	*11.5	14.0

CRP = Conservation Reserve Program
WRP = Wetlands Reserve Program
d = Data suppressed due to insufficient observations.
* = Standard error is between 25 and 50 percent of the estimate.

Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

Figure 5: Smallest percentage of U.S. farms accounting for half of U.S. agricultural sales, selected census years, 1990-97.



Source: USDA, Economic Research Service, based on Census of Agriculture, various years.

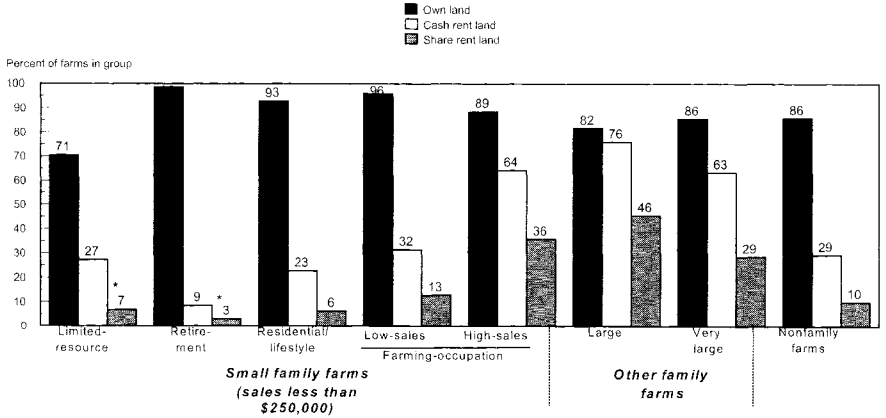
cent). These large shares reflect common specializations among small family farms (Table 4). A relatively large share of high and low -sales small family farms specialized in cash grains in 1998 (43 and 23 percent, respectively). At the same time, between one-third and two-fifths of each small family farm group – except the high-sales group – specialized in cattle. Cow-calf enterprises in particular have relatively low labor requirements (Holcomb, 1982) and often are compatible with off-farm employment, retirement, or scaling back an operation in preparation for retirement.

Despite their relatively minor share of production, small family farms collectively held 69 percent of farm assets, including 68 percent of the land. As custodians and managers of the majority of U.S. farmland, these farms play a major role in policies aimed at protecting and conserving natural resources. In fact, small family farms accounted for 84 percent of the land enrolled in the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP).

Accessing Resources

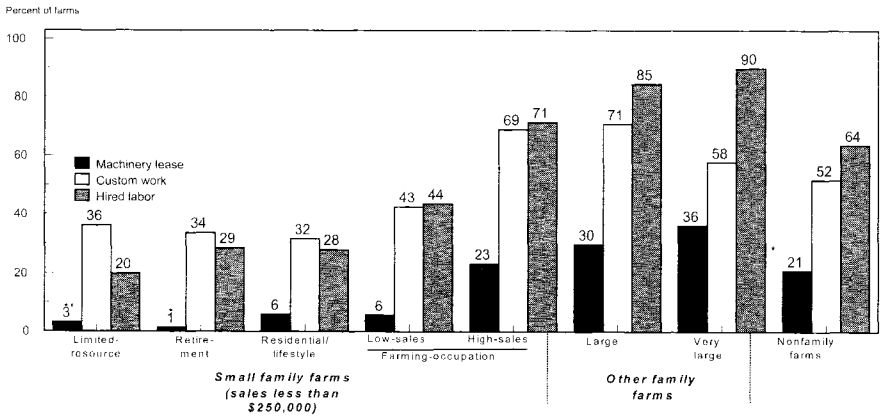
Obtaining farmland and other resources necessary for agricultural production is vital to any farm operation. In many instances, this is accomplished

Figure 6: Methods of accessing land, by farm typology group, 1998, *Ownership of land is most common among retirement, residential/lifestyle, and low-sales small farms.*



* = Standard error is between 25 and 50 percent of the estimate.
Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

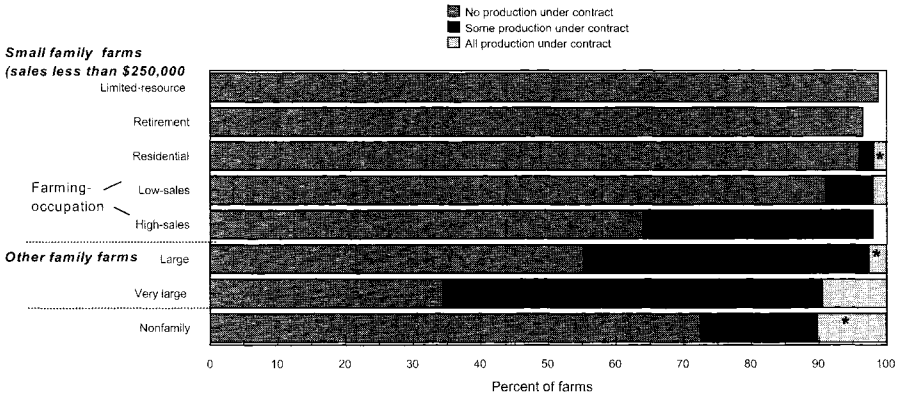
Figure 7: Selected methods of input procurement, by farm typology group, 1998, *Custom work and hired labor are common, even among small farms.*



* = Standard error is between 25 and 50 percent of the estimate.
**= Standard error is between 51 and 75 percent of the estimate.
Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

by renting the asset in question rather than buying it outright. Similarly, farm operations often utilize hired labor or custom work instead of family labor. The manner in which productive resources were secured in 1998 varies across the ERS Farm Typology. Farms in all typology groups commonly accessed

Figure 8: Distribution of farms, by production under contract and farm typology group, 1998, *Production without contracts prevails among small farms.*



* = Standard error is between 25 and 50 percent of the estimate.
Estimates of farms with some production under contract and farms with all production under contract were suppressed for selected groups, due to insufficient observations.
Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

farmland through direct ownership, but this approach was most common among small family farms in the retirement, residential/lifestyle, and low-sales categories (Figure 6). Renting land, in exchange for either cash or crop shares, was more prevalent than owning land among family farms with sales greater than $100,000.

Farms in each typology group reported leasing machinery, using custom work, and hiring labor (Figure 7). No less than one-third of each group reported using custom work, and at least one-fifth of each group reported using hired labor. In contrast, the proportion of farms that leased machinery was greater than or equal to 20 percent only in the non-family farm group and for family farms with sales of at least $100,000. Thus, there may be a size threshold below which the leasing of machinery is not economical to farms, to suppliers, or both.

Coordinating Activities

Coordinating activities refer to ways in which farms work with other firms to produce output, to sell or otherwise dispose of their product, and to purchase inputs. Coordinating activities include production and marketing

contracts, strategic alliances, direct sales to retailers and consumers, forward pricing of inputs, and cooperative membership.

Contracting and Integration. Most small family farms had no production under contract (Figure 8). Small family farms with high sales, however, had a substantially larger share of farms with production under contract than other categories of small family farms. In fact, the high-sales and large family farm groups had similar proportions of farms engaged in contracting. These last two groups used marketing contracts much more commonly than production contracts (Table 5). Both small family farms with high sales and large family farms specialized heavily in cash grains and dairy production – activities that are more likely to feature marketing contracts than production contracts. Only among very large family farms did a majority of operations (66 percent) engage in contracting for at least some of their production (Figure 8). One-third of very large family farms had production contracts, about triple the rate for small family farms with high sales and large family farms (Table 5). Two-thirds of very large family farms with production contracts specialized in poultry production.

Although most typology groups for small family farms had a relatively small proportion of operations with production or marketing contracts, small family farms accounted for a large share of all farms with such contracts. However, this result is not entirely unexpected given the large share of farms that are small family farms. Nearly two-thirds of farms with marketing contracts and over 40 percent of farms with production contracts were small (Table 6). However, they accounted for only 22 percent of the value of production under marketing contracts and about 15 percent of the value under production contracts. At the same time, very large farms (about 3 percent of all farms) accounted for over half of the value of contracted production.

The degree of coordination through contracting varies substantially by commodity (Table 7). For instance, the broiler industry evolved into a highly coordinated supply chain during the 1950s (Martinez, 1999; and Perry, et al., 1999). In contrast, hog production became increasingly integrated via contracting during the 1990s. Preliminary estimates for 1999 indicate that 60 percent of the value of hog production is coordinated through contracts, compared

Table 5: Percent of farms with selected coordinated activities, by typology group, 1998.

Typology group	*Has marketing contract(s)*	*Has production contract(s)*
	Percent	
Small family farms		
Limited-resource	*1.2	0.0
Retirement	3.0	**0.5
Residential/lifestyle	3.6	0.5
Farming-occupation		
Low-sales	7.7	1.5
High-sales	31.0	7.1
Large family farms	36.7	10.3
Very large family farms	37.8	32.5
Non-family farms	26.3	2.6

* = Standard error is between 25 and 50 percent of the estimate.
** = Standard error is between 51 and 75 percent of the estimate.
Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

with 10 percent in 1993. Other commodities with large shares of production under contract include cotton, fruits, vegetables, cattle, and dairy products.

Other Coordinating Activities. In addition to contracting, farmers engage in a variety of methods to purchase inputs and to market their output (Table 8). While cash sales were the predominant marketing method of small farms, other methods such as networks, farmer cooperatives, dealer/brokers, wholesaling, retailing, and direct sales to consumers were also used. Price locking, farmer-owned cooperatives, and negotiated price discounts were the methods most frequently used by farmers to coordinate input purchases. Use of the Internet to purchase inputs is likely to increase substantially over the next several years.

Sources and Level of Operator Household Income. For most groups of small family farms, virtually all income came from off-farm sources (Table 9). On average, farming made a substantial contribution to household income only for groups with sales of $100,000 or more, and the contribution of farming increased with sales. Households operating very large family farms (sales of $500,000 or more) received only 16 percent of their income from

Table 6: Distribution of farms and value of production under contract, by typology group, 1998.

	Typology group				
	Small family farms[1]	*Large family farms*	*Very large family farms*	*Non-family farms*	*All farms*
			Number		
All farms	1,869,201	91,939	61,273	42,296	2,064,709
			Percent		
Distribution of farms:					
All farms	90.5	4.5	3.0	2.0	100.0
Farms with contracts	61.0	17.2	16.9	4.9	100.0
Farms with marketing contracts	64.9	17.4	11.9	5.7	100.0
Farms with production contracts	44.2	17.3	36.5	2.0	100.0
Distribution of production:					
Value of production	33.0	16.8	36.7	13.6	100.0
Value under contract	19.2	12.3	53.3	15.1	100.0
Value under marketing contracts	21.9	15.8	50.4	11.9	100.0
Value under production contract	15.3	7.3	57.5	19.9	100.0
Share of value of production:					
Under contract	20.4	25.7	50.9	39.0	35.0
Under marketing contract	13.8	19.6	28.6	18.2	20.8
Under production contract	*6.6	6.2	22.3	*20.8	14.2

* = Standard error of the estimate is between 25 and 50 percent of the estimate.

[1] Includes limited-resource, retirement, residential/lifestyle, and farming occupation low and high-sales farms.

Source: USDA, Economic Research Service, 1998 USDA Agricultural Resource Management Study Phase 3, version 1.

Table 7: Share of all contract production by commodity and share of commodity produced under contract, 1998.

Commodity	*Commodity share of all contract production*	*Share of commodity produced under contract*
	Percent	
Corn	3.7	13.1
Soybean	3.2	12.2
Cotton	3.0	50.6
Vegetables	7.5	45.4
Fruit	8.7	56.7
Cattle	11.7*	25.3*
Hogs	5.5	42.9
Poultry	24.3	94.9
Dairy[1]	22.7	54.8
All other commodities	9.7	14.4
All commodities	100.0	35.0

* = Standard error of the estimate is between 25 and 50 percent of the estimate.

[1]Fluid milk is typically produced under a marketing order. However, because neither a pricenor quantity is specified before sale, farmers may or may not consider this a "contract."

Source: Perry and Banker (2000)

Table 8: Selected coordinating activities, by farm typology group, 1999.

	Farm typology group								
	Limited Resources	*Retirement*	*Residential/ lifestyle*	*Farming-occupation, low-sales*	*Farming-occupation, high-sales*	*Large*	*Very large*	*Non-family*	*All farms*
					Number				
Number of farms	126,920	297,566	931,561	480,441	175,370	77,314	58,403	39,374	2,186,950
Percent of farms	5.8	13.6	42.6	22.0	8.0	3.5	2.7	1.8	100.0
Percent of value of production	0.6	1.2	5.9	8.6	15.6	14.1	40.4	13.6	100.0
					Percent of farms using market alternative				
Sale of commodities and products									
Had cash sales only	93.8	98.0	96.9	90.7	70.0	56.3	35.9	75.8	89.9
Local or rural elevator	9.0	7.0	10.6	25.0	49.4	51.7	35.8	17.0	18.5
Networks	d	d	1.8	*1.9	3.2	5.4	6.6	d	1.9
Farmer cooperative for sales	d	2.9	6.7	18.4	40.0	40.1	34.4	*18.7	13.4
Dealer or broker	d	d	4.1	7.0	14.8	19.9	21.1	11.7	6.6
Wholesale or retail sales	d	d	2.9	4.8	6.7	9.2	10.9	9.2	4.0
Direct sales to consumers	11.2	16.3	21.0	18.1	13.5	14.1	14.3	27.1	18.2
Purchase of Inputs									
Locked-in crop input prices	d	2.5	4.0	11.3	40.4	48.8	40.7	15.5	11.0
Received price discounts	d	d	4.6	9.3	28.2	33.0	33.9	19.0	9.2
Buying club for inputs	d	d	d	d	3.5	4.6	4.9	d	1.1
Internet purchases	d	d	2.4	2.4	6.9	9.4	10.5	*6.2	3.0
Farmer-owned coop for purchases	15.6	12.9	15.5	25.3	46.5	48.6	42.8	23.6	21.9

d = Data suppressed due to insufficient observations.

* = Standard error is between 25 and 50 percent of the estimate.

Source: USDA, Economic Research Service, 1999 Agricultural Resource Management Study Phase 3.

Table 9: Income and net worth of farm operator households, by farm typology group, 1998.

Item	Operator households	Total household income			Off-farm income		Total net worth		
		Average amount	From off-farm sources[1]	Percent of U.S. average household income[2]	Average amount	From earned sources	Average amount	From off-farm sources	Percent of U.S. average household net worth[3]
	Number	Dollars per household	Percent	Percent	Dollars per household	Percent	Dollars per household	Percent	Percent
All operator households	2,022,413	59,734	88.1	115.2	52,628	74.4	492,195	17.0	174.2
Farm typology:									
Small family farms									
Limited-resource	150,268	9,924	132.5	19.1	13,153	53.3	78,718	16.0	27.9
Retirement	290,938	45,659	103.3	88.1	47,158	34.9	535,943	19.8	189.7
Residential/lifestyle	834,321	72,081	106.0	139.0	76,390	88.7	347,909	26.3	123.2
Farming-occupation									
Low-sales	422,205	34,773	106.9	67.1	37,186	57.7	576,402	14.2	204.0
High-sales	171,469	50,180	57.2	96.8	28,717	72.3	669,458	10.4	237.0
Large family farms	91,939	106,541	44.4	205.5	47,252	65.7	944,533	9.0	334.3
Very large family farms	61,273	209,105	15.9	403.2	33,240	65.1	1,508,151	6.8	533.9

Note: Household data are not collected for non-family farms.

[1]Income from off-farm sources can exceed 100 percent of total household income if earnings of the operator household from farming activities are negative.

[2]Average farm household income divided by U.S. average household income ($51,855).

[3]Average farm household net worth divided by U.S. average household net worth ($282,500).

Sources: Farm operator and farm household data are from the 1998 Agricultural Resource Management Study (ARMS) for farm operator and farm household data. U.S. average household income is from the Current Population Survey. U.S. average household net worth is from the Survey of Consumer Finances.

off-farm sources, much less than the other groups. These households also had the highest average household income ($209,100) among the typology groups, about four times the average for all U.S. households.

Households operating residential/lifestyle farms or large family farms (sales between $250,000 and $499,999) also had an average income above the U.S. average, but the sources of income differed between the two groups. Households with residential/lifestyle farms received practically all their income from outside the farm, largely from earned sources (self-employment or wage or salary jobs). In contrast, households with large family farms received only 44 percent of their income from off-farm sources.

Households operating retirement farms or high-sales small farms had an average income that did not differ statistically from the average for all U.S. households. Nearly all the income of households with retirement farms came from outside the farm, mostly from unearned sources such as Social Security. Households operating high-sales small farms relied much more heavily on farming for income than their counterparts with retirement farms, with farming accounting for 43 percent of household income, on average. Low-sales and limited-resource farm households received income below the U.S. average. Most of their income came from off-farm sources, with unearned income (Social Security and other transfer payments, interest dividends, etc.) making up nearly all of their off-farm income. This distribution reflects the relatively high percentage of elderly farmers in these groups. Approximately one-third of limited-resource farmers reported that they were retired. By definition, the operators of low-sales small farms reported farming as their major occupation, but 36 percent of these operators were over age 65.

Financial Status of Farm Businesses

Another important dimension of farm status is financial position. One approach to the analysis of financial status is to classify each farm into one of four financial performance categories based on the farm's net income and debt-to-asset ratio (Table 10). Farm businesses classified as favorable (positive net farm income and a debt-to-asset ratio less than 40 percent) are considered to be in the strongest financial condition. Those in the vulnerable group (negative net farm income and a debt-to-asset ratio greater than 40 percent) are in the

Table 10: Number of farms and financial performance classification, by farm typology group, 1998.

Item	Small family farms					Large family farms	Very large family farms	All family farms
	Limited-resource	Retirement	Residential/lifestyle	Farming-occupation				
				Low sales	High sales			
	Number							
Number of farms and households	150,268	290,938	834,321	422,205	171,469	91,939	61,273	2,022,413
	Percent							
Financial performance[1]								
Favorable	55.2	68.5	52.9	59.3	66.4	66.7	59.5	58.6
Marginal income	34.3	30.3	38.0	35.1	19.3	17.3	13.2	32.7
Marginal solvency	d	d	3.2	*2.1	9.6	11.0	22.0	3.9
Vulnerable	d	d	6.0	3.5	4.7	5.0	5.4	4.7

d = Data suppressed due to insufficient observations.

* = Standard error is between 25 and 50 percent of the estimate.

[1]Definition of financial performance classes:

Favorable: positive net farm income and debt-to-asset ratio less than or equal to 40 percent

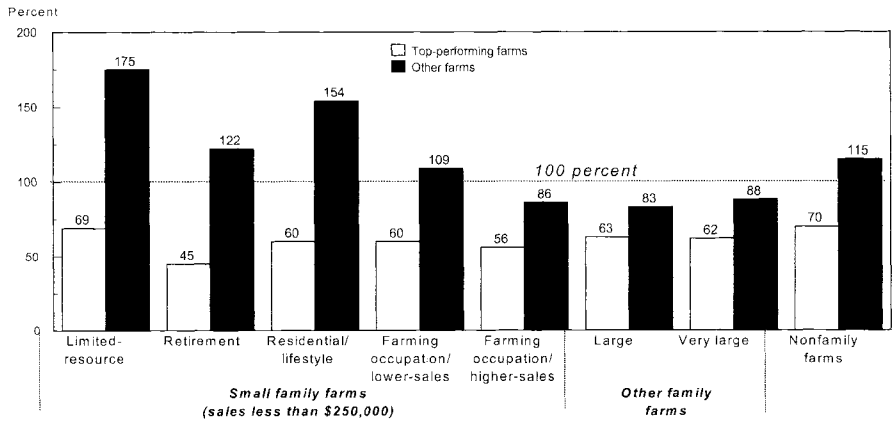
Marginal income: negative net farm income and debt-to-asset ratio less than or equal to 40 percent

Marginal solvency: positive net farm income and debt-to-asset ratio greater than 40 percent

Vulnerable: negative net farm income and debt-to-asset ratio greater than 40 percent

Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1.

Figure 9: Operating expense ratio for top-performing farms, 1997, *Top-performing farms in each typology group control costs.*



The operating expense ratio measures percentage of gross cash income absorbed by cash operating expenses. Expenses exceed income when the ratio is greater than 100.
"More successful" farms are defined as the top 25 percent of each group, ranked by returns to operators' labor and management.
Source: USDA, Economic Research Service, 1997 Agricultural Resource Management Study.

weakest financial position. About 59 percent of all farms were in the favorable group in 1998, while fewer than 5 percent were classified as vulnerable. About 5 percent of agricultural output was produced by financially vulnerable operations. A majority of these farms were very small, with less than $10,000 in sales, and focused on the production of beef, grains, or field crops.

Since this classification system evaluates the financial condition of farm businesses, it is most meaningful when applied to operations where farming provides a substantial portion of household income, namely small family farms with high sales, large family farms, and very large family farms. About 5 percent of these farms were in a vulnerable financial position in 1998. While 6 percent of residential/lifestyle farms were identified as vulnerable, their households generated sufficient income from off-farm sources to offset losses from farming.

Financially successful farms exist in all typology groups. For example, one may define top-performing farms as the top 25 percent of farms in each group, when farms are ranked by returns to the operator's labor and management (Hoppe, et al., 2000; Mishra, El-Osta, and Johnson, 1999; Mishra, El-Osta,

and Steele, 1999).[4] Top performers in each group had an expense ratio well below 100 percent, meaning that they earned positive returns (Figure 9). By controlling costs, top-performing farms in each group achieved a gross cash margin of 30-50 percent, where this margin is defined as 100 percent minus the expense ratio.

Perry and Johnson (1999) examined top-performing low-sales and high-sales farms, the two groups of small family farms whose operators report farming as their major occupation. In both groups, top-performing farms were more likely than other farms to use specific production strategies to control costs, to actively market products, and to use effective financial strategies.

Farm Size and Efficiency

In any discussion of 'efficiency', it is important to state whether the concept is defined in technical or financial terms. *Technical efficiency* measures how effectively inputs (land, labor, and capital) are employed to create output. *Financial efficiency* measures the effectiveness of management decisions in the generation of gross income. Farms may be efficient by one measure, but not the other. For example, a farmer could be highly efficient in combining the factors of production to grow crops, but financially inefficient because of shortcomings in marketing output and purchasing inputs.

Analysts frequently assert that increases in efficiency contribute to increased farm size, because large farms are likely to become more efficient than smaller farms and thus are more likely to survive and grow. However, both types of efficiency help to determine the relative economic success (or failure) of farm businesses of all sizes. Moreover, both large and small farms can be efficient by either definition of the term.

Technical Efficiency. Kumbhakar, et al. (1989) and Bagi (1982) support traditional assertions that larger farms possess greater technical efficiency. However, a more recent study (Peterson, 1999) presents evidence that small farms are as efficient as large farms if factors such as off-farm employment, land quality, and the value of the farm dwelling are incorporated in mea-

[4] The operator's returns to labor and management equal net farm income, less returns to capital and a deduction for unpaid labor performed by partners and family members.

Production Strategies	Marketing Strategies	Financial Strategies
• Control use of inputs. • Rent land or equipment to control fixed costs. • Use forward-pricing of inputs. • Diversify crops and livestock produced. • Allocate some operator labor to off-farm work.	• Use hedging or futures contracts. • Use marketing contracts. • Spread sales throughout the crop year.	***High-Sales***: • Maintain cash or credit reserves. • Purchase supplements to basic crop insurance. ***Low-Sales***: • Purchase supplements to basic crop insurance.

sures of input and output. Nehring, Banker, and Brenneman (2000) estimated the technical efficiency of small and larger farms in the Corn Belt and the Northeast, with adjustments for land quality.[5] Estimates of average technical efficiency in the states of the Corn Belt indicate that small farms tend to be less efficient than large farms (Table 11). However, specific types of small farms in some locations are more efficient than large farms in other locations. For instance, high-sales small farms in Minnesota/Wisconsin are more efficient than large farms in Illinois/Indiana, and residential/lifestyle farms are more efficient than low-sales small farms in Illinois/Indiana and Iowa/Missouri.

The authors employed a pair of Tobit models (one for the Corn Belt and one for the Northeast) to estimate the impact of various factors on the technical efficiency of farms. A number of explanatory variables were found to be statistically significant. In the Corn Belt, government income, the magnitude of livestock sales, and the respective proportions of bio-engineered corn and bio-engineered soybeans were found to increase technical efficiency, but efficiency was found to decline with the age of the farm operator. In the Northeast, the magnitude of livestock sales and the proportion of bio-engineered

[5] Ten states comprise the traditional Corn Belt: Illinois, Indiana, Iowa, Missouri, Ohio, Nebraska, South Dakota, Minnesota, Wisconsin, and Michigan. Eighteen states make up the Northeast: Illinois, Indiana, Ohio, Wisconsin, Michigan, Massachusetts, New Hampshire, Vermont, Rhode Island, Maine, Connecticut, New York, Pennsylvania, Maryland, Delaware, Virginia, North Carolina, and Georgia.

Table 11: Average technical efficiency by selected farm typology groups and states, 1998.

Type	*Illinois/ Indiana*	*Iowa/ Missouri*	*Mich./ Ohio*	*Minn/ Wisc.*	*Neb./ S. Dak.*
Small farms					
Residential/lifestyle	0.662	0.673	0.652	0.681	d
Farming-occupation, low sales	0.629	0.651	0.648	0.698	0.675
Farming-occupation, high sales	0.701	0.707	0.725	0.733	0.720
Total for small farms	0.672	0.678	0.665	0.712	0.699
Large family farms	0.721	0.708	0.744	0.757	0.738
Very large family farms	0.742	0.768	0.778	0.779	0.783
Total for large farms	0.735	0.761	0.765	0.770	0.756
All Farms	0.704	0.706	0.700	0.730	0.721

d = Data suppressed due to insufficient observations.
Source: Nehring, Banker and Brenneman (2000)

corn boosted efficiency, while the amount of off-farm income, operator age, and the debt-to-asset ratio decreased efficiency. Interestingly, 'area operated' was not a significant factor in either region.

These findings are preliminary and limited to the farm types and locations examined by the study. However, they suggest that while larger farms are in general more efficient than smaller farms, some small farms are as efficient, if not more efficient, than larger farms. The factors that affect variation in technical efficiency are likely to vary by the attributes of the farms, such as location, type, and commodity specialization.

Financial Efficiency. The relationship between size and efficiency can also be analyzed from a financial perspective. Morehart, Kuhn, and Offutt (2000) examined the financial efficiency of wheat farms, according to the ratio of economic costs to farm revenue.[6] Farms with revenue greater than or equal to economic costs were considered to be financially viable for several years. Farms with revenue greater than or equal to total cash costs were assumed to be

[6] The study covered any farm that obtained at least half of its total value of production from wheat. Economic costs included total cash costs, an allowance for depreciation, and an imputed return to management and unpaid labor of the operator and household. Farm revenue included estimated cash receipts from market sales of crop and livestock production, direct government payments, and crop insurance indemnity payments.

viable for at least one year. While nearly two-thirds of wheat farms were able to cover total cash costs, permitting survival in the short term, just over one-third earned enough to cover economic costs and thus remain in business over several years. To provide additional perspective on efficiency and cost/size relationships, farms were grouped into three efficiency categories:

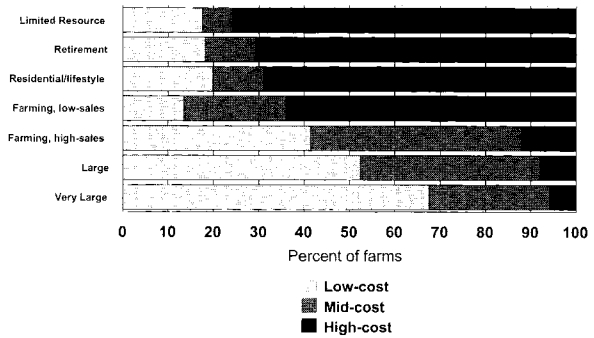
- low-cost farms, with a cost-revenue ratio less than 1;
- mid-range farms, with a cost-revenue ratio between 1 and 1.5; and
- high-cost farms, with a cost-revenue ratio greater than 1.5.

Farm size and scale economies were found to account for a large part of cost differences between low-cost and high-cost farms. However, input costs were a key differentiating factor for low-cost and mid-range farms. The authors concluded that the difference in efficiency between mid-range and low-cost farms was probably explained by relative effectiveness in management decisions on production practices and technologies, marketing strategies, and financing.

To extend these results, the cost-revenue ratio was computed for all farms by typology group for 1999 (Figure 10). The cost distribution contained two distinct clusters, with a much higher proportion of small family farms with high sales, large family farms, and very large family farms falling in the low-cost category. At least 60 percent of low-sales, residential/lifestyle, retirement and limited-resource farms fell into the high-cost category, compared with only 6-12 percent of high-sales, large, and very large farms. As with wheat farms, management decisions are likely to play an important role in determining financial efficiency.

In a study of financial returns by farm size during the period 1960-85, Harrington and Carlin (1987) found that small farms with annual sales of less than $40,000 performed nearly as well as large, commercial-size farms, in terms of real after-tax returns per dollar of annual expenditure. Real after-tax returns on annual expenditures measure the short-run financial efficiency of the farm household. It combines the household's net cash income from the market place plus constructive after-tax income from capital gains and from sheltering off-farm income from taxation as a proportion of annual cash expenditures. Over the study period, the average farm in each size group received a similar,

Figure 10: Distribution of Family Farms by Economic-Cost Category and Farm Typology Group, 1999.



Cost-to-revenue ratio is less than one for low-cost (the most financially efficient) farms, greater than or equal to one and less than 1.5 for mid-cost farms, and greater than or equal to 1.5 for high-cost farms. Economic costs include total cash costs, an allowance for depreciation, and an imputed return to management and unpaid labor of the operator and household. Revenue includes estimated cash receipts from market sales of crop and livestock production, direct government payments, and crop insurance indemnity payments.

Source: U.S. Department of Agriculture, Economic Research Service, 1999 Agricultural Resource Management Study Phase 3.

positive rate of return to its cash expenditures, although the proportions derived from the market place, asset appreciation, and tax benefits varied greatly by sales class.

Government Payments

Government payments to farms in calendar year 1998 consisted of four major components:

- loan deficiency payments (LDP's) for both the 1997 and 1998 crops;
- transition payments, which included transition payments for 1998 crops, minus advances paid in 1997 for 1998 crops, plus advances paid in 1998 for 1999 crops;
- CRP payments; and
- Disaster Assistance Program payments, which included all payments for market loss or disaster assistance but excluded indemnity payments under Federal Crop Insurance and other programs.

Although the size and composition of government payments in 1998 are not necessarily representative of current or future assistance, they do allow us to draw important general conclusions about the structural dimensions of government assistance. First, although government payments are an important

source of farm income, the operations that receive such payments make up a minority of U.S. farms. In 1998, 36 percent of all farms received some form of government payment (Table 12). These payments averaged $4,488 per farm and accounted for 5.3 percent of gross cash farm income. When only farms that received government payments are considered, these figures rise to $12,343 per farm and 8.7 percent, respectively.

Second, the proportion of farms receiving government assistance varies greatly across the Farm Typology. The typology groups of large family farms and small family farms with high sales had the first and second largest proportions of farms receiving payments, both at 76 percent. Fifty-eight percent of very large family farms received government payments, compared with 45 percent of non-family farms and 44 percent of low-sales, small family farms. Small family farms in the limited-resource, retirement, and residential/lifestyle categories were less likely to receive government payments, with the share falling between 20 and 28 percent.

Third, the proportion of gross cash farm income derived from government assistance also varies across the Farm Typology. Of the eight typology groups, retirement farms derived the highest share of income from government payments, 13 percent. This unusually high share is due to high CRP payments, averaging $1,179 per retirement farm. At the other extreme, very large family farms and non-family farms obtained 3.1 and 1.6 percent, respectively.

By treating each typology group as a separate observation, one may use the data in Table 12 to calculate Gini coefficients for the distribution of gross cash farm income and the distribution of gross cash farm income less government payments for farms receiving such payments. These calculations reveal that government payments had a negligible impact on the income distribution across typology groups, increasing the Gini coefficient from 0.2203 to 0.2248 (Figure 11).[6] This small impact was due in part to the fact that government payments were a small proportion (9.6 percent) of gross income less payments for all farms receiving such assistance. Moreover, since government

[7] See Appendix 2 for an explanation of how the observations for Figure 11 were calculated.

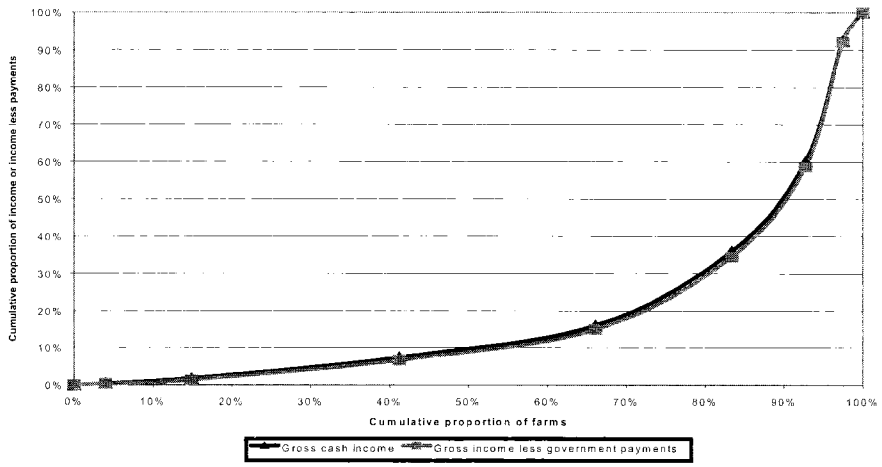
Table 12: Number of farms and financial performance classification, by farm typology group, 1998.

Item	Small family farms					Large family farms	Very large family farms	non-family family farms	All farms
	Limited-resource	Retirement	Residential/lifestyle	Farming-occupation					
				Low sales	High sales				
Total farms	150,268	290,938	834,321	422,205	171,469	91,939	61,273	42,296	2,064,709
Average gross cash farm income ($)	7,361	12,255	13,780	35,800	161,036	348,769	977,037	566,289	84,651
Average government payment per farm ($)	*722	1,566	993	2,833	12,870	24,539	29,971	8,970	4,488
Percent of gross cash farm income (%)	*9.8	12.8	7.2	7.9	8.0	7.0	3.1	1.6	5.3
Average transition payment per farm ($)	*172	178	370	1,489	7,137	13,714	17,141	4,738	2,300
Average loan deficiency payment per farm ($)	**68	*114	149	430	2,865	5,436	7,082	1,860	898
Average CRP payment per farm ($)	*355	1,179	348	491	781	961	*850	*925	585
Average disaster payment per farm ($)	*36	27	57	254	1,466	*3,277	2,778	*692	446
Farms receiving government payments	30,022	81,684	197,692	186,787	129,644	70,096	35,597	19,255	750,777
Percent of all farms (%)	20.0	28.1	23.7	44.2	75.6	76.2	58.1	45.5	36.4
Average gross cash farm income ($)	13,350	17,308	30,404	49,264	163,785	362,918	964,596	414,763	141,217
Average government payment ($)	*3,615	5,578	4,189	6,403	17,022	32,185	51,589	19,704	12,343
Percent of gross cash income (%)	*27.1	32.2	13.8	13.0	10.4	8.9	5.3	4.8	8.7
Transition payment, share of total (%)	*23.8	11.4	37.2	52.5	55.5	55.9	57.2	52.8	51.3
Loan deficiency payment, share of total (%)	**9.4	*7.3	15.1	15.2	22.3	22.2	23.6	20.7	20.0
CRP payment, share of total (%)	49.2	75.3	35.1	17.3	6.1	3.9	*2.8	*10.3	13.0
Disaster payment, share of total (%)	**5.0	1.7	5.7	9.0	11.4	13.4	9.3	*7.7	9.9
Farms with no government payments	120,246	209,254	636,629	235,418	41,825	21,843	25,676	23,041	1,313,932
Percent of all farms (%)	80.0	71.9	76.3	55.8	24.4	23.8	41.9	54.5	63.6
Average gross cash farm income ($)	*5,866	*10,283	8,618	25,118	152,517	303,365	994,287	692,915	52,329

* = Standard error is between 25 and 50 percent of the estimate. ** = Standard error is between 51 and 75 percent of the estimate.

Source: USDA, Economic Research Service, 1998 Agricultural Resource Management Study, version 1, as reported in Green (2001), Table 26.

Figure 11: Cumulative distribution of gross cash farm income and gross income less government payments, for farms receiving such payments, 1998.



payments were paid out mostly on the basis of the farm's volume of sales, their impact on larger farms was greater than it would have been if payments were made under a different basis.

The composition of payments also varied across typology groups. The composition for farming-occupation small farms, large family farms, very large farms, and non-family farms was extremely similar. Each of these groups received at least half of its government payments in the form of transition payments. For small farms with high sales, large family farms, very large farms, and non-family farms, LDP's were of the next greatest importance, providing 21-24 percent of government assistance. For small farms with low sales, CRP payments had the second greatest share, with 17 percent. For other groups of small farms (limited-resource, retirement, and residential/lifestyle), transition payments and CRP payments were most prominent. As mentioned above, retirement farms received about three-fourths of their government payments in the form of CRP payments. For limited-resource farms, most payments came in the form of CRP payments (49 percent) and transition payments (24 percent). For residential/lifestyle farms, payments from these sources were balanced almost equally, at 35 and 37 percent, respectively.

IMPLICATIONS OF U.S. AGRICULTURAL STRUCTURE

The ERS Farm Typology reveals that U.S. agriculture is incredibly diverse. Most operations are small family farms, but most of the value of production is contributed by large family farms, very large family farms, and non-family farms. Nevertheless, small family farms make an important contribution to U.S. agriculture and to international trade. Small family farms – largely those in the high-sales, farming-occupation category – produce about half of U.S. corn, soybeans, and wheat. These three crops are extremely important to U.S. agricultural trade, both as exports themselves and as inputs to the production of livestock and processed foods. As unprocessed commodities alone, corn, soybeans, and wheat accounted for 28 percent of U.S. agricultural exports in 1999 (U.S. Department of Agriculture, Economic Research Service, 2001). Moreover, because small farms own a large share of U.S. farmland, they are extremely important to resource management and conservation efforts.

Farm businesses and the households of farm operators are connected to a wide variety of other firms and households. These outside entities may own equity in the farm operation, supply inputs that are necessary to the farm operation (including financial capital and commercial services), and purchase and market the farm's output. Farmers who effectively use these linkages and successfully adopt new technologies are likely to be among the more efficient, top-performing farms. By both technical and financial measures, larger farms tend to be more efficient. This does not mean that there are no efficient small farms, however. Small farm households may optimize over a larger set of economic opportunities, where off-farm income, tax sheltering, and the imputed rental value of the farmhouse are included as output. Harrington and Carlin (1987) and Peterson (1999) argue that small farms are more efficient than larger farms, if these items are included as output. If small farms really are equally or more efficient than larger farms, they may endure longer than one would expect, given traditional analyses of efficiency.

The increased use of contracts and heightened vertical integration are important facets of increased concentration in farming. These developments involve small farms as well as larger ones, because small farms account for

nearly two-thirds of the farms with marketing contracts and over 40 percent of the farms with production contracts.

During the course of the twentieth century, farm production has become much more concentrated. According to agricultural censuses, 17 percent of U.S. farms produced 50 percent of farm sales in 1900, compared with only 2 percent of farms in 1997. Technological advances and the relative efficiency of larger farms suggest that this trend will continue. However, it is important to keep discussions of present or future concentration in historical and comparative perspective. Even in 1900, the U.S. farm sector exhibited a substantial degree of concentration. Moreover, farming is still much less concentrated than other industries. Although 2 percent of farms produce half of U.S. farm output, this group encompasses 46,100 different producers. As Stanton (1993, p. 66) points out:

> *It is important to remember that the competitive structure of agriculture, characterized by many thousands of farms, stands in stark contrast to most industries in the United States, including those that sell inputs to farmers on one side and those that buy farm products on the other. Structural change, so important in farming, is still modest when compared to the changes in farm machinery, meat packing, or the grain trade.*

These changes in the structure of farming may generate a number of positive effects, including greater efficiency in production, less dependence on government assistance, and increased competitiveness in world markets. Possible adverse effects include further depopulation of rural areas still dependent on farming, reduction in the independence of family farms, abuses of market power, and the disappearance of open signals of market price.

Additional research is needed to understand the international dimensions of structural changes in U.S. agriculture. In many instances, the forces driving structural change in this country also are altering the structure of agriculture in other countries. A meaningful contribution would be to extend the analysis of business structure presented in this paper to encompass exchanges across international borders. Another aspect to consider is the extent to which the economic integration fostered by trade agreements such as NAFTA and

more ambitious initiatives such the European Union allows for deeper utilization of scale economies.

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APPENDIX 1

EMERGENCY AND SUPPLEMENTAL ASSISTANCE

The text for this appendix is adapted from Young, Westcott, and Nelson (2000).

Ad hoc emergency assistance has played a prominent role in U.S. agricultural policy. Direct payments have been provided to producers to partially offset financial losses due to severe weather and other natural disasters or stressful economic conditions. Four recent legislative packages provide for additional emergency and supplemental assistance.

1. The *Agriculture, Rural Development, Food and Drug, and Related Agencies Appropriations Act of 1999* provided for $5.936 billion in emergency and market-loss assistance. Coverage included:
    - Crop loss disaster assistance of:
        $1.5 billion for emergency assistance to farmers who suffered losses in 1998 due to natural disasters,
        $875 million as compensation to farmers who suffered multi-year losses between 1994 and 1998, and
        $400 million of the emergency assistance and multi-year funds as an incentive for farmers to purchase higher levels of crop insurance coverage for 1999.
    - Emergency livestock assistance totaling $200 million.
    - Marketing loss assistance (MLA) payments totaling $2.857 billion to compensate farmers for the loss of markets for 1998 crops. These payments were proportional to production flexibility contract payments paid to farmers in 1998. An additional $200 million was paid to dairy producers.
    - Miscellaneous provisions totaling $279 million.

2. The *Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2000* provided assistance for Fiscal Year 2000. Coverage included:
    - 5.5 billion in MLA payments to compensate farmers for the loss of markets for 1999 crops. MLA payments were equal to production flexibility contract payments paid to farmers in 1999.
    - $475 million for direct payments to oilseed producers to compensate for market losses. Payments were based on production in 1997 or 1998 (or 1999 for new producers).
    - $1.2 billion for crop loss assistance similar to the single-year program for 1998.
    - $125 million for payments to dairy producers.
    - $328 million for payments to tobacco producers.
    - Doubling of payment limitations for loan deficiency payments and marketing loan gains from $75,000 to $150,000 for 1999 crops.
    - $200 million for a livestock indemnity program to provide relief to producers whose livestock perished due to natural disaster.
    - $400 million for a 1-year crop insurance buy-up incentive.
    - $25 million for emergency disaster loans.
    - Funding for Step 2 payments for cotton handlers.
    - $30.50 per ton in support payments for quota peanuts and $8.75 per ton for additional peanuts.

3. The *Agricultural Risk Protection Act of 2000* reformed crop insurance and provided additional emergency assistance. Coverage included:
    - $8.2 billion (over 5 years) for crop insurance reform. This included an 80-90 percent increase in insurance subsidies.
    - $5.465 billion for MLA payments to compensate farmers for the loss of markets. These payments were equal to production flexibility contract payments paid to farmers in fiscal year 2000. These funds were disbursed in September 2000.
    - $500 million for direct payments to oilseed producers in 2000 to compensate for market losses. All producers who are eligible for marketing assistance loans are eligible for assistance.
    - $5 million for loans to apple producers suffering economic loss due to low prices.

- $61.6 million in payments to peanut producers.
- $340 million for payments to tobacco producers whose quantity of quota-eligible tobacco was reduced in 2000 from 1999 levels.
- $10.5 million for direct payments to wool and mohair producers.
- $100 million for payments to first handlers of cottonseed to alleviate problems caused by unusually low prices.
- Loan deficiency (LDP) like payments on grazed acreage of wheat, oats, and barley for the 2001 crop year.
- Producers of contract crops with no production flexibility contract are eligible for LDP's for the 2000 crop year, if they meet conservation requirements.
- $10 million for boll weevil eradication loans.
- $35.2 million for non-interest loans to producers of 1999 crop grass, forage, vegetable, and sorghum seed due to the bankruptcy of AgriBiotech.
- $24 million for loss of cropland due to flooding.
- Revision of the Non-Insured Crop Disaster Assistance Program.

4. The *Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001* provided emergency disaster assistance for Fiscal Year 2001. Coverage included:
   - $80 million for the Emergency Conservation Program to restore conservation structures.
   - $13 million for the Federal Crop Insurance Corporation (FCIC) to provide premium discounts to purchasers of crop insurance reinsured by FCIC.
   - $110 million for the Emergency Watershed Program to repair damages due to flooding.
   - $200 million for the Rural Community Advancement Fund to assist communities in depressed areas, with high energy costs, who experienced major natural disasters, with water and waste grants and loans, etc.
   - S35 million for conservation technical assistance for CRP and the Wetlands Reserve Program (WRP).
   - $19 million for disease-loss compensation.

- $473 million for supplemental assistance to dairy producers of an amount equal to 35 percent of the reduction in market value of milk production in 2000.
- $490 million for livestock assistance to be administered using criteria established to carry out the 1999 livestock assistance program.
- $117 million to expand the area that can be enrolled in the WRP.
- $2.4 million for assistance to Vermont sheep producers for losses due to public health reasons.
- $58 million to compensate commercial citrus and lime trees removed due to citrus canker.
- $100 million to compensate apple producers for market losses and $38 million to compensate producers of apples or potatoes for quality losses due to fireblight or natural disasters.
- $20 million for honey non-recourse marketing assistance loans that can be repaid at the prevailing domestic price as determined by the Secretary or the producer may elect to receive loan deficiency payments in lieu of participation in the loan program.
- $10 million for livestock indemnity program for losses due to disasters, including fires and anthrax.
- $20 million for direct payments to wool and mohair producers.
- $1.6 billion for crop quantity, quality, or severe economic losses for 2000 crops, guidelines for similar programs in previous years with revised criteria for quality losses.
- $20 million for cranberry market loss and not less than $30 million to purchase cranberry juice concentrate and frozen cranberry juice.
- $2.5 million to capitalize a South Carolina grain dealers' indemnity fund.
- $6 million for technical assistance for Wildlife Habitat Incentives Program.
- $7.2 million to assist Hawaii's sugar transportation cooperative.
- $14 million for Emergency Watershed Program projects in selected States.
- $10 million for business and industry grants.
- $10 million for business and industry guaranteed loans, eliminates trigger provisions for sugar loans to become recourse if import lev-

els of tariff-rate quota fall below specified limits, raises the cap on LDP's for 2000 crops from $75,000 to $150,000.

- $20 million for payments to producers who were unable to market crops due to insolvency of a cooperative in California.
- $50 million to allow forfeitures of burley tobacco regardless of quality, and prohibits charging any costs incurred by the Commodity Credit Corporation (CCC) against the no net cost tobacco account.
- $5 million for marketing loan gains and LDP's for producers who were prohibited from receiving payments because they were debtors (eligibility is limited to the time between March 21, 2000, and the date of enactment).
- $40 million for changes in eligibility criteria for the Food Stamp Program.

APPENDIX 2

EXPLANATION OF OBSERVATIONS USED TO CALCULATE THE GINI COEFFICIENTS FOR THE INCOME OF FARMS RECEIVING GOVERNMENT PAYMENTS

For each typology group, the data in Table 12 were used to calculate the total number of farms, total gross cash farm income, total government payments, and the difference between total gross cash farm income and total government payments (see Appendix Table 2). These totals were used to calculate cumulative amounts for these totals, as one proceeds through the Farm Typology from limited-resource small family farms to non-family farms. Note that the Farm Typology groups are ordered according to average sales per farm. Next, the cumulative amounts were expressed as percentages. It is these percentages that are graphed in Figure 11.

The Gini coefficients for the distribution of gross cash farm income were then calculated according to the following procedure.

Step 1: For each Typology Group, the total number of farms is multiplied by the total gross cash farm income for the group.

Step 2: The resulting numbers from Step 1 are added together.

Step 3: The total number of all farms is multiplied by the total gross cash farm income for all farms.

Step 4: The resulting number is multiplied by 0.5.

Step 5: The result from Step 2 is divided by the result from Step 4 to obtain the Gini coefficient for gross cash farm income.

A similar procedure is used to calculate the Gini coefficient for gross cash farm income less government payments.

Appendix Table 2: Values Used to Calculate the Gini Coefficients for the Income Distribution of Farms Receiving Government Payments and to Construct Figure 12.

	Data from Table 12			*Totals for Farm Typology Group*			*Cumulative Amounts*			*Cumulative Percentages*		
Farm Typology Group	*Number of Farms*	*Average gross cash farm income per farm*	*Average government payment per farm*	*Gross cash farm income*	*Govt. payments*	*Gross cash farm income less government payments*	*Number of farms*	*Gross cash farm income*	*Gross cash farm income less government payments*	*Number of farms*	*Gross cash farm income*	*Gross cash farm income less government payments*
Unit of Measure	*Number*	*Dollars*	*Dollars*	*Millions of Dollars*	*Millions of Dollars*	*Millions of Dollars*	*Number*	*Millions of Dollars*	*Millions of Dollars*	*Percent*	*Percent*	*Percent*
Small family farms												
Limited Resource	30,022	13,350	3,615	401	109	292	30,022	401	292	4.0	0.4	0.3
Retirement	81,684	17,308	5,578	1,414	456	958	111,706	1,815	1,250	14.9	1.7	1.3
Residential/lifestyle	197,692	30,404	4,189	6,011	828	5,182	309,398	7,825	6,433	41.2	7.4	6.6
Farming-occupation, low sales	186,787	49,264	6,403	9,202	1,196	8,006	496,185	17,027	14,439	66.1	16.1	14.9
Farming-occupation, high sales	129,644	163,785	17,022	21,234	2,207	19,027	625,829	38,261	33,466	83.4	36.1	34.6
Other farms												
Large family farms	70,096	362,918	32,185	25,439	2,256	23,183	695,925	63,700	56,649	92.7	60.1	58.5
Very large family farms	35,597	964,596	51,589	34,337	1,836	32,500	731,522	98,037	89,149	97.4	92.5	92.1
Non-family farms	19,255	414,763	19,704	7,986	379	7,607	750,777	106,023	96,756	100.00	100.00	100.00