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June 2000

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Nonfarm Growth and Structural Change Alter Farming's Role in the Rural Economy

The rural economy continued to grow during the late 1990's, despite low commodity prices that caused economic problems in the farm sector. The resiliency of the rural economy is a reminder that agriculture is not the primary source of economic growth in rural America. Growth in other rural industries and structural changes in the farm sector have reduced farming's importance and altered traditional perceptions of farms. This issue of Rural Conditions and Trends examines the changing role and character of farming and other agriculturally related industries in the United States.

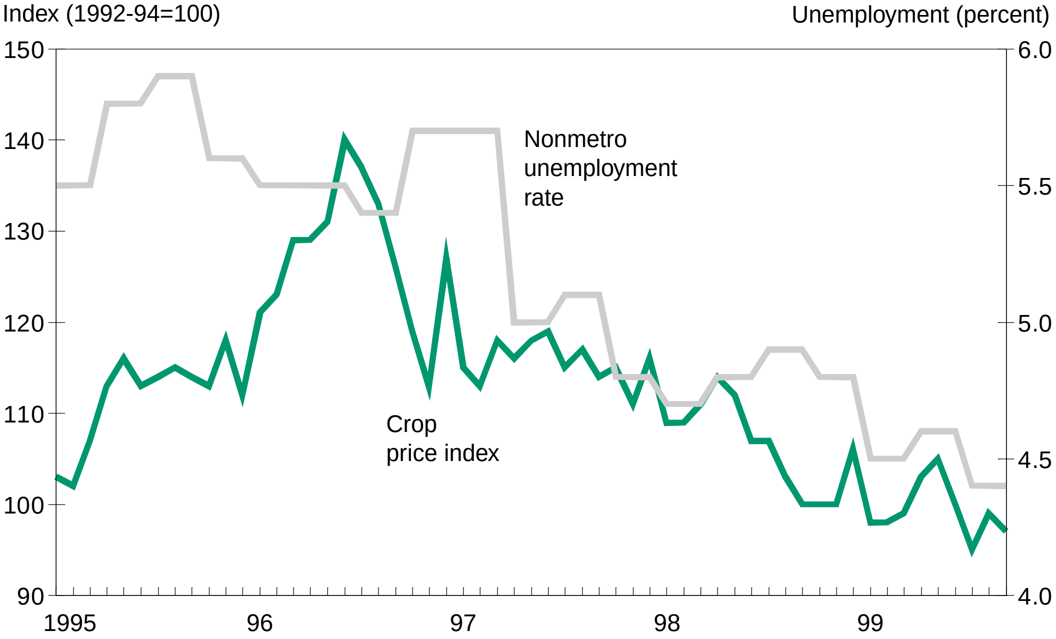
Low commodity prices and the Asian financial crisis buffeted rural America during the late 1990's, but the strength of the U.S. economy as a whole sustained the rural economy. Falling prices for many farm commodities have caused considerable hardship in recent years, but the hardship has largely been confined to the farm sector and closely related industries. USDA's index of prices received by farmers for all crops fell to less than 90 (1990-92=100) in late 1999 (indicating that crop prices were more than 10 percent below their level for the years 1990-92) after having reached 140 in 1996 (fig. 1). In most rural communities, problems in the farm sector have not spilled over to cause a general rural downturn. In fact, the rural unemployment rate fell at the same time crop prices were falling, dropping to about 4.25 percent in 1999. Knowledgeable commentators quoted in the news media and in financial publications have observed that some farmers, induced by the combination of low farm prices and nonfarm job growth, have sold off their farm assets and taken nonfarm jobs.

This issue of *Rural Conditions and Trends* examines the changing role of agriculture in the rural economy. While many people view "rural" and "agriculture" as being virtually synonymous, the ability of the rural economy to shake off severe problems in the agricultural sector is a reminder that agriculture is no longer the primary economic engine of rural America. The articles in this issue draw upon a number of different research programs and data sources from the Economic Research Service and other government agencies to look at agriculture's economic role from different perspectives.

Figure 1

Prices received by farmers for all crops and nonmetro unemployment rate,1995-99

A downturn in crop prices buffeted the farm sector, but nonmetro unemployment declined, illustrating continued overall health of the rural economy



Source: ERS analysis of U.S. Department of Agriculture and Current Population Survey data.

While recent fluctuations in farm prices have had important short-term effects on U.S. agriculture, this issue looks at how the role of agriculture in the rural economy has gradually evolved over the past several decades. Our definition of "agriculture" includes not only farms, but also the complex system of businesses that manufacture, transport, and market food and fiber products. This issue highlights two changes. First, the nonagricultural economy in rural America has grown steadily, outpacing growth in agriculture, so that agriculture's relative importance as a source of jobs and income has been reduced. Second, farms and agribusinesses are becoming closely integrated with the rest of the economy as they respond to external pressures. Rising wages in other occupations draw workers out of farming. Urbanization increases competition for use of farmland and constrains farmers in how they operate their businesses. Health concerns and changing consumer tastes give rise to demands for specific attributes in food products. As a result, agricultural businesses no longer conform to traditional perceptions.

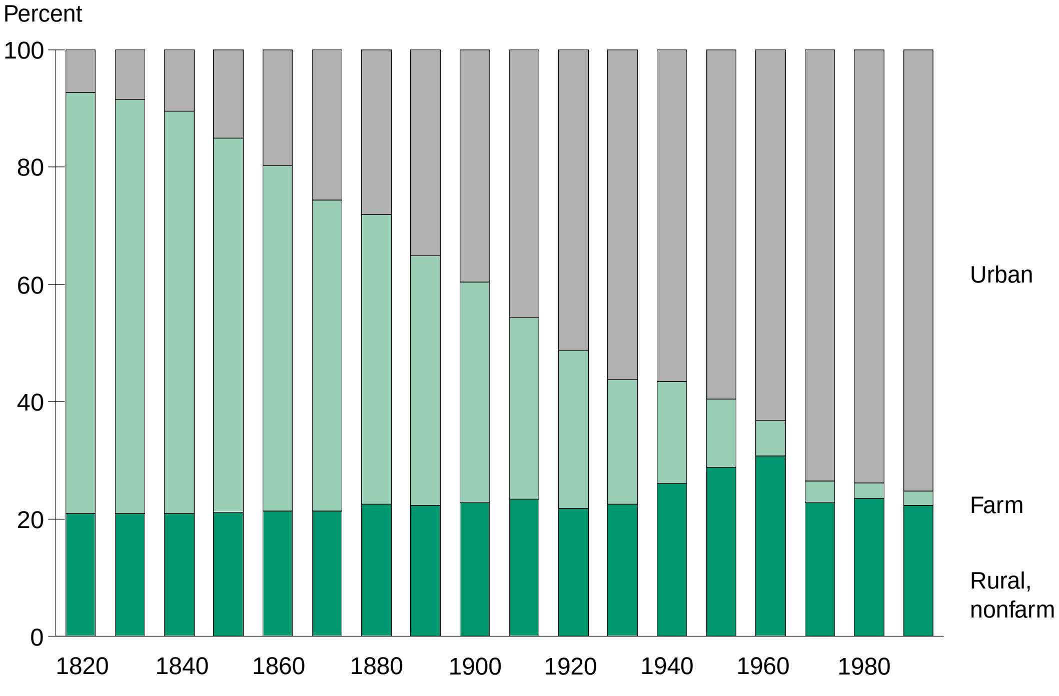
Agriculture's Share of the Economy Shrinks

It is well known that over the past two centuries the United States has evolved from a rural society with almost all of the population engaged in farming to a predominantly urban society. The urban share of U.S. population rose from less than 10 percent in 1820 to about 75 percent in 1990, while the farm share of population fell from about 75 to 2 percent over the same period (fig. 2). While growth in population and income created new demand for food and fiber as the Nation grew, growth in agriculture was limited by the fact that demand for food grows more slowly than demand for other goods and services as incomes rise. Other sectors expanded much more rapidly than agriculture. Furthermore, farm productivity (output per unit of input) rose faster than the demand for food and fiber, releasing labor and capital to be put to work in other industries. These two effects have meant that the farm population did not have to grow as fast as the population it was supplying with food. As growth in farm productivity accelerated in the 20th century, the farm population actually declined in absolute numbers after the 1930's. ERS research has

Figure 2

U.S. urban, farm, and rural nonfarm population shares, 1820-1990

The rural nonfarm share of U.S. population has been surprisingly stable



Source: Census of Population data obtained from Woods and Poole Economics.

found that farm productivity rose an average of 1.9 percent from 1948 to 1994, one of the fastest rates of growth of any sector (see M. Ahearn and others, *Agricultural Productivity in the United States*, AIB-740, USDA/ERS, January 1998). The productivity of all farm inputs rose, but increase in labor productivity was particularly rapid. The farm sector produced more than twice as much output in 1994 (in inflation-adjusted terms) as it did in 1948, but with only 29 percent as much labor.

High farm productivity benefits consumers by ensuring an abundant supply of food at low prices. Other sectors (and ultimately consumers) benefit from farming's efficient use of resources, which frees up labor and capital for other industries (initially for manufacturing in the 1940's to 1960's and more recently for service industries). Agricultural exports also make an important contribution to the balance of trade. However, despite agriculture's important role, its *share* of the economy and the number of people that depend on it for income and jobs is shrinking, both nationally and in rural areas. The Bureau of Labor Statistics (BLS) projects a 1-percent decline in agricultural employment between 1998 and 2008 (see Allison Thomson, "Industry Output and Employment Projections to 2008," *Monthly Labor Review*, November 1999, pp. 33-50). BLS projects a 13-percent decline in employment of farmers, the largest projected decline of any occupation. Employment of farm workers is projected to decline 6.6 percent, and jobs in food and kindred products manufacturing are projected to grow by only 2 percent. By comparison, nonfarm employment is projected to grow 14 percent between 1998 and 2008. Agricultural output is expected to grow, but at a slower rate than that of most other industries.

The decline in farm population share shown in figure 2 reflects the movement of farm labor into other sectors. What is less well known is that the rural *nonfarm* share remained remarkably stable at around 22 percent. While farming is perhaps the most visible rural activity, it is clearly not the only economic activity in rural America. There is enough activity in rural America to support over one-fifth of the Nation's population, but farming supports only about 2-3 percent. Rural areas have created enough new economic opportunities to maintain a constant rural nonfarm share of population, but rural nonfarm jobs were not created fast enough to absorb most of the labor released from the farm sector. Consequently, the overall rural share of population fell. In recent decades, many small communities built to serve the 19th century's farm population have become nonviable due to population loss and geographic concentration of fewer, larger firms supplying wider and wider market areas. Much rural development activity is concerned with how to create jobs in those communities.

Fewer Communities Rely on Farming

In most rural communities, nonfarm growth has reduced their economic dependence on farming. However, farming is still a primary source of income and jobs in some areas, mostly in sparsely populated areas of the Nation's heartland. "Economic Growth in Farming Areas Lags the Rest of Rural America," in this issue, takes a look at how the counties classified by ERS in 1989 as "farming dependent" have fared during the 1990's. The Nation's economic expansion during the 1990's appears to have reduced the number of farming-dependent counties by adding jobs in manufacturing and services. (Definitional changes in the way the data are reported since the 1989 classification make meaningful comparisons over time problematic.) Counties that remained in the farming-dependent category shared in the Nation's economic growth during the 1990's, but to a lesser extent than other rural counties.

Of course, agriculture's economic influence extends far beyond the farm gate. ERS produces two measures of employment in the more broadly defined agriculture sector: Food and Fiber System and Farm and Farm-Related Employment. This issue includes articles that report State-level changes in these agricultural job totals over the past two decades. Both data series tell a similar story. Jobs in farming have declined steadily, while jobs in food retail and wholesale sectors have grown. Retail and wholesale activities tend to locate close to consumers, so much of the growth in agriculturally related employment has occurred in more urbanized areas. Sparsely populated States, including those heavily represented in the farming-dependent category, have gained relatively few retail and wholesale jobs to offset their loss of farm jobs.

Faced with the continual loss of farm jobs, many rural areas have pursued value-added development strategies that encourage agriculturally related businesses (food processing and marketing) to choose rural locations. This strategy may be successful for some communities, but food processing does not appear promising as an engine for rural job growth. Many types of food processors do not use raw farm commodities and choose urban locations to gain access to suppliers of other inputs and distribution networks. While rural areas gained jobs in food and other types of manufacturing during the 1990's, service industries have generated much of the recent job growth in both urban and rural areas. The BLS employment projections cited earlier in this article predict an increase in service jobs of 2.8 percent per year between 1998 and 2008, but job growth is not expected to occur in most food manufacturing sectors.

External Pressures Reshape the Farm Sector

The agricultural sector is not a compartmentalized sector, distinct from the rest of the economy. Like other businesses, farms are under pressure to raise productivity, adopt the latest technologies, raise quality standards, respond to changing consumer tastes, and exploit economies of scale. As they do so, farms are becoming more integrated into the general economy. They are looking more like manufacturing businesses and less like traditional perceptions of “family farms.” The declining number of people who work primarily in farming is one of the most noticeable effects of these pressures. “Small and Large Farms Both Growing in Number” shows that the apparent stability in number of farms between 1992 and 1997 hides differing underlying trends. Farms operated by people who consider farming their principal occupation continued to fall between 1992 and 1997, while the number of farms operated by people primarily employed elsewhere rose. Much of the adjustment in farm numbers occurs through a demographic process, as fewer new young farmers enter to replace retiring farmers. BLS data measuring the number of people employed in farming by age group provide a more accurate count of young farmers, who are often missed by the census, but this data series also shows a decline in young farmers.

Computers have revolutionized the way most businesses operate in the 1990's. But analysis in this issue suggests that relatively few farms have taken full advantage of information technology. USDA survey data from 1999 show that more than 40 percent of farms have computers, but less than one-fourth have incorporated computers into their business operations. Most seem to have adopted computers piecemeal for bookkeeping or other applications without using information systems to integrate production, marketing, and financial data. Full use of computer technology can improve efficiency of farm operations and give farm household members the skills they need to compete for well-paid jobs outside the farm sector.

Another notable trend in agriculture is the increased use of marketing and production contracts. Contracting is not a new phenomenon, but it has become more prevalent in some sectors, most notably the hog sector. Many processors have turned to contracting in order to increase efficiency and ensure steady supply of commodities with attributes needed for specific food products demanded by consumers. Contracting changes the way farms operate, reducing farm operators' independence and forging closer ties to agribusinesses. Contracting has been associated with geographic shifts in production of hogs and other commodities, and large livestock operations associated with this trend have created environmental concerns.

Nonfarm sectors have been drawing labor out of agriculture for decades while the agricultural land base has remained relatively stable. In recent years, however, conflicts over urban encroachment on farmland have arisen in more rural communities. ERS research reported in this issue estimates that urbanization pressures from residential, commercial, and industrial development drive up farmland values by 25 percent, on average. For the 17 percent of farmland classified by ERS as “urban-influenced,” urbanization effects account for about two-thirds of per acre land value. Urbanization affects geographic patterns of farm production, encourages growth in the number of small farms, and leads to conflicts over waste disposal, chemical use, odors, water quality, and other issues. Farmland protection is an important concern for policymakers in Federal, State, and local governments.

Economic Census Data Provide a Snapshot of U.S. Industry

This issue also reports on how new 1997 Economic Census data can be used to analyze trends in rural industry. The Census Bureau began publishing the data in 1999 and will continue publishing reports through 2000 and 2001. One article describes the data and the new North American Industrial Classification System (NAICS) that replaces the Standard Industrial Classification (SIC). Two additional articles provide examples of how Economic Census data can be used to analyze manufacturing and retail industries.

This issue reports the most recent data on nonmetro earnings and employment, farm- and farm-related employment, food and fiber system employment, and jobs related to agricultural trade. Between 1996 and 1997, the most recent years available, nonmetro employment grew by 2.0 percent, slightly slower than metro growth of 2.3 percent. All nonfarm, nonmetro sectors and regions added jobs in 1997. The agricultural services, forestry, fishing, and other category had the fastest growth in jobs, followed by the finance, insurance, and real estate, and transportation and public utilities sectors. Both metro and nonmetro job growth was fastest in the Rocky Mountain, Southwest, and Far West regions. Nonmetro earnings per job also grew in all sectors except transportation and public utilities. Earnings growth was fastest in manufacturing and wholesale trade, the only sectors where earnings per job grew more than 2 percent in 1997. Earnings per job grew in all regions, but at a slower rate than metro earnings. Overall, nonmetro real earnings per job grew 1.3 percent, the first increase following several years of small declines from 1993 to 1996. *[Fred Gale, 202-694-5349, fgale@ers.usda.gov]*

World Growth and Weaker Dollar Expected To Boost Exports

The world economy was in a recession in 1998 because of the global financial crisis, but the U.S. economy continued to grow due to low interest rates, low oil prices, and solid productivity growth. However, the U.S. trade deficit increased sharply in 1998 and 1999, negatively affecting the goods-producing sector, particularly, agriculture and manufacturing. U.S. agricultural exports dropped partly due to a strong dollar and weak world growth as well as record large world supplies. Although nonmetro employment growth dipped in 1997-98, the nonmetro United States did not experience lasting damage from the global financial crisis. Based on most indicators, the world economy is clearly on the road to recovery with improvement in U.S. nonmetro employment and farm exports expected in 2000.

The world financial crisis began in the summer of 1997 with a sharp devaluation of the Thai currency. The crisis spread to other countries of East and South Asia, Russia, and Brazil. A huge outflow of investment funds from these and other developing countries resulted in a world recession in 1998. Investment funds flowed into the United States as a safe haven. As a result, the value of the dollar rose and long-term U.S. interest rates fell sharply (fig. 1). Further, weak world growth and failure of Organization of Petroleum Exporting Counties (OPEC) discipline resulted in low oil prices at the end of 1998—the lowest in real terms since 1947.

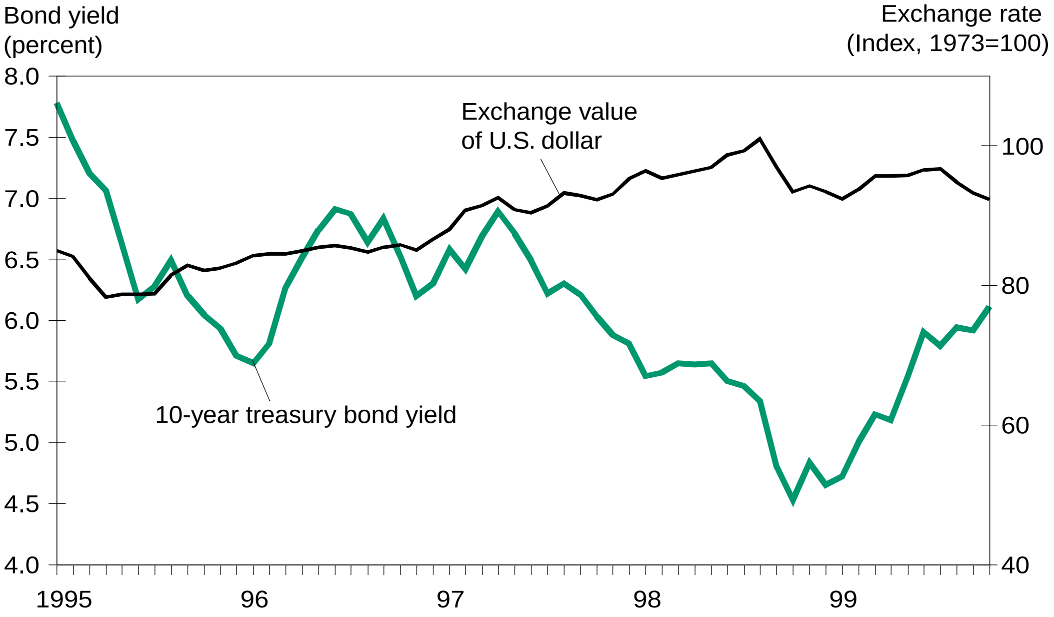
The quick turnaround in Asian and world growth was crucially dependent on a strong U.S. economy absorbing increasing trade deficits. Japan, a major trading partner of the affected Asian countries, and Europe were experiencing sluggish growth. If the United States had not been able to absorb the imports that were needed to boost the Asian economies, no other country could have.

Overall, the U.S. economy was the locomotive that pulled the world out of recession. The already fully employed U.S. economy continued to expand in 1998 and 1999 at about a 4-percent growth rate for gross domestic product (GDP), with inflation at about 2 percent. The strong dollar kept imported goods prices low while low oil prices provided a boost to the supply side of the economy and further constrained inflation. Real compensation rose with no rise in inflation due to low input price inflation, to oil price declines, and to solid U.S. productivity growth from expanded and more effective business computer usage along with a high rate of capital growth. Increasing compensation, low interest rates, and rising household wealth spurred rapid consumer spending growth. Low interest rates and

Figure 1

Treasury bond yields and value of the U.S. dollar, 1995-99

Long-term interest rates reversed their decline in 1999 as growth in the value of the dollar stalled



Note: Exchange rate is a trade-weighted index of the value of the dollar against major currencies, not adjusted for inflation. The index equaled 100 in March 1973.

Source: Federal Reserve Board.

strong equity prices allowed continued growth in business investment spending. As a result, growth continued unabated despite a sharply rising trade deficit.

Still, the major goods-producing sectors—agriculture, manufacturing, and mining—were hurt by the strong dollar and weak world growth. Exports stagnated as U.S. goods were increasingly expensive on world markets, and our foreign customers often lacked the income to afford our exported products.

U.S. agricultural exports were especially hard-hit as the world already had large surpluses of many bulk commodities. In fiscal year 1998, farm exports dropped to $53.7 billion, down from $57.4 billion in fiscal 1997. Farm exports for fiscal 1999, which ended in September, are estimated to fall further to $49 billion. The declines are concentrated in bulk-goods exports, such as feed grains and oilseeds, while high-valued product exports appear to be largely unaffected.

Prices received by farmers reflected the weakness of bulk goods markets. The index of prices of all crops went from 127 in 1996 (index value 1990-92=100) to 116 in 1997, and fell further to 107 in 1998. But prices for food grains, which are largely exported, showed even more weakness, as the index fell from 157 in 1996 to 128 in 1997, and then declined sharply to 107 in 1998. In particular, wheat prices went from $4.30 per bushel in 1996 to $3.38 in 1997, and then dropped to $2.70 in 1998. Feed grains prices were also hard hit, dropping 46 percent over 2 years.

High-value farm product prices were relatively unaffected partly because of smaller export market shares of total production and continued high export demand. High-value farm products include both certain agricultural commodities, such as fruits and nuts, and processed agricultural products, such as cigarettes and snack foods. For example, prices received by farmers for fruits and nuts dropped slightly between 1996-98. Commercial vegetables, grown to be sold as fresh produce or to be processed, saw prices rise almost 10 percent between 1996-98. Prices for processed fruits and vegetables stayed essentially level over the crisis period.

Nonmetro Labor Market Bounces Back After Crisis

The crisis brought a decline in goods export growth in 1997 followed by a sharp drop in early 1998 (fig. 2). Nonmetro employment growth declined along with goods export growth. As goods exports rebounded in late 1998 and the global financial crisis ended, the shock to the nonmetro labor market subsided. Metro labor markets were largely unaffected. Since the metro labor force is about 80 percent of the U.S. labor force, national-level employment continued to grow and the unemployment rate declined to 4.1 percent in October 1999—a 30-year low.

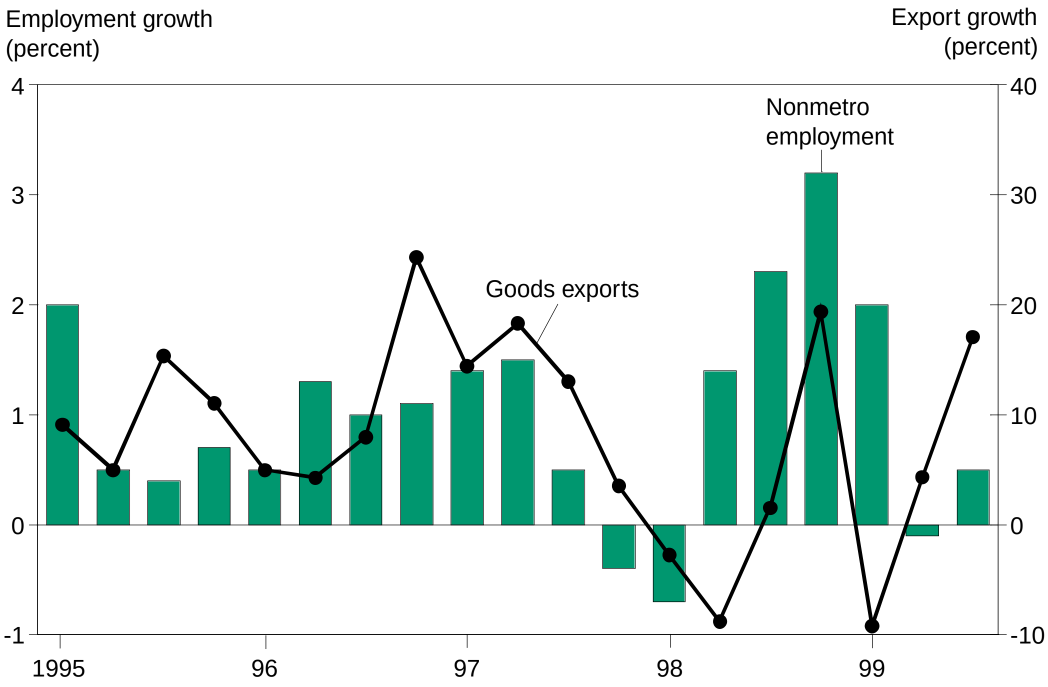
Food processing is one industry that mitigated the negative impact of the crisis on nonmetro areas. Employment in food processing is disproportionately rural, as 37 percent of the 1.8 million food processing workers live in nonmetro areas. The export category foods, feeds, and beverages, which has a high proportion of processed products, peaked in real dollar value in 1995 at $56.4 billion (1996 dollars) and dropped slightly to $55.5 billion in 1996. During the 1997-99 global financial crisis, exports of foods, feeds, and beverages stayed relatively high, with only modest declines, consistent with low impact that the crisis had on high-value agricultural exports.

At the start of the crisis, some analysts compared what was happening with the severe debt crisis of the 1980’s. That debt crisis created lingering effects on the U.S. financial situation: high interest rates, a high-valued dollar, and continuing softness of the U.S. banking system. In particular, the very high-valued dollar made U.S. goods more expensive abroad. That debt crisis hit nonmetro areas disproportionately hard. Nonmetro unemployment did not recover to 1979 levels until 1989. In addition, farm real estate prices peaked in 1982 at $823 per acre, a price not again reached until 1995 when the average acre sold for $844. Although the 1997-99 global financial crisis did indeed result in a higher valued dollar, its rise was brief, small, and not associated with higher interest rates, which

Figure 2

Annualized growth rates of nonmetro employment and goods exports, 1995-99

Growth slowed during the 1997-99 global financial crisis



Note: Export growth adjusted for inflation, constant 1996 dollars.
Source: ERS analysis of U.S. Department of Commerce and Bureau of Labor Statistics data.

could have pushed the value of the dollar even higher. Consequently, the net impact on the rural economy was brief and shallow.

Prospects for Goods Sector Recovery in 2000

The U.S. economy is expected to slow in 2000 due to moderating consumer and business investment spending. The slower spending growth will be partly offset by a falling trade deficit, reflecting improvements of manufacturing export prospects.

Manufactured goods exports are expected to rise in 2000 due to improved world growth and a weaker dollar. Low inflation and interest rates, albeit somewhat higher than in 1998 and early 1999, and continued productivity growth will keep manufacturing profitable. *[Data as of 12/16/1999. David Torgerson, 202-694-5334, dtorg@ers.usda.gov; Karen S. Hamrick, 202-694-5426, khamrick@ers.usda.gov]*

Economic Growth in Farming Areas Lags the Rest of Rural America

Fewer counties depend on farming for a large share of their income than was once the case. Growth in employment and population has lagged other nonmetro areas, as many farming counties struggle to adapt to a changing rural economic landscape. Retaining population, enhancing off-farm job opportunities, and providing public services will be pivotal determinants of the future of farming counties.

Farming areas have participated in the 1990's overall employment and population growth but not to the extent of other nonmetro areas. Population in many farming areas is still declining. Shrinking local economies spell continued uncertainty for sparsely settled farming communities unless nonfarm jobs are added.

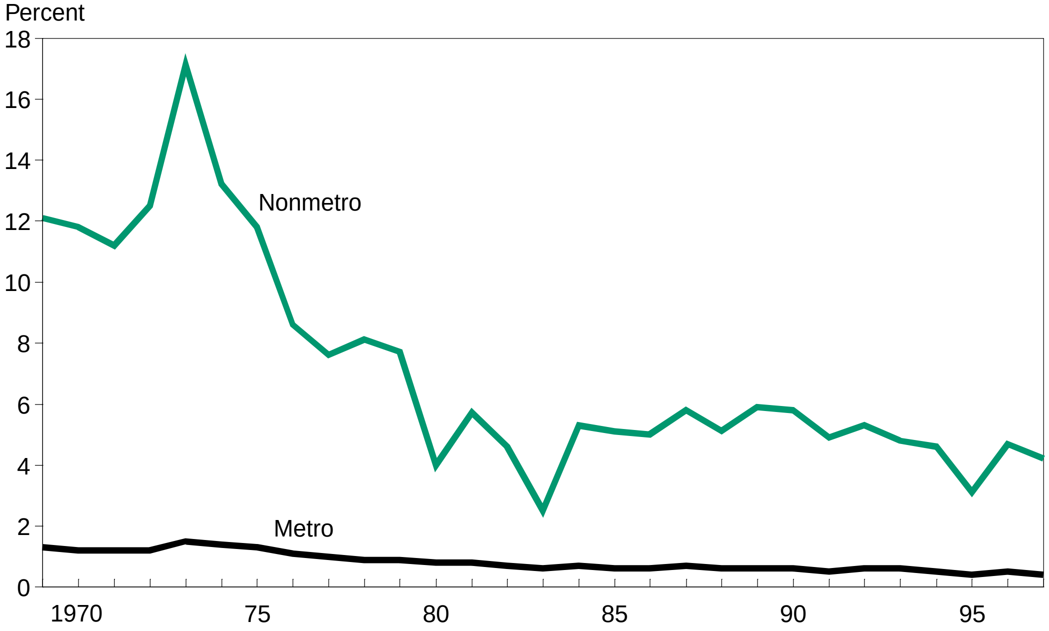
The proportion of total labor and proprietor income (LPI) that comes from farming in nonmetro economies declined substantially through the mid-1980's but has remained relatively stable in the 1990's (fig. 1). Since the early 1980's, ERS has used this measure as an indicator of the relative importance of farming to local economies. Increased productivity and structural change in the farming sector has contributed to continued decline in farm employment since 1935, and the decline is expected to continue for the foreseeable future. Growth in the number of nonfarm businesses, first manufacturing and then services, has greatly expanded the rural employment base. Thus, farming is no longer a dominant source of jobs or income in most rural communities as it was 50 years ago.

Farming contributes 10 percent or more of county-earned income for about one-fourth of nonmetro counties, clustered largely in our Nation's heartland (fig. 2). These are the communities likely to be affected the most by changes in farm financial conditions. Not only does farming have a relatively large economic presence, but the farm commodities produced are those most susceptible to price fluctuations in international markets. Federal agricultural commodity programs have historically played an important role in the farm economy of these counties. Many farming areas have not participated in the industrial diversification of America's rural economy. Therefore, they have a unique economic personality. At the same time, they represent a remnant of rural America's past.

Figure 1

Farming share of local personal income, metro and nonmetro counties, 1969-97

The share of income from farming has been relatively steady during the 1990's

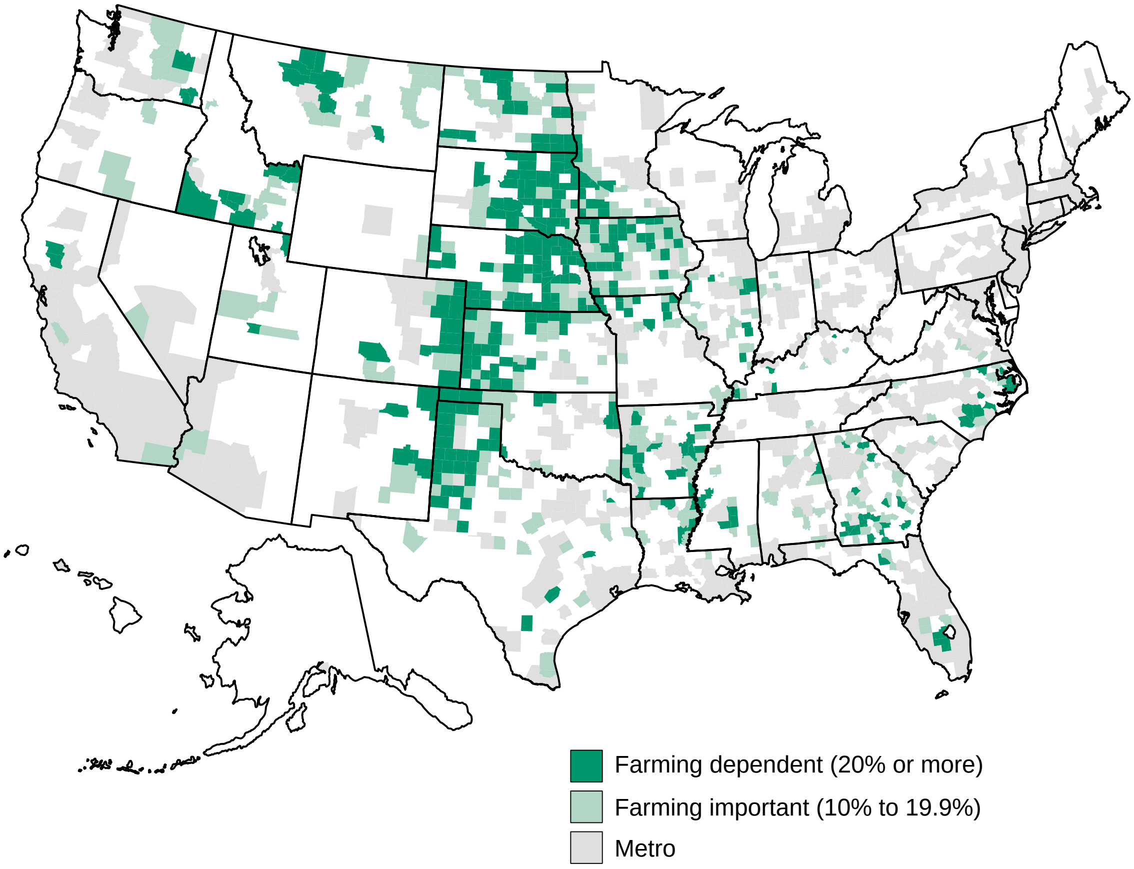


Note: Chart shows the proportion of total labor and proprietor income (LPI) that comes from farming.
Source: ERS analysis of data from the Bureau of Economic Analysis.

Figure 2

Nonmetro counties with at least 10 percent of income from farming

Most counties that rely on farming are in the Nation's heartland


🟩 Farming dependent (20% or more)
▨ Farming important (10% to 19.9%)
□ Metro

Note: Farming-dependent counties derived at least 20 percent of labor and proprietor income (LPI) from farming. Farming-important counties derived 10 to 19 percent of LPI from farming.

Source: Prepared by ERS using data from the Bureau of Economic Analysis.

We look at two groups of counties with relatively high dependence on farming. ERS classifies nonmetro counties that obtain at least 20 percent of LPI from farming as “farming-dependent.” In the mid-1990’s, there were 316 counties in the farming-dependent category, down from 556 in 1989. Another 312 nonmetro counties have a farm income share of 10 to 19.9 percent, and are classified as “farming important” (see box, “Farm Income Share Used To Classify Counties”).

Farming-Dependent Counties Experience the Slowest Growth

Average county per capita income in farming-dependent counties is higher than in other nonmetro areas (table 1). Earned income contributes about 62 percent of total personal income, while the remainder comes from unearned sources such as dividends, interest, and rent and transfer payments. Farming in these counties contributes about 30 percent of earned income, a percentage that has remained relatively constant throughout the 1990’s. It continues to be true that average farm earnings are higher in farming-dependent counties. Average earnings per farm job were $34,300 in farming-dependent counties, compared with $14,550 for the rest of nonmetro counties in 1997. The average farm (measured by total value of agricultural products sold) is larger in farming-dependent counties (table 2). Farms in these counties produced 18.2 percent of all agricultural products sold in 1997. With relatively few nonfarm jobs available in farming-dependent coun-

Table 1

Characteristics of counties by farming dependence

The more dependent a county was on farming, the less it participated in employment and population growth in the 1990's

Item	Farming-dependent	Farming-important	Other nonmetro
		Number	
Number of counties	316	312	1,662
		Thousands	
Total employment, 1997	1,347	2,328	24,359
Employment by industry:[1]		Percent	
Goods producing—	37.2	35.9	29.5
Farming	18.3	12.0	5.3
Manufacturing	10.6	15.7	16.2
Other	8.4	8.2	7.9
Services—	61.1	62.3	68.7
Business services[2]	12.3	11.8	11.7
Retail trade	14.0	15.5	17.6
Government	16.1	15.2	15.9
Other	18.7	19.8	23.5
Employment change, 1980-90	-1.6	6.8	14.1
Employment change, 1990-97	11.3	13.6	14.1
Employment change by industry:			
Goods producing—	4.4	6.4	3.7
Farming	-6.4	-6.8	-6.9
Manufacturing	12.4	14.5	4.4
Other	24.7	14.6	10.5
Services—	13.9	16.8	17.7
Business services[2]	9.2	12.6	14.4
Retail trade	20.1	20.4	21.2
Government	7.2	8.9	6.9
Other	19.0	23.7	25.2
		Dollars	
Average per capita income, 1997	19,413	18,489	19,131
		Thousands	
Population, 1998	2,692	4,631	47,218
Population change:		Percent	
1990-98	2.6	6.1	7.4
1980-90	-6.5	-1.5	3.8
Net migration:			
1990-98	.9	3.4	4.4
1980-90	-10.6	-6.5	-1.9
Proportion of counties with population loss:			
1990-98	57.6	39.4	21.0
1980-90	85.8	71.2	44.9

[1] Percentages do not sum to 100, due to suppression.

[2] Includes transportation, public utilities, wholesale trade, finance, insurance, and real estate.

Source: ERS analysis of data from the Bureau of Economic Analysis and the Bureau of the Census.

Table 2

Characteristics of farms by county farming dependence, 1987-97

The more dependent a county was on farming, the larger the decline in the number of farms and the increase in sales per farm

Item	Unit	Farming-dependent	Farming-important	Other nonmetro
Farms, 1997	Thousands	166.3	186.2	940.2
Share of all farms	Percent	8.7	9.7	49.2
Farms, 1987	Thousands	190.0	208.2	1,007.7
Change in farms, 1987-97	Thousands	-12.5	-10.6	-6.7
Market value of agricultural products sold, 1997	Billion dollars	35.9	27.9	66.4
Average sales per farm, 1997	1,000 dollars	233.9	161.2	69.2
Average sales per farm, 1987	1,000 dollars	131.6	94.8	46.0
Average land area in farms, 1997	Percent	78.4	66.5	34.4

Source: ERS analysis of data from the Census of Agriculture.

ties, farm operators are more likely to expand the size of their farms in order to maintain household income. As a result, the number of farms in these counties declined by 12.5 percent between 1987 and 1997, while the average farm's sales have increased by 78 percent, according to the Census of Agriculture.

As a group, farming-dependent counties experienced 11.3 percent job growth during 1990-97. This is in sharp contrast to the employment declines in these counties during the 1980's, although farming-dependent counties added jobs at a slower rate than other nonmetro areas (table 1). And job growth during the 1990's has not been in farming: farming-dependent counties lost farm jobs at a rate of 6.4 percent in 1990-97. Growth has occurred, however, in agricultural services, manufacturing, and services.

As a whole, goods-producing industries (farming, agricultural services, manufacturing, mining, and construction) provide a higher proportion of jobs in farming-dependent counties than in the other county types—although farming-dependent counties have relatively few manufacturing jobs. It follows that service sector jobs are a smaller share of employment in farming-dependent counties. The relative scarcity of service jobs in these counties is in large part responsible for their weak employment growth, since growth in service sector jobs drove overall employment growth in the 1990's.

While over 60 percent of jobs are in service industries, service jobs contribute only half of earned income, suggesting that wages in this sector are relatively low. In fact, earnings per service job in farming-dependent counties were only 87 percent of the rest of nonmetro counties. Farming-dependent counties have a smaller proportion of service jobs in retail trade and other services (which include health, educational, recreational, and social services). This likely reflects the small and shrinking population base in many farming-dependent counties.

About 2.7 million people (5 percent of the nonmetro population) lived in farming-dependent counties in 1998. Population growth between 1990 and 1998 averaged 2.6 percent. About one-third of this growth was due to net migration; the remainder was due to natural increase (births exceeding deaths). This is a sharp turnaround from the 6.5-percent population decline of the 1980's, a period of heavy population outmigration. Counties that have grown are located in the eastern part of the Corn Belt, the South, and the Rocky Mountains where nonfarm job opportunities are growing or where people are migrating in order to enjoy scenic landscapes. Some farming-dependent counties located along the Platte River in Nebraska and around Garden City, Kansas, have grown as a result of new jobs in meatpacking. Value-added manufacturing such as meatpacking has helped some farming areas expand their employment base and attract immigrants. Nevertheless, more than half of farming-dependent counties lost population during the 1990's. Those losing population were in the Plains, an area that has been losing population for decades.

It appears that many farming-dependent counties will have difficulty maintaining a large enough population base to support community services. Economic growth during the 1990's has favored more urban places, even within nonmetro America. Many farming-dependent counties are remote from urban growth nodes, and have low population densities. There is, however, some evidence that telecommunications has helped to overcome the distance problem, particularly for farming-dependent counties in the Rocky Mountains, which offer scenic beauty often sought by migrants to rural areas.

Farming-Important Counties Fare Better

Jobs grew faster in farming-important counties than in farming-dependent counties during 1990-97. Employment grew 13.6 percent, double the growth rate during the 1980's. Most farming-important counties are adjacent to farming-dependent counties, and some were formerly classified as farming-dependent counties in 1989. Manufacturing has a larger presence in these counties, as does the service sector. This suggests that farming-important counties have been able to expand their nonfarm employment base in order to retain or attract population. For these counties, strong job growth in manufacturing and services (especially health, educational, and recreational services) offset lost jobs in farming.

Farms in farming-important counties produced about 14 percent of the Nation's agricultural products in 1997. The number of farms in these counties declined by 10.6 percent over the 1987-97 period, slower than the decline in farming-dependent counties. The availability of off-farm jobs often helps farm households maintain income while continuing farming.

Relative to farming-dependent counties, farming-important counties have experienced robust population growth during the 1990's. Net inmigration has contributed over half this growth. Places like the Ozark-Ouachita Mountains in Arkansas and the Rocky Mountain Front offer natural amenities sought by rural inmigrants. Still, about 40 percent of the farming-important counties, many in the High Plains, continued to lose population during the decade.

Number of Farming-Dependent Counties Declined Since 1989

ERS last identified farming-dependent counties in 1989, using farm earnings over the 1987-89 period. Of the previous 556 farming-dependent counties, 275 are included in our updated analysis. Thus, 281 counties previously defined as farming-dependent are not so classified in this article. Of these 281 counties, 134 are now classified as farming-important. Rapid growth in manufacturing jobs is the one feature that differentiates these counties from our farming-dependent counties. Another 104 counties moved out of our two farming groups altogether. Job growth in these counties was unusually high in other services (health, educational, recreational, and social services) and other goods-producing (construction and mining) sectors. Finally, 43 former farming-dependent counties had negative farm earnings (farm losses) during 1994, 1996, and 1997. Given that over a fifth of their total employment is in farming, these sparsely settled counties would likely be classified as farming-dependent had the farm losses not occurred.

Forty-one new counties joined our farming-dependent category. These counties resemble our farming-important group in terms of employment structure and population size. A number of counties have a ratio of farm LPI to total LPI that is close to 20 percent. Thus, a small change in either farm earnings or nonfarm earnings could shift a county into farming-dependent status. *[Kathleen Kassel, 202-694-5428, kkassel@ers.usda.gov; Thomas Carlin, 202-694-5406, tcarlin@ers.usda.gov]*

Farm Income Share Used To Classify Counties

The Bureau of Economic Analysis, U.S. Department of Commerce, compiled the data used to classify counties. Farm labor and proprietor income includes the net income of farm operators (proprietors) and wages paid persons employed on farms. Total labor and proprietor income (LPI) includes the earnings of all proprietorship business (farm and nonfarm) in the county plus wages paid all persons working in the county. LPI also includes some nonwage but work-related income items such as employer contributions to life and health insurance.

Farming-Dependent Counties are the 316 counties where farming constituted 20 percent or more of a county's LPI in 1994, 1996, and 1997. *Farming-Important Counties* are the 312 counties where farming constituted 10-19 percent of LPI for those years. A 3-year average was used to "smooth over" year-to-year variability in farm income. The years chosen had the highest net income in the 1990's. Because of unusual conditions that reduced farm income in 1995, data from that year were excluded. A cool, wet spring delayed planting of many crops, and hot summer weather and an early frost also reduced crop production. Corn production, for example, declined by 25 percent from the 1994 record crop. Carryover stocks were rather large coming into the year. Thus, when output declined, inventories were drawn down, further lowering net farm income. Also, livestock prices fell throughout the year.

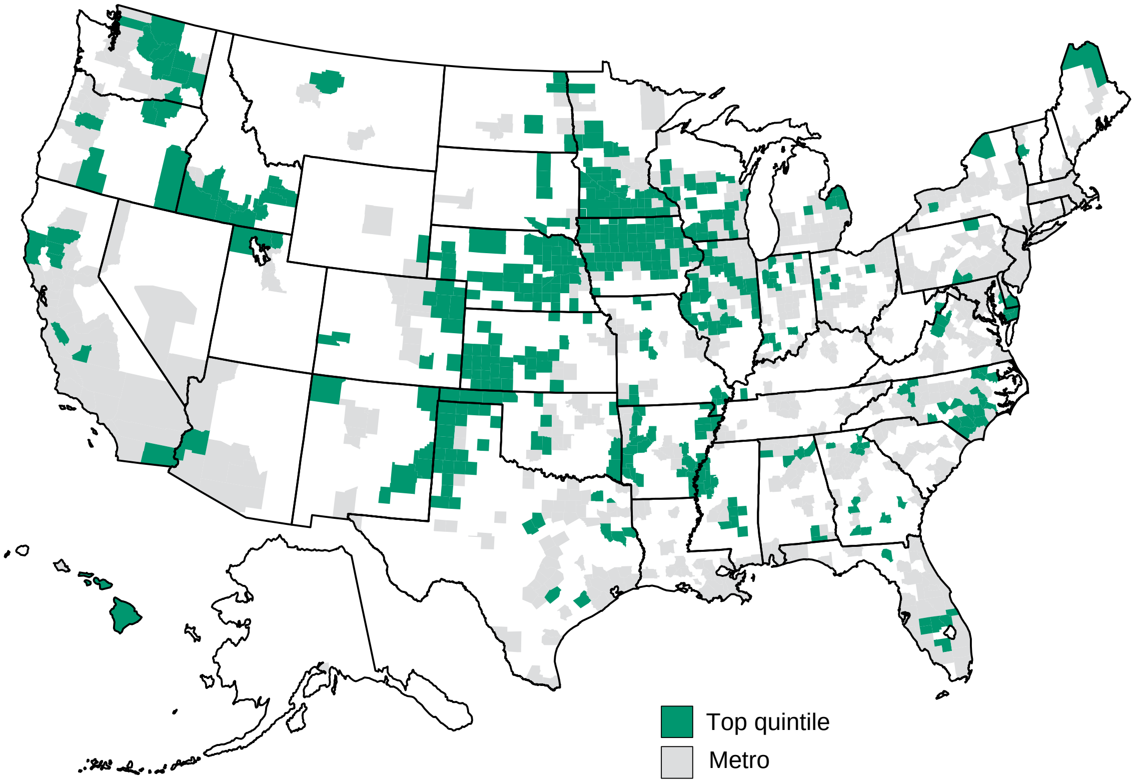
Replicating the earlier ERS classification using more recent revised Bureau of Economic Analysis (BEA) data yields 406 farming-dependent counties in 1987-89, not 556. Revisions in the data account for over half of the 281-county decrease in the number of farming-dependent counties. BEA continually revises county income estimates (both farm and nonfarm) as new information becomes available or as new estimating procedures are introduced. Even after adjusting for data revisions, the decline in the number of farming-dependent counties is substantial, particularly given that we chose the years with the highest farm income during the 1990's for analysis.

Our measure is a gauge of the importance of farming to the local economy. It is not a measure of the top agricultural counties in the Nation, as might be measured by the market value of agricultural products sold from farms (see fig. 3). There are, however, overlaps between the two concepts. For example, Iowa has 60 counties—clustered in the northern region of the State—among the top quintile of nonmetro counties ranked by the market value of agricultural products sold in 1997. Of these, 50 are also classified as farming-dependent or farming-important counties. On the other hand, most of the nonmetro counties in eastern South Dakota are farming-dependent or farming-important, but few of them are in the top quintile of nonmetro counties ranked by farm sales.

Figure 3

Leading nonmetro counties in market value of agricultural products sold, 1997

Many but not all farming-dependent and farming-important counties (see fig. 2) are top ranked in sales



Note: Chart shows the top 20 percent of nonmetro counties ranked by market value of agricultural production.
Source: Prepared by ERS using data from the Census of Agriculture.

Where Is Agriculture Important?

More than one in six U.S. jobs stem from agriculture. Even in nonfarm States, a substantial portion of jobs are in the food and fiber system. There are several ways of measuring the dependence of a State's economy on agriculture. We present several alternatives and compare these estimates of dependence in 1997 with similar estimates of 1981 conditions.

Rural development planners, rural legislators, agricultural college deans, and representatives from agricultural commodity groups all at some time or another have expressed interest in measuring the importance of agriculture in a particular State. They often want to compare agriculture's importance in different States. To address this concern, we derived estimates of agriculture's importance for all States using common estimation procedures and data.

To measure the importance of agriculture, we estimated the supporting economic activity required to produce farm products and move them to products ready for consumers. We included the activity that produces farm inputs (fertilizer, manufactured feeds, etc.), farm production, and assembling, processing, and distributing raw farm products for final consumption by domestic and foreign consumers—activities that make up the U.S. food and fiber system (FFS). Several factors help make agriculture important to a State's economy—a viable farm economy, a concentration of sector-supporting industries, and a relative scarcity of nonagricultural economic activity.

Size Versus Share of Economy

California illustrates the classification dilemma. It is the leading producer of many commodities, has many successful commercial farms, and has a strong base of farm-supporting industries. As a result, California has the largest number of workers who owe their jobs to agriculture—2.7 million. The size of its FFS workforce makes it the leading State in the national food and fiber system. But California is not an agriculturally dependent State. With a total labor force of 16 million, agriculture accounts for a smaller share of the State's economy (16.9 percent of civilian workforce) than its national share (17.8 percent of civilian workforce).

In contrast, consider the Dakotas. Their FFS employment is between 89,000 and 97,000, half of it farmers and farm workers, and FFS jobs account for more than 25 percent of all jobs in each State. FFS jobs are very important in the Dakotas, although the combined total FFS employment in these States accounts for less than 1 percent of U.S. employment in the food and fiber system.

How do you tell how important agriculture is to your State? In an earlier article, we addressed this question using 1981 data (see Gerald Schluter and William Edmondson, "How to Tell How Important Agriculture Is to Your State," *Rural Development Perspectives*, Vol. 2, No. 3, June 1986). We concluded that the importance measure depends upon what you are looking for. This article uses 1997 data to revisit our earlier analysis. We include estimates of each State's FFS employment in 1997 and 1981 (table 1), the FFS's share of total State workforce (fig.1) and of the relative importance of selected groups of workers in the region's FFS workforce.

Table 1 shows FFS jobs for 1981 and 1997 by State, while figure 1 shows FFS employment proportions of total civilian employment for each State. Between 1981 and 1997, total FFS employment rose by 3 million workers, from 21.3 to 24.3 million. Not all States shared in this growth. Nine States lost workers involved in producing, assembling, and processing raw farm products and in industries that distribute those products to domestic and foreign consumers. The loss of FFS employment followed no particular pattern. States with large FFS workforces lost jobs (New York, Pennsylvania), as did States where the share of FFS employment was high (North Dakota and South Dakota). States in similar groupings gained employment. Nebraska, for instance, had the highest percentage of FFS workers in its State workforce in 1997 and also saw its FFS employment increase nearly 28 percent from 1981 to 1997. California, the State with the largest FFS employ-

Table 1

Food and fiber system employment by State, 1981 and 1997

California was the leading State in food and fiber system employment for both 1981 and 1997

State	1997 Employment	1997 Ranking	1981 Employment	1981 Ranking	1981-97, Percent change[1]
	1,000 workers		1,000 workers		1981-97
Alabama	425.8	20	380.2	19	12.0
Alaska	53.2	50	34.7	51	53.4
Arizona	359.4	26	218.7	32	64.3
Arkansas	270.8	31	213.9	33	26.6
California	2,701.3	1	2,160.2	1	25.1
Colorado	396.5	23	299.6	26	32.4
Connecticut	259.4	32	251.0	30	3.3
Delaware	76.5	47	56.4	48	35.6
District of Columbia	63.4	48	68.8	47	-7.9
Florida	1,286.2	4	858.8	7	49.8
Georgia	774.6	10	623.8	11	24.2
Hawaii	114.4	40	103.4	40	10.7
Idaho	133.6	38	107.2	38	24.6
Illinois	1,112.3	5	1,044.2	5	6.5
Indiana	560.5	14	465.6	18	20.4
Iowa	380.9	25	361.0	23	5.5
Kansas	304.1	29	276.7	28	9.9
Kentucky	400.5	22	330.4	25	21.2
Louisiana	351.2	27	378.1	20	-7.1
Maine	111.7	41	110.3	37	1.2
Maryland	410.4	21	368.5	22	11.4
Massachusetts	526.8	16	523.8	13	.6
Michigan	794.9	9	640.2	9	24.2
Minnesota	510.3	19	478.4	17	6.7
Mississippi	235.2	34	221.9	31	6.0
Missouri	518.1	18	521.9	15	-.7
Montana	89.7	44	82.4	43	8.9
Nebraska	255.6	33	199.7	34	28.0
Nevada	136.1	37	69.5	46	95.9
New Hampshire	103.3	42	81.4	44	26.9
New Jersey	647.4	11	630.7	10	2.6
New Mexico	136.8	36	106.9	39	28.0
New York	1,351.7	3	1,472.0	2	-8.2
North Carolina	907.7	8	789.5	8	15.0
North Dakota	89.5	45	90.3	42	-.9
Ohio	999.9	7	872.6	6	14.6
Oklahoma	278.0	30	298.8	27	-6.9
Oregon	304.5	28	252.7	29	20.5
Pennsylvania	1,044.3	6	1,068.2	4	-2.2
Rhode Island	76.6	46	76.0	45	.7
South Carolina	382.6	24	353.3	24	8.3
South Dakota	97.4	43	98.2	41	-.8
Tennessee	543.2	15	487.0	16	11.5
Texas	1,639.5	2	1,405.9	3	16.6
Utah	173.2	35	120.9	36	43.3
Vermont	57.1	49	43.7	50	30.7
Virginia	617.2	12	546.9	12	12.9
Washington	524.6	17	374.1	21	40.2
West Virginia	127.2	39	134.5	35	-5.4
Wisconsin	562.5	13	522.4	14	7.7
Wyoming	49.1	51	44.7	49	9.9
United States	24,326.8	NA	21,320.0	NA	14.1

NA = Not applicable.

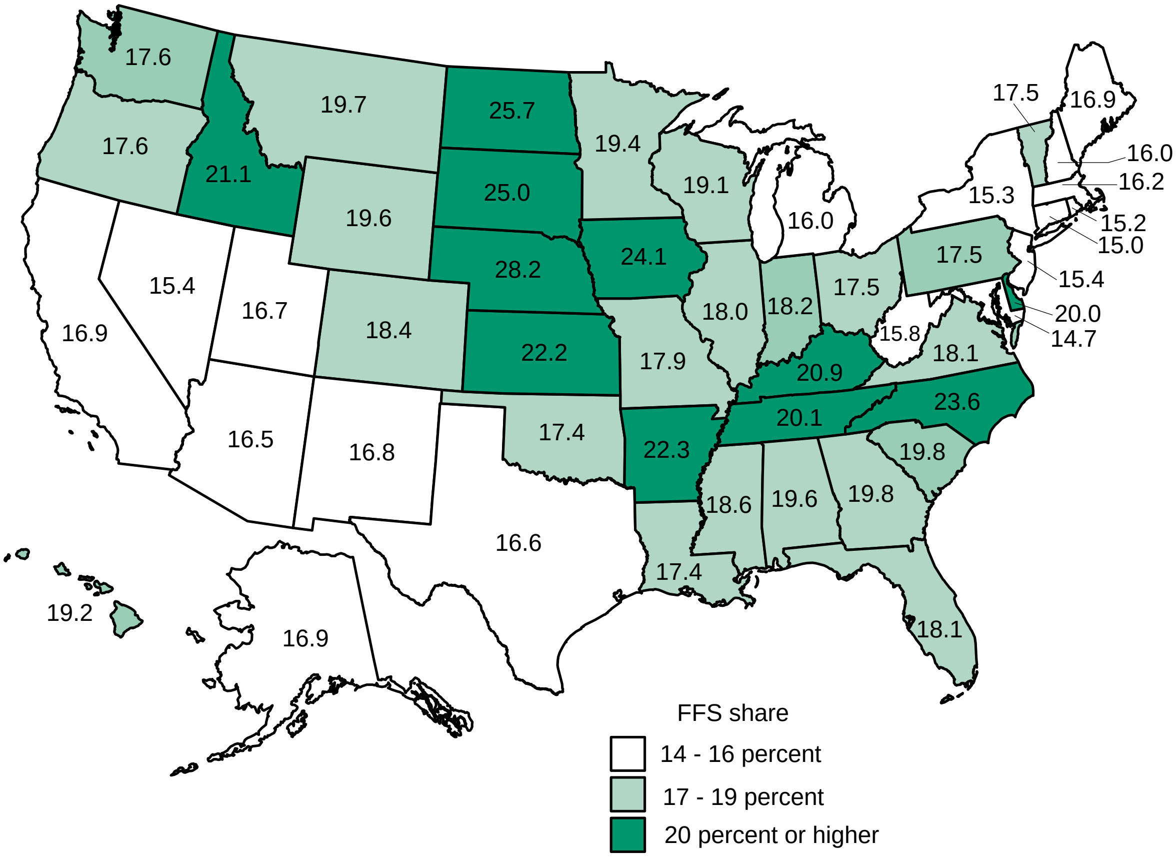
[1] Percentage change in food and fiber system employment from 1981 to 1997.

Source: ERS analysis of U.S. Department of Commerce data.

Figure 1

Food and fiber system share of employment by State, 1997

States in the Great Plains have the highest share of jobs in the food and fiber system


17.6
19.7
25.7
19.4
17.6
21.1
25.0
19.1
19.6
16.0
15.4
28.2
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16.7
18.4
18.0
18.2
17.5
16.9
22.2
17.9
20.9
15.8
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16.5
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22.3
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19.8
17.4
18.1
19.2
16.9
17.5
16.9
16.0
16.2
15.3
15.2
15.0
17.5
15.4
20.0
14.7
FFS share
14 - 16 percent
17 - 19 percent
20 percent or higher

Source: ERS analysis of U.S. Department of Commerce data.

ment, saw its FFS employment grow 25 percent from 1981 to 1997. In general, FFS employment accounts for a larger share of total employment in rural States with relatively weak combined manufacturing, forestry, and mining sectors.

The FFS is important to all States. Nationally, the FFS accounts for 17.8 percent of total employment. Among the States, the share ranges from 14.7 percent in Maryland to 28.2 percent in Nebraska, but in nearly two-thirds of the States the FFS employment share of total employment is between 15 and 20 percent. Contributing to this grouping is a growing trend to more of the FFS jobs being at the consumer end of the FFS delivery chain. These jobs tend to be in transportation, wholesale and retail trade, and food service. As we see in table 2, employment in these sectors is more evenly distributed regionally.

Composition of FFS Employment Varies by Region

While table 1 emphasizes the level of employment, table 2 illustrates how the sectoral mix of FFS employment varies regionally. As in 1981, farming and food processing jobs are more important in the Midwest. Textile manufacturing jobs accounted for more than 7 percent of FFS jobs in the South. FFS manufacturing jobs other than food processing and textile manufacturing were relatively more important in the Northeast and North Central regions.

Table 2

Types of food and fiber system jobs by region, 1997

The Midwest has the greatest concentration of farming and food processing jobs

	Northeast	North Central	South	Midwest	West	United States
			Percent			
Farming	2.23	6.44	7.24	19.49	7.97	7.49
Food processing	4.45	5.99	5.32	8.34	5.49	5.59
Textiles	5.00	.78	7.32	1.34	2.94	4.37
Other manufacturing	6.05	7.60	5.25	4.79	3.53	5.37
Wholesale and retail	38.51	35.12	32.75	29.54	32.17	33.73
Transportation	2.55	2.63	2.37	2.55	2.36	2.46
Food service	25.38	28.85	26.00	23.09	27.83	26.50
Other	15.83	12.58	13.76	10.86	17.71	14.51
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: ERS analysis of U.S. Department of Commerce data.

Alternate Views of Agricultural Dependency

Which States are agriculturally dependent? In our previous article, we chose four possible criteria and listed the 10 top States for 1981 under those criteria (see box, “Ranking States by Dependence on Agriculture). If one defines importance as the total FFS workers within a State, then the most important States are those listed in the upper left of the box. If one defines importance as the share of the State’s employment accounted for by the FFS workers, then the most important States are those listed in the upper right of the box. If one’s interest is in farm workers rather than FFS workers, the lower part of the box gives similar comparisons. We show the 1981 list alongside the 1997 list under the same criteria. In 1981, North Carolina and Iowa both appeared on three of the four lists; North Carolina on the number of FFS jobs, number of farm workers, and the FFS proportion of total and Iowa on number of farm workers, the FFS proportion of total, and farm workers’ share of State FFS employment. In 1997, North Carolina and Iowa repeated on those lists and Nebraska joined Iowa on its lists.

Why do we care about which States are farm dependent? American agriculture is in a price slump. It is no coincidence that there is a strong overlap between the States on our four lists of farming-dependent States under different criteria and the list of States whose public officials have expressed concern about the economic health of American agriculture. *[Gerald Schluter, 202-694-5395, schluter@ers.usda.gov; William Edmondson, 202-694-5374, wedmonds@ers.usda.gov]*

Ranking States by Dependence on Agriculture

States with the most food and fiber system workers:

	1997	1981
1.	California	California
2.	Texas	New York
3.	New York	Texas
4.	Florida	Pennsylvania
5.	Illinois	Illinois
6.	Pennsylvania	Ohio
7.	Ohio	Florida
8.	North Carolina	North Carolina
9.	Michigan	Michigan
10.	Georgia	New Jersey

States with the highest proportion of food and fiber system workers:

	1997	1981
1.	Nebraska	South Dakota
2.	North Dakota	North Dakota
3.	South Dakota	North Carolina
4.	Iowa	Iowa
5.	North Carolina	South Carolina
6.	Arizona	Idaho
7.	Kansas	Nebraska
8.	Idaho	Georgia
9.	Tennessee	Alabama
10.	Delaware	Tennessee

States with the most farm workers:

	1997	1981
1.	California	California
2.	North Carolina	Texas
3.	Texas	North Carolina
4.	Iowa	Minnesota
5.	Nebraska	Michigan
6.	Illinois	Wisconsin
7.	Kansas	Iowa
8.	Minnesota	Illinois
9.	Kentucky	Missouri
10.	Wisconsin	Kansas

States with the highest proportion of farm workers to the State's total food and fiber system jobs:

	1997	1981
1.	North Dakota	South Dakota
2.	South Dakota	North Dakota
3.	Nebraska	Iowa
4.	Iowa	Idaho
5.	Kansas	Montana
6.	Idaho	Kansas
7.	Montana	Nebraska
8.	Kentucky	Minnesota
9.	Arkansas	Wisconsin
10.	Wyoming	Oklahoma

Source: ERS analysis of U.S. Department of Commerce.

Farm Employment Losses Outstrip Job Gains in Farm-Related Industries in Some Nonmetro Areas

Farm jobs have declined during the past 20 years, and jobs closely related to farming have shown little growth. At the same time, the number of agriculturally related jobs away from the farm has increased, but not as fast as farm employment losses in some States.

Employment on farms—including farm proprietors and wage and salary farmworkers—in nonmetro counties diminished by almost 667,000 jobs (26.9 percent) during 1975-96 (table 1). Farm consolidation and technological changes that substitute capital for labor in farming explain much of the decline. These factors, coupled with periods of unfavorable agricultural economic conditions, caused all regions to lose nonmetro farm jobs. The Southeast and Delta regions lost the most farm employment (about 40 percent), while the Pacific, Southern Plains, and Mountain regions had relatively modest declines (from 3 to 12 percent).

As the number of farm proprietors and wage and salary farmworkers declined, employment changes were mixed in industries closely related to farming (table 2). The agricultural services, forestry, and fisheries sector in nonmetro counties gained more than 100,000 jobs (mostly in veterinary and crop services), but these gains were offset by an almost equal number of jobs lost by nonmetro industries that process and market agricultural goods after they leave the farm. Processing and marketing employment was negatively affected by mergers and acquisitions in the industry and the replacement or retooling of labor-intensive plants to rely on more automated machinery. Employment also declined in agricultural input industries, such as farm machinery manufacturers and suppliers, which lost 28,000 jobs in nonmetro counties.

Rural jobs increased the most in industries weakly linked to farming (table 2). The largest segment of these peripherally related industries—wholesale and retail trade of agricultural products, such as grocery stores and restaurants—increased by more than 1.3 million jobs (94.7 percent). Job growth in wholesale and retail trade industries is principally linked to growth in population and income. Increased personal income has changed consumer behavior, with more prepared foods being purchased at retail outlets or eaten outside the home. Compared with wholesale and retail trade, indirect agribusiness, like chemical and fertilizer mining and food products machinery manufacturing, gained only about 36,000 jobs in nonmetro areas (34.5 percent).

Table 1

Change in nonmetro farm employment, 1975-96[1]

Farm employment fell in nonmetro areas of all regions

Region	1975	1996	Change, 1975-96	
	————Number of jobs————		Number of jobs	Percent
U.S. nonmetro	2,475,218	1,808,435	-666,783	-26.9
Appalachia	371,992	256,875	-115,117	-30.9
Corn Belt	530,017	360,091	-169,926	-32.1
Delta States	197,261	121,786	-75,475	-38.3
Lake States	260,728	187,634	-73,094	-28.0
Mountain	146,914	128,374	-18,540	-12.6
Northeast	109,318	80,751	-28,567	-26.1
Northern Plains	272,140	203,236	-68,904	-25.3
Pacific	106,648	102,787	-3,861	-3.6
Southeast	203,240	115,372	-87,868	-43.2
Southern Plains	265,233	242,046	-23,187	-8.7

Note: Detail may not add to total because of data unclassified by metro/nonmetro county.

[1] Nonmetro farm employment includes farm proprietors and wage and salary farmworkers.

Source: Calculated by ERS using Department of Commerce data.

Table 2

Change in employment in nonmetro farm and farm-related industries, 1975-96

Most nonmetro farm-related job gains are in agricultural wholesale and retail trade

Industry	1975	1996	Change, 1975-96	
	Number of jobs		Number of jobs	Percent
Farming	2,475,218	1,808,435	-666,783	-26.9
Forestry, fisheries, and agricultural services	88,521	189,409	100,888	114.0
Agricultural inputs	239,601	211,518	-28,083	-11.7
Processing and marketing	1,202,916	1,102,737	-100,179	-8.3
Wholesale and retail trade	1,384,196	2,694,762	1,310,566	94.7
Indirect agribusiness	104,068	140,045	35,977	34.5

Source: Calculated by ERS using U.S. Department of Commerce data.

Farming and Its Closely Related Jobs Are Not Easily Replaced

Trends in farm and farm-related employment indicate that, nationally, nonmetro areas gained less than two jobs in industries peripheral to agriculture for each job lost in farming and its closely related industries (table 3). More striking is the low ratio of peripheral farm-related job gains to farm job losses in some States where farm production comprised a high percentage of total nonmetro employment. North Dakota, South Dakota, and Iowa, where farm production jobs comprised 20 to 26 percent of total nonmetro employment, had a job gain/loss ratio of less than one. In these States, the agricultural sector, including industries only weakly linked to farming, could not create new jobs at a pace equal to the large decline in farm jobs. Other States with low ratios, such as Missouri (1.1) and Tennessee (1.0), suffered from large losses of jobs in farming and closely related processing and marketing industries.

Although agricultural wholesale and retail trade industries may generate jobs in most nonmetro areas, employment growth in these industries depends on population increases and subsequent expansion of consumer markets. Agricultural wholesale and retail industries most likely cannot provide significant job growth in sparsely settled areas that experience little or no population expansion. Population losses in nonmetro areas of North Dakota (-13.1 percent), South Dakota (-2.3 percent), and Iowa (-7 percent) help explain the low agricultural sector job growth in these States during 1975-96. Conversely, nonmetro population increases in California (62.9 percent) and Idaho (32.1 percent), coupled with small losses of farm jobs, yield a peripheral job gain to farm job loss ratio in these States of 38.3 and 57.5, respectively. Texas, where nonmetro population increased 22 percent, had a job gain/loss ratio of 6.8, almost equal to the job gain/loss ratio of 6.9 for these industries in metro areas of the Nation.

Peripheral Farm-Related Industries Offer Job Growth...

Job growth in many nonmetro areas, which in the past relied primarily on farming for jobs, may now rest with industries only remotely related to agriculture. Agricultural wholesale and retail trade industries, which provide the final linkage between farmer and consumer, have been the principal source of new farm-related jobs in nonmetro areas during the past 20 years. In some nonmetro areas, population growth rates cannot increase the size of consumer markets needed to support wholesale and retail job gains to offset the number of jobs lost in farming and its closely related industries.

...as Farm Jobs Continue To Dwindle

Farm production has suffered large employment losses from long-term trends in farm consolidation and increases in productivity that reduced labor requirements needed to

Table 3

Jobs gained in industries peripheral to agriculture compared with jobs lost in farming and its closely related industries, 1975-96

Most of the top 15 States in which farm production jobs comprised a large percentage of total nonmetro employment gained few jobs in peripherally related farm industries to replace farm jobs lost

State/area	Farm production share of total nonmetro employment, 1975	Ratio of peripheral job gain to farm job loss[1]
	Percent	Ratio
U.S. nonmetro	14.2	1.9
Top 15 States:		
North Dakota	26.4	.5
South Dakota	25.0	.7
Nebraska	21.9	2.4
Iowa	20.6	.6
Texas	20.4	6.8
Minnesota	20.4	1.3
Missouri	20.3	1.1
Arkansas	18.2	1.2
Wisconsin	17.8	2.1
Kansas	17.1	2.2
Kentucky	16.8	2.5
Oklahoma	16.5	3.7
Tennessee	15.9	1.0
California	15.6	38.3
Idaho	15.0	57.5

[1] Ratio of peripheral farm-related job gain to loss of jobs in farming and closely related sectors.

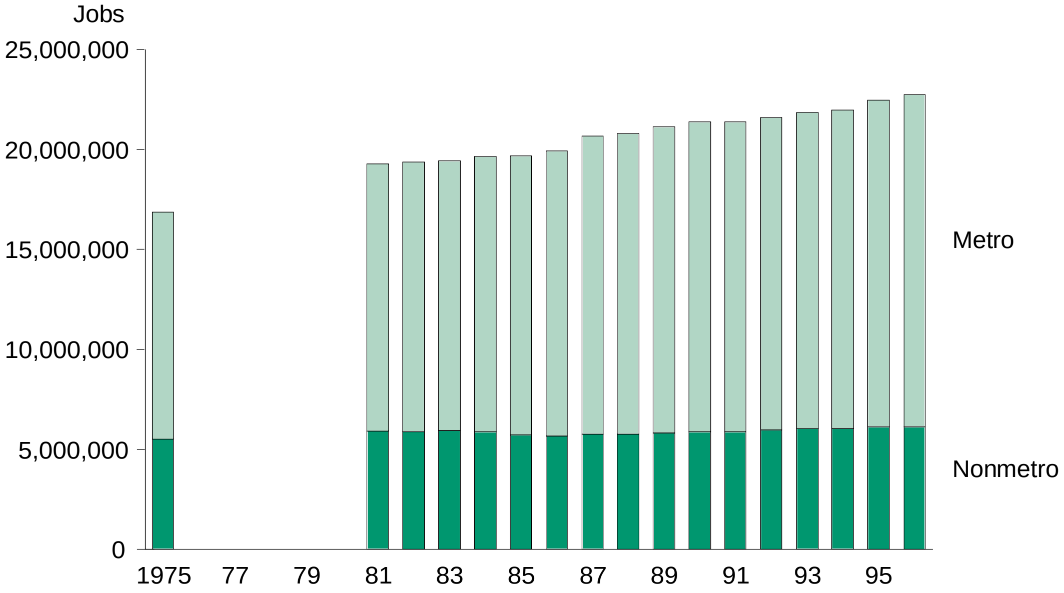
Source: Calculated by ERS using U.S. Department of Commerce data.

produce agricultural goods. These trends are likely to continue, placing farm production in a position unlikely to generate nonmetro jobs. Jobs in closely related agricultural input industries will decrease along with the decline in farm production employment. These trends are largely responsible for the declining nonmetro share of farm and farm-related jobs (fig. 1). Processing of agricultural products to add value to the region's commodities may be a source of new jobs that build upon the agricultural base in nonmetro counties, but as evidenced during 1975-96, such processing industries lost more than 100,000 jobs. Still, some rural locations may add jobs through the development of value-added agricultural operations. However, sustained employment growth in processing industries may depend on the ability to penetrate new markets through expanded distribution of existing goods or development of new products. *[Alex Majchrowicz, 202-694-5355, alexm@ers.usda.gov]*

Figure 1

Farm and farm-related employment, 1975-96

Nonmetro areas account for a declining share of all farm and farm-related jobs



Note: Complete data are not available for 1976-80.
Source: Calculated by ERS using U.S. Department of Commerce data.

Farm and Farm-Related Employment

Farm and farm-related employment includes jobs not only in farm production but also in processing, marketing, and input supply industries (see appendix, “Two Methods of Measuring Farm-Linked Employment”). Farm and farm-related industries are identified as those having generally 50 percent or more of their national workforce employed in providing goods and services necessary to satisfy the final demand for agricultural products. An exception to this criterion is indirect agribusinesses, in which percentages range between 32 and 50 percent. In this article, we classify farm-related industries into those closely related to farming (agricultural services, forestry, and fishing; agricultural inputs; and processing and marketing of agricultural goods) and industries peripherally related to farming (wholesale and retail trade of agricultural products and indirect agribusiness). Nonfarm employment estimates in this article are based on the 1996 County Business Patterns file released by the Bureau of the Census and subsequently enhanced to impute values for confidential data not published by the Bureau. Data on farm proprietors and wage and salary jobs in farm production, as well as nonfarm proprietors, government employment, and railroad workers, are not included in the County Business Patterns. Employment for these excluded groups was obtained from the Bureau of Economic Analysis, U.S. Department of Commerce. Employment data on nonfarm proprietors, available only for major industrial divisions (one-digit Standard Industrial Classification (SIC) level), were distributed among farm-related industries (two-, three-, and four-digit SIC levels) based on the proprietor’s share of total employment in the division in which the farm-related industry is classified. The percentage of proprietor employment in every industrial division was determined for each county. These percentages were applied to wage and salary employment in farm-related industries in the county.

Agriculture’s Role Shrinks as the Service Economy Expands

Rural communities have sought to offset shrinking employment in the farm sector by adding value to farm products. Agricultural value-added strategies can provide only limited rural job growth. The growing importance of the service sector as an engine of job growth appears to be bringing many rural areas into the economy’s mainstream, but some areas could be left behind.

Focusing on the role of farms as a source of raw materials for food and fiber products, officials in many agricultural States and communities have pursued “value-added” development strategies. Value added by businesses beyond the farm gate that produce, process, store, transport, and market food dwarfs the value created on the farm. Rural communities have often failed to retain or attract many businesses in these “value-added” sectors. Only a few cents of each dollar spent on food and fiber by consumers represents the value of farm-produced raw materials. Value-added strategies aim to keep a larger share of the consumer’s dollar in rural areas. Value-added strategy proponents seek to lure food processing plants to rural areas, start new processing operations, develop new consumer or industrial uses for agricultural products, or bypass conventional wholesale-retail systems to sell food products directly to consumers.

Many Factors Determine the Best Location for Food Processing

It is tempting to take for granted that industries using agricultural inputs would naturally locate in rural areas, close to their farm sources of raw materials. However, access to agricultural inputs is only one of many factors that determine the best site for a food processor. Firms choose sites that minimize the transport costs for all their inputs, as well as their output. If inputs are more costly to transport, the best site is closer to the inputs. Industries that add value to raw farm products must obtain packaging materials and other industrial inputs, as well as livestock or grain from surrounding farms. Raw farm commodities are the dominant cost component for firms such as meatpackers and grain and oil mills that do basic processing (table 1). Because it is costly to transport live animals and bulk commodities, these operations frequently locate near the source of their raw materials—in rural areas. Many other food processing industries, such as bread, snack food, pasta, and beverage makers, use little or no raw farm commodities. They purchase flour, sugar, oils, processed sugars, and sweeteners from other processors. For these types of processors, there is little advantage to locating in rural areas. Packaging is a large cost component for many food processors, often accounting for 25 percent of materials cost. For these firms, access to suppliers of containers, labels, and other materials is often a more important consideration, as is access to customers and product distribution networks. These factors often lead firms to choose an urban location. Labor is also an important cost component, and many analysts credit the search for lower cost nonunion labor for the recent migration of meatpacking jobs from the urban Midwest and Northeast to the rural South and Great Plains.

The variation in nonmetro employment shares across industries illustrates the differences in location choices for different types of food processors. Over half of meat products manufacturing employment is in nonmetro counties (fig. 1). Between 30 and 40 percent of grain mill, fats and oils, and fruit and vegetable processing jobs are in nonmetro counties. Agricultural raw materials are important inputs for each of these industries. By comparison, beverage and bakery product plants have only 12 percent of their employment in nonmetro counties.

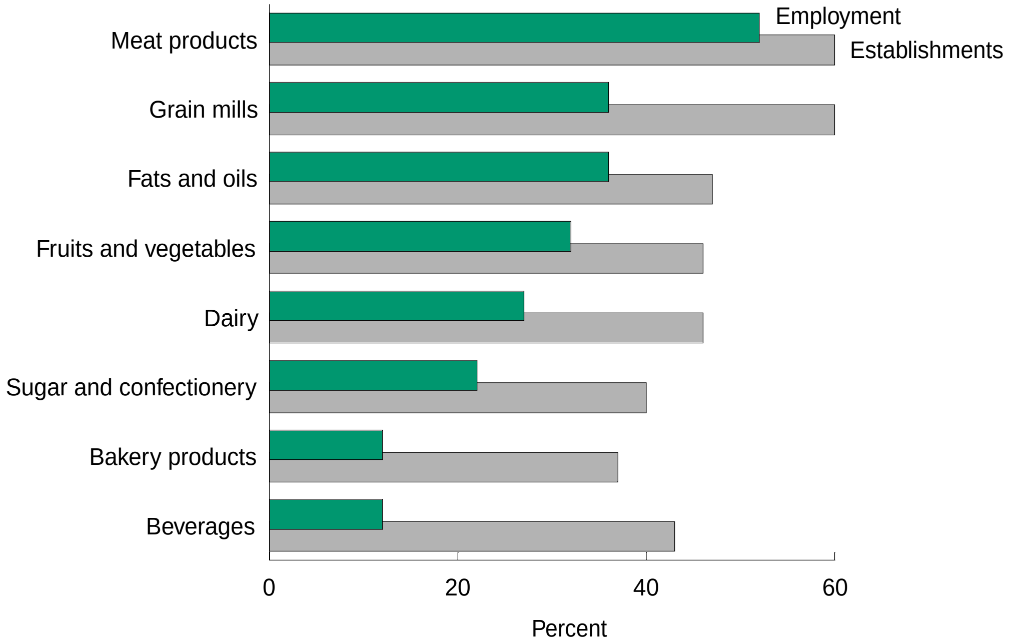
Food Manufacturing Jobs Grew in Some Nonmetro Counties During the 1990’s

During the 1990’s, food manufacturing employment grew by over 70,000 jobs, and nonmetro areas attracted most of the new jobs. Our analysis of *County Business Patterns* data indicates that nonmetro counties gained 60,800 food processing jobs between 1991 and 1996, partially offsetting the loss of nonmetro farm jobs over that period (table 2). Metro areas gained only 11,750 food processing jobs during 1991-96. Thus, the nonmetro share of food processing jobs rose from an estimated 29.2 percent in 1991 to 31.8 per-

Figure 1

Nonmetro shares of employment and establishments for food processing industries, 1996

Food processing industries vary considerably in their nonmetro share of operations



Source: ERS analysis of 1996 *County Business Patterns*, enhanced by Claritas, Inc., to impute suppresed data.

Table 1

Materials cost shares for selected food processing industries, 1992

For many food products, packaging accounts for a greater share of costs than farm commodities

	Type of materials and inputs used			
Industry	Farm commodities	Intermediate products	Packaging	Other
	Percent			
Meat packing	86	3	2	8
Beet sugar	83	0	1	13
Flour and other grain mills	79	5	3	10
Soybean oil mills	68	12	0	8
Fluid milk	62	8	9	15
Poultry slaughter and processing	50	18	4	15
Cheese	30	32	4	15
Wines, brandy	25	18	26	26
Potato chips and similar snacks	24	25	20	30
Prepared feeds	10	48	1	27
Creamery butter	9	73	1	15
Cereal breakfast foods	9	42	27	22
Ice cream and frozen desserts	8	32	15	44
Dog and cat food	0	36	25	31
Bread, cake, and related	0	73	10	18
Cookies and crackers	0	52	26	22
Bottled and canned soft drinks	0	42	41	18
Macaroni and spaghetti	0	52	22	26

Note: Farm commodities include grain, livestock, and other commodities produced by farms. Intermediate products include processed food products purchased from other food manufacturers.

Source: ERS analysis of 1992 Census of Manufactures.

cent in 1996. Nearly all of the nonmetro food manufacturing job growth was in meat and grain mill products manufacturing, the two food manufacturing sectors with the strongest nonmetro ties (fig. 2). Meat products manufacturing employment grew by about 45,000 nonmetro jobs, and grain mill products added about 17,000 nonmetro jobs. Dairy, bever-

Table 2

Growth in food manufacturing employment by county type, 1991-96

Most of the gain in food manufacturing jobs occurred in 357 nonmetro counties

Type of county	Counties	Employment gain
	Number	
Nonmetro counties	2,310	60,800
Gained at least 50 food manufacturing jobs	357	104,000
Lost at least 50 food manufacturing jobs	232	-44,300
Stable food manufacturing employment[1]	1,720	1,100
Metro counties	835	11,750

Note: Table was constructed using estimated county employment in 1991 and 1996 for food and kindred products manufacturing.

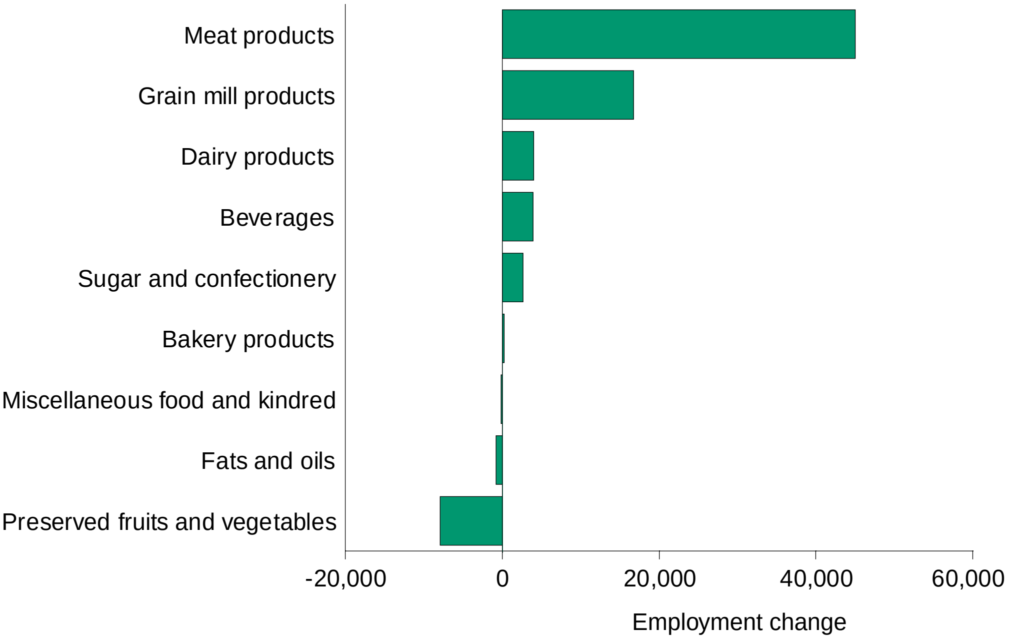
[1] Counties that gained or lost fewer than 50 food manufacturing jobs between 1991 and 1996.

Source: ERS analysis of U.S. Department of Commerce, *County Business Patterns* data, enhanced by Claritas, Inc., to impute suppressed data.

Figure 2

Nonmetro food manufacturing employment growth by sector, 1991-96

Most job gains were in meat and grain mill products manufacturing



Source: ERS analysis of 1996 *County Business Patterns,* enhanced by Claritas, Inc., to impute suppresed data.

ages, and sugar and confectionery products manufacturing each added several thousand jobs between 1991 and 1997, while preserved fruits and vegetables lost about 8,000 jobs. Nonmetro employment changed little in fats and oils, bakery products, and miscellaneous food products industries.

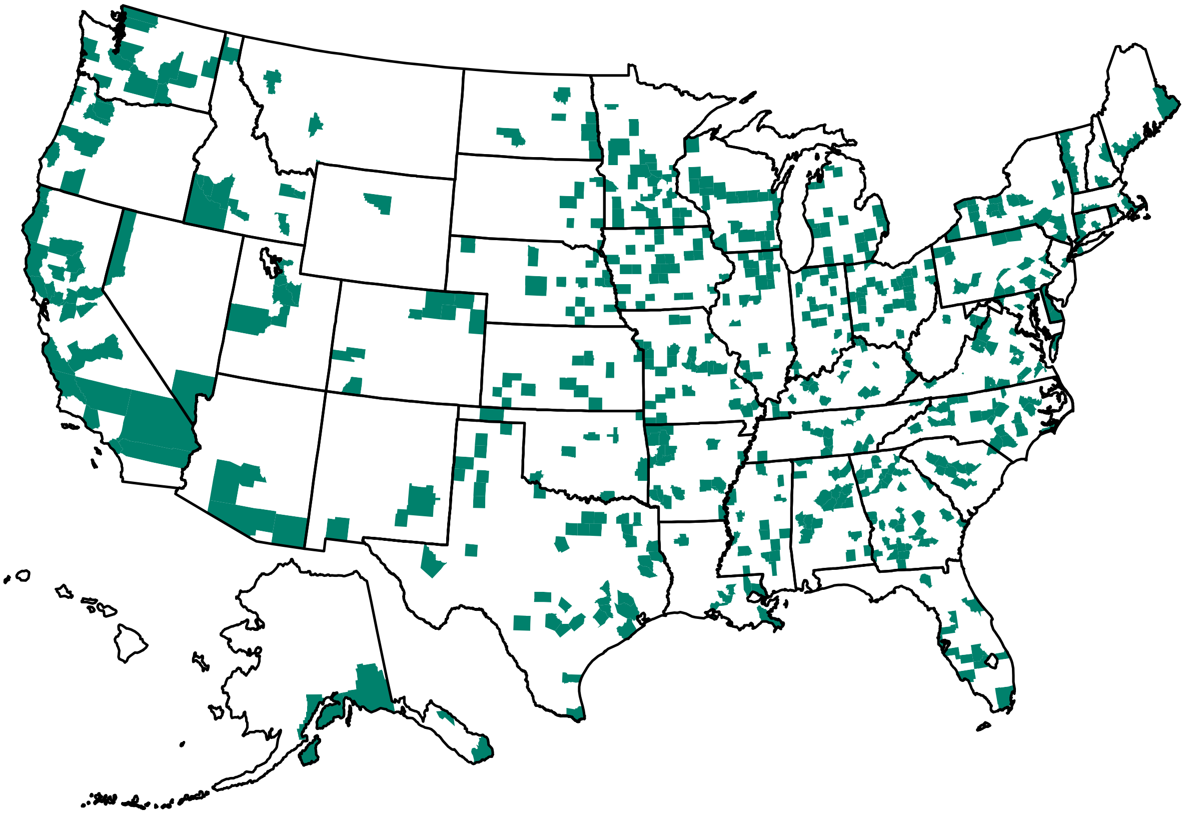
Employment gains were limited to relatively few nonmetro counties. Only 357 of 2,310 nonmetro counties gained 50 or more food processing jobs during 1991-96. Across the 357 nonmetro job-gaining counties, the average gain in food processing jobs was about 291 jobs per county. The job-gaining counties were scattered geographically across 47 States, but were predominantly in Midwestern and Southern States (fig. 3). However, most nonmetro counties did not gain food processing jobs. Food processing employment fell by at least 50 jobs in 232 nonmetro counties and was stable in the remaining 1,720 nonmetro counties during 1991-96.

Food manufacturing and other value-added activities can provide only modest growth in jobs for rural America. Food manufacturing provides only 1.7 percent of all nonmetro jobs. Even if all of the roughly 1 million food manufacturing jobs in metro areas were suddenly moved to nonmetro counties, total nonmetro employment would rise by only 4 percent. Food retail and marketing are the largest and fastest agriculturally related sectors (see "Farm Employment Losses Outstrip Job Gains in Farm-Related Industries in Some Nonmetro Areas" in this issue), but businesses in these sectors usually choose urban locations to gain access to consumers.

Figure 3

Nonmetro counties that gained at least 50 jobs in food manufacturing, 1991-96

Gains in food manufacturing jobs were geographically scattered across the country



Source: ERS analysis of U.S. Department of Commerce, *County Business Patterns* data.

Agricultural and Manufacturing Employment Expected To Decline

Nationally, farming and most food manufacturing industries are not expected to create many jobs. The Bureau of Labor Statistics (BLS) projects a decrease in agricultural employment of 0.1 percent per year between 1998 and 2008 (table 3). BLS projects falling employment in most types of food manufacturing, textiles, and apparel industries. The one bright spot is meat products manufacturing employment, which is projected to grow 1.4 percent annually. In goods-producing industries, like agriculture and manufacturing, competitive pressures are inducing businesses to cut per unit costs by raising worker productivity (output per worker). This means employment will be stagnant or declining in all but the most rapidly growing industries. Thus, even though output is expected to grow at a healthy rate, employment is expected to grow slowly or decline. For example, BLS projects annual growth in manufacturing output of 3.4 percent, but it projects no change in manufacturing employment between 1998 and 2008. Projected output growth exceeds projected job growth for nearly all goods-producing industries shown in table 3.

During the coming decade, jobs are projected to grow fastest in service-producing industries, including transportation, communications, public utilities; wholesale and retail trade; finance, insurance, and real estate; and personal, business, and health services. Service-

Table 3

Projected employment and output growth by industry, 1998-2008

Service industry employment is projected to grow the fastest

Industry	Employment growth	Output growth
	Percent	
Goods-producing industries:	0.1	3.0
Agriculture	-.1	1.4
Mining	-2.1	1.2
Construction	.9	1.3
Manufacturing	.0	3.4
Food and kindred products manufacturing	.2	1.2
Meat products	1.4	1.7
Dairy products	-1.2	.6
Preserved fruits and vegetables	-.6	.9
Grain mill products, fats and oils	.1	1.5
Bakery products	-.5	-.1
Sugar and confectionery products	-.4	.6
Beverages	-1.0	1.5
Miscellaneous foods and kindred	1.0	.9
Tobacco products	-3.1	1.0
Textile mill products	-1.7	1.2
Apparel	-2.6	.3
Service-producing industries:	1.8	3.2
Transportation, communications, and utilities	1.3	3.4
Wholesale trade	.7	3.7
Retail trade	1.3	2.7
Eating and drinking places	1.6	1.6
Finance, insurance, and real estate	1.2	3.0
Services	2.8	3.9
Government	.9	1.3

Note: Table shows projected annual growth rates. Output growth is in constant 1992 dollars.

Source: Allison Thomson, “Industry Output and Employment Projects to 2008,” *Monthly Labor Review*, November 1999, pp. 33-50.

producing sector jobs are projected to grow 1.8 percent per year, and BLS expects these industries to account for nearly all of U.S. job growth between 1998 and 2008.

Can Rural Communities Participate in the Service Economy?

Many rural areas are participating in the service economy, especially those enjoying the spillover effects of prosperity in urban areas and amenity-rich areas that attract retirees, telecommuters, vacationers, and others. Between 1991 and 1996, the services sector was the largest source of new jobs in nonmetro counties, creating about one-third of new nonmetro jobs (fig. 4). Retail trade accounted for another 20 percent of job growth. In metro counties, the services sector created half of all new jobs between 1991 and 1996. By comparison, nonmetro counties were more reliant on manufacturing and government (State and local) for new jobs. These two sectors accounted for a combined 17 percent of nonmetro job growth, compared with less than 3 percent for metro counties. The increasing service-orientation of the U.S. economy is troubling for rural areas that rely on farming, food processing, and other manufacturing for economic development. Retail; finance, insurance and real estate; construction; transportation; wholesale trade; and agricultural services (mostly landscaping and lawn service jobs) shares of job growth were similar in metro and nonmetro counties.

For many rural communities, the prospects for participating in the service economy seem less promising because service and trade industries have a greater tendency than other activities to “agglomerate” in urban places. They tend to concentrate in cities where they have access to large populations of consumers, transportation nodes, related industries and business service firms. The retail and services sectors account for 49 percent of metro jobs compared with only 41 percent for nonmetro counties. Geographic concentration of retail and service activity is especially true in a wide swath of the Great Plains and other sparsely populated areas where farming is still the chief rural economic activity (see “Economic Growth in Farming Areas Lags the Rest of Rural America” in this issue). In these regions, many smaller communities are no longer viable as retail and service centers. With larger farms, nearly universal access to automobiles, and pressure on retailers and service providers to exploit economies of scale, scattered cities and large towns in farming-dependent regions are becoming islands of commerce surrounded by a sea of sparsely populated farming areas. Remoteness seems to be the largest hindrance to development in these regions. Counties that reduced their farming dependency during the 1990’s tended to be on the fringes of the farming-dependent region.

Another problem associated with growth of service industries is that service jobs tend to have low skill requirements and low pay, especially those in food and personal services that small communities are most likely to retain. In contrast, rural jobs lost in manufacturing, mining, and farming tend to pay well. More highly paid service jobs in information, business and health services are among the most likely activities to locate in urban areas. Many highly educated professionals who fill these jobs prefer not to live in areas that lack natural amenities and/or good primary and secondary education.

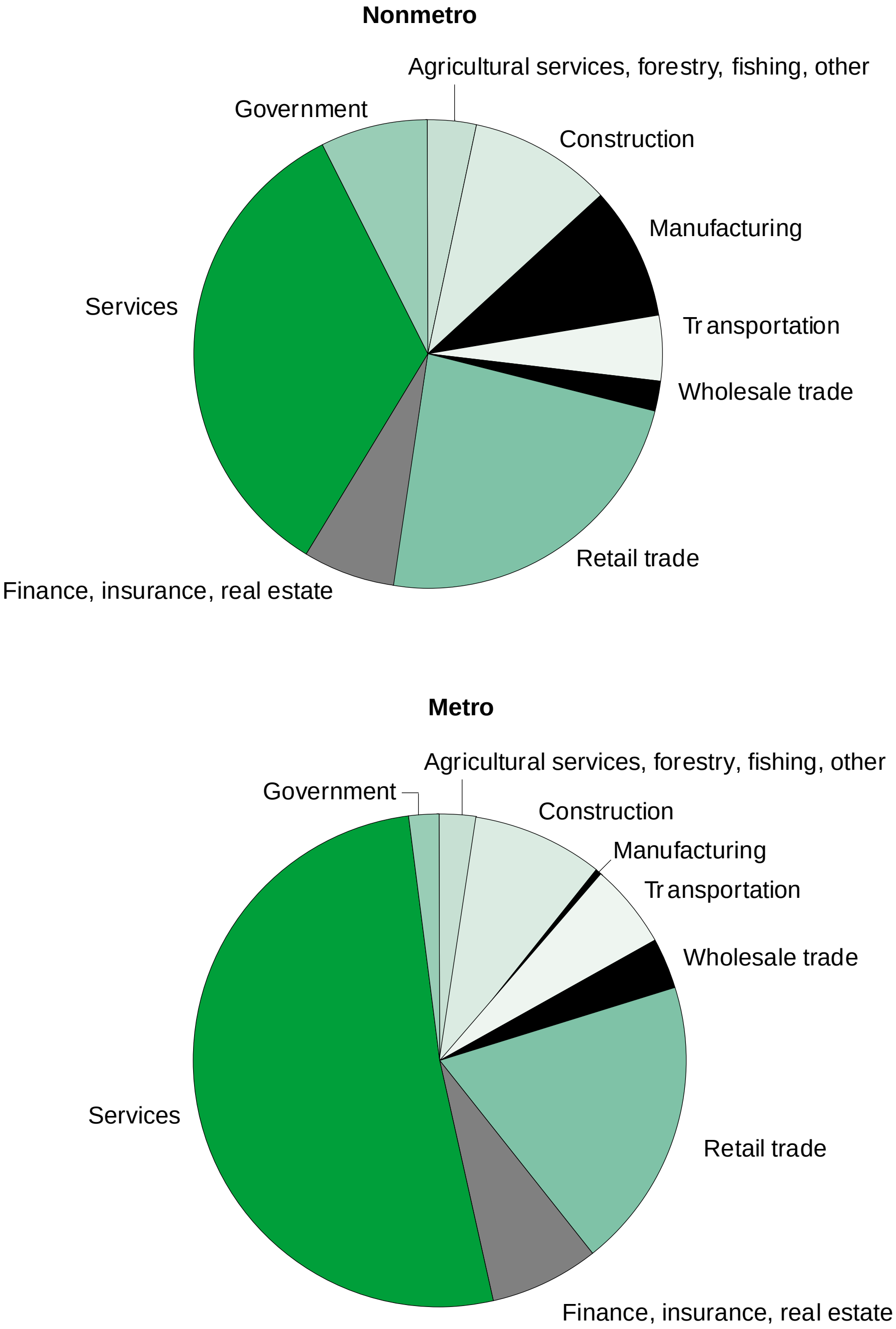
Consumer Orientation Leads to Development

The increasing consumer orientation of the service economy holds lessons for planners and policymakers. Contracting and supply chain arrangements have increased their prevalence in recent years partly because consumers are demanding food products with specific attributes. In many cases, consumers are demanding less tangible attributes. For example, the method by which a product was produced (organically or without genetic modification) is becoming an important attribute. Many consumers seem to be willing to pay a premium for these attributes. Businesses and communities have taken advantage of this to create brands associated with their particular region, production practice, or some other attribute that can command a premium price. Many farms have broadened the scope of their business to offer entertainment and recreation in the form of agricultural tourism, theme-oriented farm visits, paid fishing and hunting access, and other services. Advances in information technology also make it possible for businesses in remote places

Figure 4

Employment growth by sector, nonmetro and metro counties, 1991-96

Most job growth was in service and retail trade industries during the 1990's



Source: ERS analyis of Bureau of Economic Analysis data.

to get in touch with consumers and sell directly to them. In today's service-oriented economy, it is this type of consumer-savvy search for new market niches that is likely to lead to development. *[Fred Gale, 202-694-5349, fgale@ers.usda.gov; Maureen Kilkenny, 515-294-6259, kilkenny@iastate.edu]*

Small and Large Farms Both Growing in Number

Census of Agriculture data from 1997 seem to indicate that farm numbers stabilized in the 1990's. A closer look shows that the number of full-time farms continued declining, while part-time farms surged. Many counties continued to lose farms at a steady pace, while others gained farms.

At first glance, the latest agricultural census data indicate that the number of U.S. farms stabilized in recent years, perhaps indicating an end to the trend toward fewer, larger farms. The total of 1,911,859 U.S. farms reported by the most recent Census of Agriculture in 1997 represented a decline of less than 1 percent from the 1992 total. This was the slowest rate of decline since the late 1970's. Whereas the previous three censuses reported steady decline in farm numbers averaging about 30,000 per year, the decline in farm numbers between 1992 and 1997 was only 2,700 per year. USDA farm counts based on annual sample surveys also indicate that farm numbers stabilized from 1993 to 1998. On the surface, the data indicate that perhaps the trend toward fewer, larger farms that has done much to change the character of rural America may have finally run its course.

A closer look at the data shows some important trends that are hidden in the aggregate numbers. When the data are disaggregated by age group, type of farm, and geography, we find that various segments of the farm sector are following divergent trends. While commercial-sized farms continue to consolidate into fewer, larger farms, small noncommercial farms in various regions of the country are also growing in number. This means that many rural communities (largely in the Midwest and Great Plains) are still facing loss of population, declining retail trade and services, and a shrinking tax base that often accompany the loss of farms. At the same time, other rural communities are enjoying an influx of new farms.

Surge in Farms Operated by People Principally Employed Outside Farming

The census of agriculture asks respondents to report whether or not farming is their principal occupation. Those principally employed outside farming are largely "part-time" farmers and those pursuing dual farm-nonfarm careers. Figure 1 shows that the number of farms whose operators say farming is their principal occupation continued a trend of steady decline between 1992 and 1997. This group includes farmers who are strongly committed to a full-time farming career, as well as retirees. These farms declined in number by more than 90,000 between 1992 and 1997, comparable with the decline recorded for the two previous 5-year census intervals for this group. In contrast, the number of farms operated by people who are primarily employed outside farming has been more steady in recent decades and rose by 78,000 between 1992 and 1997.

Changes in farm numbers by size of farm show a surge of very small farms (usually operated by people primarily employed outside farming). Farm numbers grew among very small farms (less than $10,000 in annual sales) and among larger farms that have sales of $250,000 or more (table 1). Few farms earn significant profits with less than $10,000 in sales, so these data show again that much of the growth in farm numbers came from part-time "recreational" or "retirement" farms. (The definition of a farm is any place that sold, or normally would sell, at least $1,000 of agricultural products. See box, "Farm Definition Affects Farm Numbers.") Farm operators whose primary occupation is farming generally try to expand the size of their farms (although this group also includes retirees who operate small farms and generally do not expand their size). Since fixed costs are such an important part of total costs and per unit profit margins are slim, large operations are needed for most operators to earn significant income. The number of farms with sales between $10,000 and $250,000 per year fell by 100,000 between 1992 and 1997. Many farms that were in this sales class in 1992 probably moved to larger sales classes as they expanded their operations. (USDA's National Commission on Small Farms classified farms with less than $250,000 as "small farms.") However, many of them apparently left

Bureau of Labor Statistics Data Provide More Complete Count of Young Farmers

The Bureau of Labor Statistics (BLS) estimates the number of people employed in farming. These data provide a less dire picture of the rising age of farmers than does the census of agriculture, which does not provide personal data on junior partners and unpaid family members. Nevertheless, the BLS data show a steady decline in the number of young farmers during the 1990's.

There is concern over the age of farmers—specifically concern that the average age is rising and the number of young people entering the occupation is falling. The issue is not a new one. Since the 1950's, USDA has received letters from farmers who were alarmed by the decline in the number of farms, a visible rise in average age of farmers, and the apparent shortage of young new farmers. Young people were going off to "public work," they said, using a common expression of the time.

The most common source of information on the number and age of farmers has long been the census of agriculture, taken every 5 years. The data by age go back to 1890. They are very useful, but are limited in that they consistently understate the number of younger farmers, and thus overstate the average age of all farmers.

This problem stems from the fact that the census form obtains only personal characteristics (such as age) for one person from each farm or ranch. In the case of partnerships, such information is obtained only for the "senior partner or person in charge." Thus, in a typical parent/offspring partnership, age would be recorded only for the older adult. With 9 percent of all farms being partnerships and another 4 percent being small family corporations, the potential for undercount of young farmers is clear.

BLS Survey Counts Junior Partners

An alternative data source is that collected for the Bureau of Labor Statistics (BLS) by the Census Bureau, as part of its monthly national survey of employment. This survey is based on a sample of 47,000 households. Each employed person's occupation is obtained and, thus, junior partner farmers are included as well as senior partners. The BLS data differ from the census of agriculture in one other respect: persons with more than one job are tabulated by the occupation at which they spent the most time in the survey week. Therefore, persons for whom farming is secondary work are excluded from those tabulations. (People with second jobs are identified, but data on those jobs by occupation and age of worker are not available.) This can be viewed as a limitation of the data, but it does mean that the results represent people who have their main work reliance on farming. In contrast, the overall census of agriculture numbers include many thousands of people with minimal attachment to farming, given the very liberal farm definition used in the census. (A place is regarded as a farm if $1,000 or more of products were sold from it in the past year, or if it is deemed capable of selling such an amount.)

Surge of Young Farmers During 1970's Reversed During 1980's

The BLS series shown in table 1 begins in 1970. At that time, nearly 50 percent more farmers were aged 65 years and over than under 35 (fig. 1). The age trend, however, was steadily downward throughout the 1970's, as substantial numbers of young people entered the business and many older ones retired. This was a time when the large supply of "baby boom" children was coming of age, when there was a strong back-to-the-countryside movement, and when there were some years of excellent farm profits and rising farmland values. The number of farmers under age 35 rose from 248,000 in 1970 to 374,000 in 1982, by which time the relative prevalence of young and old farmers had been reversed, with the young ones two-thirds more numerous than the older ones.

The farm financial crisis in the early and mid-1980's was the worst since the 1930's. The most dramatic trend evident in the data after 1984 is the decline in the number of very young farmers, those under 25. From 1976 through 1984, their numbers were very stable, never below 96,000 or above 102,000. (The census of agriculture number for the same age group was 67,000 in 1978 and 62,000 in 1982.) Thereafter, the BLS figure for farmers under 25 fell steadily to just 41,000 in 1993, a drop of three-fifths. Part of this decline

Table 1

Number of farm operators and managers by age group, 1970-98

Annual Bureau of Labor Statistics estimates show demographic trends in employment of farm operators and managers

		Age group								
Year	Total	<20	20-24	25-34	35-44	45-54	55-59	60-64	65-older	Median age
	Thousands									Years
1970	1,753	14	43	191	281	414	219	229	364	53.4
1971	1,666	14	50	190	266	389	220	205	332	53.0
1972	1,688	16	57	191	275	386	218	225	321	52.9
1973	1,664	17	60	184	266	392	218	222	301	52.8
1974	1,643	21	69	196	262	391	215	194	295	52.0
1975	1,593	22	71	223	259	380	201	176	261	50.8
1976	1,514	18	79	218	242	361	189	155	251	50.5
1977	1,459	15	83	217	238	317	198	145	247	50.6
1978	1,480	18	83	231	247	305	183	162	251	50.3
1979	1,446	18	83	246	238	307	169	169	216	49.5
1980	1,485	20	78	245	260	313	176	174	218	49.5
1981	1,485	21	81	252	266	298	181	163	223	49.1
1982	1,452	18	82	274	256	280	163	158	221	48.4
1983	1,450	17	79	277	274	276	159	155	213	47.8
1984	1,442	19	81	274	272	281	158	154	202	47.7
1985	1,359	15	62	256	262	272	154	151	186	48.1
1986	1,337	12	55	255	250	258	151	140	216	48.7
1987	1,317	11	53	242	252	252	142	153	213	49.0
1988	1,286	14	47	234	259	244	150	122	215	48.6
1989	1,269	16	41	236	269	231	132	136	206	48.1
1990	1,211	14	40	229	262	221	117	125	203	47.7
1991	1,228	11	42	210	285	233	130	140	178	47.8
1992	1,215	10	43	187	272	235	124	136	207	49.0
1993	1,156	9	32	184	270	225	119	114	203	48.7
1994*	1,453	44	43	199	320	302	265**	**	279	49.0
1995*	1,446	46	35	191	341	288	140	124	281	48.8
1996*	1,314	10	28	178	309	275	128	118	267	49.8
1997*	1,317	15	31	173	304	273	139	126	255	50.0
1998*	1,187	11	25	147	270	277	126	115	216	50.1

Note: Data are annual averages of monthly statistics, based on number of persons whose sole or principal occupation (measured by time worked) was farm operator or farm manager.

*Data for 1994 and later years are not comparable with prior years due to use of 1990 census of population controls and changed procedures that yielded many more operators, especially female spouses and teenagers.

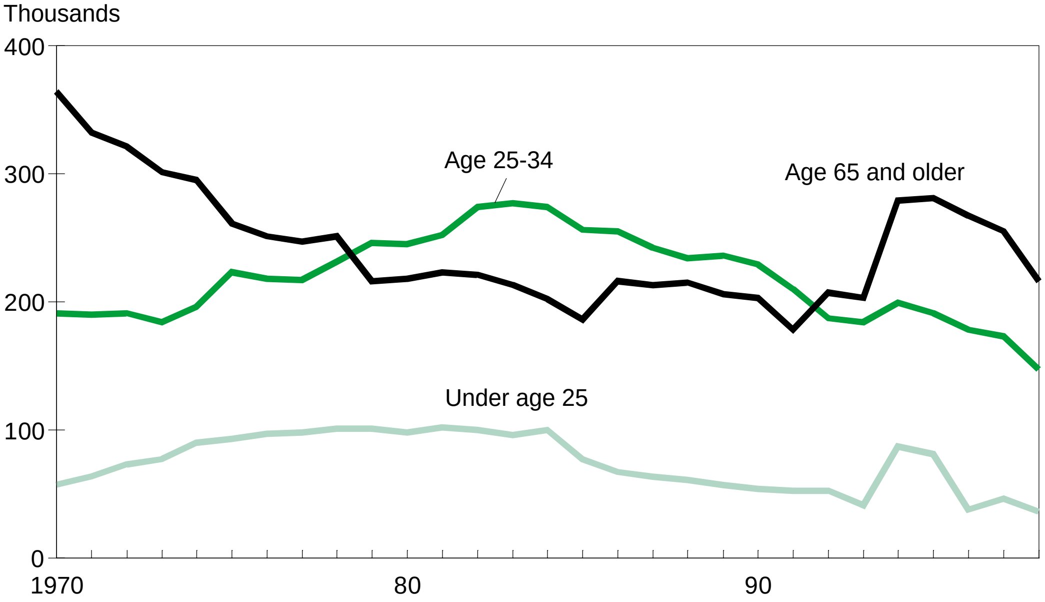
**In 1994, data were reported only for 55-59 and 60-64 age groups combined.

Source: ERS analysis of Bureau of Labor Statistics data.

Figure 1

Farmers in selected age groups, 1970-98

The number of farmers in both young and older age groups has fallen since 1994



Note: Chart shows number of people who were primarily employed as farmers or farm managers estimated from sample surveys. Estimates increased in 1994 due to a change in interview procedure that counted more female and teen-aged farm operators.

Source: ERS analysis of Bureau of Labor Statistics data.

probably stemmed from the reduced potential supply of young farmers as the smaller birth groups that followed the baby boom came of age. But it seems likely that it also reflects a reduced willingness to enter farming by young people who grew up during the stressful times of the farm crisis.

In 1994, the BLS changed its interviewing procedures in a manner that elicited a larger count of unpaid family workers. This change produced a higher number of female and teenaged farm operators. But from that time to 1998, the number of operators under 25 fell by more than half again from its revised level of 88,000 in 1994 to 36,000 in 1998.

Farmers 25-34 peaked in the early 1980's, but have since fallen in number as the "boomers" have either entered middle age, withdrawn from farming, or shifted primarily to off-farm work. As a group, farmers under 35 comprised 26 percent of all farmers from 1982-84. But as a result of disproportionate declines in both the under 25 and 25-34 groups, those under 35 were just 15 percent of total farmers by 1998. Clearly, farmers must sense a comparative shortage of young colleagues, given this degree and rapidity of change.

On the other hand, farmers under 35 comprised just 14 percent of total farmers in 1970 under the earlier procedures, a slightly smaller representation than today. And the 15 percent found in the BLS survey of persons whose sole or principal job is farming is fully double the 7 percent under age 35 measured by the census of agriculture for farmers it counts as having farming as their principal occupation. This latter group in the census is heavily weighted with persons age 65 and over, many of whom are retired and do not regard themselves as in the labor force any longer.

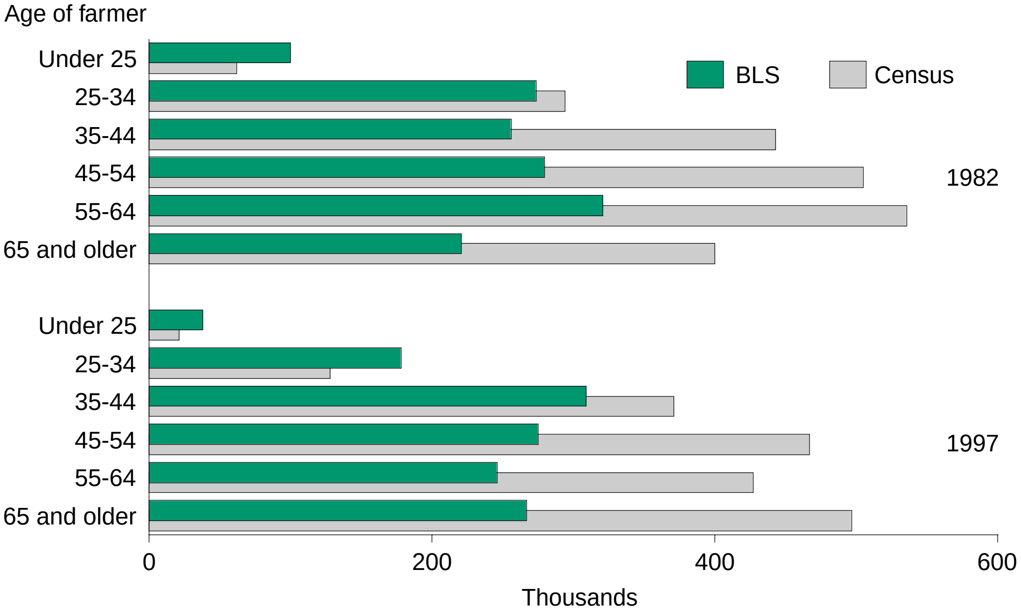
Census of Agriculture Undercounts Young Farmers

In absolute numbers, BLS found 219,000 farm operators and managers under age 35 in 1997 whose sole or principal work was farm operation, whereas the census reports 149,000, including those who just work part-time (fig. 2). Thus, the BLS data more fully

Figure 2

Comparison of BLS and census of agriculture counts of farmers by age group, 1982 and 1997

The census counts fewer young operators and more older operators



Note: BLS denotes estimated number of farmers and farm managers based on principal occupation. The census counts only the senior partner or person in charge for each farm operation.

Source: ERS analysis of Bureau of Labor Statistics and census of agriculture data.

convey both the proportion and absolute number of farmers who are young. Two points seem equally important to stress. The supply picture for young farmers is not as dire as the census data would imply if uncritically interpreted without knowledge of census procedures concerning data for partners and family corporations. That being said, the BLS data show a rapid drop in young farmers in the last decade, at a pace well above that attributable to the passing of the baby boomers into middle age.

The median age of farmers in the BLS series in 1998 was 50.3 years (the age separating the farmers into two equal groups). This is not a record high value, being below that of most of the 1970's. The median has, however, risen in each year since 1995 and is certain to be pulled considerably higher as the bulk of the large baby boom cohort (now in its 40's and late 30's) moves into the over-50 age group. *[Calvin Beale, 202-694-5416, cbeale@ers.usda.gov]*

Can Computer Use on the Farm Build Skills for Off-Farm Jobs?

The increasing use of computers on the farm raises the question of whether these new skills will be valued in off-farm employment. Data suggest that computers are used predominantly for a single group of tasks that may not develop the "systems skills" that are becoming increasingly important in off-farm employment.

Off-farm employment by farm operators and their spouses has been a key to financial survival for farm families. The mechanization of farms earlier in the 20th century gave farmers mechanical and problem-solving skills that were prized by many rural employers, largely in manufacturing and related industries that needed workers who were good at operating and repairing machinery. Many skills learned on the farm were transferable to nonfarm jobs. Those skills made the transition to nonfarm careers easier for farm youth and helped farmers in finding off-farm jobs.

As the United States moves from an industrial to an "information economy," demand for workers with mechanical skills is stagnant or declining. Many employers now seek computer skills and the ability to find and process information. Will farmers be as employable off the farm as they were in the past? Will farming communities participate in the information economy, or will they be left behind?

Onfarm Computer Use Increasing

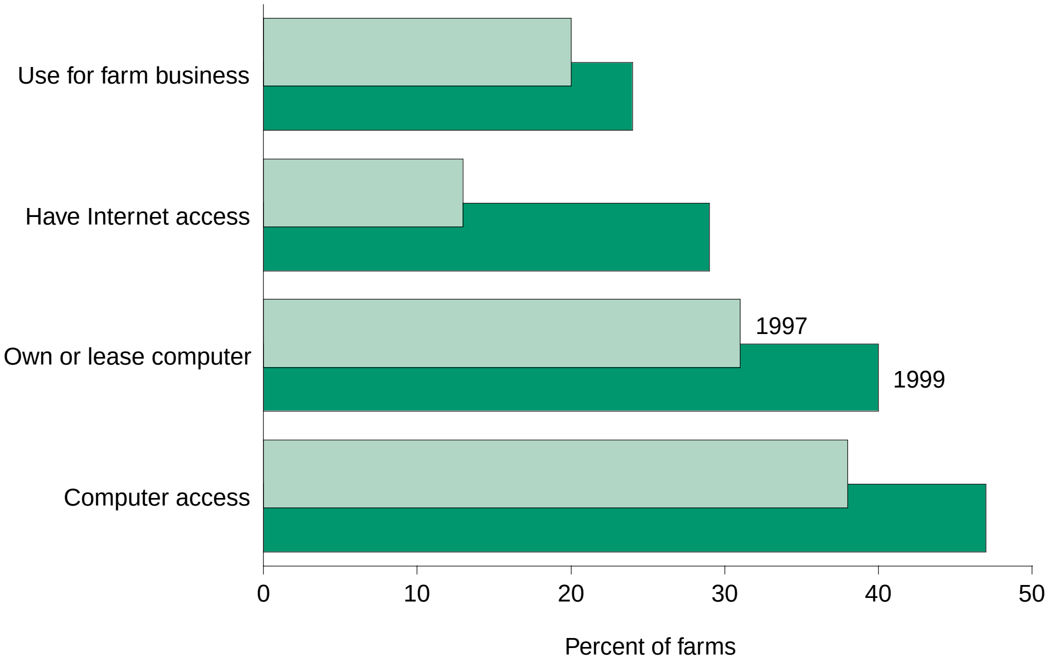
To a large extent, farms have also been participating in the information revolution. A recent USDA survey shows that nearly half of farms reported using computers in 1999 (fig. 1). Comparison with 1997 data suggests that onfarm computer use is growing rapidly. In the 2 years between 1997 and 1999, farms with access to a computer increased from 38 to 47 percent.

Internet access more than doubled in the same 2-year period, rising from 13 percent of all farms in 1997 to 29 percent in 1999. Unfortunately, these data do not include informa-

Figure 1

Farm computer use, 1997 and 1999

Computer use on the farm grew considerably between 1997 and 1999; Internet access doubled



Source: *Farm Computer Usage and Ownership,* National Agricultural Statistics Service, Agricultural Statistics Board, USDA, July 1999.

tion on the percentage of farms using this technology to get up-to-the-minute market information, to get technical information related to farming problems, or to interact electronically with suppliers or customers. However, the growth in access of itself is an important development as the usefulness of the Internet to the farm business is likely to be discovered over time. Strong sales of books such as *The Farmer's Guide to the Internet* (http://www.rural.org/favorites.html) along with the emergence of search engines devoted to agriculture (for example, The AgriSurfer available at http://www.AgriSurfer.com) suggest that many farmers are actively investigating these possibilities.

The percentage of farms using computers in the farm business in 1999 was only 24 percent and also grew at a more modest rate over the 2 years. This finding suggests that roughly half the farm households with computer access are using computers as a consumer good or for nonfarm business. The data suggest that only half of farms with access to computers use them for farm business applications.

Larger farms are more likely to have computer access and—if they have access to a computer—more likely to use computers for farm business (fig. 2). The benefits of integrating computers are more likely to exceed the costs of purchasing and learning to use them on large farms. The wide diffusion of computer technology—oftentimes used first in nonfarm activities—bodes well for the eventual use of computer technology across the farm size spectrum.

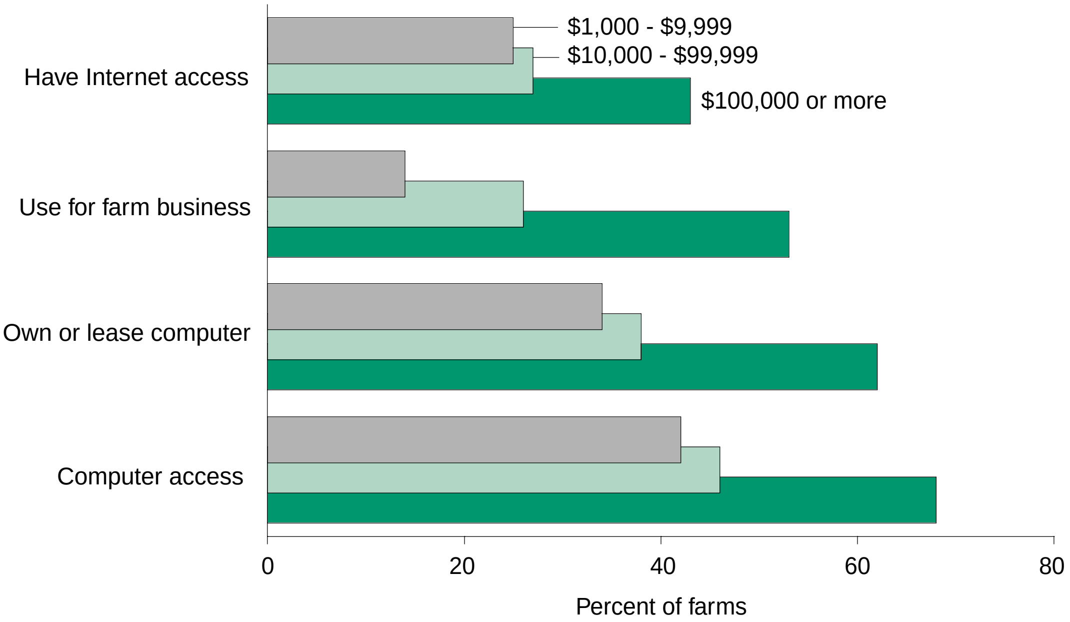
A more detailed account of the specific computer applications used in the farm business is available in the *1995 Agricultural Resource Management Study*. While the data are relatively old, they can tell us which applications are most common in the farm business and provide more detailed characteristics of farmers and farm households associated with computer use.

Computerized bookkeeping/financial analysis was by far the most common application across all farm types. For farm sizes up to $500,000 in sales, bookkeeping/financial analysis applications were roughly twice as prevalent as 'Computer software for production decisions,' the second most common application. Computer-aided chemical applica-

Figure 2

Farm computer use by farm sales class, 1999

Computer use is more likely on larger farms



Source: *Farm Computer Usage and Ownership,* National Agricultural Statistics Service, Agricultural Statistics Board, USDA, July 1999.

tions/field operations were infrequent for farms as a whole (2.5 percent) but used by 15-20 percent of farms in the two largest size classes. In contrast, using global positioning systems to aid field operations was infrequent across all size classes. Unfortunately, the data provide no information on the use of electronic market information either through the Internet or subscription services.

The data confirm that large farms, and those run by younger farm managers with a college degree, are most likely to use computers in the farm business. Both farm size and educational attainment of the farm operator produce striking differences in the rate of adoption. Farmers with a college degree are roughly 10 times more likely to use the various applications compared with farmers with less than a high school diploma. These factors are equaled or exceeded in comparing the smallest farm size class (less than $50,000 in sales) with the largest farm size class (more than $1,000,000). The increasing age of the farm operator has a more modest effect on reducing the likelihood of using the various applications.

Computers Underused

As of 1995, for each sales class, age group, and educational level, relatively few farms used computers for production operations (table 1). This suggests that the majority of farms using computers are not integrating this use across production and accounting required of a farm management information system.

A less comprehensive but more recent 1998 survey of U.S. corn growers by Novartis, Inc., provides more timely information on the adoption of ‘precision agriculture’ technologies such as Global Positioning System (GPS) mapping and yield monitors (table 2). However, these statistics are not a representative sample of all farms, and may overstate computer use compared with the 1999 USDA data. In the one comparable data item, computer use in the farm business is reported as 24.1 percent in the 1999 NASS/USDA data but 46.2 percent in the Novartis data. Despite this inconsistency, the Novartis data suggest that applications providing detailed information on the characteristics and variability of small plots within a field have been adopted by many farms in the two largest size categories. The data also provide information on the percentage of farms with Internet access that are using this technology in the farm business. Over all size classes, 21.1 percent of farms are using the Internet to retrieve agricultural information.

While these more recent data suggest a greater prevalence of computer use in production decisions than did the 1995 data, the Novartis data also give the general impression that computers are not being fully exploited to integrate information from diverse aspects of the farm operation. Roughly 46 percent of all farms use a computer in the farming operation, but less than half of those farms use the informational capabilities of the Internet for production or marketing. An even smaller percentage of farms use precision agriculture technologies.

Skill Requirements of Information-Intensive Farming

The increasing use of computers in farm businesses is encouraging. It suggests that farm managers are using some of the same information technologies that are also being used in the wider economy. However, the question remains whether farmers using computers on the farm will develop skills that are valued in the off-farm economy. Is it enough for farmers to be ‘computer literate’ or does the information economy require a broader suite of skills?

Some experts emphasize that worker skill development is no longer confined to classrooms. Both managers and frontline workers must continuously develop new skills by learning on the job. A traditional allure of farming has been the combination of mental and physical activity that values this ability to learn by doing. In the past, this mode of learning was farm-specific. However, if the capability to learn from farming operations is substantially augmented by the application of information technology, then skills developed using this new tool may also be valued in off-farm employment. That is, the concrete experience

Table 1

Computer applications of farmers by size of operation and operator characteristics, 1995

Bookkeeping/financial analysis is the most commonly used application

Item	Computerized bookkeeping/ financial analysis	Computer software for production decisions	Computer-aided chemical application/ field operations	Global Positioning System to aid field operations
	Percent of responding farms			
Farms using technology	14.6	6.5	2.4	0.8
Sales class:				
Less than $50,000	8.7	2.7	1.0	.3*
$50,000 or more	31.3	17.4	6.3	2.1
$50,000 - $99,999	20.1	11.5	3.7*	1.6**
$100,000 - $249,999	31.6	16.3	5.3	1.4*
$250,000 - $499,999	43.5	22.7	10.5	3.7
$500,000 - $999,999	54.2	35.3	14.6	6.2
$1,000,000 or more	71.2	51.6	20.3	4.2*
Operator age:				
Less than 35 years	21.3	11.4	5.3	1.8*
35 to 44	23.3	12.2	2.9	.9*
45 to 54	17.4	7.0	2.5	.5*
55 to 64	11.6	4.7	1.9	.9*
65 years or older	5.4	1.5	1.3*	.5**
Operator education:				
Less than high school	2.5	1.5*	.8*	.1**
High school	9.6	4.1	1.5	.5*
Some college	20.2	9.1	3.8	1.4*
College	33.3	14.8	4.5	1.4*

Note: About 3.5 percent of farm operators refused to answer these questions. Excludes cooperative farms.

* The relative standard error (RSE) of the estimate exceeds 25 percent, but is no more than 50 percent. The RSE provides a means of evaluating the survey results. A smaller RSE indicates greater reliability of the data. Estimates with RSE's of 25 percent or less are not marked.

** The relative standard error of the estimate exceeds 50 percent, but is no more than 75 percent.

Source: USDA, Economic Research Service, *1995 Agricultural Resource Management Study*, Farm Operator Resources version only.

Table 2

Technologies used by U.S. corn growers by size of operation, 1998

Computer use is most common on larger farms

		Acres per farm			
Computer technology	Total	50-249	250-499	500-999	1,000 or more
		Percent			
Personal computer (PC)	55.6	46.2	60.4	72.7	78.4
PC for farming operation	46.2	37.6	49.2	61.5	67.2
Internet for agriculture information	21.1	15.2	24.3	29.8	39.7
Global Positioning System (GPS)	12.2	7.2	12.3	21.6	33.9
Yield monitor on combine	16.0	8.1	18.8	27.6	47.5
Monitor tied to GPS	4.5	1.3	3.8	8.6	26.2

Source: Novartis Seeds, Inc., 1998 Farm Technology Adoption Study, available at http://novartis2.planet.net/press_releases/releases/pr_rel_923949083.html.

of learning from farming operations may outweigh the seemingly large differences with specialized goods- or services-producing operations.

The value of information-intensive farming emerges from the integration of information from production, accounting, or marketing facets of the farm enterprise to make better management decisions for the operation as a whole. Computer use in this view is not an add-on to increase the efficiency of individual farming tasks. Rather, the technology provides the central hub of a "farm management information system." A marketing example demonstrates the potential synergies. Farmers examining daily market information will make better decisions regarding the advisability of a forward or cash contract if they have a valid benchmark in the cost of production of the commodity. This, in turn, will require the integration of accounting information with production decisions to comprehensively track the cost of past and anticipated future inputs required to produce the commodity.

Sustainable agriculture provides other examples. A number of computer decision tools are being created to assist farmers in making optimal crop rotation or pasture management plans. These tools require information from all aspects of the farm operation and then help farmers to assess the production, economic, and environmental effects of various strategies. Here again, the technology requires the integration of diverse information. In addition, the results generated by these tools are usually complex, requiring the weighing of various impacts in the decisionmaking process.

A common requirement of information-intensive farming practices is the ability to exploit information from diverse sources to arrive at workable solutions to a variable set of problems. Unfortunately, these skill requirements are not as specific as, say, the ability to read at a ninth grade level or the ability to perform specific procedures in a spreadsheet program. O*Net^{TM} 98, a skills inventory developed by the U.S. Department of Labor, identifies the cognitive skills needed for more than 1,000 occupations. The list of complex problem solving and systems skills in table 3 identify the types of abilities that may be required in information-intensive farming. There have been no formal job content analyses of information-intensive farming. The skill requirements of farmers in the current version of O*Net^{TM} are rudimentary in comparison. However, the importance of these skills is emerging in discussions of precision agriculture and in the use of farm management information systems more generally.

Cognitive Skills in Organizing and Interpreting Information Are Needed

While the effect of computer technology on the skill requirements of off-farm work is a topic of considerable debate, there is one issue that is not contentious. Job security and wages will be greater in work that uses the cognitive skills outlined above compared with work where the technology serves mainly to automate tasks.

Examples from the insurance industry make this distinction more concrete. Automation of insurance claims processing initially reduced skill requirements for clerks. Computers performed calculations and there was little need for clerks to make decisions or use their own judgment. Consequently, automation initially reduced the skill needed to process insurance claims and led to less job satisfaction.

However, the decline in job satisfaction along with the realization that worker skills were being underused caused many firms to re-evaluate the potential benefits of computer technology. The focus shifted from sole interest in increasing productivity (for example, processing more claims in less time) to increasing productivity of a more valuable collection of products. For example, one company described in a book by Richard Murnane and Frank Levy (*Teaching the New Basic Skills*, The Free Press, 1996, pp. 27-28) redesigned its computer system so that every customer service representative could access information about all policies held by an individual customer. The new system gave representatives responsibility to perform multiple tasks that had previously been carried out by more numerous specialized representatives. The system also gave customer representatives latitude to solve complex customer service problems.

Table 3

Cross-functional skills inventory of information-intensive farming

Productive use of information technology requires problem-solving and systems skills

Skill	Description
Complex problem solving skills	Developed capacities used to solve novel, ill-defined problems in complex, real-world settings
Problem identification	Identifying the nature of problems
Information gathering	Knowing how to find information and identifying essential information
Information organization	Finding ways to structure or classify multiple pieces of information
Synthesis/reorganization	Reorganizing information to get a better approach to problems or tasks
Idea generation	Generating a number of different approaches to problems
Idea evaluation	Evaluating the likely success of an idea in relation to the demands of the situation
Implementation planning	Developing approaches for implementing an idea
Solution appraisal	Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts
Systems skills	Developed capacities used to understand, monitor, and improve socio-technical systems
Visioning	Developing an image of how a system should work under ideal conditions
Systems perception	Determining when important changes have occurred in a system or are likely to occur
Identification of downstream consequences	Determining the long-term outcomes of a change in operations
Identification of key causes	Identifying the things that must be changed to achieve a goal
Judgment and decisionmaking	Weighing the relative costs and benefits of a potential action
Systems evaluation	Looking at many indicators of system performance, taking into account their accuracy

Source: U.S. Department of Labor and U.S. Employment Service. O*Net^{TM} 98 Content Model (http://www.doleta.gov/programs/onet).

There are also instructive examples from manufacturing. In a pulp mill that adopted computer technology, job requirements changed from the pragmatic knowledge required of monitoring and maintaining a specific manufacturing process in the plant to a theoretical understanding of how the plant operates. The new system in this plant required production workers to interpret data received from various parts of the plant to evaluate how his or her decisions would affect the operation of the plant as a whole.

An important factor in the decision to modernize the mill was the belief that the new technology would result in all workers at the plant—not just managers—thinking systematically about how to improve the production process. In the words of one worker, “The more I learn theoretically, the more I can see in the information. Raw data turns into information with my knowledge. I find that you have to be able to know more in order to do more. It is your understanding of the process that guides you.” (As quoted in Shoshana Zuboff, *In the Age of the Smart Machine*, Basic Books, 1988, p. 94.)

In these manufacturing and services-producing examples, as with information-intensive farming, the economic activity requires the ability to exploit information from diverse sources to arrive at workable solutions to a variable set of problems. It is this ability of workers to fully exploit the value of information that differentiates the new “Information Economy” from the waning “Industrial Economy.” Computers have been central to this transformation. However, familiarity with computers, by itself, is insufficient. Computers only receive, store, and process data. Workers need cognitive skills to organize these data into valuable information. Workers competent to act on this information are then able to increase the value of services to customers or to produce exactly the good or commodity required by the market most efficiently.

The available data suggest that the integrated use of computer technology across all aspects of farming operations is not widespread. It is less likely that using single task applications such as computerized bookkeeping is going to develop the problem-solving and systems skills that are becoming increasingly important in the nonfarm economy. However, a significant minority of farms are using computers to bring together data from various aspects of the farm operation to aid better decisionmaking. If the skill of current farmers hinders adopting information-intensive farming, then there is a role for vocational agriculture in developing computer skills.

Computers Reinforce Traditional Systems Approach to Agricultural Education

Not adopting integrated farm management information systems to bring data from all aspects of the farm operation prevents farms from capturing the full decisionmaking benefits of information technology. A traditional strength of agricultural education—to understand the farm operation as a system—is not demonstrated in the single task adoption of the computer. This traditional focus has been noted in discussion on how technical education—preparing students for jobs in industry—needs to be reformed (Stuart A. Rosenfeld, “Building Industrial Competitiveness in Rural Areas,” in S.R. Johnson and S.A. Martin, eds., *Industrial Policy for Agriculture in the Global Economy*, Ames, IA: Iowa State University Press, 1993, pp. 215-16):

> [Agricultural education] prepared youth to manage their own businesses; to make decisions about new technologies; to solve technical and business problems; to understand the entire system, from seed to store; and generally to become community leaders….Youth enrolled in vocational agriculture learned the value of innovation, experimentation, and cooperation and learned to make decisions. Youth enrolled in industrial programs learned to operate equipment and follow instructions.

The computer is clearly one tool that can reinforce the traditional emphasis in problem-solving and systems skills in agricultural education. Further, cross-functionality in farm and nonfarm skills suggests that the benefits from the cross-fertilization of agricultural and technical education curricula may be significant. The diversification of student investment in human capital carries the greatest potential benefit. Current students could commit themselves to a program of study without the attendant fear that they are preparing themselves for a career they may never realize. For current farmers, the real cost and risk of investing in a new set of skills may be substantially reduced if development of these skills increases their wages in off-farm employment. However, before these strategies can be acted upon, educational institutions must identify the possible synergies between separate curricula allowing for the development of these cross-functional skills.

The public benefits of information-intensive farming include more efficient input use; better documentation of crop identity, food safety through “traceback” records, environmental compliance; and more efficient output markets leading to a more viable farming sector. A major constraint in realizing these benefits is the skill level of farmers. However, if these same skills can help diversify and increase returns from off-farm employment, there may be significant private incentives for farmers in making this investment. *[Tim Wojan, 202-694-5345, twojan@ers.usda.gov]*

Contracting Changes How Farms Do Business

Increased contracting with agribusinesses has changed the way farms do business. Contracting can potentially increase efficiency in the food system and provide a means of quickly transmitting consumer preferences to farms. However, farm operators lose some managerial independence. Farms of all sizes have contracts, but contracting is more prevalent on larger farms. In some sectors, contracting seems to have encouraged geographic shifts in production.

Traditionally, independent farm operators exercised complete control over their production and marketing decisions. Each farmer decided what kind of seed, fertilizer, pesticide, or breeding stock to use. When crops and livestock were ready for market, they were sold to the highest bidder at a local market. In recent years, agriculture has become more "industrialized." Farm producers are becoming tied more closely to agribusinesses that process and market food products by arrangements that coordinate the various stages of the food production and marketing system. Industrialization is characterized by vertical integration between farms and processors through the use of contracts, strategic alliances, joint ventures, and franchising.

Early in the 1900's, the food production and marketing system delivered mainly generic farm products that consumers prepared at home. In recent years, consumers have changed their food consumption habits to include a wider variety of food products, more processed foods, and more food eaten away from home. An increasingly complex food processing and distribution system developed to meet this change in demand. As raw agricultural commodities produced by farms were transformed by nonfarm businesses into specific food products that consumers want, the direct link between farms and consumers had weakened. In recent years, agribusinesses have sought closer ties with farm producers through contracting and vertical integration to increase efficiency and ensure steady supplies of commodities with specific attributes. Through this process, farmers are becoming more closely integrated into the food-supply chain, and they are being asked to pay more attention to consumer demands for specific product attributes. Consequently, the distinctions between farms and nonfarm businesses are blurring.

Contracting Coordinates Food Production

Agricultural contracts are agreements between farms and companies or other farmers that specify conditions of producing and/or marketing an agricultural product. Food processors and other agribusinesses use contracts to coordinate production so as to produce known quantities of standardized products with specific attributes. Contracts provide direct feedback on market preferences and rewards to those who respond. By this means, contracts forge a stronger, more direct link between farms and urban consumers of food and fiber products. By replacing cash transactions in the open market, contracting offers farm operators the advantages of reducing the risks of unknown production costs for inputs, price swings for products, and problems in seeking a market. By assuring the price in advance, or by receiving a fee for services, farmers also reduce the risk of unknown income. For contractors (primarily processors and packers), these arrangements assure a ready supply of uniform, high-quality farm products and ease inventory management problems.

There are generally two types of contracts—marketing and production. Marketing contracts are verbal or written agreements between a contractor and a grower establishing a price formula in advance of the product being delivered. Under marketing contracts, the contractee (farmer) retains ownership of the product and has a large degree of decision-making control over the production process, but has a known market and price. Typically, a production contract requires the contractee (producer) to relinquish most control over production decisions, and the producer does not own the commodity being produced. In exchange, the farmer usually receives an incentive-based fee for production services, and the contractor reimburses a portion of the farm's operating expenses. In addition, depending on contract terms, farmers can benefit from technical advice, managerial expertise, and access to technological advances such as high-quality breeding stock, that may not otherwise be readily available. A further advantage of production contracts is that the grower and contractor share risks of both production and marketing of the commodity, one reason why using contracts has become so popular.

Contracting Is Widespread

Contracting has been a significant and growing part of U.S. agriculture since at least 1960. Today more than 1 in 10 farm operators report income from contract arrangements. USDA's *1998 Agricultural Resource Management Study* (ARMS) reported that the value of products accounted for by contracting totaled $67 billion, or 35 percent of the total value of commodities produced in the sector (table 1). Farms of all sizes use marketing contracts. Sixty-one percent of these farms were family-owned with gross sales of less than $250,000, and they accounted for 20 percent of the total value of production under contract. As farms get larger, they tend to use more contracting to market and produce their products. Over half of the large family farms were involved in some type of contracting, and they accounted for 66 percent of the total value of commodities under contract. Nonfamily farms, such as cooperatives, nonfamily corporations, and farms with hired managers, can be of any size and accounted for another 15 percent of the total value of production under contract.

Over 90 percent of the total value of production under contract was accounted for by 10 commodity groups—corn, soybeans, vegetable, fruit, nursery, cotton, cattle, hogs, poultry, and dairy (table 2). While marketing contracts can be found in the livestock industry, they

Table 1

Use of contracting by type of farm, 1998

Contracting is common among all types of farms

Item	Unit	Small family farms	Large family farms	Nonfamily farms	All
Farms:					
All farms	Number	1,869,201	153,212	42,296	2,064,709
All farms	Percent	90.5	7.4	2.0	100.0
Farms with contracts	Percent	61.0	34.1	4.9	100.0
Value of production:					
Total	Million dollars	63,205	102,650	25,995	191,851
Contract value	Million dollars	12,911	44,035	10,144*	67,090
Production contracts	Million dollars	4,175*	17,624	5,413*	27,212
Marketing contracts	Million dollars	8,736	26,410	4,731	39,878
Share of contract value	Percent	19.2	65.6	15.1	100.0
Share of farms type with:					
Contracts	Percent	7.8	53.0	27.5	11.5
Production contracts	Percent	1.3	19.2	2.6	2.6
Marketing contracts	Percent	6.7	37.1	26.3	9.4
Value of production under contract	Percent	20.4	42.9	39.0	35.0

Note: Coefficients of variation (C.V.'s) of estimates are less than 25 percent unless indicated otherwise. The C.V. is computed by dividing the estimate's standard error by the estimate and multiplying by 100. Lower C.V.'s indicate more reliable estimates.

*C.V. is greater than 25 and less than or equal to 50.

Source: *1998 USDA Agricultural Resource Management Study*.

are used in pricing many crops, particularly specialty crops such as fresh vegetables and fruit. More than 194,000 farms had at least one marketing contract during 1998. The share of commodities produced under marketing contract has increased slightly over the last few years, from 16 percent in 1991 to 21 percent in 1998. Topping the list of crops produced under marketing contracts were fruits and vegetables, with $9.5 billion sold through contract, 45 percent of the value of all fruits and vegetables produced. Other crops with large shares of production value under marketing contract were cotton ($2 billion or 50 percent); corn ($2.4 billion or 12.5 percent); soybeans ($2.1 billion or 11.7 percent); and sugar beets ($1 billion or 76 percent). Almost all fluid milk is sold under marketing orders, but because neither a quantity nor a final price is set before the sale, milk producers may or may not consider the process a "contract."

Production contracts accounted for 14 percent of the total value of production in 1998 and approximately 3 percent of the farms had at least one production contract. Production contracts are used more on larger farms than are marketing contracts—and are more likely to be for livestock. Poultry and poultry products accounted for 55 percent of the total value of commodities under production contracts, and cattle and hogs another 36 percent.

Contracting Reduces, but Does Not Eliminate, Managerial Responsibility

Day-to-day management plays a key role in returns to farmers, even though, with contracting, the farmer's role in marketing and production practices may be limited. In animal production contracts, expert husbandry of the animals can positively contribute to the farmer's bottom line. And, contracting for a specific commodity is not the only decision that the farmer makes. In addition to producing for the cash market, farmers can and do have marketing and production contracts for the same or other commodities. And, farmers may contract with businesses or other farmers to gain access to inputs. For example, some farmers contract with other farmers for feed or replacement heifers. The farmer's skills in financial management, acquiring other inputs, coordination and management of

Table 2

Share of contract value of production for selected commodities, 1998

A few commodities account for most of the value of contract production

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

Note: Coefficients of variation (C.V.'s) of estimates are less than 25 percent unless indicated otherwise. The C.V. is computed by dividing the estimate's standard error by the estimate and multiplying by 100. Lower C.V.'s indicate more reliable estimates.

*C.V. is greater than 25 and less than or equal to 50.

[1] Fluid milk is typically produced under a marketing order. However, because neither price nor quantity is specified before sale, farmers may or may not consider this a "contract."

Source: *1998 USDA Agricultural Resource Management Study.*

the production of other commodities, and allocation of time provide returns to successful entrepreneurship.

Not all aspects of contract arrangements are positive for farmers. Since contracts usually specify certain practices, the loss of entrepreneurial capacity is perhaps the largest disadvantage to the farmer. Contract risk may occur when prices in the open market exceed those specified by the contract, or the contract may be terminated on short notice. Contractors may require upgrades to buildings and other infrastructure, resulting in investment risk that may not be foreseen by the grower. Buildings, for example, may not be readily convertible to alternative uses if a contract is terminated. In addition, growers operating under a relative performance system may be at an unfair disadvantage, since companies may not have the incentives to maintain strict accuracy in the accounting and allocation of inputs among growers. Issues between growers and integrators have led to lawsuits on various occasions, and several States have adopted some form of legislation regulating production contracts in agriculture.

The poultry industry has been organized as a fully integrated supply chain since new technology in breeding, disease control, and grading eggs made large-scale commercial broiler production possible in the 1950's. From the hatchery to the grower to transportation to the processing plant and then to consumers, contracts coordinate the market. To reduce transportation costs for chicks and feed, farms cluster around contractor facilities. In addition, birds do not travel well, so having farms close to the primary processor reduces losses in transit. The close coordination of marketing with specialized complexes, complete with a well-developed infrastructure of local support services, now provides a competitive advantage for the southern regions of the United States.

Compared with other farms, broiler farms have lower net income, but the contract arrangements disguise some of the financial characteristics of contract farms. Farmers selling their products in the open market, by definition, receive the full market value of the product when it is sold. For broiler operations, however, the fees the farmer receives for caring for the chickens are different from the value of the chickens. Because contractors are intensely involved in the risks and expenses of broiler production—they own the birds and provide feed, medical services, management advice, and a market outlet—they earn a large proportion of the market value of the chickens.

Thus, the comparatively low sales and low income of broiler operations are somewhat misleading. Broiler farms with sales over $50,000 have about half the asset investment of comparable size nonpoultry farms, mainly because the contractor owns the birds and provides most of the inputs. This sharing of the resources through contracts may provide avenues for young or beginning farmers to build their businesses with lower capital requirements. On average, broiler producers retained approximately 39 cents per dollar of gross sales versus 21 cents for nonpoultry farms. In addition, broiler farm households provided fewer hours to farm work (and more to off-farm work). Household income for broiler operations was 84 percent of the average for all U.S. households in 1997. Off-farm income is a higher proportion of their household income than on comparable farms. However, households associated with broiler operations had lower average income from off-farm businesses and unearned income (interest, dividends, Social Security, etc.) than comparable households without broiler enterprises. Lower household income of households with broiler operations can be attributed in part to broiler operators' lower average age and fewer years of education compared with other farm operators. And, Southern farmers may find poultry production an attractive employment alternative, given fewer off-farm employment opportunities than in Midwestern States.

Supply-chains have recently expanded to include the hog industry. Instead of farrow-to-finish operations, farmers can now specialize in each stage of production. Thus, the farmer and contractor share input costs and management expertise. Again, adoption of new technology has led to the increased use of contracts. Because technology has allowed farmers to reduce their costs by increasing pigs per litter and weight per hog, they can take advantages of economies of size and scope. Changes in the supply-chain have fueled the growth of hog farms. The number of farms with more than 2,000 head of hogs increased from 29 percent in 1992 to 55 percent in 1997. With the increasing number of hogs produced, new markets were opened and exports have become increasingly important to the hog industry in the 1990's.

Contracting in the hog industry occurred very quickly. In less than 7 years, the industry went from about 10 percent of the hogs under contract to more than 50 percent (fig. 1). According to ARMS data, in 1998, the value of hogs under contract was $3.7 billion, or 43 percent of the total hog value of production. Because of the longer life cycle of hogs, there is opportunity for contracting between each stage—breeding and farrowing, nursery, finishing, and processing. Under production contracts, integrators or other farmers move hogs from each stage of production to the next stage. With marketing contracts, processors buy hogs for slaughter from farmers or integrators. Farmers can and do have both types of contracts.

Contracts Change Market Structure

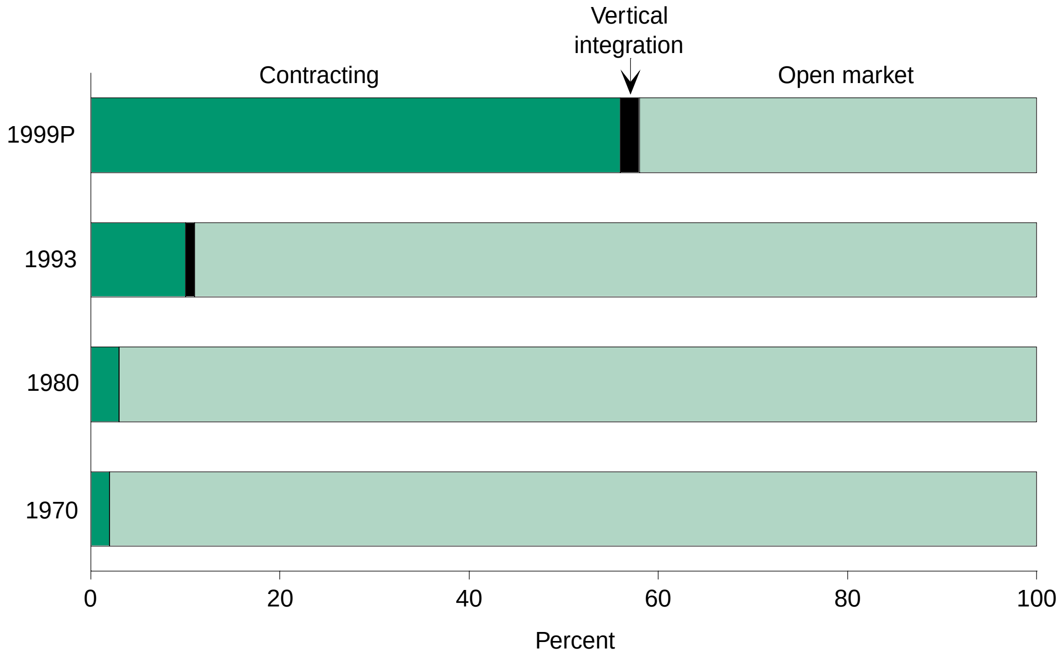
Economists use farmers as an example of classic price takers. Successful farmers typically survived by lowering their costs of production, actively marketing their products, and using strategies that helped them respond to changes in the market. Integration through contracts in the hog and poultry industry, and now in the grain industry, provides a way to lower costs, achieve access to the market, and respond to changes in consumer demands. But contracting changes the way that markets function. Intermediate prices are not visible as they are in an open market, and the only price that is public is the price to the consumer. Thus, competitors and researchers have a more difficult time measuring efficiencies in the production and intermediate marketing processes.

While economic incentives within agriculture continue to encourage structural change, environmental concerns, corporate farm laws, and conflict with nonfarm neighbors will help determine the direction of this change. Increased industrialization has environmental

Figure 1

Share of hog production by type of vertical coordination, 1970-99

Hog contracting increased rapidly during the 1990's



P=preliminary.

Source: Compiled by ERS from various studies. See Steve W. Martinez, *Vertical Coordination in the Pork and Broiler Industries.* AER-777, USDA/ERS, April 1999.

and social costs. Growth of large concentrated livestock operations near population centers may create conflicts over odor and waste disposal. In many areas, farm expansion may be limited because of farms' proximity to environmentally sensitive lands. In these areas, cost-saving opportunities through expanded production may become fewer. As population increases or environmental regulations prevent expansion, incentives may shift production back to more traditional producing areas or to new areas with opportunities for economic growth.

In addition to changing the way markets function and in the location of markets, contracting changes who does business. Contractors provide markets and may provide inputs and sometimes financing. Thus, a concern is that contract farms will be less likely to purchase inputs and market output in their local community. As farms consolidate and deal more exclusively with outside contractors, rural communities with close ties to commodities could have fewer farms and fewer businesses to keep the local economy healthy. Because farmers are sharing the value of production with other businesses, that shared portion of the profits may not benefit the local economy.

Contract production is likely to increase, despite concerns that opponents may voice. Industrialized agriculture has produced economic efficiencies through specialization, mechanization, mass production and lower transaction costs. Management of the production process continues to be consolidated. At the same time, the reduced dependence of communities on farming and related services (such as farm supply and equipment dealers, grain elevators, mills, and livestock markets) will continue a trend that has been underway for many years. These changes, however, do not mean that small communities must inevitably decline. Rural communities dependent on traditional farming may need to seek new sources of economic growth. Communities will need to explore opportunities to provide new services that meet the unique needs of farmers, such as market development, processing, packaging, transportation, and information.

Neither does contracting or vertical integration mean the end of the family farm. Ninety-eight percent of farms continue to be family owned and operated. Basic commodities will continue to be produced in massive quantities in the most cost-efficient manner, most often by large-scale family-owned operations. Rather than focusing on lowering production costs, or expanding operations, farmers can create market power by producing higher value, attribute-specific commodities that consumers demand. With recent advances in communications technology, such as the Internet, farmers will be able to participate in strategic alliances, formal contractual or similar arrangements to create linkages with businesses, and ultimately consumers, all over the world. *[Janet Perry, 202-694-5583, jperry@ers.usda.gov; David Banker, 202-694-5559, dbanker@ers.usda.gov]*

ERS Research on Contracting and Risk Management in Agriculture

Contracting, other forms of vertical coordination, and risk management have become more important in U.S. agriculture during the 1990's. ERS has published a number of reports on these important changes in how farms and agricultural businesses are managed. Many of the ideas and data summarized in this article are based on these reports, which are listed here for the interested reader. Each report was published by ERS and is available from the ERS web site.

Joy Harwood and others, *Managing Risk in Farming: Concepts, Research, and Analysis*, AER-774, March 1999. <http://www.econ.ag.gov/epubs/pdf/aer774/index.htm>

Farm Business Economics Branch, *Farmers' Use of Marketing and Production Contracts*, AER-747, December 1996. <http://www.econ.ag.gov/epubs/pdf/aer747/index.htm>

Janet Perry, David Banker, and Robert Green, *Broiler Farmers Organization, Management, and Performance*, AIB-748, March 1999. <http://www.econ.ag.gov/epubs/pdf/aib748/index.htm>

Steve Martinez, *Vertical Coordination in the Pork and Poultry Industry*, AER-777, April 1999. <http://www.econ.ag.gov/epubs/pdf/aer777/index.htm>

William McBride, *Change in U.S. Livestock Production, 1969-92*, Economic Research Service, AER-754, July 1997. <http://www.econ.ag.gov/epubs/pdf/aer754/index.htm>

Urbanization Affects a Large Share of Farmland

Although actual urbanized area accounts for only 2.9 percent of the U.S. land base, urban influence affects about 17 percent of the Nation's agricultural land. Local, State, and Federal governments have increased their efforts toward preserving agricultural lands and their associated rural amenities.

In recent decades, urban development has pushed outward from city centers, in a form that increasingly intersperses urban activities with farm activities in traditionally rural areas. Farmers in urbanizing areas sometimes face constraints on their farming activities when new neighbors object to odors, dust, noise, chemical use, disposal of farm wastes, and other agricultural practices. Farmland values inevitably rise above their value in agricultural production as land becomes valued for its future use in nonfarm activities (see box, "Importance of Farm Real Estate"). Factors unrelated to agricultural production, such as urban proximity and potential for recreational use, become important determinants of farmland values. Many consumers and rural residents alike feel that the irregular pattern of development that typically accompanies recent urbanization affects the quantity and quality of some nonmonetary benefits stemming from agricultural land use that previously may have been taken for granted. These nonmonetary benefits can include recreational opportunities, aesthetic enjoyment from viewing landscapes and wildlife, environmental quality, and nostalgia related to the moral, historic, and cultural significance of rural life. But, since these "rural amenities" cannot be bought and sold in a marketplace, collective action is needed to conserve them. While it is neither the sole nor, in all cases, the best form of response to these felt needs, government effort to preserve farmland has become an increasingly common approach. In recent decades, local, State, and Federal governments, as well as nongovernmental organizations, have increased their efforts toward preserving agriculture-related amenities via legislative initiatives to preserve farmland.

Growing Conflict Over Land Use Priorities

As the United States has become increasingly urban, with approximately 79 percent of the population currently residing in urban places, residential and commercial development has spread further from city centers, consuming more agricultural land in traditionally rural areas. The unplanned, relatively low density growth is often typified by discontiguous residential development (often interspersed with idle land, and often connected by commercial corridors along busy roads) that relies on automobiles for transportation. The level terrain that makes farmland advantageous for agricultural production also makes these lands attractive for housing and commercial uses. The favorable climates that are associated with major national production centers for many high-valued fruit and vegetable crops mean that these areas, especially, are subject to intense pressure from urban development.

Farmland is no longer an unlimited resource, as it was at the time of westward expansion, resulting in more conflicts over land use priorities. Nowhere is this conflict more evident and more intense than at the urban fringe, which is the principal interface between agricultural and nonagricultural uses of farmland. Along urban fringes, conflicts develop between farmers and new suburban neighbors over farm odors, early morning noise, commuting inconvenience, perceived health hazards posed by chemical applications, and so forth. Farmers also may face greater economic pressure from water and land use restrictions. Some farms on the urban fringe face crop-yield deterioration from urban smog, theft, and vandalism. Although production near urban areas also has some offsetting economic advantages, the rural/urban conflicts, plus the economics of rising farmland values and property taxes, give some farmers incentive to sell farmland for nonfarm development. In some cases, the land remains in use for the production of agricultural products, but the type and intensity of agricultural production changes.

How Much Farmland Subject to Urban Influence?

In recent years, concern over farmland preservation has been renewed. State and local governments have implemented or considered farmland preservation measures. For example, an unusually large number of State and local initiatives to influence urban development were on the November 1998 ballots, potentially adding to an already long list of existing programs. The Federal Government has also taken an increasing interest in the issue. This widespread concern may be a reaction to the spread of urban influence far beyond the borders of statistically defined "urbanized areas" (see appendix "Data and Definitions" in this issue for the precise definition). "Urban-influenced" is a broader term (defined later for purposes of this analysis), referring to farmland subject to the spreading economic and social influence of "urbanized areas."

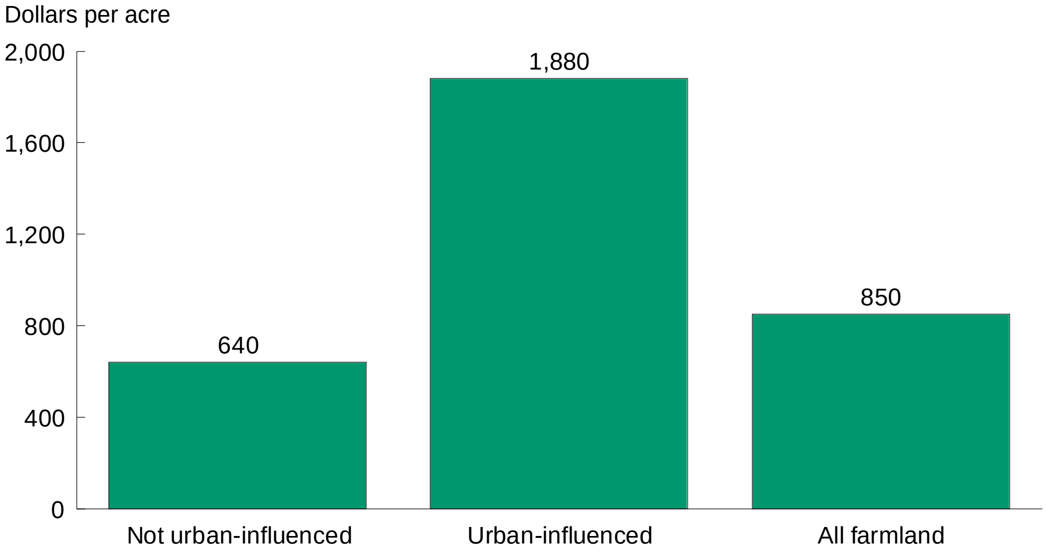
Although urban influence affects farms and rural areas in a number of ways, its effect on land values is probably the easiest to observe. When urban development spreads to rural areas, the value of urban fringe farmland increases as its value for future commercial, industrial, and residential uses grows. For most parcels in urban-influenced areas, crop and livestock production generates relatively less in net returns per acre than would nonagricultural uses. Consequently, when urbanization spreads to rural areas, the market price of potentially developable farmland is driven above its economic value for farm use. In States where farmland is in great demand for conversion to urban use, relatively large proportions of the market value of farmland is attributable to the nonfarm demand.

USDA's National Agricultural Statistics Service annually collects information on farmland values via the national June Agricultural Surveys (JAS), (see box, "Urban Influence: Data and Classification"). Using data from the JAS for 1994-96 in conjunction with a Geographic Information System (GIS), we examine two aspects of urbanization: How large is the urban-influence zone in terms of farmland acres? And how much does this influence change farmland values? For the United States, the average value of parcels *not* subject to urban influence is $640 per acre (fig.1). The average value is nearly three times higher for those parcels classified as "urban-influenced," averaging $1,880 per acre. Combining those two categories, the average value for "all" farmland is $850 per acre.

Figure 1

Average farmland values by classification, 1994-96

Urban influence raises farmland values



Source: Calculated by ERS from USDA's National Agricultural Statistics Service, June Agricultural Survey data.

The effect of urbanization on farmland values can be estimated by assuming that the value of agricultural parcels not subject to urban influence represents the value of land for purely agricultural use. The effect of urbanization, then, can be estimated by finding the difference between market value and agricultural value. Applying that technique to the analysis of JAS data yields results indicating that urban influence accounts for 25 percent of the market value of all U.S. farmland ($210 of the $850 per acre average) (fig.2). For parcels within the urban-influence zone, urban influence constitutes 66 percent of market value ($1,240 of the $1,880 per acre average).

While the large direct effect of urbanization on farmland values is well known, the extent of the urban-influence zone is less understood. In Ohio, for instance, where the State's farmland is subject to the sometimes overlapping influence of three large, yet widely spaced metropolitan areas, a large proportion of the State's farmland is urban influenced. The statistical design properties of the JAS data can be used to estimate the number of acres subject to urban influence (see box, "Urban Influence: Data and Classification"). Using the same rural/urban-influenced classification scheme, ERS estimates that about 17 percent of U.S. farmland acres are subject to urban influence (fig. 3).

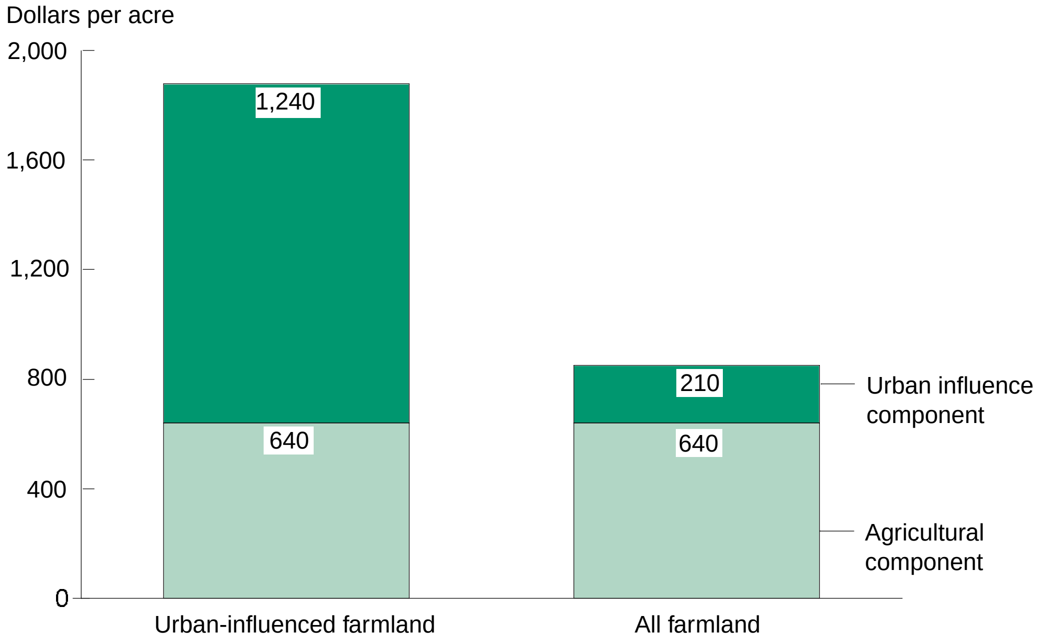
The national perspective obscures the wide regional variation in urban influence. One would expect that the most heavily populated areas, such as along the eastern seaboard, would yield the largest effects on farmland value and the largest percentages of farmland acres that are subject to urban influence. This is borne out by results from an analysis of 20 Land Resource Regions as defined by USDA's Natural Resources and Conservation Service. Figure 4 illustrates three regions for which results are reported in table 1: the predominantly agricultural Northern Plains, the moderately urbanized Corn Belt, and a heavily urbanized area labeled the North Atlantic Slope covering parts of Virginia, Maryland, New Jersey, and southeastern Pennsylvania.

In the Northern Plains, very little farmland is subject to urban influence. Only 9 percent of acreage is classified as urban-influenced (table 1). In this region, the average value of all farmland is only 6 percent higher than the average value of strictly agricultural land.

Figure 2

Urban-influenced and rural components of average farmland values, 1994-96

Urban influence adds an average of 25 percent to U.S. farmland values

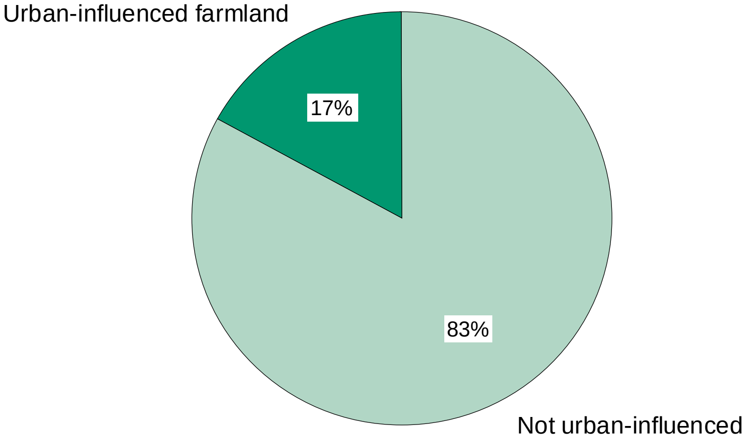


Source: Calculated by ERS from USDA's National Agricultural Statistics Service, June Agricultural Survey data.

Figure 3

Rural versus urban-influenced farmland, 1994-96

While less than 3 percent of land is officially designated as "urban," 17 percent of farmland is "urban-influenced"

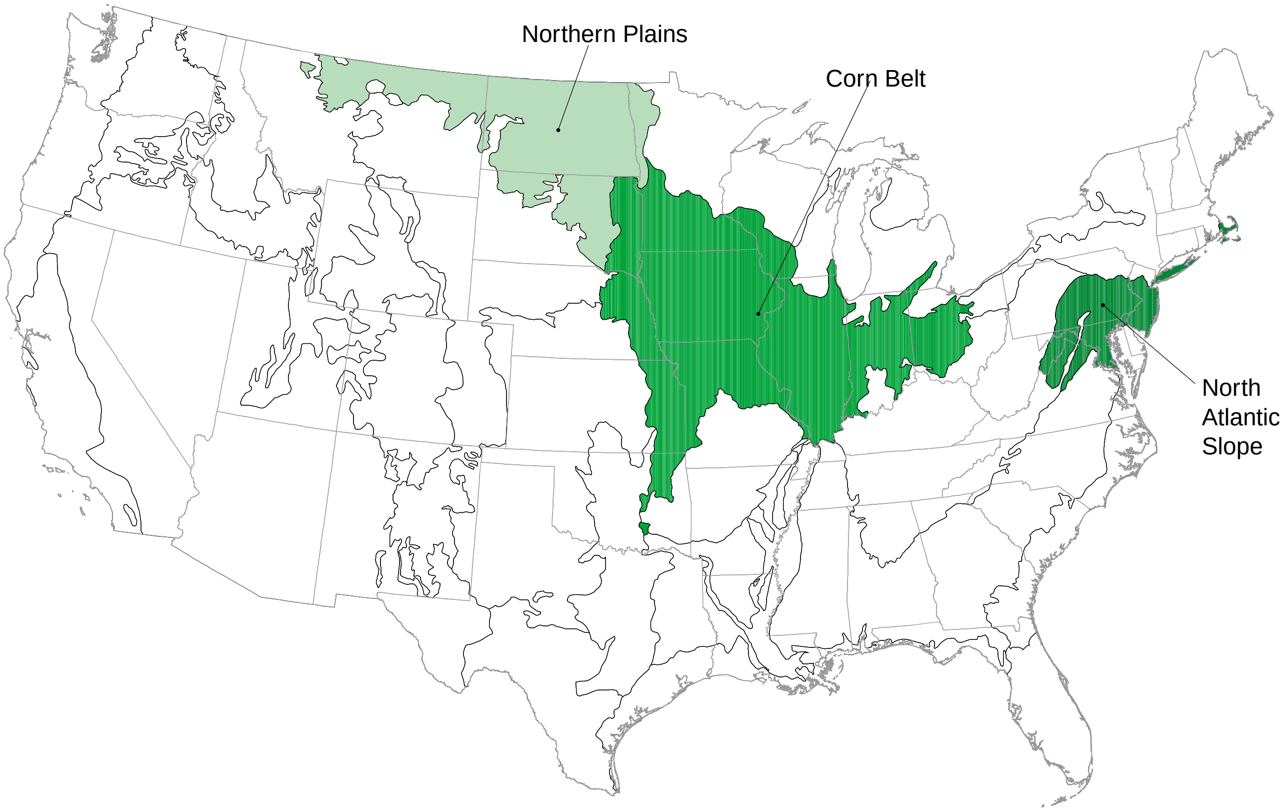


Source: Calculated by ERS from USDA's National Agricultural Statistics Service, June Agricultural Survey data.

Figure 4

Selected land resource regions

Three regions represent a wide range of urban influence



Source: USDA.

Table 1

Indicators of urban-influence for three selected regions

The geographic extent of urban influence and its degree of influence on farmland values varies considerably across regions

		Urban-influence component of market value		Market value of farmland		
	Acres influenced	All farmland	Urban-influenced	Not-urban-influenced	Urban-influenced	All
	Percent of agricultural land base	Percent		Dollars per acre		
Northern Plains	9	6	40	290	480	310
Corn Belt	22	14	42	1,090	1,860	1,260
North Atlantic Slope	55	48	63	1,970	5,300	3,790

Source: Estimated by ERS from USDA's National Agricultural Statistics Service, June Agricultural Survey data.

However, for the 9 percent of farmland classified as urban-influenced, the urban-influence accounts for nearly 40 percent of its market value.

The Corn Belt has large amounts of rural farmland, but is subject to considerably higher levels of urban-influence than the Northern Plains. In the Corn Belt, the urban influence component is about 14 percent of the market value of all farmland, about twice that of the Northern Plains (table 1). For the 22 percent of farmland acres that are subject to urban influence, that influence accounts for nearly 42 percent of market value, a percentage that is similar to the corresponding effect in the Northern Plains.

The North Atlantic Slope is one of the most urban-influenced regions in the United States. For this region, urban-influence accounts for about 48 percent of market value of the region's farmland (table 1). About 55 percent of the region's farmland is classified as urban-influenced. For urban-influenced parcels, about 63 percent of farmland's market value is attributable to the urbanization effect.

Agricultural Land Provides Multiple Benefits

In addition to producing the Nation's food and fiber, farms have always provided many auxiliary products that are socially beneficial, including wildlife habitat (with various species generating value through viewing, hunting, preservation, etc.), surface water control (including storage in lakes, streams, and reservoirs and flood control), groundwater recharge, wetlands, aesthetic experiences from viewing pastoral scenes, and open space. Until recent decades, there was little concern over loss of such benefits due to conversion of agricultural land to urban-related uses because these products were supplied in abundance. But as the land base becomes more urbanized, the nonpecuniary benefits associated with agricultural production become more valuable and important relative to food and fiber production, and losses of those amenities become a source of concern.

Evolving Importance of Governmental Policy in Preservation of Rural Amenities

With the loss of farms and interspersion of urban-related activities, consumers may perceive a loss of "rural amenities," "landscape amenities," or "visual amenities." But, there is no market mechanism through which consumers can express their desires to retain these aesthetic products. As a consequence, some form of social action may serve as a substitute for the land market's allocative functions.

Due partially to legal and cultural tradition, State and local land use policies have been the primary means of preserving rural amenities. Voters and taxpayers across the United

States have consistently supported State and local initiatives to encourage retention of private land as undeveloped or "open space" land. Even though these State and local programs can take many forms, including retention of undeveloped land in the form of publicly accessible parks and recreation areas, many open space programs focus on retention of agricultural uses of land, in part reflecting the predominant presence of agriculture in many rural areas. All 50 States have right-to-farm laws. All 50 States have some form of use-value assessment or preferential taxation favoring farmland. Conservation easements can be purchased in 20 States, at least 20 counties have transferable development rights programs, 16 States have agricultural district laws, and 24 States allow agricultural protection zoning (American Farmland Trust, *Saving American Farmland: What Works*, Washington, DC, pp. xiii).

The Federal role in farmland protection, while limited, appears to be expanding. The Farmland Protection Policy Act of 1981 required Federal agencies to conduct reviews for the purpose of "minimiz[ing] the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses." The necessary administrative rules to implement the law were adopted in 1994. The Farms for the Future program, created by the 1990 farm bill, authorized a pilot program under which federally subsidized loans to State and local governments were used for purchase of agricultural conservation easements on farmland. The Federal Agricultural Improvement and Reform Act of 1996 (FAIR) superseded the latter program and directed USDA to carry out a program to purchase agricultural conservation easements on prime and unique farmland for the purpose of protecting it from nonagricultural uses. It authorized up to $35 million (from CCC funds administered by NRCS) in matching funds for State and local farmland protection programs. More recently, Vice President Gore announced a $9.5-billion bond proposal to curb urban sprawl and proposed $1 billion in tax credits and grants to help communities preserve farmland, limit sprawl, and invest in cities.

Federal policies continue to have profound, indirect impacts on land use and rural landscapes, just as they have in the past. The Conservation Reserve Program (CRP) is a recent example, where Federal policy has the effect of holding land in open space uses for 10 years, even though the primary intent of the program was to remove marginal cropland from production. As originally conceptualized, the CRP's purpose was soil conservation. Over time, however, policymakers recognized preservation of water quality and enhancement of wildlife habitat as additional environmental benefits of the CRP program. Incorporation of these latter considerations into CRP enrollment criteria highlights growing interest in the "multifunctionality" of farmland. In addition, many other Federal programs and policies, including estate and income tax laws, commodity programs, and highway location affect land use allocations. Furthermore, the U.S. Government has played a role in preserving aesthetic landscapes for at least 125 years by designating large tracts of land as national parks, wilderness areas, and national forests.

The interest in public provision of open space amenities is not limited to the United States, and the involvement of national governments in protecting and enhancing rural amenities has become a contentious issue in international discussions concerned with agricultural trade liberalization. A number of European countries have national programs in place to conserve agricultural landscapes. The densely populated UK is an example where national policies (and budget outlay) are explicitly directed at preserving (and sometimes enhancing) desirable characteristics of the rural landscape. Member countries of the EU and Japan have used Organization for Economic Cooperation and Development (OECD) and World Trade Organization (WTO) venues to argue that preserving landscape amenities is sufficient reason to subsidize certain farmland activities in order to retain these amenities and that these subsidies should not be seen as violations of recent trade agreements—a position the United States and others refute. More information regarding trade issues surrounding rural amenities can be found by visiting the Issues Center (archive on the ERS homepage under the title, "Multifunctionality in the WTO," or directly at <http://www.ers.usda.gov/whatsnew/issues/multifunction/index.htm>. *[Charles H. Barnard, 202-694-5602, cbarnard@ers.usda.gov]*

Urban Influence: Data and Classification

Farmland values data from the June Agricultural Surveys, pooled for 1994-96, consist of more than 75,000 observations. The data are operator opinions, and the sample segments are georeferenced, meaning that parcel location information (approximate) is available in the form of latitude and longitude. Each parcel was classified as urban-influenced or not-urban-influenced based on an index of urban proximity derived from Census tract population data using statistical smoothing techniques available in Geographic Information System (GIS) software. In geographer's terminology, the index is derived from a "gravity" model of urban development, which provides measures of accessibility to population concentrations. The index accounts for both population size (within a 50-mile radius) and location of the parcel relative to that population (distance). The index increases as population increases and/or as distance from the parcel to the population decreases—hence, the "gravity" analogy. The urban-influenced and not-urban-influenced categories were determined by examining the distribution of the index across sampled parcels in "totally rural" census tracts. Census tracts were assigned to the "totally rural" category based on 1990 commuting data and Census Bureau geographic definitions (see appendix B, "Definitions" in this issue). In this analysis, "totally rural" means that the tract does not contain any part of a town of 2,500 or more residents and the primary commuting pattern was to sites within the tract. Parcels were classified as urban-influenced if their population accessibility index exceeded the 95th percentile of the index's distribution for the set of "totally rural" tracts in the region (LRR) containing the parcel.

Importance of Farm Real Estate

Farm real estate plays an important role in the farm economy. Farmland values, in most areas determined largely by capacity to produce food and fiber, are an important indicator of the well-being of the farm sector. Farm real estate is the major asset of the farm sector, traditionally accounting for about three-fourths of total U.S. farm assets. Consequently, changes in farmland value directly affect the balance sheets and solvency of farm operators who own land in urbanizing areas. In addition to being the largest single investment item in a typical farmer's portfolio, farm real estate is the principal source of collateral for farm loans, enabling farm operators to finance the purchase of additional farmland and equipment or to finance current operating expenses.

Economic Census Provides Detailed Picture of U.S. Industry

The latest Economic Census reports are a valuable source of information to analysts and policymakers in business, Federal, State, and local governments. The data are the first to use the new NAICS industry classification system, which includes new categories for emerging industries in high-tech manufacturing, communications, and services.

The 1997 Economic Census provides detailed information on all nonagricultural industries in the United States. Census data are a rich source of information for policymakers, business analysts, marketing specialists, planners, and economic development officials. The census includes data on sales, employment, pay, costs, and capital expenditures. Analysts can use the data to compare pay in different industries, find out what inputs and components are purchased by various types of manufacturers, learn what types of retail stores are the most important outlets for a particular product, or evaluate the extent to which local businesses are capturing local retail business. Many data items are available for geographic areas, including States, metropolitan areas, and counties.

Every 5 years, the U.S. Bureau of the Census collects data from establishments in all U.S. industries. The bulk of the reports from the most recent 1997 Economic Census was scheduled for release in 1999, but specialized reports, such as merchandise line sales for retail businesses, will be released in years 2000 and 2001. A guide to the Economic Census data can be found on the Internet at <http://www.census.gov/epcd/www/guide.html>. The 1997 Census is the first to use the new North American Industrial Classification System (NAICS), an updated classification of industries that replaces the Standard Industrial Classification (SIC). The NAICS system better reflects today's economy and makes it easier to find data on new emerging industries in high technology, communications, and service sectors that were previously lumped with other industries in the SIC system (see box, "The North American Industrial Classification System"). The 1997 Census is the first to be released primarily on the Internet and CD-ROM. Electronic reports can be accessed at the census web site <http://www.census.gov/prod/www/abs/economic.html>. Analysts can conduct their own database queries to create customized reports on industries or geographic areas at the Census Bureau's "American Factfinder" web site <http://factfinder.census.gov>. Only summary reports will be published in printed format.

The Economic Census covers all nonagricultural industries, including mining, manufacturing, construction, utilities, wholesale and retail trade, transportation and warehousing, and services (separate censuses of agriculture and governments were also conducted in 1997). Number of establishments, employees, payroll, and value of output (sales, revenue, value of production) are collected for all industries. Other items, including worker wages and hours, benefits, costs, energy consumption, purchases and expenditures, are collected for selected industries. Data are summarized in industry and geographic reports. Industry series reports provide detailed tabulations of national and State data for specific industries. Geographic area series reports available for some industries tabulate basic data for each county, metropolitan area, and place.

As this issue of *Rural Conditions and Trends* was being written, only a small portion of the data had been released. In this issue, we provide two brief examples of how the Economic Census data can be used. First, an analysis of the semiconductor industry shows how industry report series data can be used to profile an important industry. We then provide a brief analysis of retail trade patterns in Montana to show how geographic area series data can be used to analyze regional development issues. *[Fred Gale, 202-694-5349, fgale@ers.usda.gov]*

The North American Industrial Classification System

The North American Industrial Classification System (NAICS) is replacing the Standard Industrial Classification system in the reporting of industry statistics by the Federal Government. The 1997 Economic Census is the first data product to use the NAICS system. NAICS was developed jointly by the United States, Canada, and Mexico to provide a uniform statistical system across North America. Information on the classification system and how it compares with the SIC codes can be found on the Internet at <http://www.census.gov/epcd/www/naics.html>.

The NAICS codes follow a hierarchy, with two-digit codes assigned to broad sectors such as mining, construction, manufacturing, and six-digit codes for the most detailed industries. For example, manufacturing industries NAICS codes begin with "3" as the first digit. NAICS 334 is Computer and Electronic Product Manufacturing. That category includes six subcategories represented by four-digit codes 3341 through 3346 listed in table 1. The most detailed industries have six-digit codes. The Semiconductor and Other Electronic Components (NAICS 3344) category has eight six-digit industries. Seven of these industries correspond exactly to codes in the old SIC classification. However, establishments in NAICS 334418, Printed Circuit Assembly, were formerly found in three different SIC categories: 3577, 3679, and 3661. The value of the NAICS is in its ability to more easily analyze data for newly emerged industries such as Printed Circuit Assembly, which were hidden in various categories in the SIC classification. However, it also presents a difficulty in matching new data tabulated under the NAICS system with earlier SIC-based data.

Table 1

Example of NAICS classification and correspondence to SIC

NAICS	Description	SIC	Description
334	Computer and Electronic Product Manufacturing		
3341	Computer and Peripheral Equipment Manufacturing		
3342	Communications Equipment Manufacturing		
3343	Audio and Video Equipment Manufacturing		
3344	Semiconductor and Other Electronic Components		
334411	Electron Tube Manufacturing	3671	Electron tubes
334412	Bare Printed Circuit Board Manufacturing	3672	Printed circuit boards
334413	Semiconductor and Related Devices	3674	Semiconductors, related devices
334414	Electronic Capacitor Manufacturing	3675	Electronic capacitors
334415	Electronic Resistor Manufacturing	3676	Electronic resistors
334416	Electronic Coil, Transformer, and Other Inductors	3677	Electronic coils, transformers
334417	Electronic Connector Manufacturing	3678	Electronic connectors
334418	Printed Circuit Assembly (Electronic Assembly)	3577	Computer peripheral equipment, not elsewhere classified
		3679	Electronic components, not elsewhere classified
		3661	Telephone and telegraph apparatus (consumer external modems)
334419	Other Electronic Component Manufacturing	3679	Electronic components, not elsewhere classified
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing		
3346	Manufacturing and Reproducing Magnetic and Optical Media		

Source: U.S. Bureau of the Census.

Semiconductor Industry Growing Rapidly

Economic Census data show that semiconductor manufacturing is a rapidly growing industry. It is geographically concentrated, but rural areas may become more attractive to semiconductor manufacturers.

As microprocessors have been introduced into more and more products, the semiconductor manufacturing industry has grown rapidly. The Semiconductor Association of America reported worldwide semiconductor sales of over $11 billion per month in mid-1999. U.S. employment in the sector grew more than 25 percent from 1993 to 1999. Over that same period, other manufacturing industries generally posted only slight gains in employment (fig.1). Semiconductor manufacturing jobs are also highly paid, averaging $18 per hour for production workers in mid-1999, compared with an average for all manufacturing of under $14.

Drawn by the allure of the industry's growth in high-paying skilled jobs, relatively low emission of pollutants, and its "high-tech" image, economic development officials have offered expensive enticements for companies to locate semiconductor plants in their communities or States. The 1997 Economic Census provides information about growth in production, capital expenditures, employee earnings, and materials purchases for the semiconductor industry. This type of information can help local and State officials make informed decisions about industry recruitment, regional planning, and other issues.

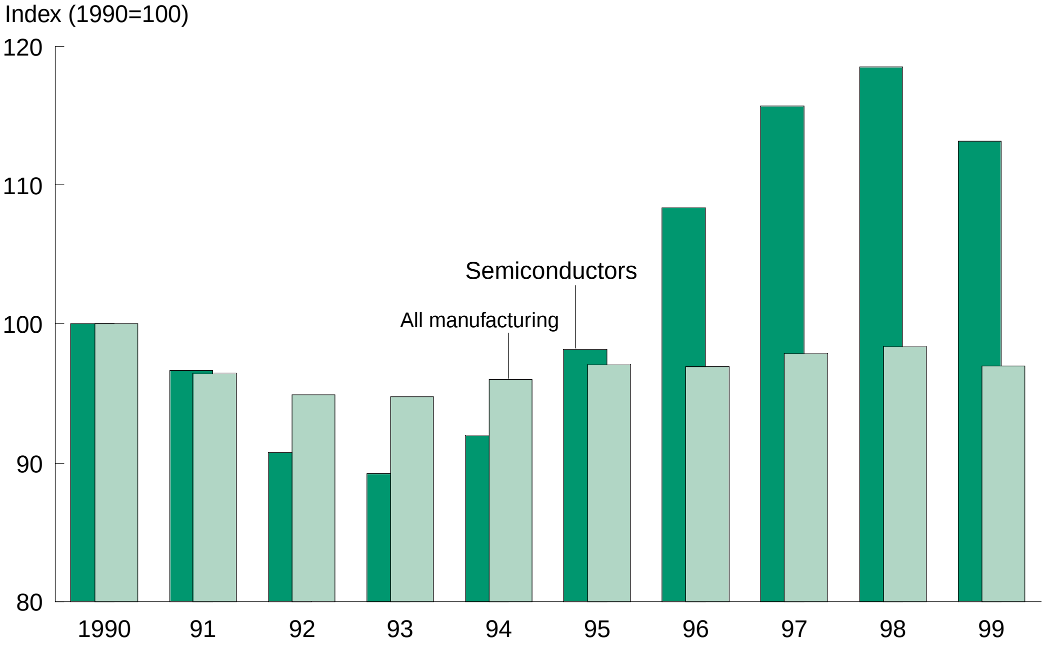
Industry Shipments More Than Doubled Between 1992 and 1997

The 1997 Economic Census reports 980 companies operating 1,082 establishments in the North American Industrial Classification (NAICS) category 334413, "Semiconductors and Related Devices" (table 1). Comparison with the 1992 Economic Census shows that the industry added 157 companies and 160 establishments between 1992 and 1997. (NAICS category 334413 is equivalent to the Standard Industrial Classification (SIC) cate-

Figure 1

Employment growth in semiconductor and all manufacturing industries, 1990-99

Employment in semiconductor manufacturing grew rapidly during the mid-1990's



Source: ERS analysis of Bureau of Labor Statistics data.

Table 1

Production and employment in the U.S. semiconductor industry, 1992-97

All measures indicate rapid growth in the semiconductor industry

Item	Unit	1992	1997	Percent change
Companies	Number	823	980	19.1
Establishments	Number	922	1,082	17.4
Value of shipments	Billion dollars	33.2	78.0	135.1
Cost of materials	Billion dollars	9.8	15.0	52.0
Value added	Billion dollars	23.3	63.7	173.6
Capital expenditures	Billion dollars	3.1	10.5	237.5
Employment	Number	172,200	198,119	15.1
Production workers	Number	84,800	105,781	24.7
Payroll	Million dollars	6,893	9,994	45.0
Benefits	Million dollars	1,564	2,250	43.9
Value added per worker	Dollars	135,290	321,760	137.8
Earnings per worker	Dollars	40,030	50,450	26.0
Benefits per worker	Dollars	9,080	11,360	25.0
Production worker hourly wage	Dollars	13.54	16.36	20.8
Capital expenditures per worker	Dollars	18,121	53,165	99.3

Note: Data are for NAICS sector 334413 for 1997 and SIC 3674 for 1992. Not adjusted for inflation.
Source: ERS analysis of U.S. Bureau of the Census, Economic Census.

gory 3674 used in previous economic censuses, facilitating easy comparison with previous years.) Employment rose by 25,919 jobs, a 15-percent increase. However, these increases appear to understate the actual growth of the industry. The number of production workers (those actually involved in production operations, excluding most administrative, management, and research personnel) and the number of hours each increased about 25 percent. Even more rapid growth in the value of industry shipments indicates that production grew even faster than labor input. The value of industry shipments rose a staggering 135 percent during 1992-97, reaching $78 billion in 1997. This figure is not adjusted for inflation—semiconductor prices actually fell in price. The rapid growth in value added suggests that worker productivity increased considerably.

The value of shipments may overstate the physical product turned out by the industry because the value is double-counted when intermediate products produced by one establishment are sold to another establishment within the same industry to manufacture a final product. The Economic Census reports value added, a measure of output that avoids the double-counting problem. Value added is the difference between the value of product shipments and the cost of materials, supplies, containers, fuel, purchased electricity, and contract work. In 1997, the semiconductors industry purchased materials and supplies valued at nearly $15 billion, and produced value added of $63.75 billion. The value of materials purchases grew by only 52 percent between 1992 and 1997, much slower than the 135 percent growth in value of product shipments. This means that value added grew even faster than shipments—174 percent—between 1992 and 1997.

Growth in Worker Productivity and Wages

Value added per worker, a common measure of worker productivity, was $321,760 for the semiconductor industry in 1997 (table 1). This value is considerably higher than for other industries. In related electronic components industries (such as circuit boards, capacitors, electron tubes) value added per worker ranged between $50,000 and $100,000. The total for all manufacturing was not available at the time of writing, but the 1996 estimate from the Census Bureau's Annual Survey of Manufactures was $93,737. Since semiconductor industry value added grew faster than the number of workers between 1992 and 1997, productivity (as measured by value added per worker) also grew rapidly. Value added per worker grew by $186,000 in the 5 years from 1992 to 1997, an increase of 138 percent.

Increases in wages are usually linked to growth in worker productivity. As the value of output produced by a worker increases, companies are willing to pay workers more. The Economic Census data show that wages grew rapidly in the semiconductor industry, but growth in wages absorbed only a small share of the increase in productivity. Wages and salaries per worker rose from $40,030 to $50,450 between 1992 and 1997, an increase of 26 percent. The general level of inflation was 12.7 percent over the period, so this represents an increase in real wages. Nonwage benefits rose at a similar rate of 25 percent, from $9,080 to $11,360 per worker. However, earnings for production-line workers grew more slowly. Average hourly wages for semiconductor production workers grew 20.8 percent from $13.54 to $16.56. While growth in wages did not keep up with growth in value added in the semiconductor industry, the growth in both wages and employment experienced by the industry stands in contrast to the generally stagnant picture in most U.S. manufacturing industries. Wages in the semiconductor industry were significantly higher and grew faster than wages in other manufacturing industries. Earnings per worker for all manufacturing were $33,770 in 1997, $16,230 less than the average for the semiconductor industry. Average wages for all manufacturing rose only 10 percent between 1992 and 1997, less than half the 26-percent increase in the semiconductor industry. In addition, total manufacturing employment fell by 6.9 percent between 1992 and 1997.

Another indicator of the semiconductor industry's rapid growth is its high level of capital expenditures. The industry made an average of $53,000 in capital expenditures for every employee in 1997. This is a very high rate of investment per worker. In 1996, capital expenditures for all manufacturing were less than $7,500 per worker (the data for 1997 were not available when this article was written), so clearly the semiconductor industry was expanding capacity more rapidly than other manufacturing sectors were. The high investment of capital per worker is consistent with the high and increasing productivity indicated by the value added per worker figures. Total capital expenditures in 1997 were $10.5 billion, including $1.9 billion spent on buildings and facilities, and $8.6 billion spent on machinery and equipment. The industry's assets were valued at $59.57 billion at the end of 1997, over $300,000 per worker.

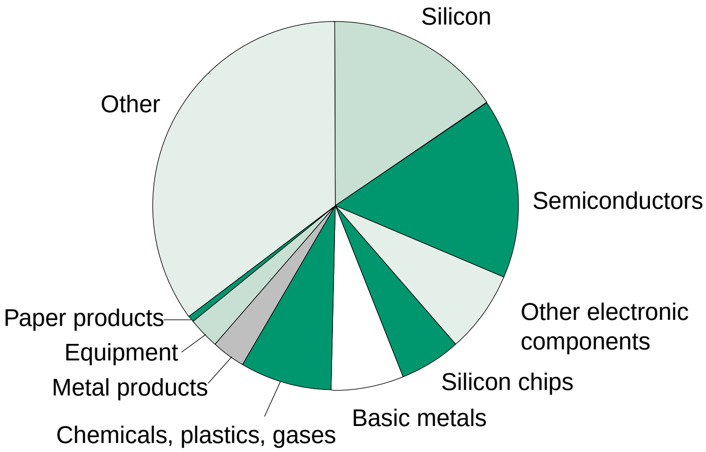
A Variety of Raw Materials Are Purchased

The Economic Census provides detailed information on the range of products made and the materials consumed by each industry. Materials purchases can help analysts evaluate the backward linkages to suppliers in a particular industry. Knowledge of what materials are purchased by manufacturers is helpful in determining whether a community has adequate access to suppliers to attract a plant in a given industry. It is also useful for estimating local economic impacts of manufacturing plants. The census lists 35 types of materials, components, equipment, and parts that are consumed by manufacturers in the semiconductor industry. They are summarized in 10 categories shown in figure 2. The largest single categories of materials are hyperpure silicon (the basic raw material for semiconductors) and semiconductors themselves, each of which had purchases of $1.5 billion in 1997. (Semiconductors are purchased as intermediate products to be used in the manufacture of semiconductor-based microprocessors, integrated circuits, and other products.) Other expenditures are for a variety of raw materials, including basic metals and alloys, plastics, chemicals, and gases, fabricated metal products, computing, communications, optical equipment, instruments, and a large "other materials" category, for which materials were not specified. Expenditures for many materials increased rapidly between 1992 and 1997, indicating that growth in semiconductor production benefited many supplying industries. Expenditures on silicon more than doubled from $675 million to $1.5 billion, and purchases of bolts, nuts, screws, washers, and rivets rose from $3 million to $16.7 million between 1992 and 1997. Other expenses collected by the Economic Census include quantity of electricity consumed, expenditures on electricity, purchased services, and rental payments.

Figure 2

Semiconductor industry purchases of materials, 1992

Semiconductor manufacturers purchase a variety of raw materials



Source: ERS analysis of U.S. Bureau of the Census, 1997 Economic Census.

Semiconductor Manufacturing Is Geographically Concentrated

Semiconductor manufacturers are desirable targets of industry recruiters because they are a growing industry, pay high wages, and employ a relatively educated labor force. While Economic Census data paint a picture of a rapidly growing industry, the prospects of recruiting semiconductor plants for rural communities appear discouraging.

The semiconductor industry is geographically concentrated in the West, Southwest, and Northeast. The two dominant States, California (27.6 percent) and Texas (28.7 percent), had a combined share of 46 percent of semiconductor jobs in 1997 (table 2). However, their share of industry value added was smaller, at 35.3 percent. Arizona, with only one-third as many semiconductor workers as California, recorded value added of $9.7 billion, only 12 percent less than California's total. Oregon and Washington also had shares of value added much greater than their share of employment.

California and Texas received the largest share of semiconductor capital expenditures, but the ratio of capital expenditures to workers suggests that capacity is expanding rapidly in other States. On average, the semiconductor industry made about $53,000 in capital expenditures per worker. In Oregon and Washington, investment was far higher, at $143,500 and $117,000 per worker, respectively. Investment in Arizona and Florida was also above the average, at $74,000 and $65,000 per worker. Texas, Colorado, and Minnesota each had capital expenditures of between $50,000 and $60,000 per worker. All other States had expenditures below $50,000 per worker, including California, at $44,800.

The semiconductor industry is heavily urbanized. According to the Census Bureau's *County Business Patterns* data, only 62 out of 940 semiconductor manufacturing establishments were in nonmetro areas. (Economic Census data on establishments by county had not yet been released when this article was written.) Three-fourths (682) of semiconductor manufacturing establishments were located in large metropolitan areas with population of 1 million or more. Another 15.6 percent of establishments were in metro areas with populations of 500,000 to 1 million, and only 26 establishments were in small metro areas.

In 1995, 50 nonmetro counties had semiconductor establishments, with estimated employment totaling nearly 8,000 jobs (5 percent of the industry total). Nonmetro establishments were scattered across the country, but were largely concentrated in the West,

Table 2

Semiconductor employment, value added, and capital expenditures by State, 1997

California and Texas are the leading employers in the semiconductor industry, but several other States had higher levels of capital investment per worker

State[1]	Employment	Value added	Capital expenditures	Capital expenditures per worker
	Number	Million dollars	Million dollars	Thousand dollars
California	54,597	10,969.1	2,446.4	44.8
Texas	37,088	11,549.2	2,110.9	56.9
Arizona	18,070	9,701.8	1,346.4	74.5
Massachusetts	9,387	1,358.5	261.1	27.8
Oregon	8,309	7,075.8	1,192.6	143.5
Pennsylvania	7,916	3,514.5	230.4	29.1
New York	7,830	625.6	98.7	12.6
Colorado	4,953	1,093.8	258.7	52.2
Florida	3,452	513.6	224.3	65.0
Washington	3,104	350.3	363.5	117.1
Minnesota	2,036	264.7	106.1	52.1
New Jersey	1,934	241.1	74.4	38.4
Ohio	1,932	278.5	35.2	18.2
North Carolina	1,796	166.9	81.9	45.6
New Hampshire	1,450	209.8	57.4	39.6
Connecticut	629	91.9	11.1	17.6
Utah	613	8.5	6.6	10.7
Maryland	594	42.8	18.1	30.4
Wisconsin	519	34.1	1.7	3.2
Illinois	407	38.8	9.6	23.6
Michigan	331	21.2	5.6	16.9
Other States	31,172	15,596.7	1,592.3	51.1
Total	198,119	63,747.2	10,532.9	53.2

[1] States with less than 100 employees and those for which operations of individual firms might be disclosed are not shown.
Source: Calculated by ERS from U.S. Bureau of the Census, 1997 Economic Census data.

Northeast, and Midwest (fig. 3). Pennsylvania had the most nonmetro semiconductor establishments (seven), followed by Iowa (six). However, most of these establishments were very small. The three Oregon establishments accounted for about half of nonmetro employment in semiconductors.

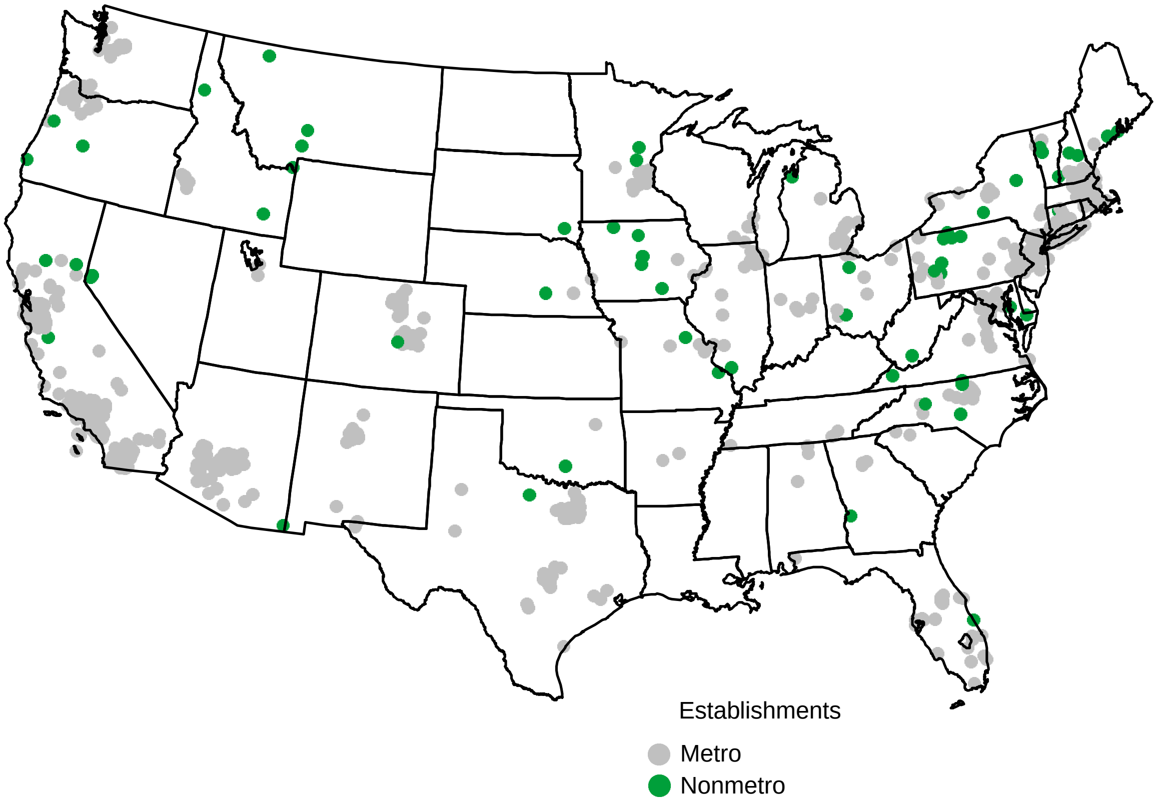
Rural Locations May Become More Attractive

The semiconductor industry appears to be on the upswing of the “product cycle.” According to the product cycle theory, new, innovative industries tend to prefer urban locations where they have access to new ideas, knowledge, and innovation. The geographic concentration of semiconductor establishments seems to be in line with this theory. However, the product cycle suggests that rural locations may become more attractive. As the semiconductor industry matures, it may become more conscious of costs and less concerned about innovation, making rural areas with lower land and facilities costs more attractive. A couple of other factors may brighten prospects for rural areas to gain a greater share of this industry. Advances in telecommunications improve access to information in rural areas, and natural amenities of rural areas may be particularly attractive to environmentally conscious managers and employees in this industry. However, rural areas also must compete with overseas locations in Asia and other regions where labor costs are often lower and environmental and other regulations can be less stringent. *[Fred Gale, 202-694-5349, fgale@ers.usda.gov]*

Figure 3

Metro and nonmetro semiconductor establishments, 1995

Semiconductor manufacturers are geographically concentrated in the West, Northeast, Midwest, and parts of Texas and Florida



Source: Calculated by ERS from U.S. Bureau of the Census, *1995 County Business Patterns* data.

Completely Rural Montana Counties Lost Fewer Retail Dollars in 1997

Economic Census data show differences in spending in rural States like Montana. The most-rural counties lose about 40 percent of their retail spending to larger towns and cities, but the effects on local economies are small and stable.

Economic Census data are a rich source of information about geographic patterns of retail trade, a sector that provides about 15 percent of rural jobs. Many rural communities are concerned about the loss of local retail activity to larger towns and cities. Loss of retail trade means not only loss of jobs, but also symbolizes decline of small town "main streets." State and local officials are also interested in retail trade because sales taxes are an important source of revenue in most States. This article shows how Economic Census data can be used to analyze retail sales, using Montana as a case study. (When this article was written, geographic data were available only for Montana and nine other Western States, but data for most States should be available by the time of publication.)

In 1997, Montana had 5,042 retail establishments with at least one employee and those establishments together had sales of $7.78 billion. (Data for nonemployer establishments will be released later.) The largest retail sectors were automotive dealers ($2.1 billion), food and beverage stores ($1.3 billion), general merchandise stores ($1.1 billion), building materials and garden supply stores ($932 million), and gasoline service stations ($754 million). Seven other retail sectors had sales ranging between $150 million and $250 million.

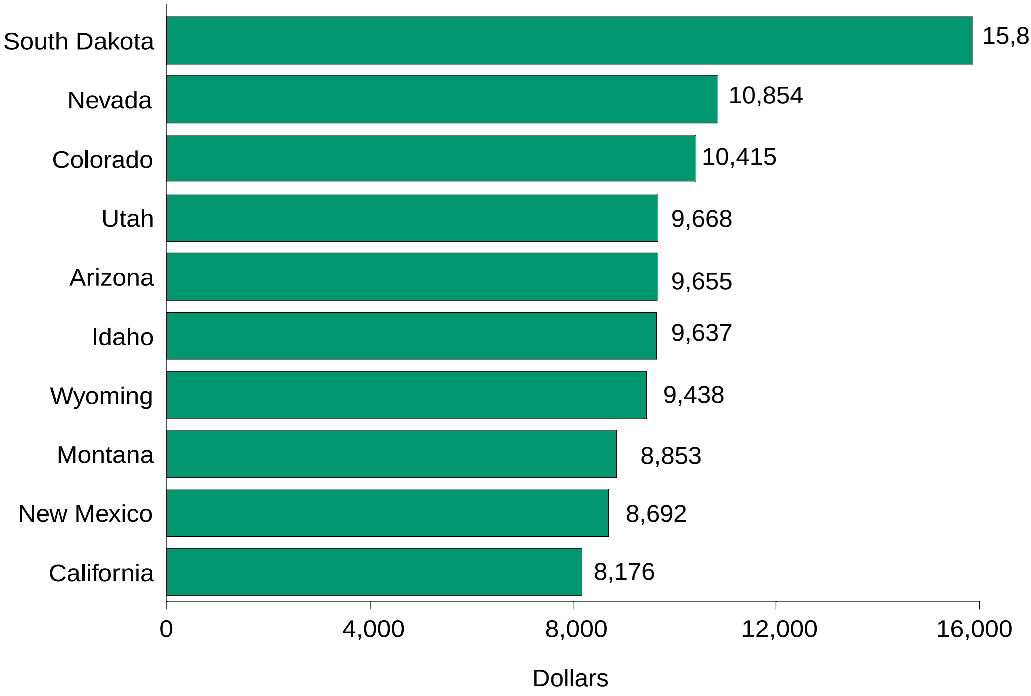
High Transportation- and Building-Related Spending

Montana's retail sales per capita in 1997 were $8,853. Figure 1 compares retail sales per capita for Montana with nine other States for which data were available at the time this article was written. Retail sales in Montana were lower than in seven other Western States. Of the 10 States for which data were available, only California and New Mexico

Figure 1

Per capita retail sales for 10 States, 1997

Montana sales per capita are lower than in most neighboring States



Source: Calculated by ERS from 1997 Economic Census data.

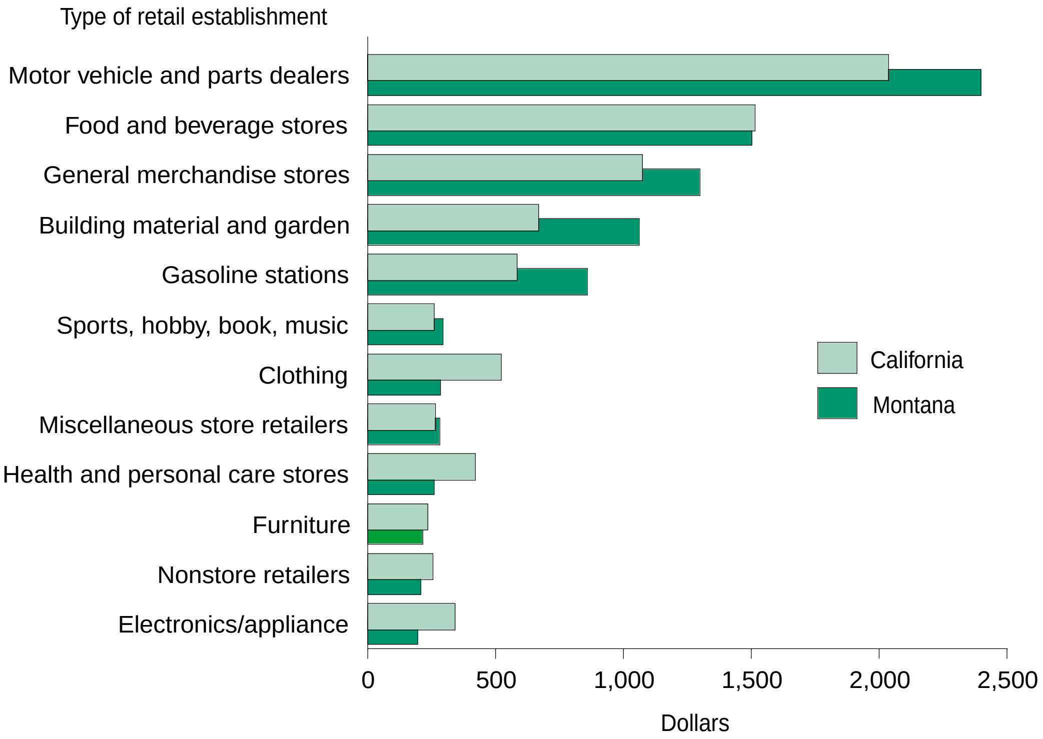
had lower sales than Montana. South Dakota's sales are clearly higher than other States. Closer inspection of the data shows that this is due to high sales by "nonstore retailers," largely due to the presence of Gateway Computers in North Sioux City, South Dakota. (When this category is excluded, per capita sales in South Dakota are similar to sales in other States.) Nevada and Colorado have per capita incomes about $7,000 higher than other States in the region and are important tourist destinations, which probably accounts for their high per capita sales. Comparing Montana and Idaho (two States with nearly identical per capita incomes) per capita sales by category shows that higher sales of motor vehicles and nonstore retailers account for the higher level of per capita retail sales in Idaho.

Comparing per capita retail sales by category between California, a largely urban State, and Montana provides insight about different retail patterns between urban and rural States (fig. 2). Montana's higher retail sales can be attributed to higher sales in motor vehicles, gasoline stations, building materials and garden supply stores, and general merchandise stores. Greater expenditures on motor vehicles and gasoline reflect the greater reliance on automobile transportation in a sparsely populated State like Montana, in comparison with California. Building and garden supplies sales may reflect greater construction, home improvements, and landscaping in Montana, which was gaining population in the mid-1990's. The greater amount of open space in Montana also may increase spending on landscaping and gardening supplies. Higher spending in general merchandise stores reflects the greater popularity of discount mass merchandisers in rural areas. In contrast, California had higher retail sales in clothing, health and personal care, and electronics and appliance stores. These reflect differences in preferences and spending on luxury items in California, where personal income is higher. Per capita spending in other types of stores was very similar between the two States.

Figure 2

Per capita retail sales by sector, Montana and California, 1997

Montana residents spent more per capita at motor vehicle dealers, gas stations, general merchandise stores, and building material and garden supply stores



Source: Calculated by ERS from 1997 Economic Census data.

Large Share of Spending Leaks From Completely Rural Counties

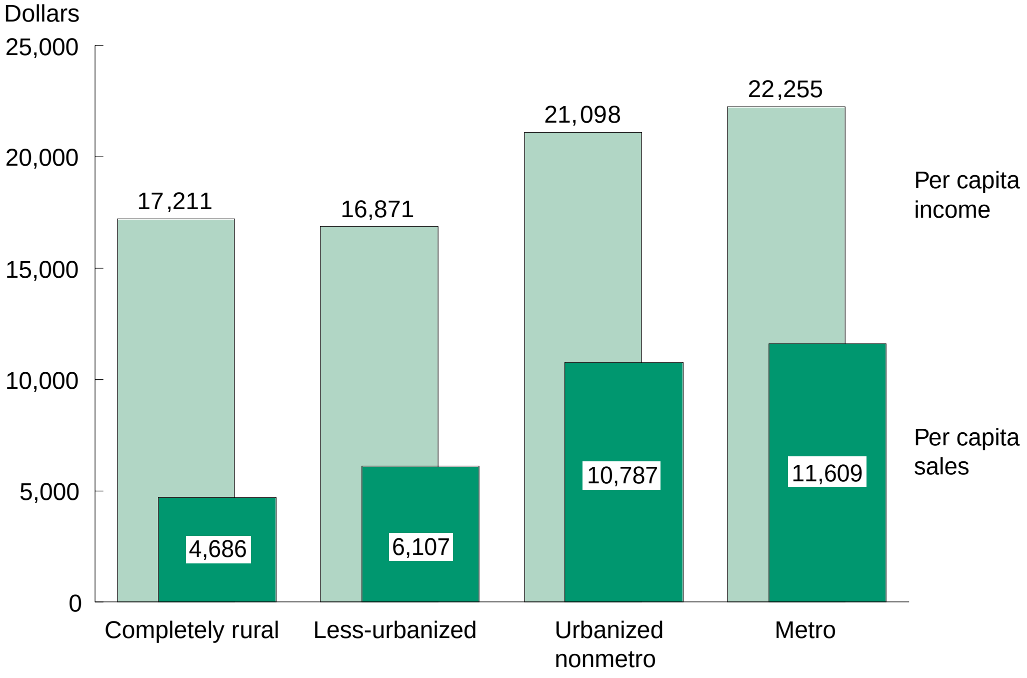
While per capita sales do not vary that much from State to State, they vary considerably across counties, since residents of small communities often cross county lines when they make shopping trips to large towns and cities. Comparing retail sales for rural and urban Montana counties makes this clear (fig. 3). Completely rural counties (with less than 2,500 people living in urban places) had per capita retail sales of $4,700 in 1997, about $4,150 under the Statewide average. Less-urbanized nonmetro counties (where between 2,500 and 10,000 people live in urban places) had per capita sales of $6,100, still considerably less than the Statewide average. Urbanized nonmetro counties (with at least 10,000 people living in urban places) had per capita sales of $10,800, and the two metropolitan counties in Montana (the Great Falls and Billings metro areas) had sales of $11,600. Higher incomes in the more urbanized counties may explain part of the difference in sales, but it seems clear that retail expenditures are "leaking" from small rural counties to more urbanized "retail trade centers." Using Statewide average per capita retail sales as an estimate of retail expenditures per person with an adjustment for differences in income, one can estimate a "pull factor" that estimates the extent to which a community captures retail expenditures of its residents. Completely rural counties capture an estimated 60 percent of their residents' retail expenditures, which means residents make 40 percent of their retail expenditures outside their county of residence. Less-urbanized nonmetro counties do better, capturing 80 percent of local retail trade. In contrast, urbanized nonmetro counties attracted per capita sales that were an estimated 15 percent greater than expenditures by their residents, while sales in metro counties were 18 percent higher than their residents' estimated expenditures.

The employment effects of these retail trade patterns are fairly small. In dollar terms, about $740 million in retail expenditures "leaked" from completely rural and less-urbanized counties, combined. Assuming one job for every $161,000 of retail sales (the State average), that translates to an equivalent of about 4,600 retail jobs. That works out to an average of 96 jobs per county lost to retail sales leakage for the 58 completely rural and less-

Figure 3

Per capita income and retail sales by Montana county type, 1997

Per capita sales are much lower in rural counties



Source: ERS analysis of 1997 Economic Census.

urbanized Montana counties. In 1997, the average retail job paid about $15,400 in Montana.

Leakage From Completely Rural Counties Seems To Have Fallen

The most interesting question is whether the rate of leakage is accelerating. Comparison with 1992 data indicates that completely rural Montana counties actually reduced their leakage between 1992 and 1997. Using the same method to estimate pull factors for 1992 yields an estimated leakage rate of 47 percent for completely rural counties, higher than the 40 percent estimated for 1997. However, for less-urbanized Montana counties the leakage rate rose slightly from 16 to 20 percent. This comparison is not entirely valid because the composition of the retail trade sector changed, due to the new North American Industrial Classification System (NAICS). The biggest change in the NAICS is the exclusion of eating and drinking places, which were included in the Standard Industrial Classification retail sector in 1992 (see box, “NAICS Excludes Food Service From Retail Sector”). However, eating and drinking places are one of the most geographically dispersed industries, so leaving this sector out should increase the rate of retail leakage. More careful analysis is needed to arrive at stronger conclusions, but it appears that rural retail is fairly stable in Montana. The situation may be quite different in other rural regions, however. Earlier research found that leakage was falling in Western rural areas, but increasing in farming areas of the Midwest and Great Plains. *[Fred Gale, 202-695-5349, fgale@ers.usda.gov]*

NAICS Excludes Food Services From Retail Sector

Food service establishments (formerly eating and drinking places, SIC 58) were a large retail sector under the Standard Industrial Classification system, but the NAICS now classifies this as a service industry. Montana food service establishments had sales of $861 million in 1997, so the sector’s exclusion from the retail sector makes it difficult to compare retail figures between the NAICS and SIC classifications. Other problems are introduced by the NAICS inclusion of a small number of wholesaling establishments that sell directly to the public. These establishments were formerly classified as parts of several wholesale sectors under the SIC. Analysts cannot adjust for this change using published data, but the share of sales in these sectors is so small that the effect on most analyses will not be noticeable.

Data Sources

Census of Agriculture is an enumeration of all U.S. farms conducted every 5 years. A farm is currently defined as any place that sells, or normally would sell, at least $1,000 of agricultural products annually. USDA conducted the most recent Census of Agriculture in 1997. For publications and more information, see <http://www.nass.usda.gov/census/>. The U.S. Bureau of the Census conducted agricultural censuses for 1992 and earlier years.

County Business Patterns. The U.S. Bureau of the Census publishes an annual series, the County Business Patterns, that provides estimates of employment, establishments, and payroll by industry for each U.S. county. These data are the most comprehensive source of information on geographic patterns of employment for detailed industries. For more information, access to databases and electronic publications, see <http://www.census.gov/epcd/cbp/view/cbpview.html>. The Census Bureau does not publish data that could disclose information about the operations of individual companies or establishments. To account for these confidential data, ERS uses an enhanced County Business Patterns file (acquired from a private vendor) that imputes values for the suppressed data. Employees totally exempt from the Federal Insurance Contribution Act (farm operators and other self-employed persons, hired farm workers, most government employees, railroad workers, and domestic service workers) are not counted by County Business Patterns.

Economic Census is an enumeration of all nonagricultural businesses conducted by the U.S. Bureau of the Census at 5-year intervals. Data on number of establishments, employment, payroll, output or sales, and other variables are collected from all U.S. business establishments. The most recent economic census was in 1997. Preliminary data are described in several articles in this issue. For more information, see <http://www.census.gov/epcd/www/guide.html>.

Macroeconomic Data. The economic indicators used to monitor macroeconomic changes in the U.S. economy are derived from Federal sources. Measures of inflation, including the consumer and producer prices indexes, productivity, employment cost, and employment and unemployment data are developed by the U.S. Department of Labor's Bureau of Labor Statistics (BLS), see <http://www.bls.gov>.

National income and product account (NIPA) information on capital investment, gross domestic product, and net exports is produced by the Bureau of Economic Analysis (BEA), U.S. Department of Commerce. On October 28, 1999, BEA released new NIPA estimates that incorporate a number of major definitional and statistical improvements designed to better measure the evolving U.S. economy. Information about BEA's recent comprehensive revision of the NIPA accounts is available at <http://www.bea.doc.gov/bea/an1.htm>. Macroeconomic data and Food and Fiber System estimates published in this issue of *Rural Conditions and Trends* reflect the revised NIPA data, and may not match data published in earlier issues.

Information on monetary policy (including changes in interest rates and foreign exchange rates) and industrial production data are obtained from the Federal Reserve Board.

Employment Data. Data on metro and nonmetro employment and unemployment reported in this issue come from three sources. The monthly Current Population Survey (CPS), conducted by the Bureau of the Census for the Bureau of Labor Statistics, U.S. Department of Labor, provides detailed information on the labor force, employment, unemployment, and demographic characteristics of the metro and nonmetro population. The CPS derives estimates based on interviews of a national sample of about 47,000 households that are representative of the U.S. civilian noninstitutional population 16 years of age and over. Labor force information is based on respondents' activity during 1 week each month. Among the data products of the CPS are the monthly files, the earnings microdata files, and the March Annual Demographic Supplement (known as the March CPS). For more information, see <http://www.bls.gov/cpshome.htm>.

BLS county-level employment data, the Local Area Unemployment Statistics (LAUS), are taken from unemployment insurance claims and State surveys of established payrolls which are then benchmarked to State totals from the CPS. The BLS data series provides monthly estimates of labor force, employment, and unemployment for individual counties. For more information, see <http://www.bls.gov/lauhome.htm>.

BEA employment data, unlike the household data collected by the CPS and BLS, provide establishment data on the number of jobs rather than the number of workers. The BEA data are taken primarily from administrative reports filed by employers covered under unemployment insurance laws and from information from the Internal Revenue Service and the Social Security Administration. Thus, jobs and earnings for these jobs are counted at the place of work and are based on a virtual universal count rather than a sample. The BEA data provide detailed information on the number of jobs and amount of earnings by industry at the county level. A shortcoming of the BEA data is the 2-year lag between when they are collected and when they are available for analysis.

Each of these data sets has its advantages and disadvantages. The CPS furnishes detailed employment, unemployment, and demographic data for metro and nonmetro portions of the Nation. The LAUS provides less detailed employment data than the CPS, but offers very current employment and unemployment information at the county level. The BEA provides estimates of the number of jobs and earnings by industry for individual county areas (as well as States and metropolitan areas). For access to the BEA database, see <http://fisher.lib.virginia.edu/reis/index.html>.

While these data sources are likely to provide different estimates of employment conditions at any point in time, they generally indicate similar trends. For a comprehensive listing of regional economic data available online, see <http://www.econdata.net>.

June Agricultural Survey is a national survey of farmland values conducted annually by USDA. For more information about USDA estimates of agricultural land values, see <http://usda.mannlib.cornell.edu/reports/nassr/other/plr-bb/>.

Agricultural Resource Management Study (ARMS) is an annual survey that collects detailed information on financial status, production, and management of a nationwide sample of U.S. farms. The ARMS survey is conducted annually by USDA's National Agricultural Statistics Service, and is the most comprehensive national annual data available on farm financial and operating characteristics. The sample is chosen carefully to be representative of all U.S. farm operations. The ARMS is a probability-based survey, where each respondent represents a number of farms of similar size and type. Thus, the sample data can be expanded to represent the entire farm sector for the contiguous 48 States.

Definitions

Farming-dependent county — Farming contributed a weighted annual average of 20 percent or more of total labor and proprietor income over the 3 years of 1987-89. County typology codes are described in Peggy J. Cook and Karen L. Mizer, *The Revised ERS County Typology: An Overview*, RDRR-89, U.S. Department of Agriculture, Economic Research Service, December 1994.

Farm Types

Small family farms – Sales less than $250,000 per year.

Larger family farms – Sales above $250,000 per year.

Nonfamily farms – Farms organized as nonfamily corporations or cooperatives, as well as farms operated by hired managers.

Goods-producing industries. Industries that primarily produce physical goods or commodities: farming, agricultural services, manufacturing, mining, and construction.

Input-output model. An economic model that represents the economy as a set of sales and purchases between sectors, final demands, and payments to labor, capital, profits, and indirect business taxes.

Land in farms (farmland or agricultural land) consists primarily of agricultural land used for crops, pasture, or grazing on any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year.

Metropolitan Statistical Areas (MSA's) are defined by the Office of Management and Budget in terms of counties, except in New England, where the definitions are in terms of cities and towns. Additional contiguous counties are included in the MSA if they are economically and socially integrated with the core county. Metro areas are divided into central cities and areas outside central cities (suburbs). Throughout most of this publication, "urban" and "metro" have been used interchangeably to refer to people and places within MSA's. The entire territory of the United States is classified as metropolitan (inside an MSA or CMSA) or nonmetropolitan. In this issue, the article, "Urbanization Affects a Large Share of Farmland," uses a measure based on farmland values to identify areas where land values are subject to urbanization effects to show that urbanization can affect places outside of MSA's.

Nonmetro areas. Counties outside MSA or CMSA boundaries. Throughout this publication, "rural" and "nonmetro" are used interchangeably to refer to people and places outside of MSA's.

Regions

Bureau of Economic Analysis regions:

New England—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Mideast—Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania.

Great Lakes—Illinois, Indiana, Michigan, Ohio, and Wisconsin.

Plains—Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

Southeast—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.

Southwest—Arizona, New Mexico, Oklahoma, and Texas.

Rocky Mountain—Colorado, Idaho, Montana, Utah, and Wyoming.

Far West—Alaska, California, Hawaii, Nevada, Oregon, and Washington.

Services-producing industries. Industries that produce services, rather than physical goods: transportation, communications, and public utilities; finance, insurance, and real estate; wholesale trade; retail trade; services.

Totally rural census tracts, as defined by ERS, are delineated based on 1990 commuting data and Census Bureau geographic definitions. In this analysis, "totally rural" means that the tract does not contain any part of a town of 2,500 or more residents and the primary commuting pattern was to sites within the tract.

Urban and rural population are Bureau of the Census definitions. The urban population basically comprises all persons living in incorporated or census-designated places of 2,500 or more inhabitants. The population not classified as urban constitutes the rural population.

Urbanized area comprises one or more places and adjacent densely settled surrounding territory that together have a minimum population of 50,000 persons.

Latest Trends in Nonfarm Jobs and Earnings

With the release of 1997 data by the Bureau of Economic Analysis (BEA), we can update the analysis of nonfarm jobs and earnings that was published in Vol. 9, No. 3 of *RCaT*. When BEA releases a new year of data, it also revises the previous 2 years' estimates. The data shown here do not match data for the same years published in earlier issues of *RCaT* because of the BEA revisions and because ERS has converted earlier years' earnings to 1997 dollars.

Jobs

Nonfarm jobs increased by 2.0 percent during 1996-97, slightly slower than the 2.3 percent job growth in metro areas (app. table 1). That nonmetro rate of job growth is slower than the 2.5 percent annual growth nonmetro areas averaged during 1991-97. During 1996-97, the agricultural services, construction, transportation and public utilities, retail trade, finance, insurance and real estate, and services industries added jobs at a faster than average rate in both nonmetro and metro areas. Federal Government employment declined. Retail trade; agricultural services; and finance, insurance, and real estate added jobs at slightly faster rates in nonmetro than in metro areas. Both metro and nonmetro job growth was fastest in the Rocky Mountain and Southwest regions. Nonmetro job growth was between 1.7 and 2.2 percent in other regions. Metro job growth rates exceeded nonmetro growth rates in each region.

Earnings per Nonfarm Job

Real earnings per nonfarm job increased during 1996-97, by 1.3 percent in nonmetro areas and 2.1 percent in metro areas (app. table 2). Both of these increases exceeded average earnings growth over the 1991-97 period. Nonmetro earnings grew in all sectors except construction and transportation and public utilities. The fastest earnings growth in nonmetro areas was in manufacturing and wholesale trade. In metro areas, jobs in mining; wholesale trade; finance, insurance, and real estate; and manufacturing had the fastest earnings growth.

Real nonfarm earnings per job increased in all regions. Metro earnings growth exceeded nonmetro earnings growth in all regions. Among nonmetro regions, earnings growth was highest in the New England, Great Lakes, Plains, and Southeast regions, at 1.5 percent. Among metro regions, earnings growth was highest in the New England, Southwest, and Far West regions.

Trends in Earnings per Nonfarm Job, 1969-97

Average nonmetro earnings per job were $9,813 less than average metro earnings in 1997. Even after adjusting for inflation, this is the largest gap measured since the data series began in 1969. The gap between metro and nonmetro earnings per job has widened in most years since 1979 (app. table 3). In 1997, average nonmetro earnings were 70.1 percent of metro earnings, down from 70.7 percent in 1996. The nonmetro-metro earnings ratio peaked at 81 percent in 1979. *[Fred Gale, 202-694-5349, fgale@ers.usda.gov]*

Appendix table 1—Nonfarm jobs, by industry and BEA region, 1997

	Nonmetro	Metro	Change from previous year, 1996-97		Annual average change, 1991-97	
			Nonmetro	Metro	Nonmetro	Metro
	Thousands		Percent		Percent	
Total nonfarm jobs	25,875	127,581	2.0	2.3	2.5	2.1
By industry:						
Agricultural services, forestry, fisheries, and other[1]	508	1,465	4.8	4.3	4.9	5.2
Mining	344	489	.2	1.7	-3.0	-3.2
Construction	1,552	6,813	2.7	4.4	4.6	3.6
Manufacturing	4,433	14,983	.6	1.3	1.3	.1
Transportation and public utilities	1,153	6,398	3.0	3.4	2.6	2.4
Wholesale trade	867	6,311	1.9	2.5	1.5	1.4
Retail trade	4,804	21,552	2.1	1.9	3.3	2.5
Finance, insurance, and real estate	1,315	10,463	3.8	3.7	3.3	1.8
Services	6,526	41,702	2.9	3.6	3.6	3.6
Government and government enterprises	4,373	17,407	.9	.5	1.0	.3
Federal civilian	363	2,451	-.6	-2.3	-1.1	-1.7
Federal military	380	1,785	-1.5	-2.6	-3.1	-3.2
State and local	3,631	13,170	1.3	1.5	1.9	1.3
State	990	3,786	.3	.5	1.5	1.1
Local	2,642	9,383	1.7	1.9	2.0	1.4
By BEA region:						
New England	1,160	7,175	1.8	2.4	1.9	1.7
Mideast	1,808	23,198	1.8	1.9	1.2	.9
Great Lakes	4,407	21,002	1.7	1.9	2.5	2.0
Plains	4,014	7,567	2.0	2.5	2.5	2.5
Southeast	8,576	27,852	1.8	2.8	2.4	3.0
Southwest	2,423	13,747	2.7	3.9	2.5	3.5
Rocky Mountain	1,545	3,823	2.9	3.7	4.5	4.4
Far West	1,942	23,218	2.2	2.9	2.6	1.6

[1] Other are employees of foreign embassies working in the United States.

[2] Government enterprises are government agencies that cover a substantial portion of their operating costs by selling goods and services to the public and that maintain their own separate accounts—for example, the Postal Service.

Source: Calculated by ERS using data from the Bureau of Economic Analysis.

Appendix table 2—Earnings per nonfarm job, by industry and BEA region, 1997

Industry and region	Nonmetro	Metro	Change from previous year, 1996-97: Nonmetro	Change from previous year, 1996-97: Metro	Annual average change, 1991-97: Nonmetro	Annual average change, 1991-97: Metro
	Dollars		Percent		Percent	
Earnings per nonfarm job	22,986	32,799	1.3	2.1	0.5	1.1
By industry:						
Agricultural services, forestry, fisheries, other[1]	12,265	16,390	0.1	1.6	-3.4	-1.6
Mining	41,544	57,986	1.8	6.6	1.6	5.2
Construction	25,502	34,536	0.0	1.2	0.4	0.3
Manufacturing	32,207	47,607	2.7	2.9	1.2	1.6
Transportation and public utilities	33,999	45,544	-.4	1.5	-.2	1.0
Wholesale trade	28,862	44,458	2.8	3.2	1.4	1.6
Retail trade	13,764	17,311	1.4	1.8	-.1	.3
Finance, insurance, and real estate	17,030	37,180	.1	3.0	2.2	5.1
Services	18,958	29,974	1.7	2.2	1.1	1.0
Government and government enterprises	26,397	34,445	1.0	1.1	.8	.9
Federal civilian	41,309	48,664	1.5	2.0	1.9	2.0
Federal military	17,288	22,990	.9	1.0	.7	1.1
State and local	25,860	33,351	1.0	1.0	.6	.6
State	28,853	33,527	.8	1.3	.2	.4
Local	24,739	33,280	1.1	.9	.7	.7
By BEA region:						
New England	24,489	35,551	1.5	2.7	.2	1.2
Mideast	24,471	37,706	.8	1.7	.2	1.3
Great Lakes	23,934	32,809	1.5	2.2	.8	1.3
Plains	21,326	30,533	1.5	2.2	.8	1.3
Southeast	22,981	29,103	1.5	1.9	.7	1.1
Southwest	21,684	31,482	1.0	2.7	.2	1.5
Rocky Mountain	21,890	29,074	1.1	2.3	.3	1.5
Far West	24,502	33,602	.4	2.6	-.2	.9

Note: Change from previous years is in real 1997 dollars. Previous years' earnings were converted to 1997 dollars using chain-type personal consumption expenditures price index.

[1] Other are employees of foreign embassies working in the United States.

[2] Government enterprises are government agencies that cover a substantial portion of their operating costs by selling goods and services to the public and that maintain their own separate accounts—for example, the Postal Service.

Source: Calculated by ERS using data from the Bureau of Economic Analysis.

Appendix table 3—Real earnings per nonfarm job, 1969-97

						Change from previous year	
	United States	Nonmetro	Metro	Metro-nonmetro earnings gap[1]	Earnings ratio[2]	Nonmetro	Metro
	1997 dollars				Percent		
1969	27,416	21,837	28,590	6,753	76.4	NA	NA
1970	27,756	22,147	28,937	6,790	76.5	1.4	1.2
1971	28,238	22,597	29,441	6,843	76.8	2.0	1.7
1972	29,106	23,324	30,348	7,023	76.9	3.2	3.1
1973	29,277	23,680	30,473	6,793	77.7	1.5	0.4
1974	28,529	23,332	29,640	6,308	78.7	-1.5	-2.7
1975	28,449	23,543	29,503	5,960	79.8	.9	-.5
1976	29,296	24,512	30,340	5,828	80.8	4.1	2.8
1977	29,529	24,552	30,613	6,061	80.2	.2	.9
1978	29,764	24,877	30,821	5,944	80.7	1.3	.7
1979	29,516	24,731	30,541	5,810	81.0	-.6	-.9
1980	28,832	24,025	29,849	5,824	80.5	-2.9	-2.3
1981	28,595	23,682	29,628	5,946	79.9	-1.4	-.7
1982	28,488	23,309	29,571	6,262	78.8	-1.6	-.2
1983	28,744	23,393	29,855	6,462	78.4	.4	1.0
1984	29,301	23,854	30,418	6,564	78.4	2.0	1.9
1985	29,528	23,798	30,680	6,882	77.6	-.2	.9
1986	29,776	23,695	30,980	7,285	76.5	-.4	1.0
1987	29,998	23,409	31,299	7,889	74.8	-1.2	1.0
1988	30,183	23,366	31,518	8,152	74.1	-.2	.7
1989	29,875	23,066	31,210	8,144	73.9	-1.3	-1.0
1990	29,814	22,737	31,209	8,472	72.9	-1.4	0
1991	29,529	22,476	30,934	8,458	72.7	-1.1	-.9
1992	30,341	22,862	31,849	8,987	71.8	1.7	3.0
1993	30,338	22,925	31,842	8,918	72.0	.3	0
1994	30,255	22,907	31,761	8,855	72.1	-.1	-.3
1995	30,359	22,741	31,921	9,180	71.2	-.7	.5
1996	30,521	22,701	32,117	9,416	70.7	-.2	.6
1997	31,144	22,986	32,799	9,813	70.1	1.3	2.1

Note: Earnings were converted to 1997 dollars using chain-type personal consumption expenditures price index.
NA = Data for years prior to 1969 were not available to compute change.

[1] Earnings gap is the difference between metro and nonmetro earnings in 1997 dollars.

[2] Earnings ratio is nonmetro earnings as a percentage of metro earnings.

Source: Calculated by ERS using data from the Bureau of Economic Analysis.

Two Methods of Measuring Farm-Linked Employment

The Economic Research Service uses two methods to measure economywide employment related to agriculture: farm and farm-related employment (FFR) and the food and fiber system (FFS). Both methods are widely respected, and, while they provide different employment totals, both point to the continued importance of farm-related jobs in an era when direct farm employment has declined to modest levels. Both methods also recognize the wide-ranging influence of farm-related activity in the U.S. economy beyond the farm gate.

The two methods each have strengths and weaknesses. The FFS estimates are based on a method that explicitly models the interrelationships between various sectors of the economy. The FFS estimates have a close relationship to the U.S. Department of Commerce's National Income and Product Accounts. The FFR estimates have the advantage of rich geographic detail that can provide valuable information about the importance of agriculture in various regions of the country.

Farm and Farm-Related Employment

The Census Bureau's enhanced County Business Patterns data are combined with farm employment data from the Bureau of Economic Analysis to estimate farm and farm-related employment (app. tables 4 and 5). Farm and farm-related employment includes jobs not only in farm production, but also in its closely related industries—agricultural services, forestry, and fishing; agricultural inputs; and processing and marketing of agricultural goods—as well as industries peripherally related to farming—wholesale and retail trade of agricultural products and indirect agribusiness. Farm and farm-related industries are identified as industries having 50 percent or more of their national workforce employed in providing goods and services necessary to satisfy the final demand for agricultural products. An exception to this criterion is indirect agribusiness, in which percentages range between 32 and 50 percent. *[Alex Majchrowicz, 202-694-5355, alexm@ers.usda.gov]*

Food and Fiber System

The Food and Fiber System (FFS) is the set of producers of goods and services required to assemble, process, and distribute raw farm products to U.S. and foreign consumers. FFS employment estimates (app. table 6) are developed using a national input-output model that describes input use and factor payments for each sector of the economy. The model is used to estimate the amount of employment in each sector needed to support the final demands for agricultural products. Thus, this measure includes jobs in all sectors of the economy, even those where the link to agriculture is weak. However, unlike the FFR measure, the FFS estimates do not count all jobs in a particular sector; only the jobs needed to support demand for agricultural products are counted. The FFS measure is available at the State and national levels. *[William Edmondson, 202-694-5374, wedmonds@ers.usda.gov]*

Appendix table 4—Share of total State employment by farm and farm-related industry, 1996

State	Total farm and farm-related industries	Total farm and farm-related industries	Farm production, agricultural services, forestry, and fishing	Agricultural inputs	Agricultural processing and marketing	Agricultural wholesale and retail trade	Indirect agribusiness
	Jobs	Percentage of total employment					
United States	22,732,653	15.1	2.3	0.3	2.1	10.1	0.4
Alabama	426,442	18.6	2.8	.4	4.8	10.2	.5
Alaska	58,993	16.5	4.2	.1	2.2	10.0	—
Arizona	306,809	13.2	1.2	.2	.6	11.1	.1
Arkansas	282,053	20.5	5.0	.6	5.1	9.0	.8
California	2,481,102	14.4	2.1	.2	2.0	10.0	.3
Colorado	355,115	14.3	1.8	.2	1.3	10.7	.2
Connecticut	218,945	11.0	.7	.1	.7	9.2	.3
Delaware	60,096	13.4	1.1	.2	2.4	9.4	.3
Florida	1,107,739	14.6	1.6	.2	1.0	11.6	.2
Georgia	739,493	17.1	1.7	.3	3.9	10.7	.6
Hawaii	115,601	16.0	1.9	.1	1.3	12.7	—
Idaho	143,066	21.2	6.5	1.1	3.0	10.4	.4
Illinois	935,488	13.6	1.6	.6	1.6	9.2	.5
Indiana	519,146	15.4	2.5	.3	1.4	10.6	.5
Iowa	411,527	22.9	7.3	1.6	3.9	9.7	.5
Kansas	305,497	18.9	5.3	.8	2.7	9.7	.4
Kentucky	412,498	19.9	5.6	.3	3.0	10.5	.5
Louisiana	336,026	15.1	2.3	.4	1.6	10.4	.5
Maine	117,120	16.7	2.5	.1	3.1	10.6	.4
Maryland	340,413	12.2	1.1	.1	1.0	9.9	.2
Massachusetts	472,957	12.3	.5	.1	1.3	10.0	.4
Michigan	730,341	14.1	1.7	.2	.9	11.0	.3
Minnesota	482,814	15.7	3.7	.6	1.9	9.1	.4
Mississippi	262,395	19.2	4.6	.5	4.2	9.4	.5
Missouri	537,976	16.6	4.0	.5	2.2	9.5	.4
Montana	95,607	19.3	6.2	.6	.8	11.6	.2
Nebraska	245,857	22.1	6.7	1.7	4.0	9.5	.2
Nevada	105,717	10.8	.7	.1	.4	9.6	.1
New Hampshire	95,340	13.5	.9	.1	1.2	11.0	.4
New Jersey	527,408	11.9	.5	.1	1.6	9.2	.5
New Mexico	130,318	14.9	2.7	.1	.8	11.0	.3
New York	1,167,099	12.1	.8	.1	1.5	9.3	.3
North Carolina	848,279	19.1	2.3	.3	6.3	9.7	.6
North Dakota	97,140	23.2	9.5	1.6	2.1	10.0	—
Ohio	900,114	14.1	1.7	.2	1.1	10.6	.5
Oklahoma	310,319	17.2	5.1	.3	1.5	10.2	.2
Oregon	342,671	18.0	4.6	.3	1.6	11.2	.3
Pennsylvania	926,621	14.2	1.3	.2	2.3	10.0	.4
Rhode Island	71,169	13.2	.5	.1	1.8	10.4	.5
South Carolina	378,757	18.3	1.7	.2	5.0	10.8	.7
South Dakota	106,669	22.7	8.6	1.0	2.7	10.1	.3
Tennessee	553,057	17.4	3.2	.3	3.1	10.2	.5
Texas	1,602,979	15.0	2.8	.2	1.6	10.1	.3
Utah	159,012	13.3	1.7	.2	1.4	9.8	.3
Vermont	60,810	16.8	3.0	.2	1.7	11.6	.3
Virginia	561,827	14.4	1.9	.2	2.5	9.4	.4
Washington	523,318	16.4	3.4	.3	1.6	10.8	.4
West Virginia	121,284	14.8	2.9	.2	1.2	10.2	.2
Wisconsin	550,168	17.6	3.7	.6	2.4	10.1	.8
Wyoming	51,246	17.1	4.6	.4	.5	10.6	1.0

— = Less than 0.1 percent.

Source: Calculated by ERS using Department of Commerce data.

Appendix table 5—Share of total nonmetro employment by farm and farm-related industry, 1996

State	Total farm and farm-related industries	Total farm and farm-related industries	Farm production, agricultural services, forestry, and fishing	Agricultural inputs	Agricultural processing and marketing	Agricultural wholesale and retail trade	Indirect agribusiness
	Jobs	Percentage of total employment					
United States	6,146,906	23.1	7.5	0.8	4.2	10.1	0.5
Alabama	178,567	28.3	5.9	.8	11.2	9.4	1.0
Alaska	39,343	21.0	7.2	.2	3.8	9.7	—
Arizona	44,814	16.7	2.3	.2	.3	13.9	.1
Arkansas	162,874	24.9	7.9	1.0	6.7	8.8	.6
California	100,182	21.7	8.1	.5	1.4	11.5	.2
Colorado	95,647	21.3	6.0	.5	1.8	12.9	.1
Connecticut	19,392	15.0	1.8	.1	2.2	10.1	.8
Delaware	18,014	27.8	3.9	.7	9.8	13.4	—
Florida	89,868	22.1	6.9	.6	1.7	12.4	.5
Georgia	280,333	24.5	4.5	.7	8.7	9.8	.8
Hawaii	39,121	22.5	5.7	.1	2.1	14.7	—
Idaho	105,815	24.6	8.7	1.4	3.3	10.8	.5
Illinois	204,119	22.0	7.7	1.6	2.4	9.7	.6
Indiana	164,905	19.3	5.8	.7	2.4	9.7	.8
Iowa	265,085	28.7	12.2	2.1	4.6	9.2	.6
Kansas	181,209	26.5	10.9	1.4	4.6	9.2	.4
Kentucky	225,477	24.9	9.8	.5	4.3	9.8	.5
Louisiana	89,024	21.2	7.5	1.0	3.2	8.8	.8
Maine	66,627	17.6	3.5	.1	2.9	10.6	.5
Maryland	39,103	20.2	4.3	.4	3.2	12.1	.2
Massachusetts	7,549	15.1	2.6	.1	1.1	10.8	.5
Michigan	142,954	18.8	5.1	.3	1.1	11.8	.5
Minnesota	214,225	26.2	10.4	1.5	4.1	9.7	.5
Mississippi	196,023	22.3	6.3	.7	5.7	9.0	.6
Missouri	224,699	25.3	11.0	.9	4.1	9.0	.3
Montana	75,465	20.3	7.6	.5	.7	11.3	.2
Nebraska	155,611	31.4	13.8	2.7	5.4	9.4	.1
Nevada	17,060	13.1	3.0	.4	.3	9.4	.1
New Hampshire	37,367	13.7	1.2	.1	1.1	10.9	.3
New Jersey	NA						
New Mexico	59,203	18.8	5.4	.3	.9	11.6	.6
New York	114,712	16.7	4.0	.3	1.5	10.6	.3
North Carolina	315,097	26.1	4.7	.5	10.6	9.7	.8
North Dakota	64,532	29.7	16.1	2.0	2.5	9.1	—
Ohio	201,865	19.4	5.2	.7	2.3	10.4	.9
Oklahoma	152,682	24.8	11.5	.7	2.8	9.7	.3
Oregon	118,327	23.8	8.8	.6	1.8	12.3	.4
Pennsylvania	154,557	18.7	3.7	.3	3.5	10.7	.5
Rhode Island	5,759	13.2	1.0	—	.3	11.9	—
South Carolina	123,367	24.4	3.4	.3	9.5	10.4	.8
South Dakota	76,490	26.5	12.8	1.4	2.8	9.5	.1
Tennessee	203,150	24.0	7.7	.5	5.9	9.2	.7
Texas	375,302	27.1	13.5	.8	3.3	9.2	.3
Utah	45,384	19.4	5.6	.4	2.0	11.1	.4
Vermont	41,453	17.3	3.5	.3	1.5	11.9	.2
Virginia	168,651	24.0	6.1	.5	7.4	9.3	.8
Washington	119,918	26.0	10.5	.9	2.3	11.4	.9
West Virginia	66,768	15.6	4.3	.2	1.5	9.5	.2
Wisconsin	219,209	24.5	8.7	1.3	3.2	10.4	.8
Wyoming	40,008	19.1	5.9	.4	.7	10.7	1.4

— = Less than 0.1 percent.

NA = Not applicable. New Jersey has no nonmetro counties.

Source: Calculated by ERS using Department of Commerce data.

Appendix table 6—The food and fiber system and the domestic economy, 1988-98

Item	1991	1992	1993	1994	1995	1996	1997	1998
				Millions of jobs				
Total civilian labor force	126.3	128.1	129.2	131.1	132.3	133.9	136.3	137.7
Food and fiber system employment	23.5	23.1	23.6	24.3	24.7	24.5	24.6	24.8
				Percent				
Food and fiber system share of labor force	18.6	18.0	18.3	18.6	18.7	18.3	18.1	18.0
Food and fiber system employment by sector:				Millions of jobs				
Farm sector	2.0	1.9	1.8	1.9	2.0	2.0	1.9	1.8
Nonfarm sector	21.5	21.2	21.8	22.4	22.7	22.5	22.7	23.0
Food processing	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4
Manufacturing	2.6	2.5	2.5	2.5	2.4	2.4	2.3	2.2
Transportation, trade and retailing	7.9	7.9	8.1	8.4	8.6	8.6	8.8	9.0
Eating and drinking places	6.1	6.0	6.3	6.5	6.6	6.6	6.7	6.8
All other	3.4	3.3	3.4	3.5	3.6	3.5	3.6	3.6
				Billions of dollars				
Total Gross Domestic Product (GDP)	5,986.2	6,318.9	6,642.3	7,054.3	7,400.5	7,813.2	8,300.8	8,759.9
Total food and fiber system GDP	881.8	924.8	971.4	1,077.1	1,140.8	1,216.5	1,323.3	1,367.2
				Percent				
Food and fiber system share of GDP	14.7	14.6	14.6	15.3	15.4	15.6	15.9	15.6
Food and fiber system GDP by sector:				Billions of dollars				
Farm sector	71.1	75.5	73.1	78.3	75.3	86.7	84.5	74.3
Nonfarm sector	810.7	849.3	898.3	998.8	1,065.5	1,129.8	1,238.8	1,292.9
Food processing	110.9	112.9	120.0	134.4	145.8	144.1	158.8	166.9
Manufacturing	131.6	135.4	143.0	164.5	180.6	193.2	209.6	215.2
Transportation, trade and retailing	261.0	278.0	294.7	328.7	347.8	376.9	419.1	441.4
Eating and drinking places	110.4	117.6	127.3	141.4	148.7	161.0	181.0	188.1
All other	196.7	205.5	213.3	229.9	242.6	254.5	270.3	281.3

Note: These improved estimates of Food and Fiber employment and GDP differ slightly from data tables published in previous issues of *RCaT*, due to extensive revisions to the National Income and Product Accounts data used in the ERS calculations.

Source: Calculated by ERS from supporting ERS economic models using data from the Bureau of Economic Analysis, Bureau of Labor Statistics, and Bureau of the Census.

Economic Activity Triggered by Agricultural Trade

Estimates of economic activity related to agricultural exports show that exports make an important contribution to the farm sector and to the U.S economy as a whole (app. table 7). In 1998, the United States exported $51.8 billion of agricultural products, down from $57.3 billion in 1997. Exports fell further to $48.3 billion during 1999. The decline in dollar value of exports is due to falling prices for bulk commodities, large world supplies, weak global demand as a result of economic crises in Asia, Russia, and Latin America, and a strong U.S. dollar.

Agricultural exports play an important role in the economy, supporting jobs on farms, in food processing, other manufacturing plants, and in the transportation and trade sectors. Agricultural exports generated an estimated 808,000 jobs in 1998, of which 320,000 were on farms. The impact of agricultural exports on the U.S. economy is far-reaching. Every dollar of exports generated an additional $1.31 in economic activity in supporting sectors.

Imports of agricultural products were worth $37.1 billion in 1998, up from $36.3 billion in 1997. In 1999 they rose further to $37.9 billion. Since agricultural exports exceeded imports, the United States had a positive trade balance in agricultural products of $14.7 billion in 1998. The positive agricultural trade balance shrank in 1998 and will fall again in 1999-2000 if exports decline as expected. About $9 billion of imports were such commodities as bananas, coffee, and tea that do not compete with U.S. products. The remaining $28.1 billion is comprised of imports, such as meat, dairy products, fruits, nuts, vegetables, sugar, and wines that compete with U.S. products.

Processed agricultural products have more extensive impacts on the U.S. economy than exports of bulk unprocessed commodities. Nonbulk products account for most of the economic activity generated by agricultural exports. In 1998, they accounted for 478,000 of the 808,000 jobs attributed to agricultural exports. Each dollar of nonbulk agricultural exports (fresh fruits and vegetables and “value-added” processed products) generated an additional $1.52 in supporting activity, compared with $0.92 for each dollar of bulk exports (grains, oilseeds, and cotton). For the first time since calendar year 1991, bulk exports have generated more U.S. jobs per $1 billion of exported commodity than processed. In 1998, $1 billion of bulk exports supported 16,900 U.S. jobs, compared with 14,800 for nonbulk exports. Also for the first time in 1998, the U.S. imported more processed or high-value foods than it exported, resulting in a negative trade balance in nonbulk commodities. Part of this shift in trading patterns is due to a redefinition and reclassification, by ERS, of what is a “bulk” commodity. Up until 1997, estimates of economic activity related to agricultural trade used U.S. Department of Commerce (Bureau of Economic Analysis and Bureau of Census) classifications of commodities. In 1998, this analysis switched to a classification scheme used in other ERS publications to maintain consistency across agency products. *[William Edmondson, 202-694-5374, wedmonds@ers.usda.gov]*

Appendix table 7—U.S. economic activity triggered by agricultural trade

	1996	1997	1998		
Item	Total	Total	Total	Bulk	Other
			Billion dollars		
Economic activity generated by agricultural exports	139.9	130.8	119.7	37.5	81.5
Exports	60.4	57.3	51.8	19.5	32.3
Supporting activities	79.5	73.5	67.9	17.9	50.0
Farm	21.9	16.6	14.2	0.8	13.4
Food processing	6.7	6.2	5.7	.1	5.6
Other manufacturing	15.5	16.2	15.1	5.1	10.0
Trade and transportation	9.7	10.9	10.8	3.0	7.8
Other services	25.6	23.6	22.1	8.9	13.2
			Percent		
Farm share of total income from exports	34	29	27	39	19
Nonfarm share	73	77	79	96	73
Export multiplier (additional business activity generated by $1 of exports)	1.32	1.28	1.31	.92	1.52
			1,000 jobs		
Employment generated by agricultural exports	859	871	808	330	478
Farm	292	321	320	182	138
Nonfarm	566	550	488	149	339
Food processing	86	90	78	0	78
Other manufacturing	70	76	65	20	45
Trade and transportation	196	175	155	59	96
Other services	214	209	190	70	120
Employment per billion dollars of agricultural exports	14.2	15.2	15.6	16.9	14.8
			Percent		
Share of farm workforce supported by agricultural exports	8	9	9	5	4
			Billion dollars		
Agricultural imports	33.6	36.3	37.1	4.3	32.8
Complementary	8.2	9.4	9.0	0.0	9.0
Competitive	25.4	26.9	28.1	4.3	23.8
Domestic equivalent of economic activity generated by competitive imports	62.8	63.9	66.7	8.2	58.5
Agricultural trade balance	26.8	21.0	14.7	15.2	-.5
Net business surplus of agricultural trade	68.9	57.5	44.0	29.3	14.7

Source: Calculated by ERS from supporting ERS economic models using data from the Bureau of Economic Analysis, Bureau of Labor Statistics, and Bureau of the Census.