Greasing the Wheels of the Marketplace

In a 1921 case before the U.S. Supreme Court involving the business practices of trade associations, Justice Brandeis wrote in the Court's opinion about the role of trade associations in providing information:

> By substituting knowledge for ignorance….[information] tends also to substitute research and reasoning for gambling and piracy….In making such knowledge available to the smallest concern, it creates among producers equality of opportunity. In making it available, also, to purchasers in the general public, it does all that can actually be done to protect the community from extortion.
>
> *American Column & Lumber Company* v. *The United States*, 257 U.S. 377, 1921

Economists tend to speak less eloquently—but feel every bit as passionately—about the importance of information in facilitating fair and efficient exchange of goods between buyers and sellers. To economists, information is the grease for the wheels of the marketplace.

For goods like computers or cars, the marketplace is well-greased with several sources of objective information, such as *Consumer Reports* magazine, that help consumers assess quality and make informed buying decisions. Consumers surely want safe food every bit as much as they want fast computers and reliable cars, but it is very difficult for ordinary consumers to measure and assess food safety. Economists have long argued that the so-called market for food safety is "incomplete" because of the lack of accessible consumer information.

PhotoSpin

Two articles in this issue make it clear that information has a growing role in creating more workable markets for food safety. The feature on food safety innovations explains how fast food chains and other buyers of large quantities of meat use pathogen test results and other information to bolster the safety of meat products delivered by their suppliers. These "savvy buyers" reward suppliers for strengthening their food safety controls with price premiums and long-term contracts, resulting in more efficient transactions between food producers and retailers.

The feature on food traceability explains how information on the production and distribution of food can help protect consumers from fraud and producers from unfair competition. The information provided by traceability systems can also help minimize the production and distribution of unsafe products by making it easier to find and remove such products from the system.

As information systems for food safety continue to evolve, the marketplace will function more and more efficiently—and not just for producers and retailers, but for consumers as well. We are not there yet, but it is no longer difficult to imagine an information system for food safety as complete as *Consumer Reports*, greasing the wheels for ordinary consumers and their marketplace.

Nicole Ballenger, Chief, Diet, Safety, and Health Economics Branch
Food and Rural Economics Division, ERS

FEATURES

FINDINGS

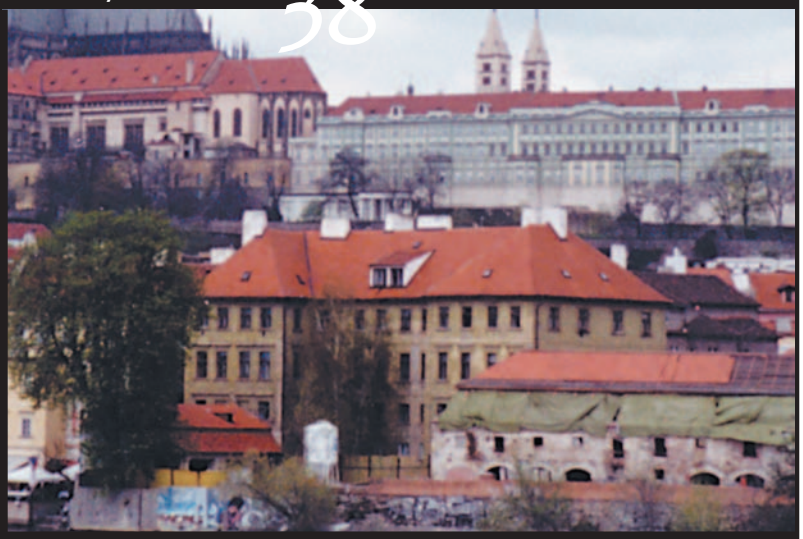
Beyond Environmental Compliance: Stewardship as Good Business

Jeffrey Hopkins and Robert Johansson

U.S. agriculture is a source not only of food but also of pollutants. Can environmental stewardship coexist with a healthy bottom line? Corn producers using crop residue management think so.

A Historic Enlargement: Ten Countries Prepare To Join the European Union

Nancy Cochrane



Eight former communist countries in Central and Eastern Europe are slated to join the European Union in May 2004, enlarging the arable land of that trading bloc by nearly 40 percent. Farmers will receive higher prices for some products and EU subsidies. So why are they apprehensive?

Processed Products Propel Gains in U.S. Agricultural Exports

PhotoDisc

Processed high-value products (HVPs) accounted for most of the growth in U.S. agricultural exports between 1976 and 2002, with $11 billion of the $30-billion total gain in U.S. agricultural exports during that period. In 2000 and 2001, exports of processed HVPs alone (meats; canned, dried, and frozen fruits and vegetables; processed grain products; dairy products; essential oils; juice; and wine) surpassed bulk agricultural exports to become the largest category of U.S. agricultural exports. Most of the growth in processed HVP export value occurred in the 1990s, the result of the depreciation of the dollar (between 1986 and 1996) and trade agreements, such as the North American Free Trade Agreement (NAFTA).

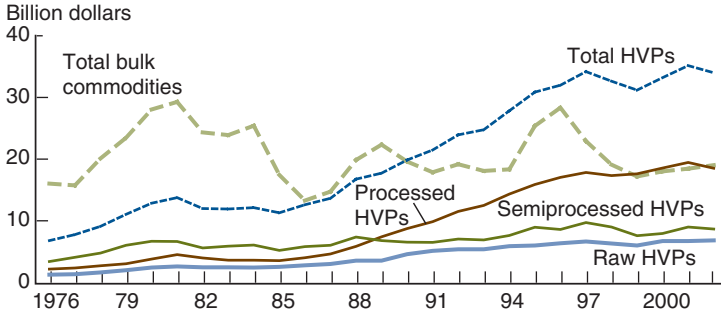
Exports of raw HVPs—fresh fruits and vegetables, live animals, nuts, and nursery products—also expanded over the 26-year period and have shown strong growth since 1989. These benefited greatly from NAFTA because of the high cost of special handling needed to preserve freshness. Shipping by truck to neighboring countries is far less costly than air freight to more distant destinations. Exports of raw HVPs rose 5.1 percent annually between 1989 and 2002. In 2002, as a result of growth in exports of U.S. raw HVPs to Canada and Mexico, U.S. agricultural exports to the Americas exceeded those to Asia for the first time in history. Canada surpassed Japan as the largest single market for U.S. agricultural exports, with Mexico ranked third.

The third subgroup of HVPs, semiprocessed HVPs, includes feeds, hides, fats, fibers, and oilseed products. Semiprocessed HVPs showed much less growth in exports, averaging only 2 percent yearly from 1989 to 2002.

U.S. exports of bulk commodities—wheat, rice, coarse grains, oilseeds, cotton, and tobacco—formerly the largest category of U.S. agricultural exports, were overtaken by HVPs in 1991. Bulk exports were $3 billion lower in 2002 than in 1989, and between 1976 and 2002, their share of total U.S. agricultural exports plummeted from 70 to 30 percent. Bulk exports are more variable than HVPs, depending on global supplies, global income growth and consumer demand, prices, and relative exchange rates. Gains in bulk exports were dampened, particularly in the 1990s, by the protectionist policies of the European Union, reduced demand from the former Soviet bloc countries as they became more market oriented, and increased export competition from these countries, as well as Argentina, Brazil, and China.

Although corn, soybeans, and wheat—all bulk commodities—are still the largest U.S. agricultural exports in value, fresh beef has been the fastest growing export. In 2002, beef ranked fourth among individual product exports.

U.S. agricultural exports, bulk and high-value products



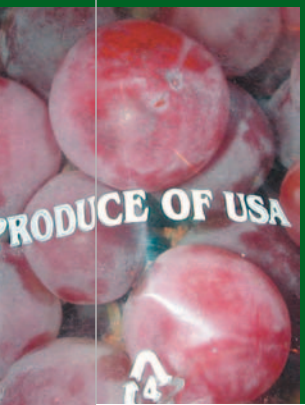
Source: Economic Research Service, USDA, and Census Bureau, U.S. Department of Commerce.

Carol Whitton, cwhitton@ers.usda.gov

This finding is drawn from . . .

Processed Agricultural Exports Led Gains in U.S. Agricultural Exports Between 1976 and 2002, by Carol Whitton, FAU-85-01, USDA/ERS, February 2004, available at: www.ers.usda.gov/publications/fau/feb04/fau8501/

Mandatory Country-of-Origin Labeling—Will It Benefit Consumers?



Barry Krissoff, USDA/ERS

Demands for mandatory country-of-origin labeling (COOL) for some retail food products have sparked considerable controversy. Proponents—primarily some cow-calf producer and fruit and vegetable grower/shipper associations—claim such labels would benefit consumers who are concerned about food safety, who wish to support U.S. producers, or who believe that U.S. foods are of higher quality than imports. Others—cattle feeder and hog finishing operators, meatpackers, processors, and retailers—argue that mandatory labeling will merely raise costs and bring few benefits.

In 2002, Congress incorporated COOL in the Farm Security and Rural Investment Act. Mandatory labeling rules were slated to go into effect by September 30, 2004, but Congress has recently agreed to delay COOL for 2 years to revisit some of the legislative requirements and consider making COOL voluntary. Unless the law is changed, retailers will be required to identify red meats (beef, lamb, and pork), fish and shellfish, fresh and frozen fruits and vegetables, and peanuts as being from the United States, from another country, or from mixed origins. The 2-year delay will apply to meats, produce, and peanuts, but not to farm-raised and wild fish.

Researchers have tried at least two ways to determine whether benefits of mandatory COOL exceed costs. The first, an engineering approach, requires a calculation of likely expenditures for segregation and recordkeeping—the activities necessary to prove a product's origin—along with an estimate of what labels are worth to consumers. To estimate value to

U.S. Seafood Market Shifts to Aquaculture

Ken Hammond, USDA

The wild harvest of seafood, man's last major hunting and gathering activity, is at a critical point. Technology has enabled harvesting to outpace the speed at which species can reproduce.

In response, the seafood industry is beginning to shift from wild harvest to aquaculture, the production of aquatic plants and animals under grower-controlled conditions. Aquaculture is growing rapidly in many countries, particularly China, Chile, and Thailand. It is also expanding in the United States—the estimated value of U.S. production in 2001 was $935 million. Aquaculture accounts for a growing share of U.S. seafood consumption as well.

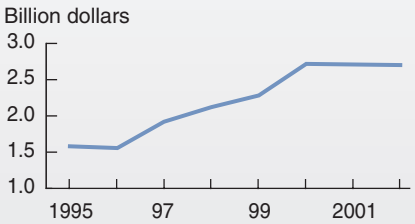
Aquaculture has a number of advantages over wild harvest. Growers can more easily maintain a steady supply of products. Farmed seafood is likely to be more uniform in size and quantity, thus moderating price swings. Selective breeding can be used to enhance disease resistance, increase growth rates, or promote other desirable traits, such as better feed conversion. Finally, consumers benefit from declining real prices as growers increase their efficiency and supply.

There are also a number of possible disadvantages to farmed seafood production. These include waste disposal from intensive production sites, the introduction of non-native species, and the destruction of coastal marsh areas for the development of new production areas. Concerns have also been raised about possibly dangerous levels of cancer-causing chemicals in farmed salmon.

Despite such concerns, the United States has become a major market for the global aquaculture industry. U.S. seafood consumption has been steady over the past decade at around 16 pounds per person per year, but a growing share of the supply is being imported, much of it from countries using aquaculture. In 2002, imports accounted for roughly 45 percent of seafood consumed in the U.S. Seafood imports included shrimp (946 million pounds), Atlantic salmon (413 million pounds), and tilapia (148 million pounds). Most of the imported salmon and tilapia and approximately half the shrimp were farm-raised, representing over 1 billion pounds of aquaculture products with a value of $2.7 billion. To put these imports in perspective, the U.S. poultry industry, the world's largest poultry exporter, shipped 5.4 billion pounds of poultry products, valued at $1.6 billion in 2002. Aquaculture also supplies U.S. consumers with catfish from Vietnam, crayfish and mollusks from China, and mussels from Canada and New Zealand.

For a number of countries, aquaculture has become a major part of their economies and a growing source of foreign exchange earnings. For the U.S., the large influx of imported aquaculture products has meant lower prices for consumers, but lower returns for producers. In response, a number of anti-dumping suits have been filed against foreign aquacultural producers.

U.S. aquaculture imports have risen dramatically since 1996



Source: Economic Research Service, USDA, and Census Bureau, U.S. Department of Commerce.

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This finding is drawn from . . .

Aquaculture Outlook, by David J. Harvey, LDP-AQS-17, USDA/ERS, March 2003, available on the ERS Briefing Room on Aquaculture: www.ers.usda.gov/briefing/aquaculture/

consumers, some analysts have relied on consumer surveys asking consumers whether they want labels. Such surveys must be carefully designed if they are to reveal consumers' willingness to pay for labels. The second approach entails drawing inferences about costs and benefits from the actual behavior of suppliers and consumers in the marketplace.

Food manufacturers infrequently label food as "Made in USA." The absence of such voluntary labeling suggests that suppliers believe consumers either do not care where their food comes from or prefer the imported product. It is also possible that consumers prefer domestic products, but are unwilling to pay higher prices to cover labeling costs. Any of these explanations implies that suppliers believe it is generally not profitable to label.

Some consumers may actually prefer such labels, but this group may be too small for markets to satisfy their demands profitably. In this case, consumers who value the information may be better off with mandatory COOL, depending on how much they are willing to pay for label information and the cost of providing it. Even for these consumers, however, costs could exceed the benefits. For consumers who are indifferent to labels, the higher prices resulting from mandatory COOL would make them unequivocally worse off.

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This finding is drawn from . . .

Country-of-Origin Labeling: Theory and Observation, by Barry Krissoff, Fred Kuchler, Kenneth Nelson, Janet Perry, and Agapi Somwaru, WRS-04-02, USDA/ERS, January 2004, available at: www.ers.usda.gov/publications/wrs04/jan04/wrs0402/

Food Stamp Participation Up in 2003

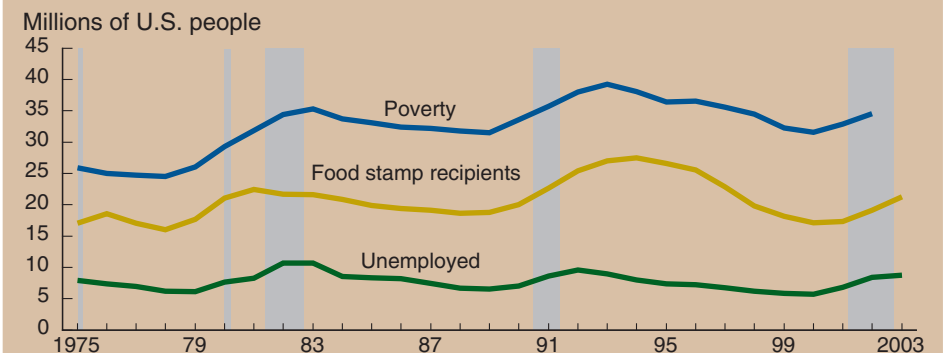
Participation in USDA's Food Stamp Program averaged 21.3 million people per month in fiscal year 2003—an 11-percent increase over the previous year, but below the record 27.5 million participants in fiscal 1994. The weak job market, along with increased efforts by States to improve program access, explains much of the increase in the number of Americans receiving food stamps during fiscal 2003.

Historically, changes in the country's economic conditions significantly affect participation in the Food Stamp Program. The number of food stamp recipients typically rises during recessionary periods when the number of unemployed and poor people increases, and falls during periods of growth as the number of unemployed and poor people decreases. The labor market was weak during 2003, as the economy remained sluggish. The annual unemployment rate increased from 5.8 percent in 2002 to 6.0 percent in 2003, the highest rate since 1994.

The Food Stamp Program is available to most needy households (subject to certain work and immigration status requirements) with limited incomes and assets. Economic and social conditions affect program participation and expenditure levels through their influence on the size of the eligible population, the rate of participation among eligible people, and the level of benefits provided. Rising food stamp participation is a continuation of a longer term trend: between August 2000 and September 2003, participation in the Food Stamp Program increased in all but 5 of the 38 months. Expenditures for the Food Stamp Program totaled $23.7 billion, unadjusted for inflation, in fiscal 2003 (October 1, 2002, to September 30, 2003)—a 15-percent increase over the previous fiscal year. This dramatic increase in expenditures was due to both increased numbers of people participating and rising per person benefits. The average benefit per person was $83.91 a month, up from $79.68 a month in fiscal 2002.

About 1 in 5 Americans is served by at least 1 of USDA's 15 domestic food assistance programs aimed at improving the nutrition, well-being, and food security of needy Americans. Preliminary data from USDA's Food and Nutrition Service indicate that expenditures for these food assistance programs rose 9 percent in fiscal 2003 and totaled $41.6 billion, exceeding the previous record of $38.1 billion spent on food assistance in fiscal 1996. A recent ERS report looks at participation and spending levels for the Food Stamp Program and the four other major Federal food assistance programs—the National School Lunch Program, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the School Breakfast Program, and the Child and Adult Care Food Program.

Changes in economic conditions significantly affect participation in the Food Stamp Program

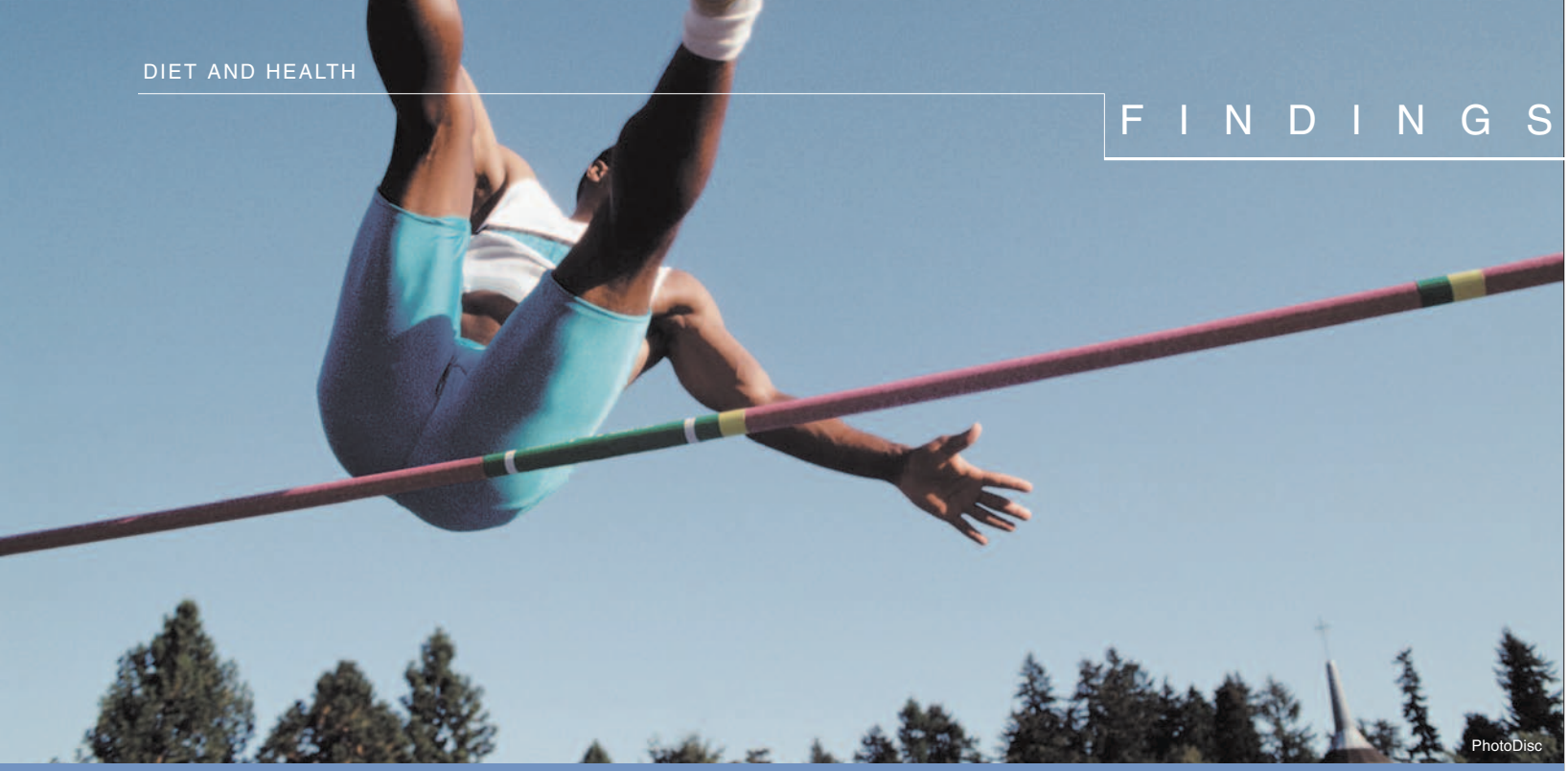


Note: Gray bars indicate recessions as defined by the National Bureau of Economic Research.

Victor Oliveira, victoro@ers.usda.gov

This finding is drawn from . . .

The Food Assistance Landscape: March 2004, by Victor Oliveira, FANRR-28-4, USDA/ERS, March 2004, available at: www.ers.usda.gov/publications/fanrr28-4/



Market Incentives Raise Food Safety Bar

According to the results of a new survey, food safety expenditures by the meat and poultry industry during 1997-2001 were due mainly to compliance with regulatory requirements, though market incentives are challenging some in the industry to meet even higher standards than those required by law. Slaughter and processing plants today are increasingly reacting to stringent requirements for pathogen control set out by large meat and poultry buyers who reward suppliers who meet the standards and punish those who do not, in effect raising the food safety bar (see "Savvy Buyers Spur Food Safety Innovations in Meat Processing" on page 22).

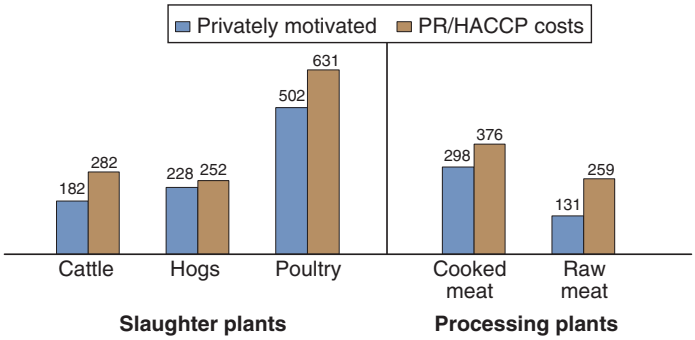
The survey, sponsored by ERS and conducted by Washington State University, details the type, size, and motivating factors of meat and poultry industry investments in food safety since Congress mandated the Pathogen Reduction/Hazard Analysis Critical Control Program (PR/HACCP) in 1996. Surveys were sent to 1,725 slaughter and processing plants; 996 responded. Plants ranged in size from establishments with only a handful of workers slaughtering one or two animals per week to facilities with more than 1,000 workers producing millions of pounds of product per year.

Survey results indicate that over the 5-year period 1997-2001, the industry invested about $570 million on new food safety equipment and quality control/production personnel to meet regulatory requirements set by PR/HACCP and spent another $380 million per year to ensure that their plants remain in compliance. On top of these expenditures, the industry invested another $360 million to meet food safety requirements set by major meat and poultry buyers, such as McDonald's restaurants and Kroger grocery stores, and by importing countries. The average investment of $180 million per year accounts for a sizable share of total industry capital expenditures of about $1.8 billion in 1997, as reported by the Bureau of the Census.

The survey results also show that large and small plants have responded differently to regulatory requirements. Large plants have complied with PR/HACCP by emphasizing investments in new equipment, while small plants have focused on improving sanitation and plant operating procedures. Large meat and poultry buyers, both U.S. and foreign, have imposed more stringent food safety demands than PR/HACCP, requiring suppliers to make greater use of equipment and testing and have more intensive cleaning and sanitation practices.

Privately motivated investments supplement PR/HACCP costs

$1,000 per plant, 1997-2001

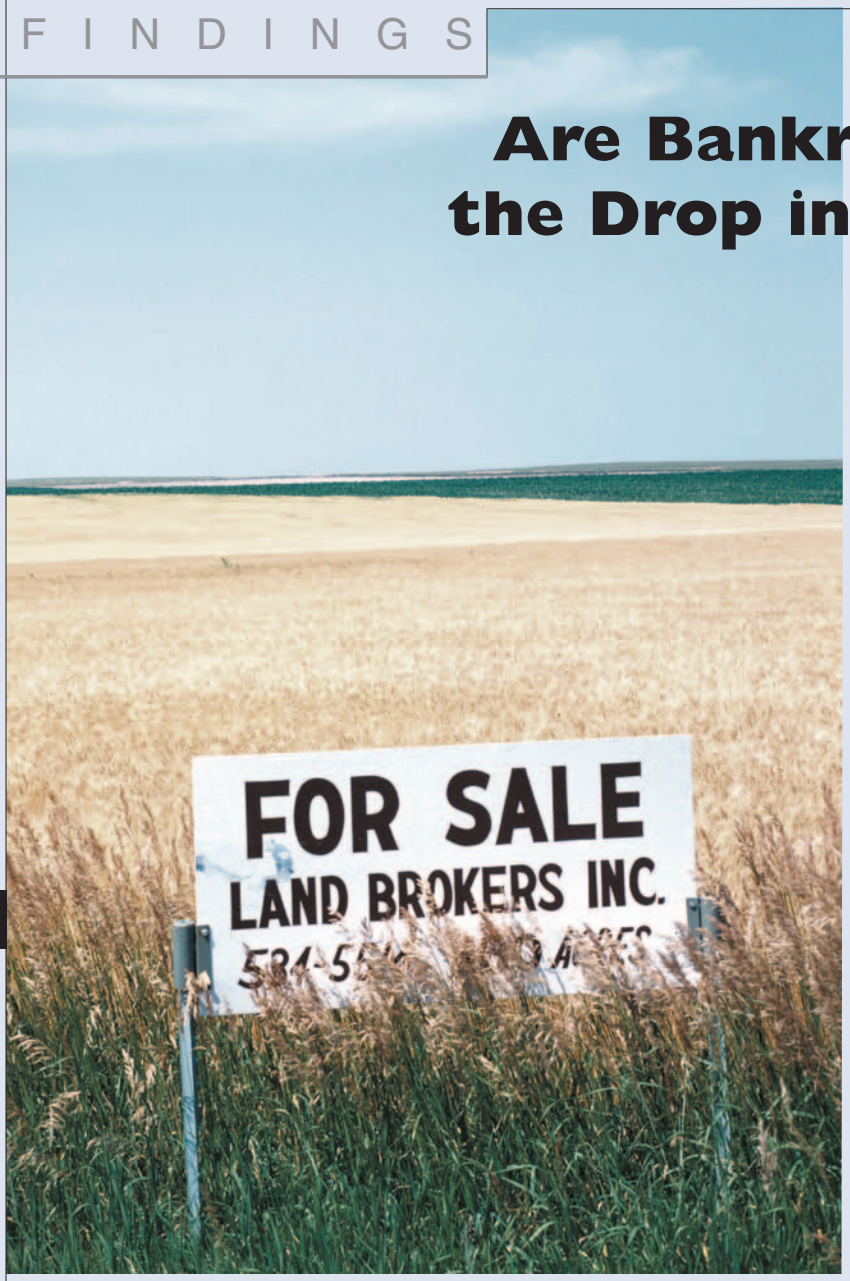


Michael Ollinger, ollinger@ers.usda.gov

For more information . . .

Complete survey results can be found at: www.ers.usda.gov/data/haccpsurvey/

Are Bankruptcies Behind the Drop in Farm Numbers?



Grant Heilman/Grant Heilman Photography

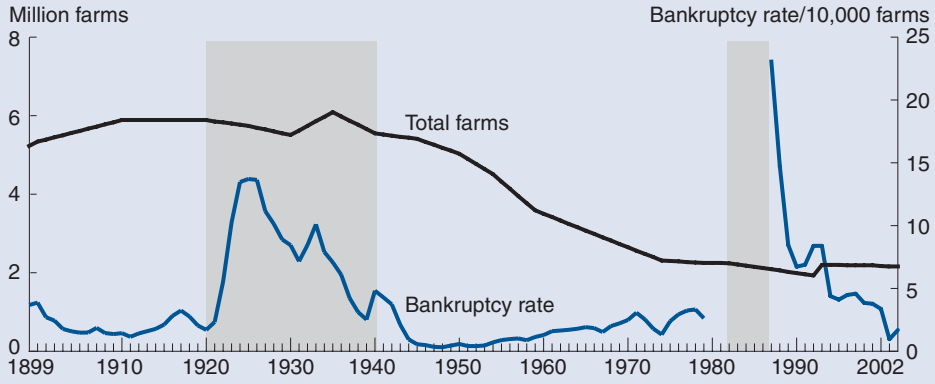
The number of farms in the United States has declined by two-thirds over the past seven decades, from a historic high of 6.8 million in 1935 to 2.2 million in 2002. While this decline is commonly associated with high rates of farm bankruptcy, a new study by ERS and the University of Arkansas finds the link between dwindling farm numbers and farm bankruptcies to be weak.

Farm bankruptcy rates spiked to unusually high levels twice during the past century. From 1920, with the post-World War I decline in the farm economy, through the Great Depression of the 1930s, farm bankruptcy rates were double to triple those of previous years and peaked at 13.7 per 10,000 farms in 1925. During that time, farmers had three bankruptcy options available to them. Fifty years later, during the farm financial crisis of the early to mid-1980s, farm numbers declined to about 2.3 million, and the rate of bankruptcy filings rose to 23.1 per 10,000 farms in 1987. By this time, a new bankruptcy category had been established by Congress and had become a frequently used option of farmers who declare bankruptcy.

Though comparisons of bankruptcy data across time are complicated by periods of incomplete data (there are no data from 1980 to 1986) and changes in the filing options available to farmers, comparisons of bankruptcy rates against data on farm numbers show no direct relationship. Most of the decline in farm numbers occurred between the 1940s and the 1970s, when bankruptcy filings were at relatively low levels and available filing options were stable. Farm numbers have even risen when bankruptcies have been relatively high or rising, such as during the early 1930s or the early 1990s.

Not all bankruptcies result in farm exits, and most farm exits involve other factors, such as retirement. Bankruptcies are only one phenomenon within a broader set of changing economic circumstances—including rising agricultural productivity and expanding off-farm job opportunities—that influence the size and structure of the farm sector.

Farm-sector financial stress during the 1920s, 1930s, and 1980s led to higher bankruptcy rates but had little effect on farm numbers



Note: Shaded areas indicate general periods of farm financial stress. All applicable bankruptcy chapters were included for the 1899-1979 data; data for 1987-2002 are for Chapter 12 only. Data for 1980-86 are not reported due to changes in the bankruptcy law. Farm data exclude sharecroppers.
Sources: Administrative Office of the U.S. Courts and U.S. Census of Agriculture.

Jerome M. Stam [Contact person: Robert Hoppe, rhoppe@ers.usda.gov]

This finding is drawn from . . .

Farmer Bankruptcies and Farm Exits in the United States, 1899-2002, by Jerome M. Stam and Bruce L. Dixon, USDA/ERS, AIB-788, March 2004, available at: www.ers.usda.gov/publications/aib788/

The ERS Briefing Room on Bankruptcies: www.ers.usda.gov/briefing/bankruptcies/

Is Carbon Sequestration in Agriculture Economically Feasible?

Comstock

Increased atmospheric concentrations of carbon dioxide and other "greenhouse" gases have contributed to the gradual rise in global temperatures over the last 50 years. Two options for reducing the amount of carbon in the atmosphere are to increase the amount of land planted with permanent grassland or forest vegetation and to reduce the frequency or intensity of tillage operations. Either option would store—or sequester—additional carbon on the affected lands. In February 2002, the White House announced a plan to reduce the growth of U.S. greenhouse gas emissions, in part by developing incentives for farm and forestland owners and operators to adopt land uses and management practices that extract carbon from the air and sequester it in soils and vegetation.

U.S. agricultural soils have lost, on average, about one-third of the carbon they contained before wide-scale cultivation began in the 1800s. Soil science studies suggest that changes in land use and land management practices could increase the carbon content of crop and grazing land soils by 104-318 million metric tons per year. Forestry studies suggest that afforestation of cropland and pasture could add another 91-203 million metric tons per year.

While the U.S. farm sector's technical potential to store carbon is important to know, it is really the economic potential for storing carbon that is most directly relevant to policymakers. Using different incentive payment structures, ERS researchers analyzed the economic feasibility of increasing carbon levels in soils and vegetation by providing various levels of payments to convert croplands and pasture to trees, shift cropland to permanent grasses, and/or increase the use of conservation tillage systems.

At payment levels below $10 per metric ton of additional permanently stored carbon, landowners find it more cost-effective to adopt conservation tillage practices, as compared with other changes to land use and management practices. At higher payment levels, converting cropland to trees becomes more cost effective. For payments equal to $125 per metric ton of additional permanently stored carbon, farmer adoption of conservation tillage and afforestation of crop or grazing land could yield 72-160 million metric tons of carbon, enough to offset 4-8 percent of gross U.S. emissions of greenhouse gases in 2001. Converting cropland to grass did not prove to be a cost-effective option at any payment level analyzed.

The economic potential, even at the $125-payment level, is much less than the technical potential suggested by soil science and forestry studies because activities that are technically feasible are not always economically feasible. Furthermore, the share of the technical potential that is economically feasible varies greatly across activities because of the wide variation in the costs farmers would incur in adopting different carbon-sequestering land uses and practices.

Jan Lewandrowski, janl@ers.usda.gov, Carol Jones, cjones@ers.usda.gov

This finding is drawn from . . .

Economics of Sequestering Carbon in the U.S. Agricultural Sector, by Jan Lewandrowski, Mark Peters, Carol Jones, Robert House, Mark Sperow, Marlen Eve, and Keith Paustian, TB-1909, USDA/ERS, April 2004, available at: www.ers.usda.gov/publications/tb1909/

FINDINGS

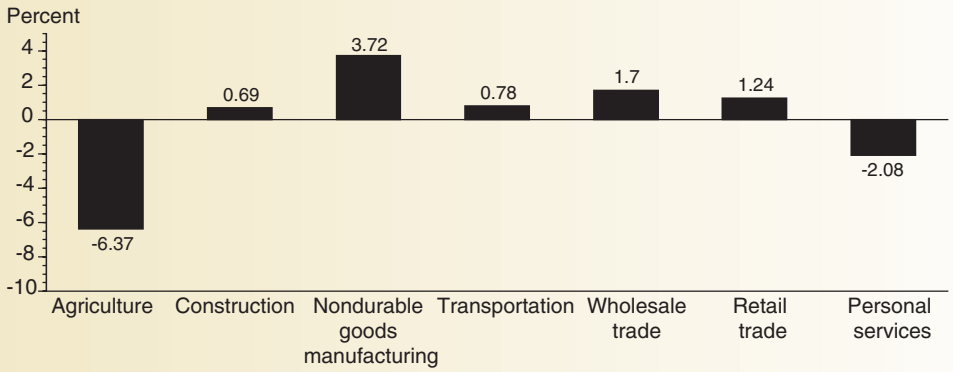
Growth of Hispanics in Rural Workforce

Corbis

Technological change and industrial restructuring in rural America in the 1990s led some employers to demand more unskilled workers relative to skilled workers (particularly males). Many of those unskilled workers were Hispanics who now represent an increased share of the rural workforce due to the rapid growth of the Hispanic population in the rural U.S. during the decade, especially in the South and Midwest.

Recent ERS research found that shifts in labor demand significantly affected wages for all rural workers regardless of gender and skill level. Two types of changes occurred in labor demand over the 1990s: 1) technological change or change in the skill mix of labor demanded (unskilled, skilled, or professional), and 2) change in the total labor demanded of each skill type. Changes in the skill mix favored unskilled workers (not high school graduates) and to a lesser extent professional workers (college-educated); but the change in the skill mix occurred in a small subset of rural industries. This change positively affected the wages of unskilled workers in those industries, broadly known to be service and manufacturing industries. On the other hand, larger changes in total labor demand strongly favored skilled workers (high school graduates) and positively affected skilled workers' wages, especially for males.

Change in nonmetro Hispanic employment by industry, 1990 to 2000



Concurrent changes in the workforce due to the influx of Hispanics, however, negatively affected the wages of skilled men. The wages of other groups, such as females and unskilled males, were not affected by the increased labor supply of the Hispanic workforce. The results are not surprising when considering the large Hispanic population increases which occurred in specific regions. Though the rural Hispanic population was small to begin with, it tripled in more than a dozen States in the South and Midwest during the 1990s. Some rural industries, such as meatpacking, were restructured in the 1990s, and many of these industries now employ Hispanics as the majority of their workforce. During this period, the Nation's share of Hispanics employed in agriculture fell by 6 percent while the share employed in nondurable manufacturing increased by almost 4 percent.

These results suggest that some rural service and/or manufacturing industries hired unskilled labor as substitutes for skilled labor, but that this effect is dwarfed by the larger increase in total demand for skilled labor occurring in most rural industries. The integration of this new workforce presents challenges to rural communities in terms of housing and public infrastructure, but it also presents an opportunity to revitalize communities that have been losing population.

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This finding is drawn from . . .

Impacts of Hispanic Population Growth on Rural Wages, by Constance Newman, AER-826, USDA/ERS, September 2003, available at: www.ers.usda.gov/publications/aer826/

Bob Nichols, USDA

Rural Homeownership Rising

Having grown for nearly a decade, U.S. homeownership rates continue to break records, particularly in rural or nonmetro areas. At the start of 2004, about 75 percent of nonmetro households and 67 percent of metro households owned their homes. On average, nonmetro homes appear to be a good investment, having appreciated in value at least as rapidly as metro homes during the past decade.

Homeownership generally helps both owners and their communities. Owning one's home has financial advantages, as homeownership serves as a hedge against rising housing costs, and contributes to investment and wealth accumulation. For most households, tax advantages also add to the benefits of homeownership. For all U.S. homeowners, the median equity in their home accounted for over half of their total net worth in 2001. And, homeownership by low-income households is associated with their children's greater educational attainment and future financial success. Rural communities also benefit from homeownership. Homeowners tend to become more involved in their communities and work toward community improvements, such as better schools.

Homeownership levels and rates of change are distributed unevenly across geographic areas. Although the overall nonmetro homeownership rate rose 3 percentage points during the 1990s, one of every four nonmetro counties actually experienced a decline. Nonmetro homeownership rates were lowest in the West and along the Mississippi River in Arkansas and Alabama. Nonmetro homeownership was highest in the upper Midwest, from Michigan to North Dakota.

Nonmetro homeownership rates vary by age group as well. Homeownership rates are particularly high for older persons. Over 82 percent of nonmetro householders age 65 or older owned their home in 2000, compared with 76 percent in metro areas. For most age groups, nonmetro homeownership rates exceed metro rates. Nonmetro minority households and poor households consistently have rates of homeownership well below the norm, but these households are also experiencing the most rapid gains. In nonmetro areas, 59 percent of Hispanics owned their homes in 2000, up from 50 percent a decade earlier. Low-income households may benefit from Federal, State, and local programs designed to make homeownership more affordable. One such program is USDA's single-family direct home loan program, in operation for over 50 years in rural America. This has been the major Federal program to provide low-income rural families with low-interest home mortgages over the last three decades.

What does the future hold for homeownership in rural America? Most likely, nonmetro homeownership will continue to grow. This was even the case during the recent economic downturn, when the most vulnerable population groups experienced the largest increases. Nonmetro homes appear to be a good investment, and rural borrowers today are better off in the cost and availability of home mortgages than in the mid-1990s.

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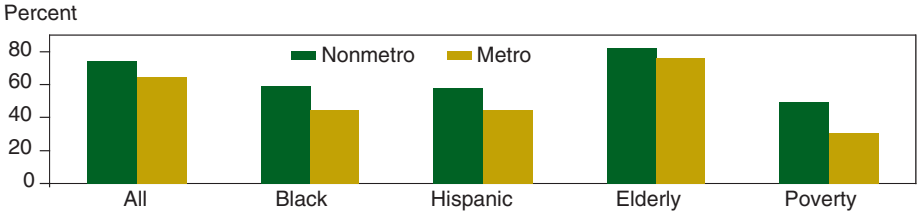
For more information on rural housing, visit . . .

The Rural Housing chapter of the ERS Briefing Room on Infrastructure and Rural Development Policy at: www.ers.usda.gov/briefing/infrastructure/ruralhousing/

Nonmetro homeownership rates exceed metro rates overall and for various household types, 2000

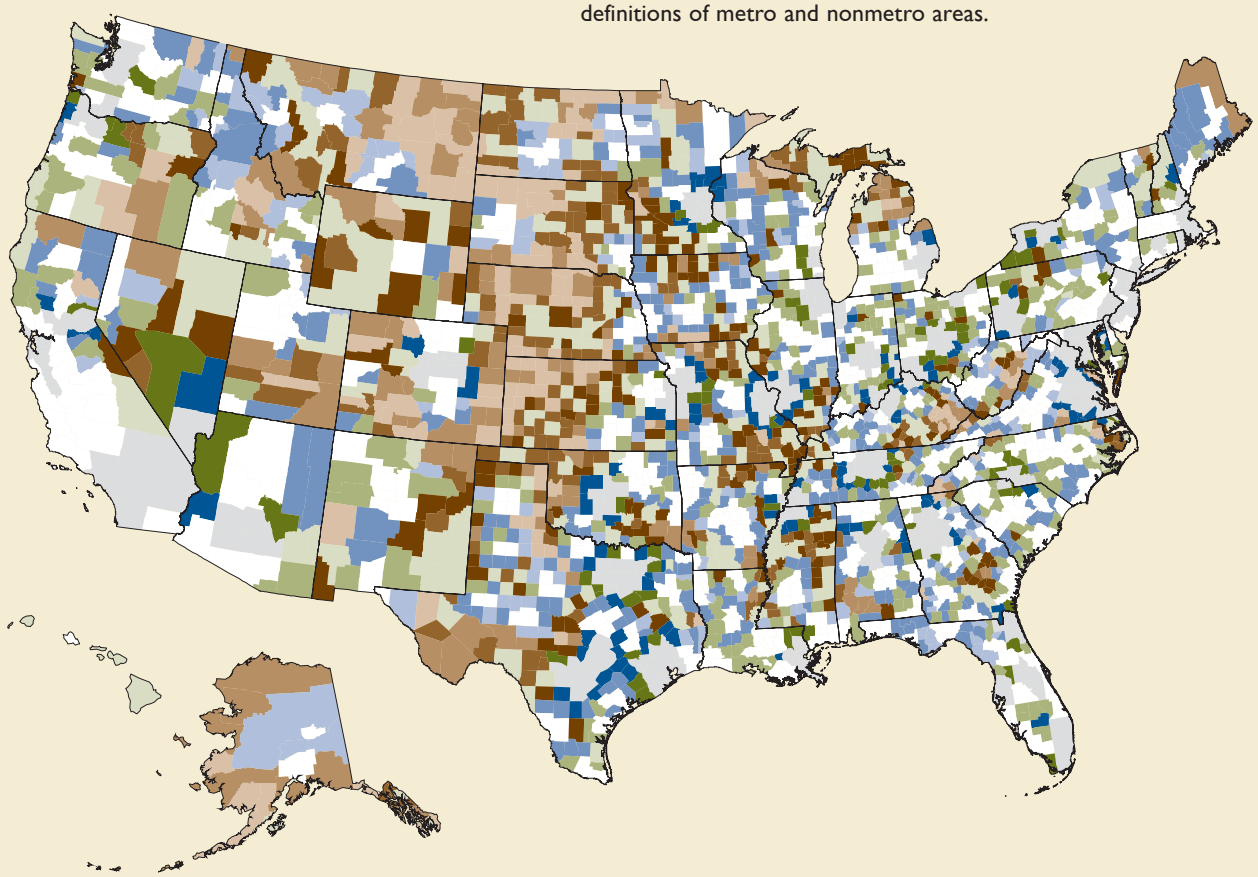


Source: ERS tabulations from 2000 Census data.

Using the 2003 Urban Influence Codes To Understand Rural America

County-level data analysis adds depth to research on rural America. The size of the largest city or town in a county determines the variety of goods and services available and the adequacy of the labor supply to meet business needs. Proximity to larger economies also has a significant effect on county development, as easy access to larger centers of information, trade, health care, and finance may connect the county to national and international marketplaces. These basic concepts underpin ERS's new 2003 *urban influence codes*, which were developed to help researchers and policymakers understand geographic differences in economic opportunities at the county level. The importance of city size and adjacency to larger places is reflected in various county-level measures, such as population change, educational attainment, managerial/professional employment, and earnings.

ERS's 2003 *urban influence codes* divide counties, county equivalents, and independent cities in the United States into 12 groups—2 metropolitan (metro) and 10 nonmetropolitan (nonmetro) (see Behind the Data, page 47). Metro counties are either large (those with populations of 1 million or more) or small (those with less than a million residents). Nonmetro counties are first classified as either micropolitan (with an urban core of at least 10,000 residents) or noncore (without an urban core that large). The micropolitan (micro) counties are further classified by adjacency to a large metro area, a small metro area, or no metro area. The noncore counties are further classified by adjacency to metro or micro areas and by whether or not they have a town of at least 2,500 residents. The 2003 *urban influence codes* are based on the June 2003 Office of Management and Budget (OMB) definitions of metro and nonmetro areas.

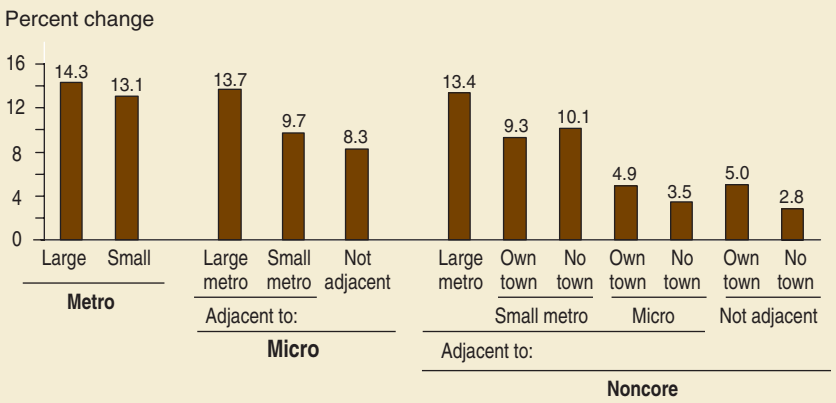


Education, occupation, and earnings by urban influence

County types	Counties	Share of residents 25 and older with at least a bachelor's degree, 2000	Share of employed civilians 16 and older with managerial or professional jobs, 2000	Earnings per job, 2001
	Number	*Percent*		*Dollars*
United States	3,141	24.4	33.6	37,258
Metro:				
Large	413	28.3	36.6	43,102
Small	676	22.8	32.0	32,417
Micro:				
Adjacent to large metro	92	15.7	26.3	27,200
Adjacent to small metro	301	15.6	26.6	26,847
Not adjacent to a metro area	282	18.1	28.0	26,403
Noncore:				
Adjacent to large metro	123	12.5	24.8	23,381
Adjacent to small metro with own town	358	12.8	25.3	23,625
Adjacent to small metro no town	185	12.2	25.7	21,706
Adjacent to micro with own town	201	13.4	25.9	23,251
Adjacent to micro no town	198	12.4	27.8	20,431
Not adjacent to metro/micro with own town	138	15.7	28.2	24,796
Not adjacent to metro/micro no town	174	14.5	29.7	20,622

Sources: Education and occupation calculated using data from the 2000 Census of Population; earnings calculated using data from the Bureau of Economic Analysis' Regional Economic Information System.

Population change by county type, 1990-2000



Source: Calculated by ERS using data from the 1990 and 2000 Censuses of Population.

Population change

Between 1990 and 2000, population grew fastest in large metro counties and in nonmetro counties adjacent to them. Nonmetro counties adjacent to large metro areas grew faster than small metro areas did. This contrasts with population change in the 1980s, when all types of nonmetro counties grew more slowly than both large and small metro counties. Much of the growth in adjacent nonmetro counties is due to spillover effects as residents of large metro areas moved to such counties for rural amenities or lower housing costs. Nonmetro micro counties had higher population growth than noncore counties. And, within noncore counties, those with towns grew more than those without towns. Small towns often serve as regional service centers for surrounding counties without such towns.

Educational attainment

The highest shares of persons with college degrees are found in large (28 percent) and small (23 percent) metro areas. These areas also have large numbers of professional and managerial jobs (employing about one-third of civilian workers) that generally require a college degree. Micro counties adjacent to large and small metro areas have lower proportions of persons with college degrees (16 percent) than nonadjacent micro counties (18 percent). The college-educated are more likely to find jobs and live in metro areas, partially explaining the lower proportion of college graduates in adjacent micro counties. Nonadjacent micro counties have more college-educated residents because they are often home to small colleges and universities and serve as regional centers of specialized services.

Among noncore counties, those adjacent to metro or micro areas have lower shares of college graduates (12-13 percent) than nonadjacent noncore counties (15-16 percent). Lacking direct competition from larger communities in professional and managerial services, nonadjacent noncore counties have slightly higher shares of residents employed in such jobs (28-30 percent) than adjacent counties (24-25 percent).

Earnings

Earnings per job are far higher in metro areas (both large and small) than in any of the nonmetro county groups. Large metro areas averaged $43,102 per job and small metro areas $32,417 per job, compared with $20,431 to $27,200 per job in nonmetro counties. Among micro counties, those adjacent to large metro areas had the highest earnings per job—$27,200. Competition for workers from large metro areas may push employers in adjacent micro counties to offer higher wages. Micro counties adjacent to small metro areas had earnings per job ($26,847) only slightly higher than nonadjacent micro areas ($26,403). Because average earnings in small metro areas are much lower than in large metro areas, small metro areas apparently provide less competitive pressure on wages than large metro areas.

Noncore counties with towns average higher earnings than those without towns. Adjacency to either metro or micro areas does not seem to boost earnings in noncore counties. Just as higher percentages of college graduates and workers in professional and managerial jobs are found in nonadjacent-noncore counties, earnings per job are higher in noncore counties with towns than in adjacent-noncore counties with towns.

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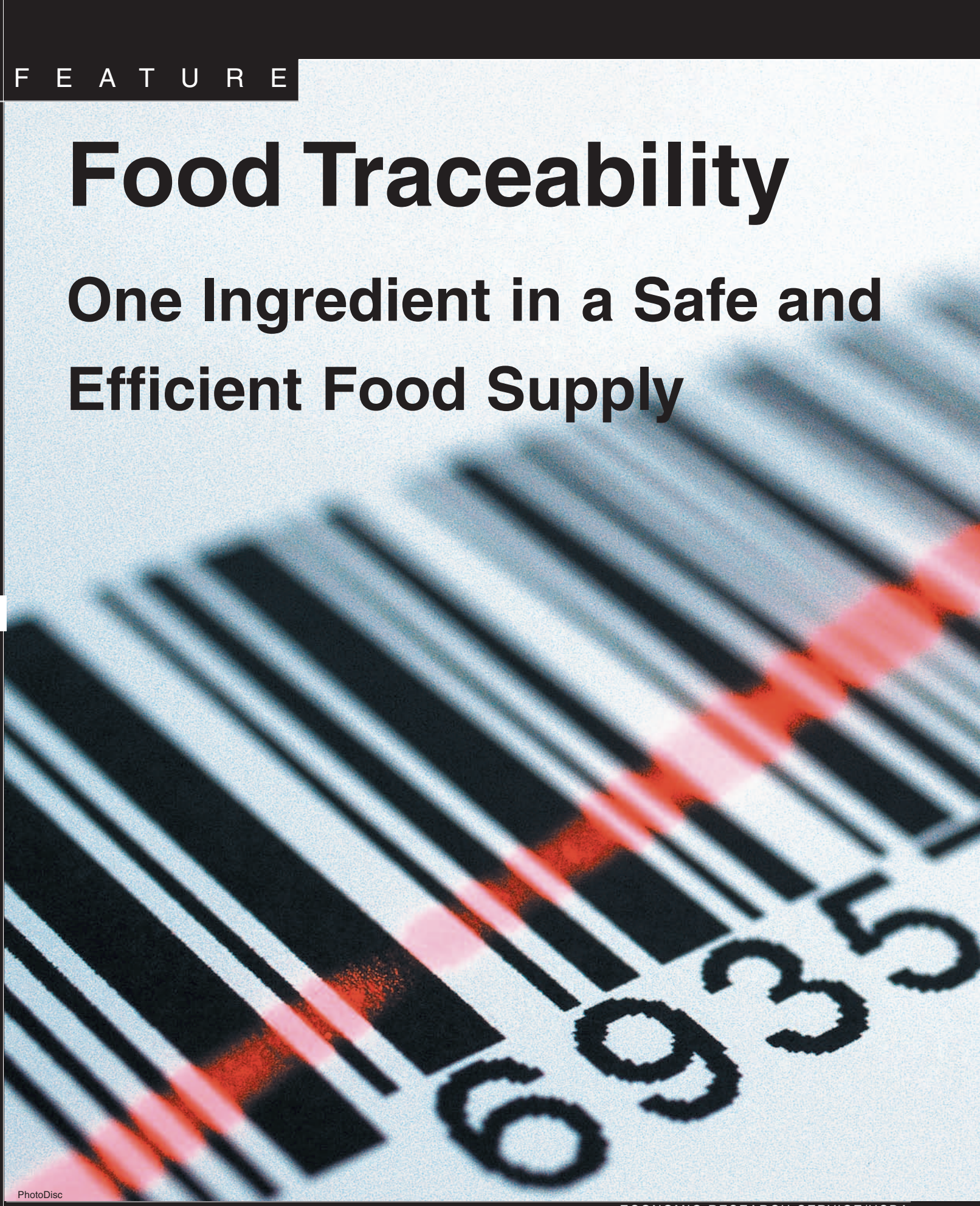
This article is drawn from . . .

ERS Urban Influence Codes Data Page:
www.ers.usda.gov/data/urbaninfluencecodes/

Food Traceability

One Ingredient in a Safe and Efficient Food Supply



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Food traceability is in the news—in articles ranging from food safety and bioterrorism to the consumer's right to know. Recent news stories have focused on tracking cattle from birth to finished product to control the risk of mad cow disease, on tracking food shipments to reduce the risk of tampering, and on traceability systems to inform consumers about food attributes like country of origin, animal welfare, and genetic composition.

Traceability is not only newsworthy, but investment worthy too. Food producers have voluntarily built traceability systems to track the grain in a cereal box to the farm and the apples in a vat of apple juice to the orchard. However, traceability is just one element of any supply-management or quality/safety control system. What exactly is traceability, how does it work, and what can it accomplish? Most important, does the U.S. food supply have enough of it?

Our examination of U.S. food traceability systems involved research into the market studies literature, interviews with industry experts, and site visits in which we interviewed owners, plant supervisors, and/or quality control managers in fruit and vegetable packing and processing plants; beef slaughter plants; grain elevators, mills, and food manufacturing plants; and food distribution centers. In some cases, we accompanied auditors for USDA procurement programs and were shown the firm's complete traceability records.

What Is Traceability?

ISO (International Organization for Standardization), which develops voluntary international standards for products and services, defines traceability as the "ability to trace the history, application, or location of that which is under consideration." This definition is quite broad. It does not specify a standard measurement for "that which is under consideration" (a grain of wheat or a truckload), a standard location size (field, farm, or county), a list of processes that must be identified (pesticide applications or animal welfare), or a standard identification technology (pen and paper or computer). It does not specify that a hamburger be traceable to the cow or that the wheat in a loaf of bread be traceable to the field. It does not specify which type of system is necessary for preserving the identity of tofu-quality soybeans; controlling the quality of grain used in a particular cereal; or guaranteeing correct payments to farmers for different grades of apples.

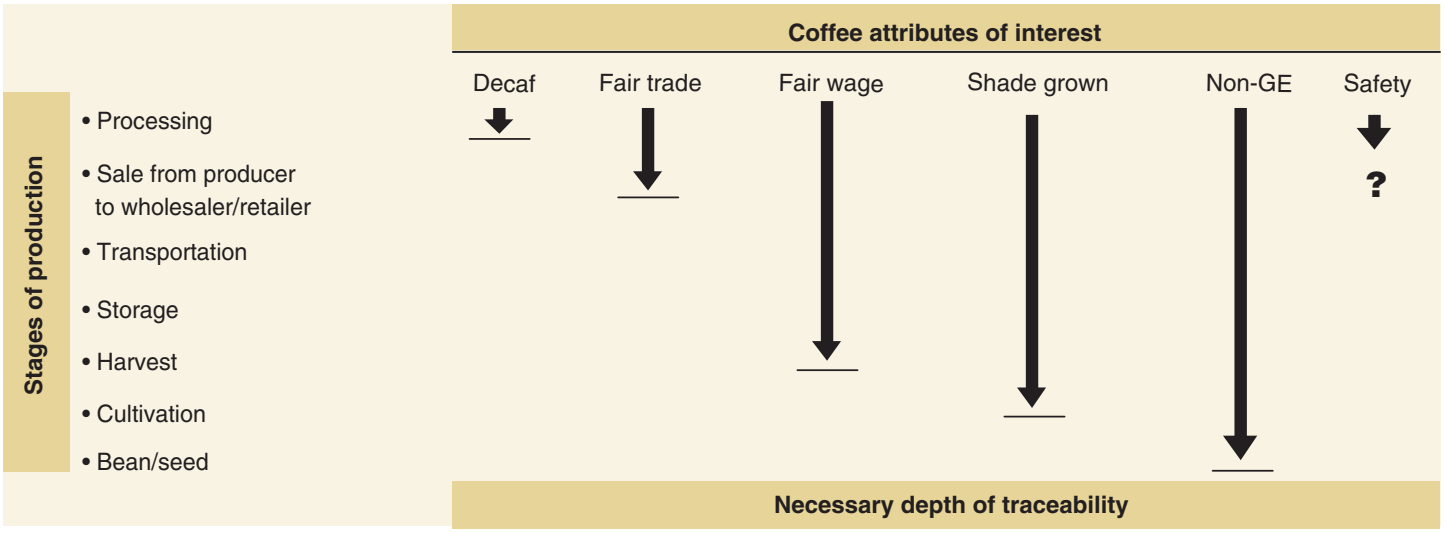
What exactly is traceability, how does it work, and what can it accomplish? Most important, does the U.S. food supply have enough of it?

The definition of traceability is necessarily broad because food is a complex product and traceability is a tool for achieving a number of different objectives. As a result, no traceability system is complete. Even a hypothetical system for tracking beef—in which consumers scan their packet of beef at the checkout counter and access the animal's date and location of birth, lineage, vaccination records, and use of mammalian protein supplements—is incomplete. This system does not provide traceability with respect to bacterial control in the barn, use of genetically engineered feed, or animal welfare attributes like hours at pasture and play time.

A system for tracking every input and process to satisfy every objective would be enormous and very costly. Consequently, firms across the U.S. food supply system have developed varying amounts and kinds of traceability. Firms determine the necessary *breadth*, *depth*, and *precision* of their traceability systems depending on characteristics of their production process and their traceability objectives.

Breadth describes the amount of information collected. A recordkeeping system cataloging all of a food's attributes would be enormous, unnecessary, and expensive. Take, for example, a cup of coffee. The beans could come from any number of countries; be grown with numerous pesticides or just a few; be grown on huge corporate organic farms or small family-run conventional farms; be harvested by children or by machines; be stored in hygienic or pest-infested facilities; and be

Depth of a traceability system depends on the attributes of interest



decaffeinated using a chemical solvent or hot water. Few, if any, producers or consumers would be interested in all this information. The breadth of most traceability systems would exclude some of these attributes.

Depth is how far back or forward the system tracks the relevant information. For example, a traceability system for decaffeinated coffee would extend back only to the processing stage. A traceability system for fair-trade coffee would extend only to information on price and terms of trade between coffee growers and processors. A traceability system for fair wages would extend to harvest; for shade grown, to cultivation; and for nongenetically engineered, to the bean or seed. For food safety, the depth of the traceability system depends on where hazards and remedies can enter the food production chain. For some health hazards, such as Bovine Spongiform Encephalopathy (BSE, or mad cow disease), ensuring food safety requires establishing safety measures at the farm. For other health hazards, such as foodborne pathogens, firms may need to establish a number of critical control points along the entire production and distribution chain.

Precision reflects the degree of assurance with which the tracing system can pinpoint a particular food product's movement or characteristics. In some cases, the objectives of the system will dictate a precise system, while for other objectives a less precise system will suffice. In bulk grain markets, for example, a less precise system of traceability from the elevator back to a handful of farms is usually sufficient because the elevator serves as a key quality control point for the grain supply chain. Elevators clean and sort deliveries by variety and quality, such as protein level. Elevators then blend shipments to achieve a homogeneous quality and to meet sanitation and quality standards. Once blended, only the new grading information is relevant—there is no need to track the grain back to the farm to control for quality problems. Strict tracking and segregation by farm would thwart the ability of elevators to mix shipments for homogeneous product.

What Does It Do?

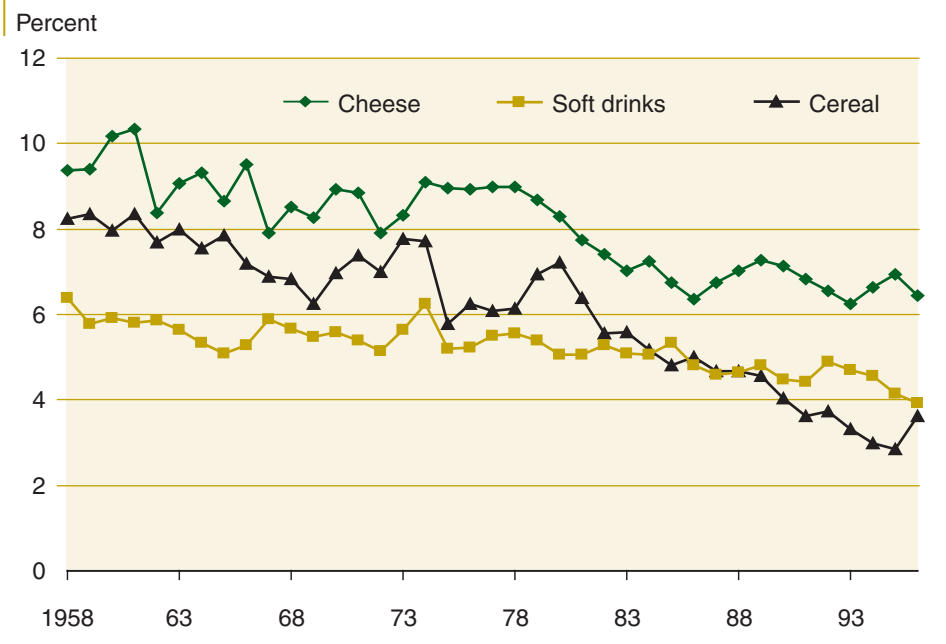
Firms have three primary objectives in using traceability systems: improve supply management; facilitate traceback for food safety and quality; and differentiate and market foods with subtle or undetectable quality attributes. The benefits associated with these objectives include lower cost distribution systems, reduced recall expenses, and expanded sales of products with attributes that are difficult to discern. In every case, the benefits of traceability translate into larger net revenues for the firm. These benefits are

Eyewire

U.S. manufacturing companies have reduced inventory-to-sales ratios. . .

Source: Bureau of Economic Analysis, National Income and Product Accounts.

. . .as have U.S. food manufacturers



Source: Bartlesman, Eric J., Randy A. Becker, and Wayne B. Gray (2000). "NBER-CES Manufacturing Industry Database." www.nber.org/nberces/nbprod96.htm.

driving the widespread development of traceability systems across the U.S. food supply chain.

Traceability to improve supply management. Industry analysts calculate that during 2000, American companies spent $1.6 trillion on supply-related activities, including the movement, storage, and control of products across the supply chain. The ability to reduce these costs often marks the difference between successful and failed firms. In the food industry, where margins are thin, supply management, including traceability, is an increasingly important area of competition. A firm's traceability system is key to finding the most efficient ways to produce, assemble, warehouse, and distribute products.

Electronic coding systems, from the granddaddy barcode system to cutting-edge technologies like radio-frequency identification systems, are helping to streamline the U.S. food supply system. As technological innovation drives down the cost of these devices, more firms across the food supply chain are using electronic tracking systems. In some cases, buyers manage these systems to monitor internal supply flow. In others, firms establish systems that link suppliers and buyers, allowing them to automate reordering. Retailers such as Wal-Mart have created proprietary supply-chain information systems, which they require their suppliers to adopt.

Inventory-to-sales ratios are further evidence that U.S. companies are embrac-

Advances in coding technologies are helping to streamline the U.S. food supply system.

Ken Hammond, USDA

ing new logistic systems to better control inventory flow. The ratio of private inventories to final sales of domestic business has fallen by half since the end of WWII. The same trend can be observed in many sectors of the domestic food industry, including natural, processed, and imitation cheese; cereal breakfast foods; and soft drinks and carbonated waters. In each case, the inventory-to-sales ratio fell, with the largest decline in the cereal sector, where the ratio fell from over 8 percent in 1958 to 3-4 percent in the early 1990s. This downward trend in inventories reflects growing efficiencies in supply management in the U.S. food industry, including traceability systems. This trend is expected to continue as food manufacturers continue to adopt technologies already in use in other industries.

Traceability for safety and quality control. Traceability systems help firms isolate the source and extent of safety or quality control problems. This helps reduce the production and distribution of unsafe or poor-quality products, which in turn reduces the potential for bad publicity, liability, and recalls. The better and more precise the tracing system, the faster a producer can identify and resolve food safety or quality problems. One surveyed milk processor uniquely codes each item to identify time of production, line of production, place of production, and sequence. With such specific information, the processor can trace faulty product to the minute of production and determine whether other products from the same batch are also defective.

The better and more precise the tracing system, the faster a producer can identify and resolve food safety or quality problems.

Many buyers, including many restaurants and some grocery stores, now require their suppliers to establish traceability systems and to verify, often through third-party certification, that such systems work. The growth of third-party standards and certifying agencies is helping push the whole food industry—not just those firms that employ third-party auditors—toward documented, verifiable traceability systems.

Traceability to market and differentiate foods. The U.S. food industry is a powerhouse producer of homogeneous bulk commodities such as wheat, corn, soybeans, and meats. Increasingly, the industry is tailoring goods and services to the tastes and preferences of various groups of consumers. Consumers easily spot some of these new attributes—green ketchup is hard to miss. However, other innovations involve credence attributes, characteristics that consumers cannot discern even after consuming the product. Consumers cannot, for example, taste or otherwise distinguish between conventional corn oil and oil made from genetically engineered (GE) corn.

Credence attributes can describe content or process characteristics of the product. ***Content attributes*** affect the physical properties of a product, although they can be difficult for consumers to perceive. For example, consumers are unable to determine the amount of isoflavones in a glass of soymilk or the amount of calcium in a glass of enriched orange juice by drinking these beverages.

Process attributes do not affect final product content but refer to characteristics of the production process. Process attributes include country of origin, free-range, dolphin-safe, shade-grown, earth-friendly, and fair-trade. In general, neither consumers nor specialized testing equipment can detect process attributes.

Traceability is an indispensable part of any market for process credence attributes—or content attributes that are difficult or costly to measure. The only way to verify the existence of these attributes is through recordkeeping that establishes their creation and preservation. For example, tuna caught with dolphin-safe nets can only be distinguished from tuna caught using other methods through a recordkeeping system that ties the dolphin-safe tuna to an observer on the boat from which the tuna was caught. Without traceability as evidence of value, no viable market could exist for dolphin-safe tuna, fair-trade coffee, non-biotech corn oil, or any other process credence attribute.

Does the Private Sector Supply Enough Traceability?

Firms in every sector of the U.S. food supply system are investing in traceability to improve production and distribution efficiency, monitor and control food safety and product quality, and differentiate and market products with credence attributes. However, traceability systems alone do not accomplish any of these objectives. Simply knowing where a product is in the supply chain does not improve supply management unless the traceability system is paired with a real-time delivery system or some other inventory-control system. Tracking food by lot in the production process does not improve safety unless the tracking system is linked to an effective safety control system. And of course, traceability systems do not create credence attributes, they simply provide evidence of their existence.

The only way to verify the existence of some attributes is through recordkeeping that establishes their creation and preservation.

Firms use traceability systems together with a host of other management, marketing, and safety/quality control tools to achieve their objectives. The dynamic interplay of the costs and benefits of these tools has spurred different rates of investment in traceability across sectors—and continues to do so. Observers of this mish-mash of traceability may conclude that such variation is an indication of inadequacy. It is more accurately an indication of efficiency, the result of a careful balancing of costs and benefits coordinated by relative prices.

All of this is not to argue that companies always invest in the socially optimal amount of traceability. In some instances, the private costs and benefits of traceability may not be the same as the social costs and benefits. There are circumstances where market incentives could lead to less traceability than is desirable for product differentiation or for food safety. Both industry and government have a number of options to help correct this market failure.

Curtia Taylor, USDA/ERS

Options To Enhance Traceability

In cases where markets do not supply enough traceability for product differentiation, individual firms and industry groups have developed systems for policing and advertising the veracity of credence claims. Third-party safety/quality auditors are at the heart of these efforts. These auditors provide consumers with verification that traceability systems exist to substantiate credence claims. For example, auditors from Food Alliance, a nonprofit organization, certify foods grown with a specific set of sustainable agricultural practices.

Government may also require that firms producing foods with credence attributes substantiate their claims through mandatory traceability systems. For example, the Government requires that firms producing organic foods verify the claim. If firms are not required to prove that credence attributes exist, some may try to gain price premiums by passing off standard products as products with credence attributes.

One difficulty with mandatory traceability proposals is that they often fail to differentiate between valuable quality attributes, those for which verification is needed, and less valuable attributes for which no verification is needed. For example, though consumers may desire verification that organic foods are indeed organic, no such verification is necessary for conventionally produced foods. There is no potential for fraud in the case of conventional foods, no danger that producers would try to cheat consumers by misidentifying organic products as conventional ones. Likewise, there is no danger that producers would try to cheat consumers by

Ken Hammond, USDA

This article draws from the ongoing research of ERS's Traceability Team. Read more about the team and their work on page 52.

selling non-GE (genetically engineered) soybeans as GE soybeans.

In cases where markets do not supply enough traceability for food safety traceback, a number of industry groups have developed food safety and traceback standards. For example, the California cantaloupe industry has incorporated traceability requirements in their marketing order to monitor food safety practices. In addition, buyers in every sector are increasingly relying on contracting, vertical integration, or associations to improve product traceability and facilitate the verification of safety and quality attributes. For example, many hog operations are now integrated by ownership or contractually connected to slaughtering firms. As a result, identification by herd or batch is much easier today than 50 years ago.

When the cost of distributing unsafe food goes up, so, too, do the benefits of traceability systems.

Government may also consider mandating traceability to increase food safety, but this may impose inefficiencies on already efficient private traceability systems. The widespread voluntary adoption of traceability complicates the application of a centralized system because firms have developed so many different approaches and systems of tracking. If mandatory systems do not allow for variations in traceability systems, they will likely end up forcing firms to make adjustments to already efficient systems or creating parallel systems.

Other policy options give firms incentives to strengthen their safety and traceability systems without requiring any specific process for achieving these objectives. For example, standards for mock recall speed (in which firms must prove that they can locate and remove all hypothetically contaminated food from the food supply within a certain amount of time) give firms the freedom to develop efficient traceback systems while ensuring that such systems satisfy social objectives.

Policy aimed at increasing the cost of distributing unsafe foods, such as fines or plant closures, or policies that increase the probability of catching unsafe food producers, such as increased safety testing or foodborne illness surveillance, will also provide firms with incentives to strengthen their traceability systems. When the cost of distributing unsafe food goes up, so, too, do the benefits of traceability systems.

One area where industry has no incentive to create traceability systems is for tracking food once it has been sold and consumed. No firm has an incentive to monitor the health of the Nation's consumers in order to speed the detection of unsafe product. Government-supplied systems for monitoring the incidence of foodborne illness, such as FoodNet and PulseNet, are one option for helping close this gap in the food system's traceability network. Foodborne illness surveillance systems increase the capability of the entire food supply chain to respond to food safety problems before they grow and affect more consumers.

This article is drawn from . . .

Traceability in the U.S. Food Supply: Economic Theory and Industry Studies, by Elise Golan, Barry Krissoff, Fred Kuchler, Linda Calvin, Kenneth Nelson, and Gregory Price, AER-830, USDA/ERS, March 2004, available at: www.ers.usda.gov/publications/aer830/

The ERS Briefing Room on Traceability in the U.S. Food Supply: www.ers.usda.gov/briefing/traceability/

Dupont Qualicon

Savvy Buyers Spur Food Safety Innovations in Meat Processing

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Recent industry innovations improving the safety of the Nation's meat supply range from new pathogen tests, high-tech equipment, and supply-chain management systems to new surveillance networks. Innovation, along with diffusion of innovation through imitation, helps lower the cost of safe food and increase consumer choice. With innovation, consumers can better choose the level of safety they desire.

Though food safety and food safety innovations are desirable, meat processors face special challenges that weaken their incentives to invest in food safety improvements. Some restaurant chains and large retailers are encouraging processors to overcome these challenges. These large, savvy meat and poultry buyers are setting and enforcing safety standards and creating markets for food safety. As a result, they are driving increases in food safety investments throughout the meat supply chain.

Marketing "safe" meat products is difficult, though some firms are taking steps in this direction. For example, one Danish company sells *Salmonella*-free chicken.

Incentives for Innovation Relatively Weak for Food Safety

In research conducted for well over half a century, economists have found that appropriability, the ability to control and exploit the benefits of an innovation, plays a key role in innovation. A firm will invest in food safety innovation only if it expects to reap benefits, such as an increase in sales, price premiums for safer foods, improved brand equity, consumer loyalty, lower recall costs, and reduced liability (see box, "How Is Innovation Defined?").

Unfortunately, meat producers have had difficulties appropriating the benefits of food safety innovation because improved food safety is a difficult attribute to market to consumers. For the most part, food safety is a credence attribute, meaning that consumers cannot evaluate the existence or quality of the attribute before purchase, or even after they have consumed the product. Consumers cannot usually determine whether a food was produced with the best or worst safety procedures, or whether a food poses a health risk. For example, consumers cannot detect by sight, smell, or price whether a raw egg is contaminated with *Salmonella.*

Food companies have successfully marketed a long list of products involving credence attributes. For example, companies advertise their organic, dolphin-safe, and nongenetically engineered products and have developed a number of ways, such as third-party certification, to verify these credence claims. Surprisingly, in the food safety area, producers have been slow to adopt these verification mechanisms or to advertise their good safety records.

One reason may be that in advertising their good safety records, and thereby disclosing the poorer safety records of their competitors, firms also disclose general food facts that may alarm consumers. Firms may fear that consumers will not react positively to claims like "our *Salmonella* count is 50 percent less than the leading brand." Meat producers may decide that though such advertising could differentiate them

How Is Innovation Defined?

Innovation is all the activities that result in new products or new production methods. It is all the scientific, technological, organizational, financial, and commercial activities necessary to create, implement, and market new or improved products or processes. Innovation takes two forms: product innovation and process innovation.

A product innovation is the development and commercialization of a product with improved performance characteristics. Product innovation tends to expand consumer choice. More product choice allows more consumers to find products that better match their particular set of tastes and preferences, thereby expanding consumer welfare. For example, pre-washed lettuce, baby carrots, and green ketchup have expanded consumer choice and well-being.

This welfare-increasing effect of product innovation is not guaranteed, however. Product innovations that become the industry or regulatory standard may ultimately reduce, not increase, product differentiation and consumer welfare. For example, some cities prohibit sales of unpasteurized milk to protect consumers from pathogens in unpasteurized milk. However, this regulation eliminated consumers' choice to buy raw milk.

A process innovation is the development or adoption of a new or significantly improved production or delivery method. Process innovations may be technological or organizational, involving changes in equipment, human resources, working methods, or any combination of these. Process innovation tends to make production more efficient. Some or all of these efficiency gains may be passed on to consumers in the form of lower prices.

The distinction between product and process innovation for food safety is not clear cut. Food safety process innovations often lead to product innovations—safer foods—not just the same level of safety at less cost. Ultra-high-temperature heating (UHT) and irradiation are two process innovations that have created product innovations: safe, shelf-stable juices and milks in convenient boxes in the case of UHT, and safer spices and meat patties in the case of irradiation. Even such processing changes as properly refrigerated trucks, lot coding, lay-date stamping on eggs, pathogen testing, and instant-read thermometers all lead to safer final products, blurring the line between process and product innovation.

Jack in the Box, Inc.

from poorer quality producers, any overt mention of safety risks could drive customers away.

In addition, firms may want to avoid specific safety guarantees that could expose them to greater liability. Food safety is not easy to guarantee, particularly in the case of pathogen contamination. While careful producers can greatly reduce their risks, even they can undergo a food safety problem. Deviations from planned procedures, uncertainty regarding input contamination, equipment malfunction, personnel factors, pathogen grow-back, and sampling variability all contribute to the potential for safety breaches. When a batch of Odwalla apple juice was made from apples that had fallen to the ground, contrary to company policy to use apples fresh off the tree, the deviation caused the 1996 *E. coli* O157:H7 outbreak.

Finally, some meat producers may not invest in producing safer food because they lack technical expertise, or know the probability of getting caught as the cause of a foodborne disease outbreak is low. For example, an individual consumer who becomes ill after eating contaminated ground beef cannot be certain that the hamburger caused the illness. The 1- to 5-day lag between ingestion and illness makes it difficult to know with certainty which of the multitude of foods eaten in this time period was responsible. This uncertainty reduces the risk of detection for firms with lax safety procedures.

Channel Captains Create Markets for Food Safety

What has happened in the last decade to spur food safety innovation? Foremost are the stringent requirements for pathogen control demanded by large meat and poultry buyers like Jack in the Box, Red Lobster, and many foreign buyers. These buyers have successfully created markets for food safety through their ability to enforce safety standards with testing and process audits, and to reward suppliers who meet safety standards and punish those who do not. These companies are referred to as "channel captains"—savvy buyers who monitor food safety up and down their supply chain. Through contracts with these channel captains, meat and poultry processors are better able to appropriate the benefits of their investments in new food safety technologies.

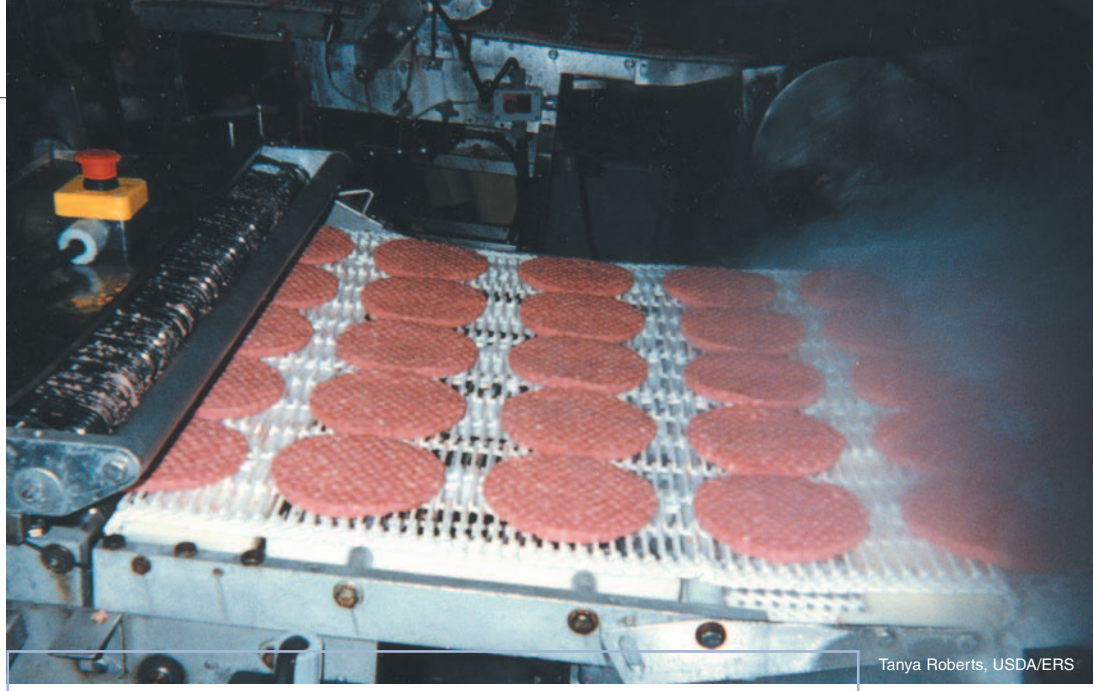
Two case studies and a national survey of meat and poultry plants illuminate the role of these savvy buyers in creating a market for food safety and driving innovation.

Innovative Pathogen Detection Program Meets Buyers' Requirements

After the deaths of several children in the 1993 outbreak of *E. coli* O157:H7 caused by contaminated ground beef, Jack in the Box canceled all its contracts with hamburger patty suppliers, required new food safety assurances, and asked the meat companies to work with them to ensure the safety of their hamburger patties. Texas American Foodservice Corporation was one of two companies to answer this challenge. Texas American, a large supplier of hamburger patties to fast food chains, developed a system for sampling and testing ground beef and hamburger patties for microbial pathogens. Texas American collaborated with the pharmaceutical firm DuPont, which had developed a superior system for detecting *E. coli* O157:H7 as the cause of human illness. The DuPont detection system uses Polymerase Chain Reaction (PCR) technology, which is faster and more reliable than traditional microbiological testing methods. Texas American and DuPont worked together to apply the PCR testing technology to ground beef.

Red Lobster®

Red Lobster, Inc.



Tanya Roberts, USDA/ERS

Texas American Foodservice Corporation flash freezes its hamburger patties for pathogen control.

Texas American also developed a sampling protocol for the new system. Sampling protocols are critical to the management of pathogen risk because while testing every product is not economically feasible, enough product must be tested to manage risk to an acceptably low level. Texas American tests samples at three locations in the plant: incoming beef trim, ground beef at the final grind head, and hamburger patties. Samples are taken at 15-minute intervals and suppliers are notified if any pathogens are detected. In addition, the temperature of incoming beef trim must be 40 degrees Fahrenheit or less, and all beef trim must be ground within 5 days after the carcass is broken into steaks, roasts, and trim. Random tests verify the efficacy of Texas American's sanitation procedures.

The emergence of technically proficient buyers and the development of a market for safer hamburger patties have allowed Texas American to benefit from its food safety investments. Texas American evolved from being a commodity producer dependent on the spot market to a contract supplier. A contract supplier knows how much product is to be delivered by set dates and can plan its inventory and production schedule accordingly. This shift has allowed Texas American to improve its operational efficiency through better planning for capacity utilization, capital investment, spending plans, and other business activities. Texas American has also been able to use its expertise in pathogen control to attract new customers. Texas American estimates that 25-30 percent of its new sales between 1998 and 2001 occurred because of its superior safety record.

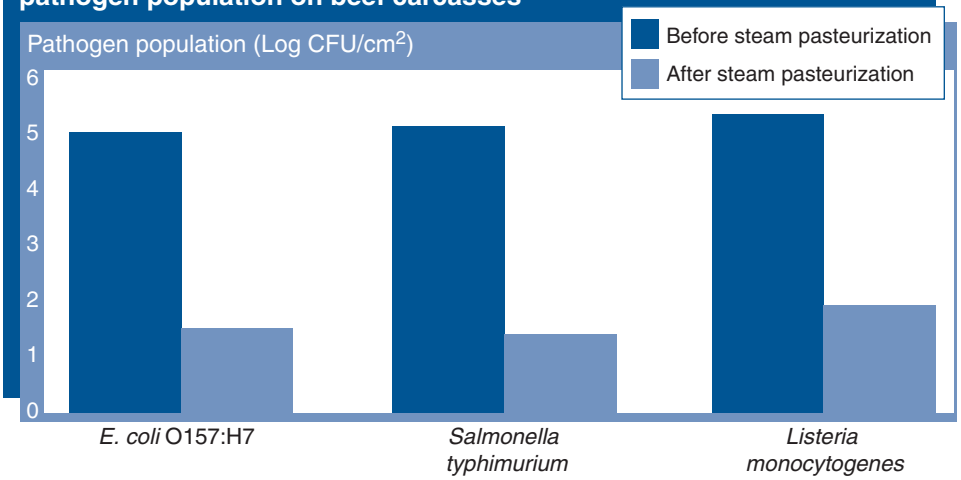
Equipment Innovation Requires a Buyer and Collaboration

The development and commercialization of Frigoscandia's beef steam pasteurization system illustrates the ripple effect that the emergence of food safety markets can have on the entire supply chain—all the way down to equipment manufacturers.

In 1993, Frigoscandia Equipment, a Swedish refrigeration company, designed a system to reduce the level of microorganisms, particularly pathogens, on the surface of meat carcasses using steam. The use of steam to kill pathogens was not new, but its application to sides of beef was. A stainless steel cabinet is installed at the end of the slaughter line, just before the sides of beef (hanging from an overhead rail) enter the chiller. Within the cabinet, a blanket of steam kills pathogens on the surface of the beef. The clean beef then enters the chiller. From the chiller, the beef will be cut up into steaks, roasts, and trimmings for hamburger.

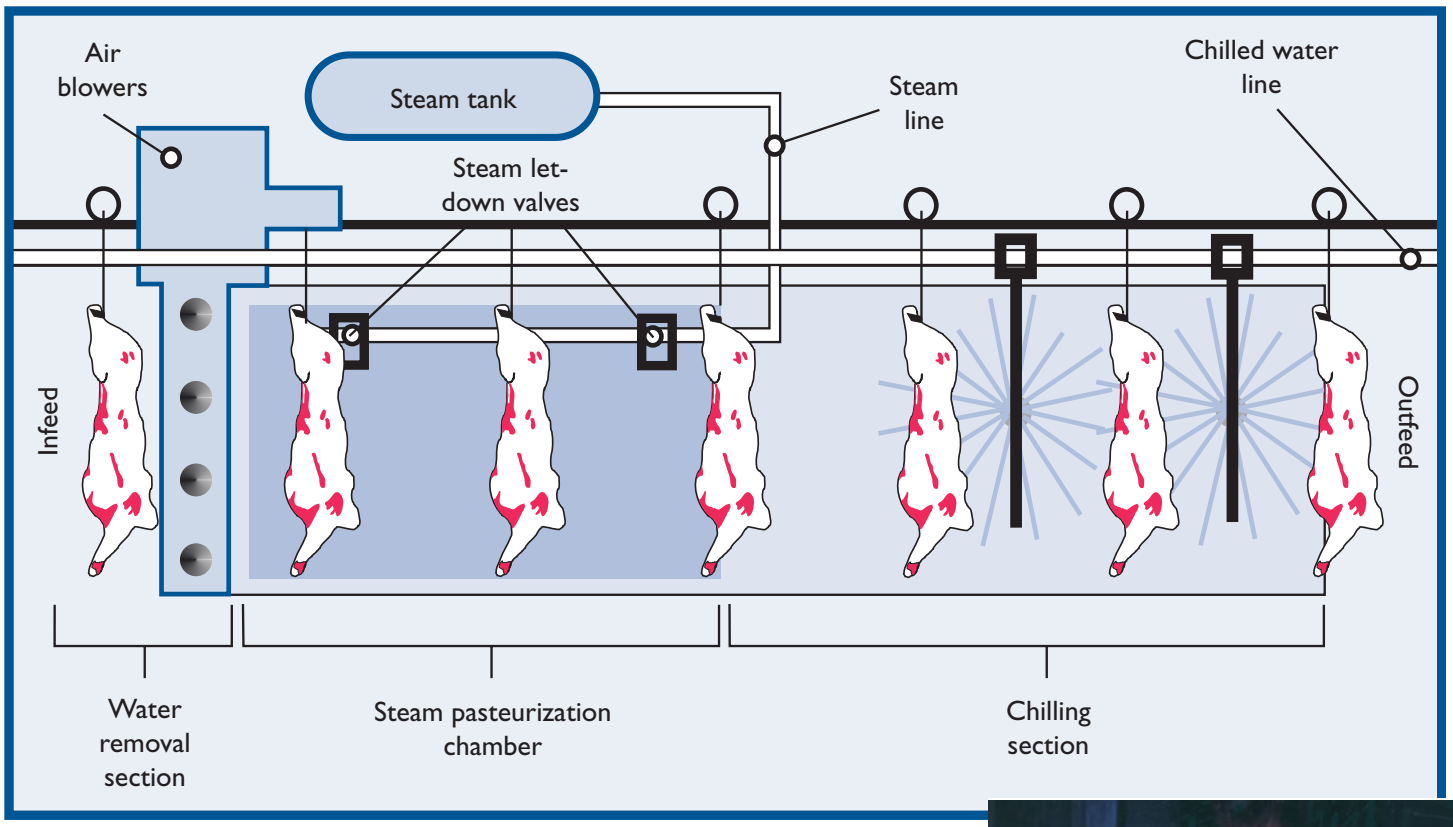
To reduce marketing risk and better tailor the invention to the needs of the beef industry, Frigoscandia Equipment partnered with Excel, the second largest U.S. beef packing company. With Excel's expertise in operating beef packing plants,

Steam pasteurization reduces average pathogen population on beef carcasses



Source: Data from Phebus, R.K. et al., 1997, "Comparison of Steam Pasteurization and Other Methods for Reduction of Pathogens on Surfaces of Freshly Slaughtered Beef," *Journal of Food Protection* 60(5).

Beef Steam Pasteurization System—Static Chamber Unit



Source: Frigoscandia Equipment.

the innovation could be tested in high-speed, large plants to create a commercially viable new technology. Frigoscandia and Excel then asked Kansas State University microbiologists to independently test the pathogen-reducing performance of the equipment. The Kansas State team found that steam pasteurization was the most effective control method of those studied in reducing pathogenic bacteria on surfaces of freshly slaughtered beef.

After receiving acceptance of the technology from USDA's Food Safety and Inspection Service (FSIS) in 1995, Frigoscandia Equipment began marketing its equipment. To keep competitors from selling "knockoffs," Frigoscandia secured four patents. Frigoscandia benefited from its innovation with strong sales.

By 1997, Excel had installed the equipment in all its beef slaughter plants, and IBP, the largest beef packer in the U.S. announced its intent to install the equipment in its plants. Excel benefited from its early collaboration with Frigoscandia by positioning itself as a leader in food safety and enjoying an increase in beef sales and contracts.

A National Survey Confirms the Importance of Buyer Specifications

Both case studies indicate the importance of channel captains in creating markets for food safety and spurring innovation. But how widespread is this phenomenon in the U.S. meat and poultry industry?

Tanya Roberts, USDA/ERS

Beef sides exiting the steam pasteurization chamber in a Colorado plant.

Tanya Roberts, USDA/ERS

Systematic testing is a critical component of Texas American's safety protocol.

Plant Managers Queried About Safety Procedures

Almost 1,000 plant managers or food safety officers responded to the ERS/Washington State University survey. Forty questions covered food safety protocols, investments, and recent changes in response to market conditions or to the 1996 Pathogen Reduction/HACCP regulations. Sample questions from each of the five categories follow:

- **Equipment.** Does the plant use a steam carcass pasteurizer, such as Frigoscandia's?
- **Testing.** Does the plant conduct more tests than required by Federal regulation and, in particular, does it test raw or cooked product for *E. coli* O157 or *Listeria*?
- **Dehiding.** Does the plant use an air exhaust system vacuum or other system that creates negative air pressure around the carcass in the dehiding area?
- **Sanitation.** How often are drains sanitized?
- **Plant operations.** Are employees offered incentives, such as gifts or compensation, for detecting and reporting possible sources of contamination or unsanitary conditions?

A national survey of U.S. meat and poultry slaughter/processing plants was conducted by researchers from ERS and Washington State University (see "Market Incentives Raise Food Safety Bar" on page 7). The survey contained 40 questions about food safety technologies and practices in five broad categories: equipment, testing, dehiding (for cattle slaughter plants), sanitation, and plant operations (see box, "Plant Managers Queried About Safety Procedures"). An index from zero to one was created to rate the use of food safety technologies and practices across meat and poultry plants. Plants earned higher ratings if they reported sophisticated food safety equipment, conducted more extensive pathogen testing, or employed more intensive cleaning operations. The data reveal wide variability in food safety practices among U.S. plants.

Food safety rating higher for beef plants with buyer specifications or exports

Food safety practices and technologies (1.0 is highest rating)	Buyer specifications[1]		Exports products[2]	
	No	Yes	No	Yes
Overall food safety rating	**0.43**	**0.63**	**0.43**	**0.64**
Equipment	0.30	0.56	0.28	0.62
Testing	0.35	0.77	0.36	0.79
Dehiding	0.28	0.48	0.28	0.51
Sanitation	0.51	0.61	0.54	0.60
Plant operations	0.58	0.68	0.59	0.68
Number of plants	128	98	169	84

[1] Survey question: "Do some major customers of plant test product for pathogens or harmful bacteria or require sanitation and product handling practices that are more stringent that those demanded by FSIS?" Twenty-nine plants did not indicate whether customers impose standards.
[2] Survey question: "Does this plant export products outside the United States?" Two plants did not indicate whether they export.

Food safety index scores are considerably higher in all five safety categories for beef companies that face buyer specifications for pathogen control than for those that do not. For example, plants that said their products must meet stringent buyer requirements, including foreign buyers, had scores of 0.77 for testing, while those that did not had scores of 0.35. The results support what was learned in the two case studies. Buyers who pay a premium or guarantee sales for higher safety standards enable suppliers to benefit from investments in food safety technologies.

In all five categories, the food safety index score is markedly higher for beef companies that export than for those that do not, suggesting that foreign buyers are imposing food safety requirements and acting very much like large domestic buyers. Differences in the index scores are larger for equipment, testing, and dehiding technologies than for sanitation and plant operations.

Keith Weller, USDA/ARS

Technician with USDA's Meat Animal Research Center reads DNA sequence of livestock.

Channel Captains Benefit, Too

The emergence of large, technically proficient buyers is helping to create markets for food safety and spur food safety innovations. The question remains as to why some fast food restaurants and large retailers have adopted the role of channel captains, monitoring the safety of products up and down the hamburger supply chain. Why have they taken on the added expense of testing and audits?

The major, name-brand fast food restaurant chains and large retailers are able to appropriate some of the benefits of their investments in food safety because of enhanced reputations for safe food. Maybe even more importantly, though, these firms benefit from their investments through a reduced risk of being associated with a foodborne illness outbreak. This is doubly important for restaurants that tend to have higher risk of liability than others in the meat supply chain because they are more easily identified than others in the chain and because they are responsible for final food preparation. In addition, restaurant and retail chains have much to lose if identified as the source of an outbreak, namely their large investments in brand name equity.

Could Government Provide Additional Incentives?

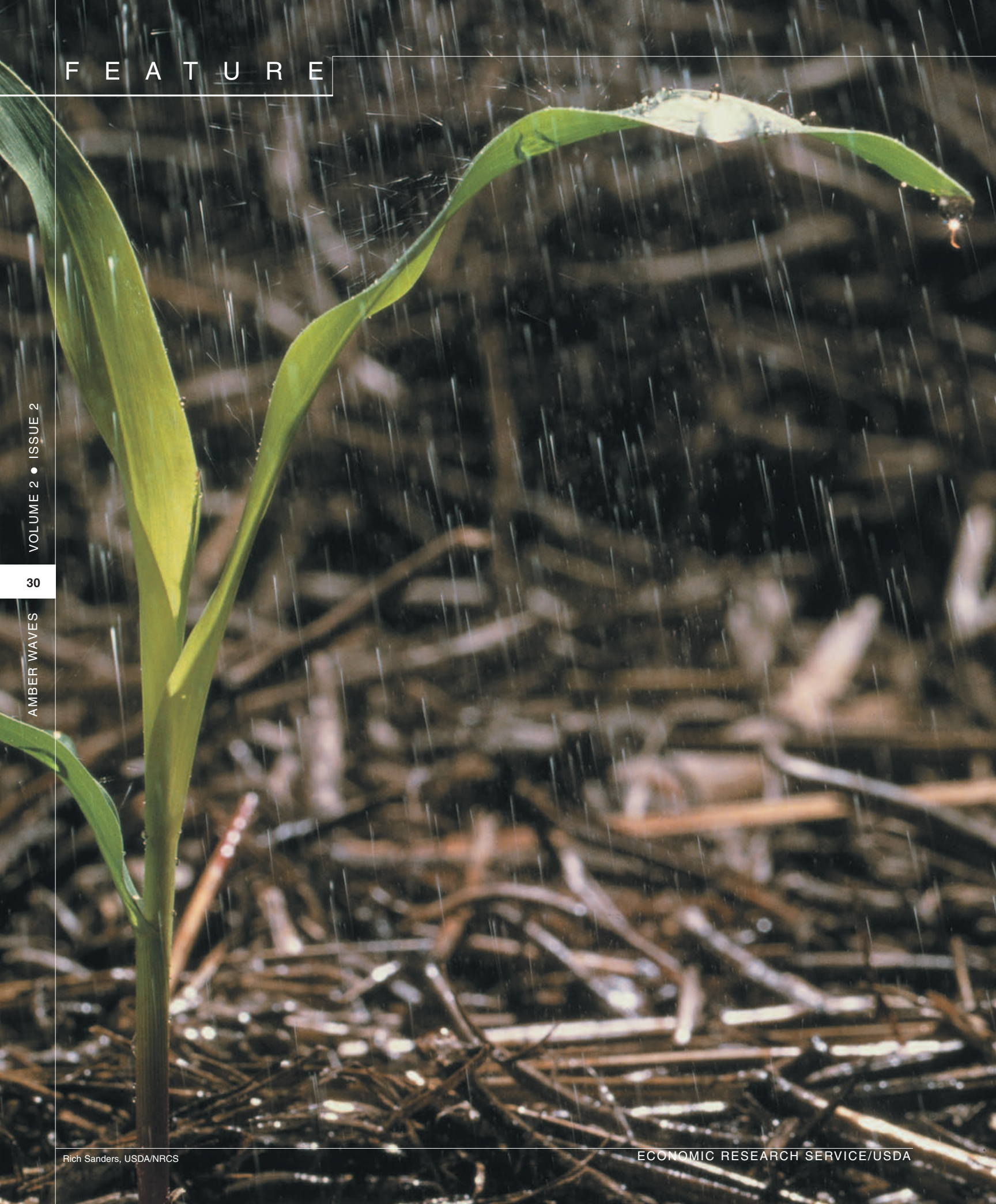
The success of the fast food restaurants and other channel captains in stimulating innovation reveals the importance of information for safety performance. All channel captains require their suppliers to provide testing and/or other evidence that food safety standards have been met.

Government policy targeted at increasing information on safe and unsafe producers may help spur innovation. The Federal Government, for example, could post more food safety information about the performance of individual plants and their products, enabling consumers and commercial buyers to compare safety records. Government-approved "Enhanced Food Safety" labels would be an additional cue to consumers. This information increases the visibility of food safety innovators, allowing them to appropriate the benefits of their investments.

This article is drawn from . . .

Food Safety Innovations in the United States: Evidence from the Meat Industry by Elise Golan, Tanya Roberts, Elisabete Salay, Julie Caswell, Michael Ollinger, and Danna Moore, AER-831, USDA/ERS, April 2004 available at: www.ers.usda.gov/publications/aer831/

For more information on ERS's food safety research, visit: www.ers.usda.gov/emphases/safefood/



Rich Sanders, USDA/NRCS

Beyond Environmental Compliance

Stewardship as Good Business

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Agriculture is intrinsically linked to the environment: roughly half of all land in the lower 48 States is farmland, including cropland, land in the Conservation Reserve Program, pastureland, and rangeland. Both crop and animal production generate pollutants that enter the air as well as surface and ground waters. The Natural Resources Conservation Service estimates that the annual loss of soil from water erosion is approximately 1.07 billion tons per year. The U.S. Environmental Protection Agency (EPA) estimates, based upon areas sampled, that pollutants originating from this runoff contribute to an estimated 60 percent of impaired river areas, 30 percent of impaired lake areas, 15 percent of impaired estuarine areas, and 15 percent of impaired coastal shoreline.

Agricultural pollution is difficult to control. For one thing, agricultural pollutants are transmitted from widely dispersed sources, such as through runoff from many individual farms. For this reason, programs to address agricultural pollution have remained largely voluntary.

However, growing evidence suggests that good economic performance is compatible with good environmental performance. For example, firms in the Dow Jones Sustainability Index (companies that incorporate environmental and societal concerns into their long-term economic investment strategies) outperformed the 2,500 largest capitalized companies that make up the Dow Jones Global Index (with cumulative gains in nominal market value of 85 percent compared with 57 percent) between 1993 and 2003. The positive correlation between environmental and economic performance is especially apparent in industrial sectors with substantial exposure to environmental risk. This evidence challenges the traditional notion that complying with environmental regulations saps profitability and suggests that going "beyond compliance" can result in a competitive advantage. For example, firms with better environmental records may be more attractive to investors due to reduced compliance costs and a lower risk of future liabilities.

Recent ERS analysis suggests that agricultural producers can also benefit economically by voluntarily adopting environmentally beneficial practices. An efficient farm would naturally minimize unnecessary applications of pesticides and fertilizer, enhancing the bottom line as well as minimizing environmental impacts. But additional incentives may exist for farms to invest in environmental management. For example, those producers who accurately anticipate regulations or changes in consumer tastes for food grown with environmentally friendly technologies could gain a competitive advantage in the marketplace.

In other words, incentives facing agriculture are not that different from those facing other firms trying to plot a sustainable growth path. Specifically, ERS research found this to be true for U.S. corn producers who use crop residue management (CRM) to minimize damages from agricultural runoff. These producers enjoy a clear economic edge over non-CRM corn producers.

Nature of Agricultural Pollution

There are a few cases in which regulations affect agriculture directly. These include the Food Quality Protection Act of 1996, which enables the EPA to regulate pesticide use; the Endangered Species Act, which allows the Federal Government to restrict agricultural practices as part of species recovery plans; and the Federal Water Pollution Control Act of 1972 (including the Clean Water Act provisions), which requires landowners to obtain a permit before discharging pollutants into wetlands linked to navigable waters and restricts manure management practices on concentrated animal feeding operations.

Yet, these affect only a subset of agricultural producers. Agricultural rowcrop production is for the most part exempt from Federal environmental regulation. Many regulatory approaches used in other industries are not well suited for

Dow Jones Sustainability Index exceeds Dow Jones Global Index

Source: ERS tabulation of Dow Jones index data, www.djindexes.com

Barry Runk/Stan, Grant Heilman Photography

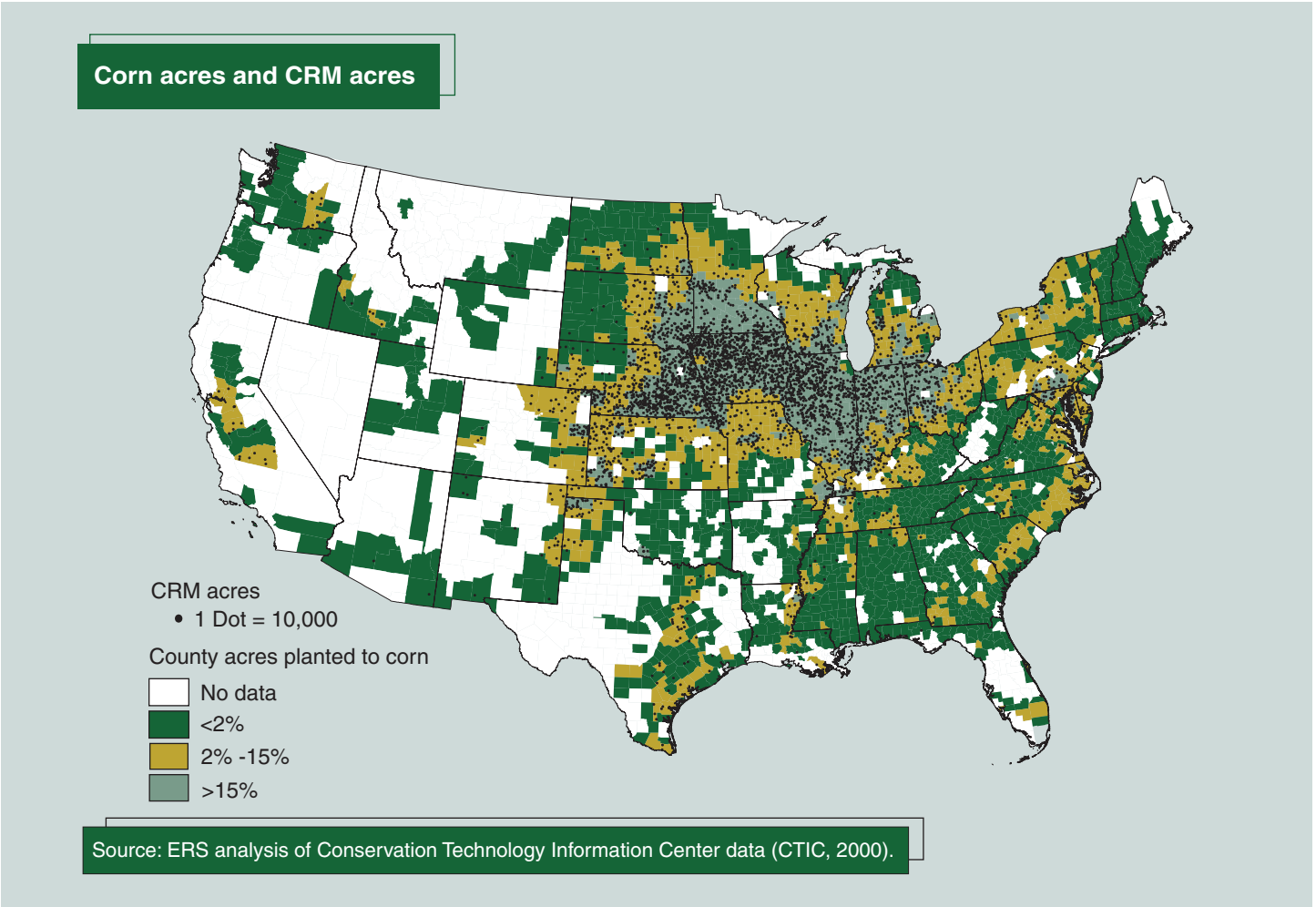
agriculture. Agricultural pollutants are transmitted through runoff, through groundwater leaching, or through the atmosphere, so it is difficult to identify individual sources of excessive agricultural pollutants in a stream or lake. Similarly, the amount of pollutants leaving a particular farm in a particular year may not be "excessive," but, over time and combined with runoff from other farms, these pollutants may contribute to a significant degradation of U.S. air, water, and soil.

For the most part, U.S. agricultural policies have relied on voluntary programs—such as the Conservation Reserve Program and the Environmental Quality Incentives Program—to reduce or mitigate impacts of agricultural production on the environment. Highly erodible acreage is subject to conservation compliance requirements, which tie the receipt of most Federal farm payments to the adoption of an approved soil conservation system. Although 87 percent of all corn farmers participate in farm commodity and environmental programs, only 30 percent operate highly erodible lands. Yet, 60 percent of corn farmers use crop residue management, even though many do not need to in order to meet conservation compliance requirements. Links between economic performance on U.S. farms and their environmental management can be identified regardless of the regulatory environment.

U.S. Corn Sector

Corn production occupies a large share of land used in agriculture—76 million acres—and generated $19 billion in sales in 2001, over 75 percent of total U.S. grain production. In addition, corn production uses more than 40 percent of commercial fertilizer applied to crops. Rainfall and snowmelt can cause significant erosion on cornfields, which has been linked to declining soil quality, contamination of surface-water drinking supplies, and degraded aquatic habitats and recreational opportunities. Thus, the environmental stewardship of corn producers has a significant bearing on the overall environmental performance of U.S. agriculture.

Many management technologies are available to mitigate the environmental impacts of erosion and agricultural runoff from grain production. Such practices include alternative fertilization, tillage, crop rotation, and pesticide regimes. ERS research has focused on one such practice: conservation tillage or crop residue management (CRM). Conventional or "clean tillage" practices turn over soil in order to clear away the remains of the previous crop and prepare the seedbed prior to planting. With CRM, the producer plants the new crop directly into residue from the previous crop. This practice has been used for several decades because it reduces area planted or yields only



slightly, yet significantly decreases soil loss and agricultural runoff relative to conventional tillage. Agricultural engineers estimate that soil erosion can be reduced by a third if 15 percent of after-harvest residue from corn is left on the field rather than turned under by tilling. Higher rates of CRM (i.e., leaving more crop residues on top of the soil) will reduce soil erosion even further, but at a diminishing rate.

On the other hand, adoption of a specific environmental management system, such as CRM, by itself does not necessarily result in overall improvements in environmental performance. Environmental performance is multifaceted and improvement in one area may come at the expense of another. For example, use of CRM sometimes requires higher pesticide use, in which case reduced soil erosion must be weighed against a greater potential for pesticide runoff.

Good Environmental Managers Are Also Efficient

Recent ERS research indicates a relationship between corn producers' economic efficiency and their investments in environmental management, with CRM adherents enjoying a clear economic edge over farmers using conventional tillage. The research was based on data from the 2001 Agricultural Resource Management Survey. The average total resource cost (which includes land and operator labor costs as well as material inputs) across all farms producing corn was $1.78 per dollar of output. The average was 31 cents lower for CRM corn farms versus non-CRM corn farms. The two groups vary in other ways as well. For example, CRM users generally operate larger acreages (273 acres versus 151 acres on non-CRM farms) and had higher yields per acre (131 versus 121 bushels.) These differences complicate efficiency comparisons.

A number of studies have noted that CRM tends to lower costs of labor, equipment, and fuel in corn production, and that these costs savings more than offset declines in crop yields or increased pesticide use. The gap in economic efficiency is observable not only at the mean, but among both lowest cost and highest cost farms as well. Of course, economic efficiency varies widely among both adopters

Agricultural Resource Management Survey (ARMS) — 2001 Corn Producers

Studies of publicly held businesses use stock prices to examine the correlation between economic and environmental performance. In lieu of stock prices, ERS uses the "total farm expense ratio," or total resource costs per dollar of corn output, as a measure of a farm's economic performance or efficiency. This measure of farm efficiency is endorsed by the Farm Financial Standards Council.

The data used in the analysis of crop residue management (CRM) and farm efficiency come from the 2001 Agricultural Resource Management Survey (ARMS) of U.S. corn farm operators. Our subsample of 1,544 corn producers, when expanded, represents 94 percent of all acres planted to corn for grain. (Full coverage is not possible because detailed corn data were drawn only from the 19 highest producing States). ARMS is USDA's primary source of information on the financial condition, production practices, resource use, and economic well being of America's farm households. Sponsored jointly by ERS and the National Agricultural Statistics Service (NASS), ARMS began in 1996 as a synthesis of the former USDA cropping practice, chemical use, and farm costs and returns surveys, which dated back to 1975. ARMS data are essential to USDA, congressional, administration, and industry decisionmakers when weighing alternative policies and programs that touch the farm sector or affect farm families. In short, ARMS is the mirror in which American farming views itself.

Detailed cost and return data allow for assessment of the efficiency of the corn operation within the overall farm. Corn returns are calculated as the market value of a farm's corn output, but do not include the value of government payments received. Costs are calculated as the sum of the value of all purchased inputs and the opportunity costs associated with land, capital, and labor. While both prices and quantities are available from the ARMS for many purchased inputs such as chemicals, fuel, and seeds, the cost of some resources must be estimated (such as the cost of replacing capital) based on the value of a farm's corn output relative to the value of all other outputs. The value of an operator's own labor is estimated on the basis of wages paid to farm operators working off-farm, and cropland is valued at the cash rental value for similar acreage in the area.

The analysis cited in the main text compared total resource costs of CRM users versus nonadopters. Total resource costs include operating costs (items used as inputs in corn production), the annualized cost of maintaining the machinery and other capital invested, and the cost for other resources such as land and the operator's labor. These costs averaged $1.78 per dollar of output. Average operating costs alone were $0.76 per dollar of output, and average operating and ownership costs (excluding land and operator labor) were $1.20 per dollar of output.

Approximately 60 percent of corn farms reported using CRM in 2001. Farm-level data show that the best way to predict whether any individual farm uses CRM is whether the farm has used it in the past. Farms that operated acreage particularly susceptible to erosion due to soil type, the lay of their fields, or the amount of rainfall received were also especially likely to adopt CRM. Farmers with highly erodible fields (about 20 percent of all corn farms operate such fields) are required under Conservation Compliance to apply an approved soil conservation system in order to maintain their eligibility for commodity program benefits. Interestingly, farms that are more efficient economically were also more likely to adopt CRM than less profitable farms, testament to the dual economic and environmental payoff of CRM adoption.

Corn production survey data (2001)

Characteristic	Units	All corn farms	CRM adopters	Nonadopters
Crop residue management user	Percent	60	100	0
Corn acres planted	Acres	224	273	151
Economic efficiency (cost per $ of output)	$ input/$ output	1.78	1.66	1.97
Operator age	Years	52	52	52
Limited-resource part-time	Percent	25	24	26
Received cost-share	Percent	3	4	1
Installed drainage system	Percent	38	41	33
Actual yield	Bushels per acre	127	131	121
Yield goal	Bushels per acre	140	143	135
Owned share of total corn acres	Percent	53	53	52
Sold corn in cash market	Percent	46	46	48
Precision agriculture user	Percent	16	20	10
Corn acreage is highly erodible	Percent	19	24	11
Used no-till in the past	Percent	24	33	10

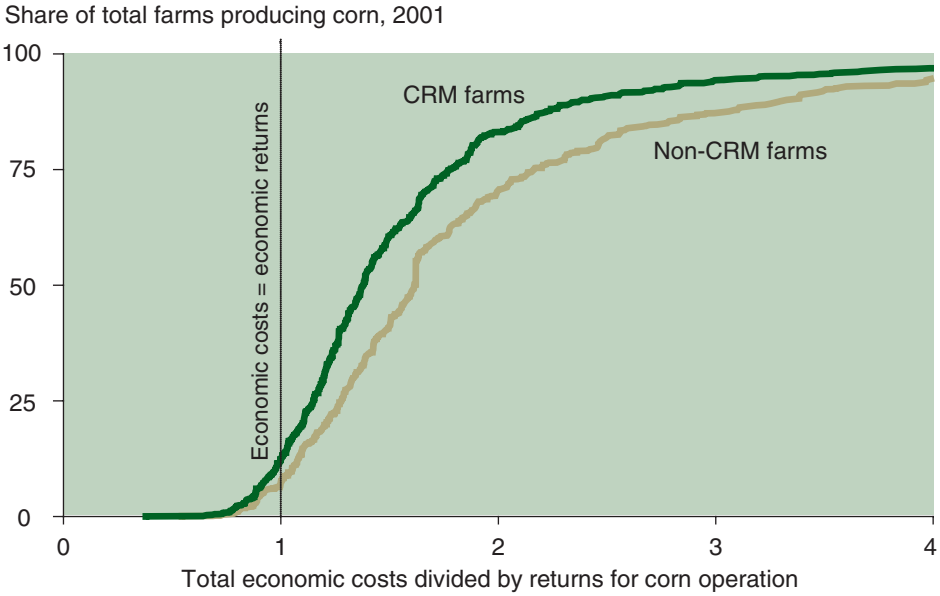
Source: ARMS.

Tim McCabe, USDA/NRCS

and nonadopters of CRM, due to underlying differences in management and growing conditions. Along the full range of corn farms, those that employ CRM are more efficient than those that do not. In general, the gap in efficiency between the two groups grows as total costs per dollar of output increase. The benefits of CRM vary with soil and climate conditions, among other factors. About two-thirds of CRM corn farms are found in the Heartland, the most favorable climate for corn production; CRM is less likely to be found in the northernmost reaches of the Heartland.

Unobservable differences (such as management abilities) between the groups are important in determining the CRM premium, affecting both the decision to adopt CRM as well as the economic efficiency of the corn enterprise. As a result, even with the promise of increased economic efficiency, some farms may not switch from conventional tillage to residue management. Nonadopters may have lower overall management abilities, they may believe that conventional tillage simplifies their overall farm management, or off-farm work may preclude the deployment of management-intensive production systems. (CRM use requires an operator to pay closer attention to moisture and weather conditions during the planting season, especially during cool and damp weather.) The average economic efficiency of CRM users, after correcting for unobservable sample selection effects, was estimated to be $1.05 (in other words, on average $1.05 of costs were incurred in the production of a dollar's worth of corn). Compared with the overall average ($1.78), this represents a premium for CRM adoption of 73 cents, much higher than the 31-cent premium found from a simple comparison of adopter and nonadopter means.

CRM farms more efficient than non-CRM corn farms



Source: ARMS.

Going Beyond the Bottom Line

This study builds on the growing literature that documents and explains the positive relationship between environmental performance and financial performance within and across many industrial sectors, especially those with considerable exposure to risky and undesirable environmental outcomes. In general, improved environmental performance over the past 15 years in these industries has been the result of environmental regulation; innovation has taken place in part

Laura Greiner, USDA/NRCS

because of the need to comply with those regulations. However, a growing number of firms in all sectors have voluntarily introduced measures that go beyond compliance and have simultaneously improved economic performance. This trend suggests that industry can be a major force in improving environmental conditions, not just in the U.S. but worldwide.

Might not the same be true for agriculture? U.S. agriculture contributes more than $80 billion a year to GDP and has significant links to the environment. Although agriculture has not been heavily regulated with respect to its environmental impacts, it is coming under increasing scrutiny in this regard from some consumers. Affluent consumers are demanding more environmentally benign products, and large foodservice firms are responding. Agriculture too has the potential to improve environmental conditions through efforts that go beyond compliance with program requirements. The extent to which this potential is realized will depend on the market and policy incentives that shape farmers' decisions.

In the corn sector, many farmers are employing crop residue management practices voluntarily. Although, in part, CRM use is likely the result of the desire to maintain eligibility for farm program payments, CRM also brings demonstrable efficiency gains to farmers. So why have 40 percent of the corn farms sampled not adopted this technology?

For one, farmers may consider the benefits small relative to other ways that can improve profitability. Moreover, year-to-year fluctuations in costs and returns may obscure the returns to CRM. The technology may also be less suited to some regions and soil types. In particular, CRM adoption rates have been lower in colder and wetter climates. However, our results indicate that even in these areas corn producers adopting CRM on their corn acres were no less profitable than nonadopters. The data behind the ERS survey, although extensive, are unfortunately not comprehensive enough to control for everything affecting farm profitability, and some of these factors could help explain nonadoption. Farmers ultimately make "bottom-line" decisions in a context that includes not only market conditions but also regulations, voluntary incentive programs, and household goals and objectives. While our findings indicate that many farmers will choose to go beyond compliance with program requirements, whether farmers go "far enough" to meet broader environmental objectives remains an open question.

This article is drawn from . . .

"Beyond Compliance: Sustainable Business Practices and the Bottom Line," by Dennis Aigner, Jeffrey Hopkins, and Robert Johannson, *American Journal of Agricultural Economics*, December 2003.

The ERS Briefing Room on Farm Income and Costs: ww.ers.usda.gov/briefing/farmincome/

A Historic Enlargement

Ten Countries Prepare To Join the European Union

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European Commission, Peter Hudec

From the day the Berlin Wall fell in 1989, the governments of the formerly communist countries of Central and Eastern Europe (CEE) began to discuss the idea of joining the European Union (EU). In May 2004, after a 14-year transition from central planning to market economies, eight CEE countries (Poland, Hungary, the Czech Republic, Slovakia, Slovenia, Estonia, Latvia, and Lithuania), plus Cyprus and Malta, will join the EU. Bulgaria and Romania are also preparing for accession and are expected to join in 2007. In 2002, Croatia submitted its application for membership, and it is possible that Croatia, too, will be ready to join in 2007 (see box, "Who Are the Acceding Countries?").

This enlargement of the EU, the largest in its history, will bring profound changes to Europe. The EU population will grow by 28 percent, with arable land increasing by nearly 40 percent. Grain area in the 10 candidate countries totaled 16 million hectares in 2000, nearly half the grain area in the current EU-15. The EU-15 is already a larger agricultural producer than the United States. The EU-25 will be an even larger presence on the global agricultural market.

Accession to the EU carries deep political symbolism for the citizens of the candidate countries. It will be a concrete signal to the world that these countries have finally broken free from their Communist past and rejoined Europe. East European voters approved accession in a series of referenda held in 2003, in the hope that membership would expand markets, raise incomes, and attract new foreign investment.

But many CEE farmers are apprehensive. In the early 1990s, many of them welcomed EU accession and the potential for higher prices and incomes. However, the expected financial gains will likely be limited by several factors. First, EU and CEE agricultural prices for many products have converged over the last decade. Second, CEE farmers will generally receive lower payments than their EU-15 counterparts. Third, though producers will receive direct payments from the EU, they will also incur the costs of complying with EU sanitary, veterinary, and animal welfare regulations.

CEE countries have already made several adjustments to their production and trade approaches in preparation for accession. As a result, the short-term impacts of enlargement on CEE and global commodity production and trade will likely be moderate. In the longer term, however, CEE producers may be forced to restructure their agriculture sectors to maintain competitiveness, which could lead to a significant rise in agricultural productivity.

EU Membership Will Bring Costs as Well as Benefits

Much has changed since the early 1990s, when most CEE farmers anticipated significantly higher incomes as a result of joining the EU. At that time, EU commodity prices were substantially higher than CEE prices, and EU farmers received generous income support. But the short-term benefits of accession will be less than initially expected, and CEE farmers have become increasingly aware that there will be costs as well.

Price gaps have narrowed. Over the past decade, the gap between EU and CEE prices has narrowed considerably, for a number of reasons:

- Exchange rates have changed. The currencies of the candidate countries have gradually strengthened against the euro.
- The EU itself underwent significant agricultural policy reform (see box, "The EU Common Agricultural Policy: A Decade of Reform"). In 1992, the EU reduced intervention prices (price supports) and introduced a system of direct payments to producers to compensate for the lost income. Agenda 2000, introduced in 1999, further reduced intervention prices.

European Commission, Mario Dudar

Nancy Cochrane, USDA/ERS

Who Are the Acceding Countries?

There is considerable diversity among the acceding countries, despite the fact that eight of them have a common history of 40 years under communism. Poland and Hungary are by far the largest agricultural producers. Hungary and the Czech Republic are dominated by large-scale farming, while Poland is characterized by 2 million farms, most under 10 hectares. Some countries, such as Hungary and Slovenia, are well prepared for accession; Poland, on the other hand, will face some serious adjustment difficulties.

Cyprus and Malta, unlike the other candidates, have long traditions as market economies. But they are similar to many of the CEEs in that they are dominated by small, largely part-time farmers. Their main products are fruits, vegetables, meat, and dairy products.

Hungary, the Czech Republic, and Slovakia are dominated by large-scale farming. During the early 1990s, land belonging to the state and cooperative farms was returned to private ownership, but most landowners have chosen to lease their land to new, market-oriented corporate or cooperative farms. The three countries produce large amounts of grain, and are usually net grain exporters. Hungary, however, is the only net agricultural exporter among all 10 candidate countries. Hungary has also managed to reduce the share of labor employed in agriculture, mainly by providing generous pensions to encourage retirement.

The three Baltic countries—Estonia, Latvia, and Lithuania—have smaller agricultural sectors, dominated by livestock products, mainly dairy. Only Lithuania has significant grain production. Small- to medium-sized private farms dominate in all three countries.

Slovenia, once the richest republic of the former Yugoslavia, gained its independence in 1991. The country has enjoyed rapid growth since independence and now has the highest per capita GDP of all the East European candidates. It also has the smallest agricultural sector, accounting for only 3 percent of GDP in 2001. Slovenia's agricultural landscape is dominated by small, private farms averaging just 5 hectares. The main output is dairy products, followed by meat.

Poland is the largest of all the candidate countries, in terms of both population and agricultural production. Poland is also the largest potential headache for the enlarged EU. In many ways, Poland has been among the most successful reformers of Eastern Europe—the overall economy has achieved significant positive growth every year since 1992. However, agriculture has grown more slowly, and productivity is low—the sector employs 19 percent of the labor force but contributes only 4 percent of GDP. Even during the Communist period, 80 percent of Poland's agricultural land was in the hands of private farmers. Poland currently has about 2 million farms, averaging just 8 hectares, and many farms are highly fragmented, consisting of several noncontiguous plots. Less than half of Poland's farms produce for the market; the remainder produce mainly for home consumption. EU officials continue to fret over the cost of subsidizing Poland's 2 million farmers and are hoping to see a considerable reduction in this number after accession. At the same time, the Polish Government is under intense political pressure to get the most favorable deal for its farmers, and Polish officials in Brussels have proven to be very tough negotiators.

Basic indicators of the acceding countries, 2001

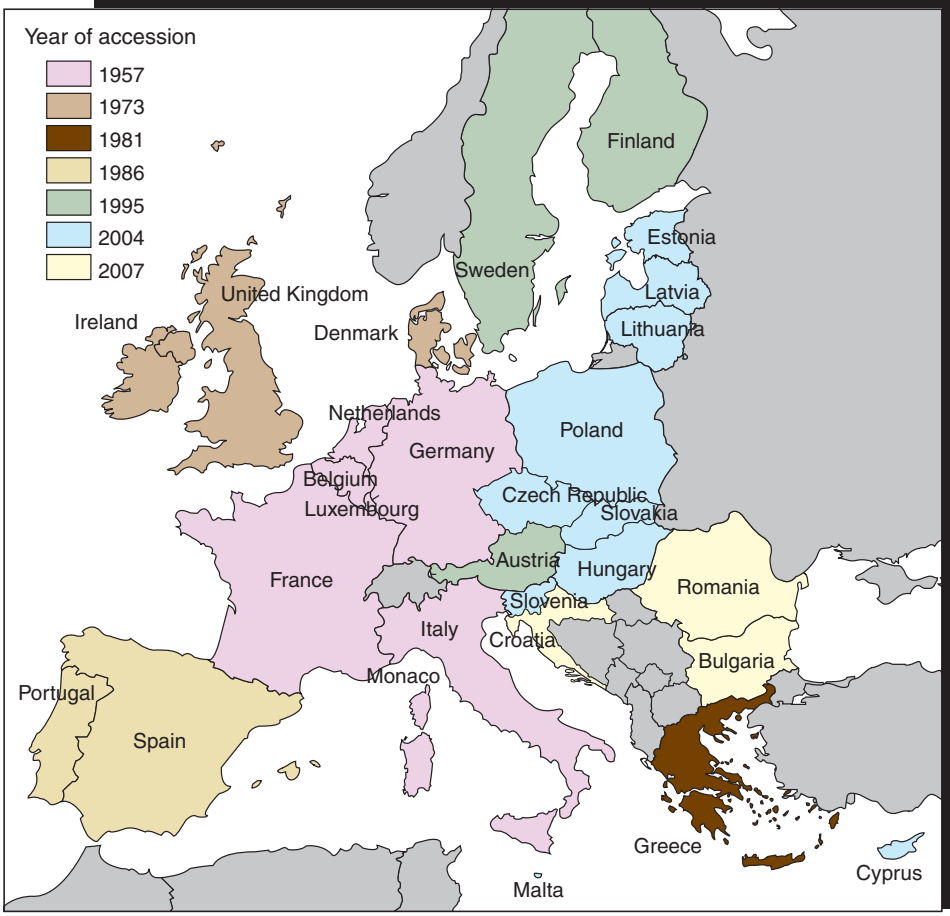
Country	Population	Per capita GDP as percent of EU average	Agricultural land	Arable land	Agricultural share of GDP	Agricultural share of employment
	1,000	*Percent*	*1,000 hectares*		*Percent*	
Cyprus	790	83	117	72	4.0	4.8
Czech Republic	10,260	61	4,278	3,076	4.2	4.6
Estonia	1,377	37	1,433	1,120	5.7	7.1
Hungary	9,917	52	5,865	4,614	4.3	6.1
Latvia	2,406	30	2,480	1,841	4.8	15.1
Lithuania	3,689	28	3,487	2,930	7.2	16.5
Malta	392	n.a.	10	9	2.6	2.3
Poland	38,577	38	18,392	13,974	3.8	19.2
Slovakia	5,403	50	2,450	1,450	4.5	6.3
Slovenia	1,985	73	510	285	3.3	9.9
All 2004 candidates	74,796	n.a.	38,479	28,496	n.a.	n.a.
EU-15	375,346	n.a.	142,614	74,470	1.5	4.7

n.a. = Not available.
Sources: Food and Agriculture Organization of the United Nations, EU Commission, Eurostat.

- During the 1990s, CEE governments, in an effort to align their policies with those of the EU, began to intervene strongly in some markets, resulting in higher CEE prices. Poland maintains an aggressive intervention program for wheat, rye, sugar, and dairy products. Hungary and the Czech Republic, on the other hand, have supported their livestock sectors more than crops.
- For many products, the price gaps of the early 1990s reflected quality differences more than policy differences. Pork and beef prices reported by the EU are for the top three grades—in terms of lean meat content—of the EU grading system (known as EUROP). CEE statistical offices have historically reported average prices for all grades. Throughout the CEE, however, the average lean meat content has been increasing, and more pork and beef now meets the top three EU grades. CEE prices for pork and poultry are now, as a result, on par with EU prices.

CEE producers will receive lower direct payments per hectare than their EU counterparts. A major bone of contention during the accession negotiations was the level of direct payments that CEE producers will receive (see box, "The EU Common Agricultural Policy: A Decade of Reform"). The EU Commission realized that it would be impossible to provide the full range of direct payments to CEE farmers without violating the budget limits agreed upon in Agenda 2000. For this reason, the final compromise provides for a 10-year phase-in of payments. The EU will provide only 25 percent of the payments from the Common Agricultural Policy (CAP) budget during the first year; this share will increase by 5 percent each year until CEE farmers receive 100 percent of EU payments. However, national governments will be allowed to top off these payments by a maximum of 30 percent each year, so that payments during the first year of accession could be as much as 55 percent of what current EU farmers receive.

The 2004 European Union enlargement will be the most ambitious ever. . .



. . .and the acceding countries have been preparing for 10 years

1994 Signing of the Europe Agreements granted important trade preferences to CEEs

1998 Formal start of negotiations

1999 EU's Agenda 2000 established the budgetary framework for enlargement

2000 Trade agreements expanded trade preferences

2002 Further trade agreements liberalized most EU-CEE trade

Dec 2002 Negotiations finalized at the Copenhagen Summit

April 2003 Signing of Accession Treaty

May 2004 Ten new members join the EU

Nancy Cochrane, USDA/ERS

Direct payments will also be lower for CEE countries because of the way the payments are computed. Payments are tied to the yields associated with a reference period—1995-99—and to a reference area. Because of the disruptions caused by the transition from central planning to free markets, CEE yields during 1995-99 were substantially lower than those of the EU, which will keep CEE payment levels lower relative to EU payment levels.

CAP reforms approved in June 2003 will convert these payments to a single whole-farm payment between 2005 and 2007, so that they will be fully decoupled from production decisions. The reforms also call for additional direct payments to compensate for cuts in dairy prices. According to subsequent statements from the EU Commission, the whole-farm payment and all other new payments to CEE farmers will be phased in according to the same 10-year schedule.

The result is that per hectare payments received by the average CEE farmer during the first year of accession will be one-fourth the amount received by the average EU farmer. Payments will vary, of course, by country and by farm size. Small farms in Poland will receive less than 300 euros per year, while large farms in the Czech Republic or Hungary will receive as much as 40,000 euros ($1=0.8 euro).

Compliance with EU regulations will have costs. All the candidate countries must adopt the entire body of laws and regulations of the EU, known as the *acqui communautaire*. There are approximately 80,000 pages of EU laws and regulations relating to market regulation, veterinary and sanitary controls, animal welfare, and the administrative structures needed to implement EU price and income support programs.

To receive EU price and income supports, CEE producers will have to absorb the costs of this compliance. Grain producers, for example, will have to meet minimum quality requirements to receive the EU price. Livestock breeders will have to raise, transport, and track all animals according to the animal welfare regulations and recordkeeping requirements of the EU. All these measures will increase production costs, which will erode net returns of producers.

In addition, the administrative burden to acceding CEE governments will be considerably large, as agencies must maintain detailed databases on production, animal numbers, and other pertinent information for each farm that will receive EU payments.

Short-Term Impacts on Commodity Output Will Be Mixed

Given these facts, recent ERS analysis suggests that, in the short term, CEE out-

The EU Common Agricultural Policy: A Decade of Reform

The fundamental objectives of the EU Common Agricultural Policy (CAP) are to: (1) increase agricultural productivity, (2) ensure a fair standard of living for farmers, (3) stabilize markets, (4) guarantee regular supplies of agricultural products, and (5) ensure reasonable food prices for consumers.

To accomplish these objectives, the EU uses several basic policy instruments:

Intervention prices. The EU fixes floor prices for grains, beef and veal, dairy products, and sugar. When market prices fall below that floor, farmers can sell their produce to the EU intervention agencies at annually adjusted prices. Products must meet minimum quality requirements in order to be accepted into intervention, but intervention agencies must accept all commodities that meet those standards. Surplus commodities are then placed in member state storage facilities.

Import tariffs. The EU sets tariffs at the external borders of the EU at levels that prevent imported commodities from being sold at prices below the desired internal market prices.

Export subsidies. When world prices are below the EU market prices, EU exporters can receive a subsidy that enables them to export competitively at the lower world price. Conversely, if world prices rise above the EU internal price, EU authorities may impose an export tax.

Direct payments. These payments were introduced in the 1992 CAP reform in an effort to compensate producers for the price cuts that were imposed. These payments will be consolidated into a single whole-farm payment beginning in 2005. Under the current system, payments are only partially decoupled from production decisions, since producers must produce something in order to receive the payments, but with the upcoming CAP reform, they will be almost fully decoupled from production.

For arable crops—that is, grains and oilseeds—EU producers receive a per hectare payment calculated as a per ton amount multiplied by a so-called reference yield. The reference yield is defined for each region based on historical average yields. These payments are also subject to regional area ceilings, again based on recent historical averages.

Payments for beef cattle are limited by regional herd ceilings (based on historical averages) and limits on stocking density.

Supply controls. The 1992 reforms required producers who were eligible for direct payments to idle, or set aside, a certain percentage

put changes as a result of enlargement will be mixed. Enlargement is likely to lead to a substantial decline in wheat output by Poland, which currently supports wheat producers at levels higher than the EU, but wheat output in the other candidate countries will increase slightly. As a result, net wheat exports by the enlarged EU will likely be slightly less than combined net exports of the EU-15 and the candidate countries would be without enlargement. In contrast, CEE corn and barley output could rise dramatically.

CEE beef output is likely to increase significantly, since the EU maintains intervention prices for beef that are higher than current CEE prices. As a result, exportable surpluses in the candidate countries will grow. However, only small changes are expected in CEE pork and poultry output.

Under the current EU system of direct payments, farmers must produce grain and oilseeds in order to receive the area payments, and cattle breeders must maintain certain types of beef cattle to receive the beef premiums. Under the new system, which takes effect in 2005, farmers will only need to keep their land in "good agricultural condition." They could convert their land to pasture, plant nothing, and still receive a payment; the incentive to increase output or produce anything is therefore reduced.

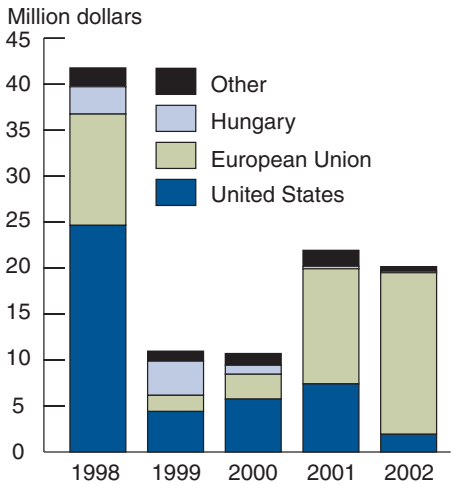
Enlargement Likely To Bring Short-Term Losses to U.S. Exporters

U.S. exports to Central and Eastern Europe will likely contract because CEE countries will have to adopt the stricter import policies of the EU. For example, the EU bans all poultry meat imports from the United States due to a ban on treating carcasses with chlorine. If this issue is not resolved, then all acceding CEE countries will also ban U.S. poultry upon accession.

But these losses will be small relative to those that have already taken place as a result of preferential trade agreements between the EU and the CEEs. In 2000, the EU signed "double zero" agreements with all the candidate countries, which provided duty-free quotas for pork and poultry trade and duty-free trade on a number of other goods. The "double profit" agreements signed in 2003 opened duty-free quotas for wheat, corn, beef, and dairy products, and allow nearly free trade in fruits and vegetables. So much of the CEE-EU trade is already completely liberalized, and this has reduced trade with third countries, including the United States.

During most of the 1990s, the United States was the principal supplier of poultry meat to Poland and the Baltic States. However, since the signing of the double

The United States has lost market share in Poland's poultry imports



Source: World Trade Atlas.

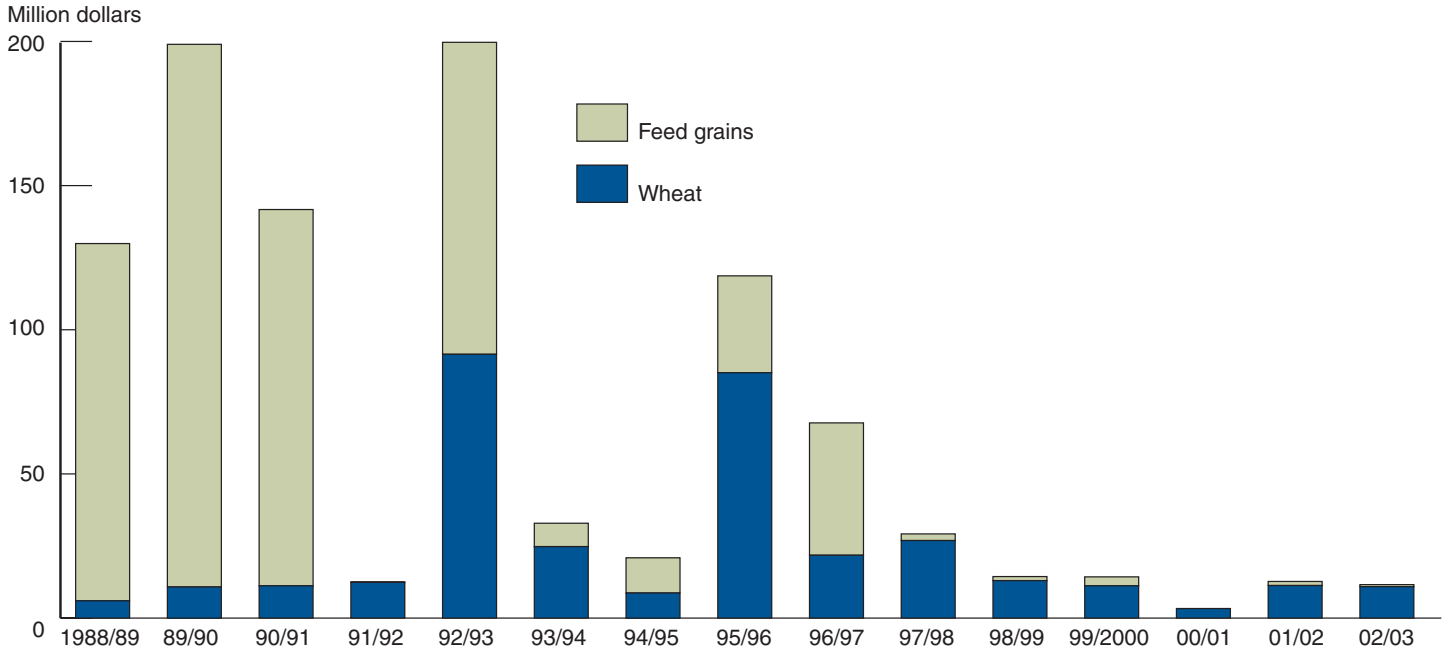
of their land each year, for which they receive an additional payment. Small producers, those who produce less than 92 tons of grain per year, are exempt from the set-aside requirement. EU policy also imposes dairy and sugar quotas. Direct payments are tied to historical "reference" areas, yields, and herd levels.

Other. Other mechanisms include storage subsidies and consumer subsidies to encourage consumption of dairy products. There is no direct government intervention in fruit and vegetable markets. However, growers must join producer organizations, which receive funds from the EU and can set minimum quality standards and withdraw products from the market when prices fall to a given level. The EU also subsidizes fruit and vegetable exports and controls imports through preferential trade agreements.

The use of these tools has changed over the last decade, though the basic EU objectives remain unchanged.

- A set of reforms introduced in 1992 reduced intervention prices, or price supports, and introduced a system of compensatory payments (now known simply as direct payments) to compensate producers for losses incurred through the reduction in support prices. The 1992 reforms also introduced a number of supply controls.
- As a result of commitments made to the World Trade Organization, the EU made further changes in 1995, such as reducing export subsidies annually.
- Agenda 2000 brought further reductions in support prices, offset by increases in direct payments. Agenda 2000 also laid out a budgetary framework for enlargement to support the new member countries through 2006.
- The newest CAP reform was announced in June 2003. The reform will eliminate price support for rye and reduce support for rice and dairy products. The EU also plans to consolidate all direct payments, described above, to a single whole-farm payment that will be decoupled from production (individual member countries will be allowed to retain up to 25 percent coupling for crops and higher degrees of coupling for beef and veal.) The reform further calls for a gradual reduction of payments after 2005 and will require farmers to comply with all EU sanitary, veterinary, and environmental regulations in order to receive these payments.

U.S. grain exports to Eastern Europe have been declining for years. . .



Source: Bureau of the Census, U.S. Department of Commerce.

zero agreement, the U.S. market share has been mostly supplanted by the EU. Remaining exports are mostly in the form of transshipments to the countries of the former Soviet Union, which will likely continue after EU enlargement.

U.S. grain exports to the CEEs also declined throughout the 1990s. In part, this is the result of a drop in CEE demand for feed grains as CEE livestock sectors contracted. In addition, Poland maintains a zero-tolerance policy for grain contaminated with ragweed seed, and U.S. grain shipments have not met that requirement. Also, many of the CEEs have barred imports of genetically engineered corn as they seek to align their policies with the EU.

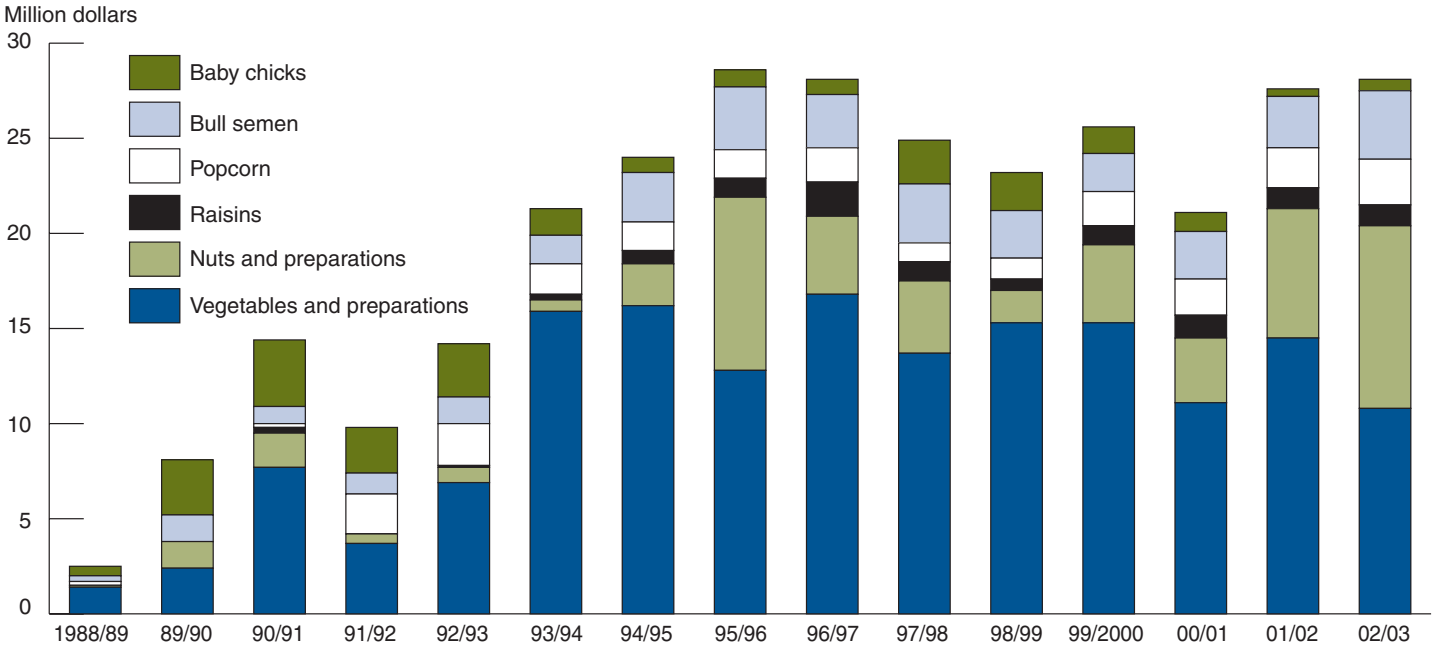
Wheat imports by the enlarged EU are projected to rise slightly, but the United States may not benefit from that. Poland will be the largest net wheat importer after accession, and if Poland is forced to give up its ban on ragweed seed (the EU does not maintain such a policy), U.S. wheat exports to Poland might resume.

Even as U.S. grain exports have declined during the CEE transition period, exports of other products have grown. Significant among these are exports of nuts, raisins, popcorn, and other snack foods. CEE tariffs on most of these products will fall on accession, as the CEEs harmonize their tariffs with those of the EU, as will tariffs on wine, cigarettes, and tobacco. Rising incomes among the CEEs could stimulate increased demand for these products and lead to new markets for high-value U.S. products.

Future U.S. trade with the new member countries also depends on livestock developments. The United States is an important supplier of animal genetics (bull semen, baby chicks, etc.) to the region. Market access for these products will not change with accession, and opportunities could expand if CEE livestock producers seek to improve the genetics of their stock to become more competitive in the enlarged EU. ERS analysis suggests no immediate increase in EU imports of soybeans or meal. But demand for U.S. soybeans could expand in the longer term if the new members are able to expand pork and poultry production.

Nancy Cochrane, USDA/ERS

. . .but exports of other products have risen



Source: Bureau of the Census, U.S. Department of Commerce.

Longer Term Pressures for Restructuring

CEE agriculture employs land and labor, both plentiful, more intensively than does EU agriculture. Use of material inputs such as fertilizers, high-quality seed, and pesticides is lower, and capital is difficult to obtain. As a result, CEE crop yields are significantly lower than those in the EU (CEE grain yields averaged 2.3 tons per hectare in 2000, less than half the EU-15 average), and a higher share of labor is employed in agriculture. Accession will bring pressures for change from several sources.

The need to meet all EU standards and compete in a single market will bring significant pressure for restructuring of CEE agriculture and food processing. Farmers will need to meet EU quality standards or be barred from the market. Slaughterhouses will have to install equipment for measuring back fat, apply the EU grading system to all carcasses, and meet a formidable array of requirements concerning flooring, equipment, and separation of the "clean" from the "dirty" stages of processing.

These foreseen pressures have already led to investment and concentration in CEE processing sectors. Similar trends may emerge at the farm level. Smaller farms unable to meet the new standards will not be allowed to sell their products on the market and will eventually be forced out of business. This momentum toward farm consolidation could mean fewer, larger, and more capital-intensive farms and a reduction in demand for agricultural labor.

Uncertainty Remains

Overall, short-term impacts of EU enlargement on EU commodity output and world agricultural trade will not be nearly as large as once believed. In the longer term, accession can bring many benefits to the candidate countries. Consumer incomes will likely rise, and pressures for restructuring will lead to more efficient agricultural sectors in the CEEs.

At the same time, accession could bring hardship to many small farmers and processors in the CEEs. Processors that cannot meet strict EU standards will be forced out of business, and some farmers will see a deterioration in their net income. It remains to be seen how quickly the CEEs can generate new employment for those displaced from agriculture. So while a majority of CEE voters have embraced EU membership, much of the farming population remains apprehensive.

This article is drawn from . . .

U.S.-EU Food and Agricultural Comparisons, by Mary Anne Normile and Susan E. Leetmaa, WRS-04-04, USDA/ERS, February 2004, available at: www.ers.usda.gov/publications/wrs0404/

The ERS Briefing Rooms on the European Union, Poland, and Hungary, which can be accessed from: www.ers.usda.gov/briefing/

Updates of *Agricultural Outlook's* statistical tables are just a click away at www.ers.usda.gov/publications/AgOutlook

Farm, Rural, and Natural Resources Indicators

	1990	1995	2000	2001	2002	2003	Annual percent change 1990-2000	2001-02	2002-03
Cash receipts ($ billion)	169.5	188.0	192.0	199.8	192.9	209.9f	1.3	-3.5	8.8
Crops	80.3	100.8	92.4	93.4	99.5	105.6f	1.4	6.5	6.1
Livestock	89.2	87.2	99.5	106.4	93.5	104.3f	1.1	-12.1	11.6
Direct government payments ($ billion)	9.3	7.3	22.9	20.7	11.0	19.7f	9.4	-46.9	79.1
Gross cash income ($ billion)	186.9	205.9	228.6	235.3	219.4	246.0f	2.0	-6.8	12.1
Net cash income ($ billion)	52.7	52.5	56.5	59.2	49.1	65.1f	0.7	-17.1	32.6
Net value added ($ billion)	80.8	74.8	92.0	94.2	76.9	100.1f	1.3	-18.4	30.2
Farm equity ($ billion)	702.6	815.0	1,025.6	1,070.1	1,110.7f	1,147.2f	3.9	3.8	3.3
Farm debt-asset ratio	16.4	15.6	14.8	14.8	14.8f	14.8f	-1.0	0.0	0.0
Farm household income ($/farm household)	38,237	44,392	61,947	64,117p	65,757p	68,884f	4.9	2.6	4.8
Farm household income relative to average U.S. household income (%)	103.1	98.8	108.6	110.2	na	na	0.5	na	na
Nonmetro-metro difference in poverty rate (%)	3.6	2.2	2.6	3.1	2.6	na	-3.2	-16.1	na
Cropland harvested (million acres)	310	302	314	311	307p	na	0.1	-1.3	na
USDA Conservation Program expenditures ($ bil.)[1]	3.0	3.5	3.4	3.7	3.5q	na	1.3	-5.4	na

Food and Fiber Sector Indicators

U.S. gross domestic product ($ billion current)[2]	5,803	7,401	9,825	10,082	10,446	10,863f	5.4	3.6	4.0
Food and fiber share (%)	15.1	14.2	12.6	12.3	na	na	-1.8	na	na
Farm sector share (%)	1.4	1.0	0.8	0.8	0.8	na	-5.4	0.0	na
Total agricultural imports ($ billion)[1]	22.7	29.8	38.9	39.0	41.0	45.7	5.5	5.1	11.5
Total agricultural exports ($ billion)[1]	40.3	54.6	50.7	52.7	53.3	56.2	2.3	1.1	5.4
Export share of the volume of U.S. agricultural production (%)	22.5	25.8	22.4	22.5	21.9p	na	-0.0	-2.7	na
CPI for food (1982-84=100)	132.4	148.4	167.9	173.1	176.2	180.0	2.4	1.8	2.2
Share of U.S. disposable income spent on food (%)	11.2	10.6	10.2	10.2	10.1	na	-0.9	-1.0	na
Share of total food expenditures for at-home consumption (%)	55.4	53.9	53.3	53.8	53.9p	na	-0.4	0.2	na
Farm-to-retail price spread (1982-84=100)	144.5	174.5	210.3	215.4	221.2	na	3.8	2.7	na
Total USDA food and nutrition assistance spending ($ billion)[1]	24.9	37.9	32.6	34.2	38.0	41.6	2.7	11.1	9.5

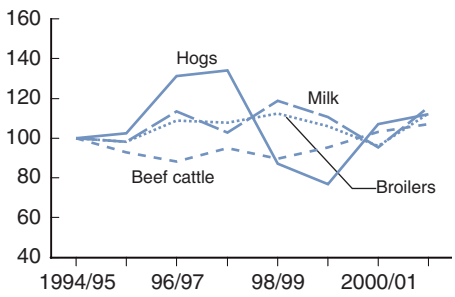
f = Forecast. p = Preliminary. q = 2002 Administration request. na = Not available.

[1] Based on October-September fiscal years ending with year indicated.

[2] Forecast for 2003 based on the Office of Management and Budget's Midsession Budget Review, July 2003.

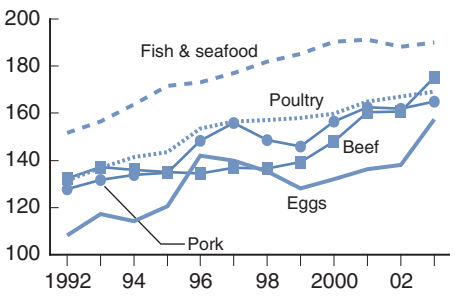
Indices of annual prices received by farmers: Livestock and milk

1994-95=100

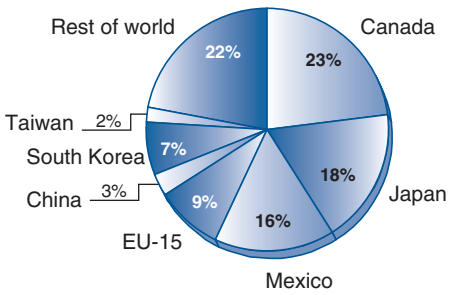


Consumer price indices for high-protein foods consumed at home

1982-84=100



Value of U.S. processed HVP* ag exports by top destinations, 2003



*High-value products.

For more information, see www.ers.usda.gov/amberwaves/

Behind the Data

Developing a County-level Measure of Urban Influence

An area's geographic context has a significant effect on its development. Economic opportunities accrue to a place by virtue of both its size and its access to larger economies. Population size, urbanization, and access to larger communities are often crucial elements in county-level research. To advance such research, ERS developed a set of county-level urban influence categories that captures some differences in economic opportunities.

The 2003 Urban Influence Codes divide the 3,141 counties, county equivalents, and independent cities in the United States into 12 groups. Counties are first divided into metropolitan (metro) and nonmetropolitan (nonmetro) categories according to the official classification announced by the Office of Management and Budget (OMB) in June 2003, based on population and commuting data from the 2000 Census of Population. Metro counties are then divided into two groups by the size of the metro area they are in—large and small (see box, "County Definitions"). Nonmetro counties are divided into 10 groups, first by micropolitan (micro) versus noncore status, then by proximity to metro- or micro-areas.

Nonmetro micro counties are divided into three groups by their adjacency to metro areas—adjacent to a large metro area, adjacent to a small metro area, and not adjacent to a metro area. Nonmetro noncore counties are divided into seven groups by their adjacency to metro or micro areas and whether or not they have their "own town" of at least 2,500 residents.

Nonmetro counties are defined as adjacent if they abut a metro area (noncore counties may also abut a micro area) and have at least 2 percent of employed persons commuting to work in the core of the metro area (or in the micro area). When a nonmetro county was adjacent to more than one metro (or micro) area, it was designated as adjacent to the area to which the largest percentage of its workers commuted.

In concept, the 2003 Urban Influence Codes are comparable with those of earlier decades. However, as a result of changes in metro area delineation procedures and in rural and urban area measurement, our new codes are not fully comparable with those of earlier years. Those changes are explained on the ERS website at: *www.ers.usda.gov/briefing/rurality/newdefinitions/*

County Definitions

Large metro: In areas with at least 1 million residents

Small metro: In areas with less than 1 million residents

Micropolitan: Areas containing an urban core of at least 10,000 residents

Noncore: Counties without an urban core of at least 10,000 residents

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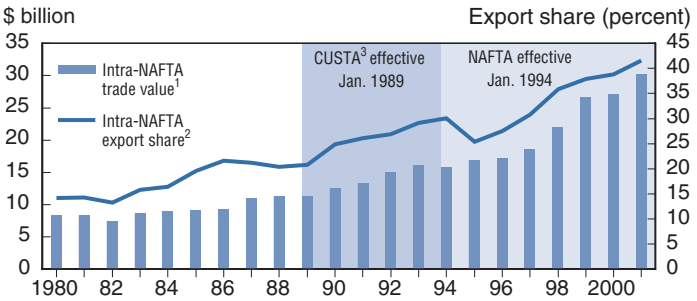
2003 Urban Influence Codes

County type	Number of counties	2000 population	Population per sq. mile
Metropolitan counties:			
In large area of at least 1 million residents	413	149,224,067	558
In small area of less than 1 million residents	676	83,355,873	132
Nonmetropolitan counties:			
Micropolitan counties—			
Adjacent to large metro	92	5,147,233	55
Adjacent to small metro	301	14,668,144	51
Not adjacent[1]	282	9,139,821	27
Noncore counties—			
Adjacent to large metro	123	2,364,159	27
Adjacent to small metro with own town	358	7,855,590	24
Adjacent to small metro with no own town	185	1,879,264	6
Adjacent to micro with own town[2]	201	3,227,833	17
Adjacent to micro with no own town[2]	198	1,313,175	7
Not adjacent to metro or micro with own town[1]	138	2,247,189	5
Not adjacent to metro or micro with no own town	174	999,558	4
Total	3,141	281,421,906	80

[1]Micro counties that are not adjacent are often local trade centers. Nonadjacent-noncore counties with towns may be service centers for surrounding smaller counties, especially in less-populated areas of the Great Plains.
[2]The micro area that a noncore county is adjacent to may itself be adjacent to a small or large metro area. This hierarchical commuting relationship is not reflected in the coding system.

Markets and Trade

Intra-NAFTA trade has accelerated since signing of free trade agreements

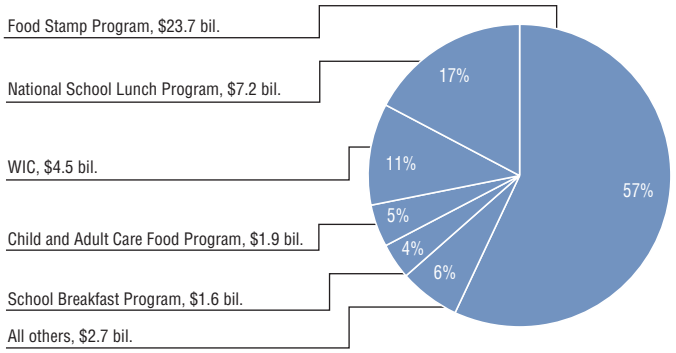


[1]Total value of U.S., Canadian, and Mexican agricultural exports to (imports from) each other.
[2]Exports by NAFTA partners to each other as a share of exports to countries worldwide.
[3]Canada-U.S. Free Trade Agreement.

Source: ERS International Bilateral Agricultural Trade data derived from UN Comtrade deflated by FAOSTAT trade indices. Source: USDA's National Agricultural Statistics Service.

Diet and Health

Food stamps accounted for over half of the $41.6 billion USDA spent for food and nutrition assistance in fiscal year 2003

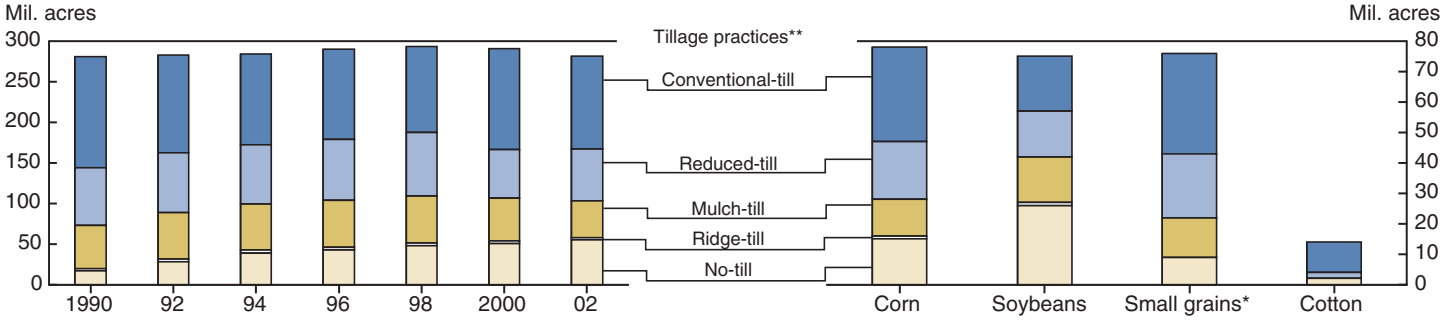


Source: USDA, Food and Nutrition Service, *Program Information Report (Keydata) for September 2003*, November 2003.

Natural Resources and Environment

No-till use on cropland has increased steadily since 1990

In 2002, conventional tillage dominated cotton production

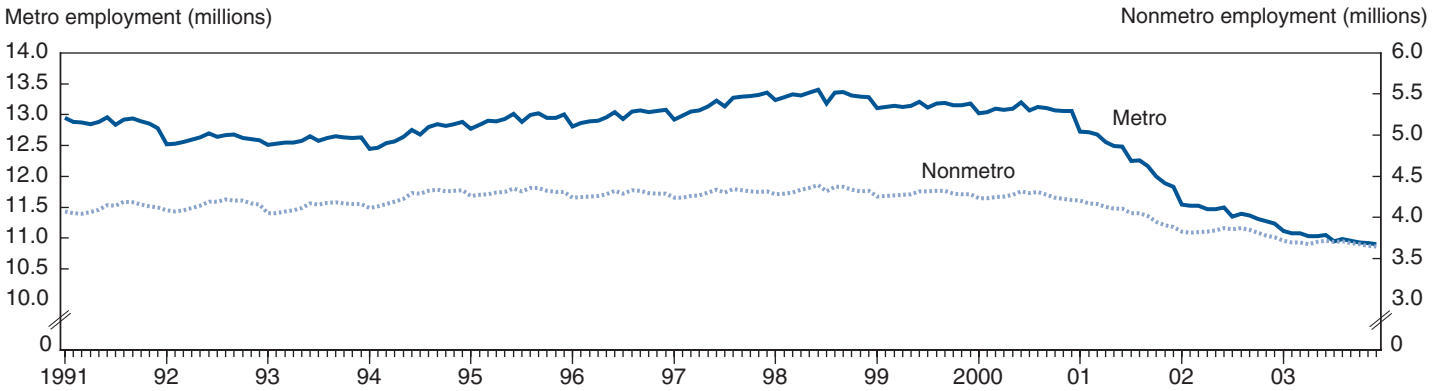


* Wheat, barley, oats, rye, and rice.
** No-till, ridge-till, and mulch-till are conservation tillage practices where, after planting, more than 30 percent of the soil surface remains covered by residue from the previous crop, protecting the soil from erosion and improving soil quality. In reduced-till, 15-30 percent of the soil surface remains covered, while in conventional-till, less than 15 percent remains covered.

Source: ERS analysis of Conservation Technology Information Center data.

Rural America

Manufacturing employment has declined dramatically in both metro and nonmetro areas



Source: Prepared by ERS from Current Employment Statistics data, Bureau of Labor Statistics.

On the Map

Nonmetro population change. The nonmetro population grew by 9.1 percent during the 1990s, below the 14.0-percent growth rate of metro areas. The West and South together accounted for over three-fourths of nonmetro population growth during the decade.

For more information, see:
www.ers.usda.gov/data/population

Kathleen Kassel
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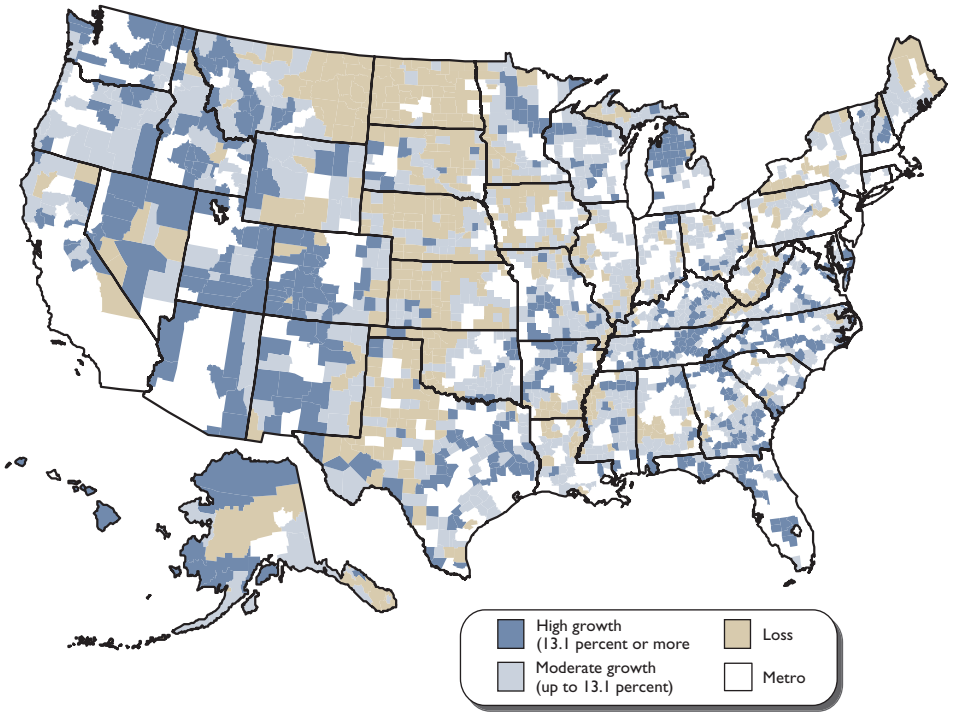
Nonmetro population change, 1990-2000



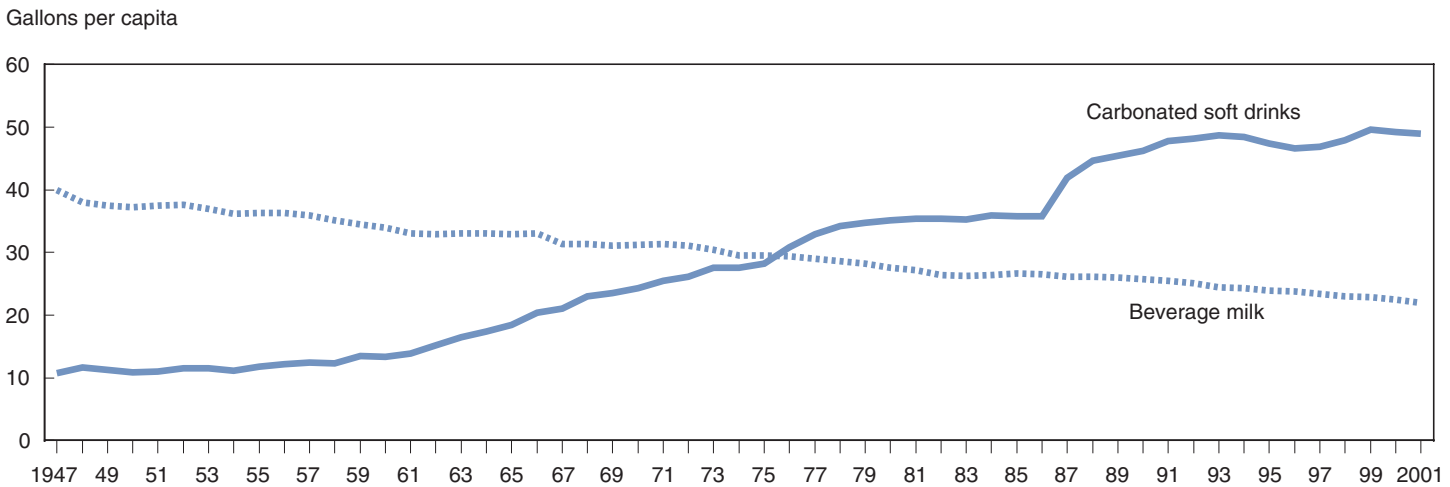
Note: Metro/nonmetro status based on 2003 definition. The U.S. population growth rate for this period was 13.1 percent.

Source: U.S. Census Bureau, map prepared by Economic Research Service.

In the Long Run

Between 1947 and 2001, per capita consumption of carbonated soft drinks more than tripled while beverage milk consumption declined by almost one-half. In 1947, Americans consumed on average 11 gallons of carbonated soft drinks and 40 gallons of beverage milk. In 2001, per capita milk consumption had dropped to 22 gallons, while soft drink consumption soared to 49 gallons.

Jane Allshouse
allshous@ers.usda.gov




Southern University, LA

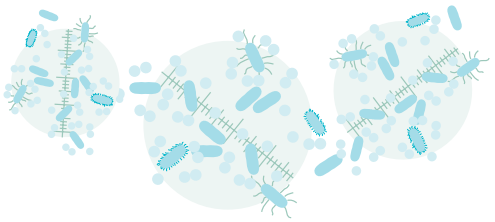
Current Activities

Collaboration With the National Center for Food and Agricultural Policy

In May 2004, ERS will join with the National Center for Food and Agricultural Policy (NCFAP) to sponsor a national workshop on the links between agricultural policy and farm households and the rural economy. The workshop will broaden the information base decisionmakers have at their disposal for consideration of the next farm bill. The workshop will highlight not only the effects of farm policy on commodity production and trade but also the intended and unintended consequences of farm policy for farm households and rural America. The workshop will be held in Washington, DC, and is open to the public. Presentation materials will be available on the NCFAP website, www.ncfap.org, following the workshop. **Leslie Whitener, whitener@ers.usda.gov**

Education as a Rural Development Strategy

The role of education in local, regional, and national economic development has become a central public policy issue in recent years. Rural communities view increased educational investments as a key element of economic development but are sensitive to the partial loss of their investment, as young people migrate to areas with better education and job opportunities. ERS is partnering with land-grant universities to measure the relationship between education and economic outcomes, both for the individual worker and rural community, to help local communities better target their economic development and school improvement efforts. **Robert Gibbs, rgibbs@ers.usda.gov**



Economic Costs of *Campylobacter*

Researchers from ERS and the Foodborne Diseases Active Surveillance Network (FoodNet) are updating estimates of the economic costs of human illness due to *Campylobacter*, which causes more illness than any other foodborne pathogen except *Salmonella*. FoodNet is a collaborative effort by the Centers for Disease Control and Prevention, USDA's Food Safety and Inspection Service, the Food and Drug Administration, and State health departments and local investigators to measure the economic burden of foodborne illness. Foodnet has also investigated the incidence of Guillain-Barré syndrome, a form of acute neuromuscular paralysis that can be triggered by *Campylobacter* infections. The *Campylobacter* cost estimates will be made available on the ERS website in the form of an interactive cost calculator that allows users to modify parameters of the estimate to assess changes in illness, medical costs, and other factors. **Paul D. Frenzen, pfrenzen@ers.usda.gov**

Recent Meetings

Annual Meeting of Regional Economists

In March 2004, ERS participated in the Southern Regional Social Science Association (SRSA) meetings in New Orleans, Louisiana. SRSA provides intellectual leadership in the study of social, economic, political, and behavioral phenomena that have a spatial dimension. ERS researchers presented findings on the economic impacts of public infrastructure projects on rural and urban communities; the impact of school quality on migration in rural areas; the effects of welfare caseload change on local labor markets; the effects of landscape, climate, and settlement on nonmetropolitan migration; and the economic and fiscal conditions in rural recreation counties. **Robert Gibbs, rgibbs@ers.usda.gov**

Southern Agricultural Economics Association

In February 2004, ERS participated in the 36th annual meeting of the Southern Agricultural Economics Association in Tulsa, Oklahoma. ERS presentations covered such diverse topics as determinants of farm size in the southeastern U.S., the pollution risk from manure and commercial fertilizer nutrients on livestock farms, domestic demand for imported lamb, and demand for U.S. feed by Egypt's poultry sector. **Keithly Jones, kjones@ers.usda.gov**

American Association for the Advancement of Science

In February 2004, ERS participated in the annual meeting of the American Association for the Advancement of Science (AAAS) in Seattle, Washington. AAAS is the world's largest general scientific society and publishes the journal *Science*. The annual meetings bring together scientists from around the world to discuss new discoveries and applications. The objective of this symposium was to examine the array of new policy options, including priority setting and pathogen performance standards, for establishing foodborne pathogen controls for domestic consumers and international trade. In addition to presenting work on the economics of pathogen performance standards, ERS researchers organized a symposium on the science and economics of food safety regulation and their impact on international trade and the control of foodborne pathogens. **Elise Golan, egolan@ers.usda.gov**


Corbis

New Releases

Land Degradation and Agricultural Productivity

ERS economists have been collaborating with soil scientists and geographers at other institutions to examine how land quality and land degradation affect agricultural productivity and food security. ERS published a summary report, *Linking Land Quality, Agricultural Productivity, and Food Security* (AER-823) in June 2003, and a more detailed discussion has now been published as a book: *Land Quality, Agricultural Productivity, and Food Security: Biophysical Processes and Economic Choices at Local, Regional, and Global Levels*, edited by Keith Wiebe (Edward Elgar Publishing). The authors find that land degradation generates productivity losses that are relatively small in most areas and at the global level because farmers generally have incentives to address degradation and its impacts. But land degradation does pose problems in areas where soils are fragile and markets function poorly. Key to addressing these challenges are measures to strengthen property rights, infrastructure, education, and research to enhance farmers' incentives to invest in sustaining land quality. **Keith Wiebe, kdwiebe@ers.usda.gov**

Lynn Betts, USDA/NRCS

Characteristics and Production Costs

As part of a series of reports on the costs of agricultural production and the variation in costs across different segments of the U.S. farm population, ERS has published two new reports on the dairy and rice sectors. *Characteristics and Production Costs of U.S. Dairy Operations* (SB-974-6) reports that total costs of producing milk in 2000 ranged from an average of $11.58 per hundredweight (cwt) of milk sold in the Fruitful Rim-West region to $18.23 per cwt in the Eastern Uplands. Costs were generally lower on large farms than on small farms. About 72 percent of surveyed farms covered their operating costs at the average farm price of milk in 2000 ($12.19 per cwt). Fewer were able to cover the full range of costs associated with production (including ownership costs and the opportunity cost of farmers' labor). *Characteristics and Production Costs of U.S. Rice Farms* (SB-974-7) reports that total costs of producing rice in 2000 averaged $6.00 per hundredweight but varied widely by region and other characteristics. Costs were generally lower in the Arkansas non-Delta region than in California and the Gulf Coast region. The link between farm size and production costs is weaker for rice than it is for other commodities. When Government payments are added to the value of production, 97 percent of rice farms were able to cover operating costs and about 84 percent of farms covered both their operating and ownership costs of rice production in 2000. **Sara Short, sshort@ers.usda.gov, and Janet Livezey, jlivezey@ers.usda.gov**

PhotoDisc

Coping With Risk in Agriculture

Concern about risk and the ability of farmers to cope with risk has served as an important backdrop for Government agricultural support programs since the Great Depression. In the last decade, Government programs that directly target risk have been expanded to include countercyclical payments and increased subsidies on yield and revenue insurance. In addition, Congress periodically approves ad hoc disaster assistance. These policies have revived interest in classic economic questions about how well private markets would provide risk-coping tools to farmers in the absence of Government policies and to what extent Government programs actually alleviate the costs of coping with risk. A new ERS report, *Risk, Government Programs, and the Environment* (TB-1908), provides a brief overview of the relevant Government programs, characterizes the different kinds of production alternatives available to farmers, and identifies a range of technical problems that need to be overcome before a robust picture can be painted of how those alternatives affect risk, returns, and environmental quality. **Michael Roberts, mroberts@ers.usda.gov**

The citations here and in the rest of this edition are just a sample of the latest releases from ERS. For a complete list of all new ERS releases, view the calendar on the ERS website: www.ers.usda.gov/calendar/

The Traceability Team

The confirmation in December 2003 of a case of bovine spongiform encephalopathy (BSE, or mad cow disease) in the United States thrust traceability to the forefront of the public consciousness. It was the first time many Americans had ever heard of the concept of tracking foods, food ingredients, and food animals as they move from farms to processing to markets to consumers' plates.

For the ERS Traceability Team, whose members are experts in food labeling, food safety, biotechnology, commodity markets, and international trade, traceability is far from an unknown concept. Team members have been researching and analyzing different aspects of traceability for the last few years. Their early efforts examined traceability as it relates to genetically engineered crops, foods, and food ingredients.

The team includes: Elise Golan and Fred Kuchler of the Food and Rural Economics Division; and Linda Calvin, Barry Krissoff, and Kenneth Nelson of the Market and Trade Economics Division. Team members authored the new traceability briefing room on the ERS website, www.ers.usda.gov/briefing/traceability/, and several related reports, including *Traceability in the U.S. Food Supply: Economic Theory and Industry Studies, Economics of Food Labeling,* and *Country-of-Origin Labeling: Theory and Observation.* Two articles in this issue of *Amber Waves* are drawn from this body of work.

In their recent traceability report, the researchers found that, for the most part, the food industry is successfully developing and maintaining traceability systems to meet changing objectives, though the speed and success of industry responses have varied. Their analysis suggests that Government efforts to improve the Nation's traceback capabilities should focus on providing firms with incentives to strengthen their safety and traceability systems without dictating any specific process for doing so.

Up next for team members: an expansion of their traceability research into other hot-button areas. They will be addressing the role of government in facilitating trade when product safety and/or quality is an issue, exploring the feasibility of animal identification systems, and examining consumer demand for country-of-origin labeling.

Tom McDonald, USDA/ERS

Traceability Team Members *(l to r)*: Kenneth Nelson, Fred Kuchler, Linda Calvin, Elise Golan, and Barry Krissoff