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Center for Agricultural and Rural Development

Risk-Free Farming?

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The direction of U.S. farm policy changed with the passage of the 2002 farm bill and the 2000 Agricultural Risk Protection Act. Previous farm bills, together with the old crop insurance program, had gradually moved the crops sector toward greater market orientation, with farmers taking on more market risk in exchange for greater planting flexibility. But the beginning of this decade brought with it increased protection against both adverse price movements and crop losses. These policy changes were brought about largely at the behest of farm commodity organizations, who argued that they needed increased protection against the vagaries of weather and market conditions. As we will demonstrate, the reduction in risk that U.S. crop farmers obtain from crop insurance and commodity programs is now so dramatic that we may have entered a new era of risk-free farming.

The U.S. proposals for farm policy reform to the World Trade Organization (WTO) would, if adopted, move U.S. farm policy back toward its previous trajectory of greater market orientation. However, the WTO talks have stalled, so it is worthwhile to take a step back and assess where U.S. policy currently stands. We use illustrations of the distribution of returns with and without government programs to show the impacts of these programs on farm financial risk in a single growing season. The assessment begins with a review of the U.S. farm policy legislation process and whom it most benefits.

What Type of Producer Benefits from U.S. Farm Policy?

Evidence would suggest that U.S. farm policy is primarily designed to meet the interests of commodity associations. Early in 2001, Larry Combest, then the chairman of the House agriculture committee, asked the National Corn Growers Association, the National Cotton Council, the American Soybean Association, the Rice Growers Association, the Wheat Growers Association, the National Barley Growers Association, and other associations what farm program provisions they wanted to see in the new farm bill. Chairman Combest, along with the members of the House and Senate agriculture committees, then designed a bill to meet their wishes. The legislation passed through Congress and was signed into law by the president in May 2002.

These commodity associations are national associations of farmers. It seems self-evident that the associations represent the interests of their farmer-members. But typically, the association leaders are chosen from the most successful farmers, who often have large, well-financed operations with lower-than-average costs and higher-than-average volumes.

Profit incentives in a commodity system lead crop producers to focus on low costs and high yields. Thus, commodity organizations, who are led by the most successful commodity producers, will tend to support farm policies that support the kinds of farm operations that are most successful in a commodity system.

Mechanisms of Support and Financial Impacts

Here, we focus on the subsidies that producers of corn, wheat, oilseeds, rice, cotton, barley, and grain sorghum receive. We examine corn in detail to show how farm programs and crop insurance affect revenue and we include wheat and cotton for comparison. In addition to farm program payments, 75 percent of U.S. corn was insured under the U.S. crop insurance program in 2003. The most popular product was a form of revenue insurance whereby the insurance guarantee increases if the harvest price is greater than the projected harvest price at planting time. The most popular coverage level is 75 percent coverage (the farmer takes the first 25 percent loss before payments begin). At the 75 percent coverage level, farmers pay only 45 percent of the actuarially fair premium, which is defined as the premium that over time would generate enough total dollars to pay all insurance claims. Thus farmers receive a subsidy equal to 55 percent of the actuarially fair premium.

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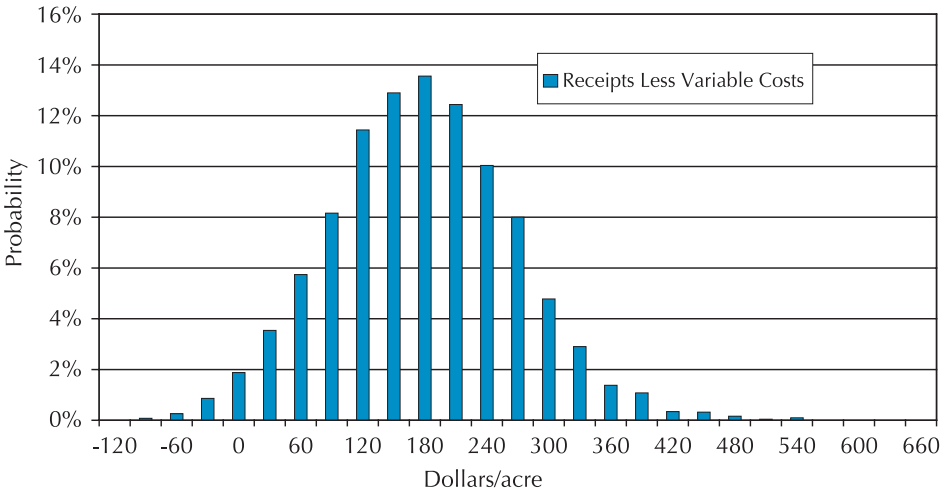

Figure 1. Histogram of net revenue for a representative corn farm

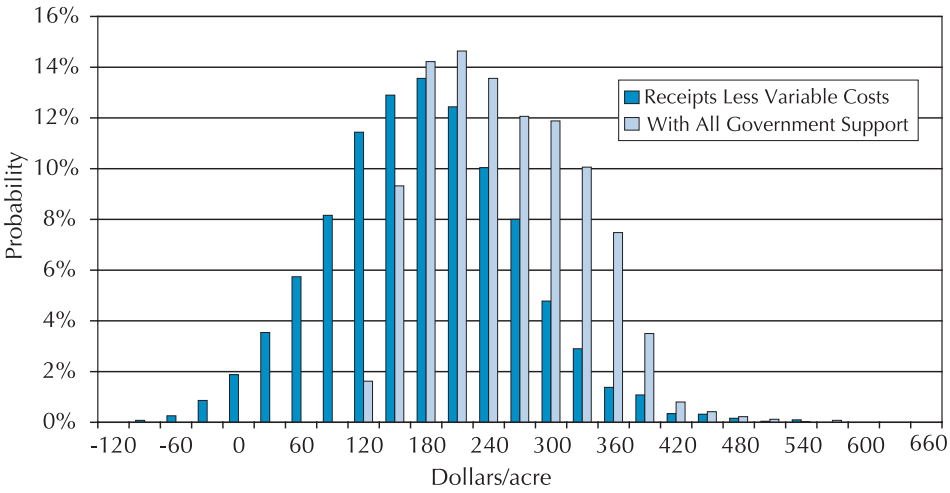

Figure 2. Effect of government programs and crop insurance on risk

Before examining the financial effects of the various government programs, let's look at a representative farm's financial picture without farm programs. At planting time, U.S. farmers do not know either the price they will receive for their crops or what their harvested yield will be. To capture this uncertainty, we build a representative farm and repeat a crop year 5,000 times and record the outcome. There are 5,000 different yield and price outcomes. We chose a representative corn farm in Boone County, Iowa, with a local expected farm price set at $2.15/bushels (bu) and an expected yield of 150 bu per acre (ac). The standard deviation of price is set at $0.45/bu and the standard deviation of yield is 43 bu/ac.

A histogram constructed from the 5,000 revenue draws is shown in Figure 1. The histogram shows the range of possible revenue outcomes as well as the probability of outcomes. Variable costs of $150 are subtracted so that the distribution shows net revenue. One measure of the amount of risk that a farmer faces is the probability that revenue will not be adequate to cover a certain level of variable production costs. A farmer who covers variable costs has some money left over to pay off fixed expenses. Figure 1 shows that that average net returns for this corn farmer are about $163/ac. There is a very low probability (4 percent) that net returns are negative. On average, this farmer will

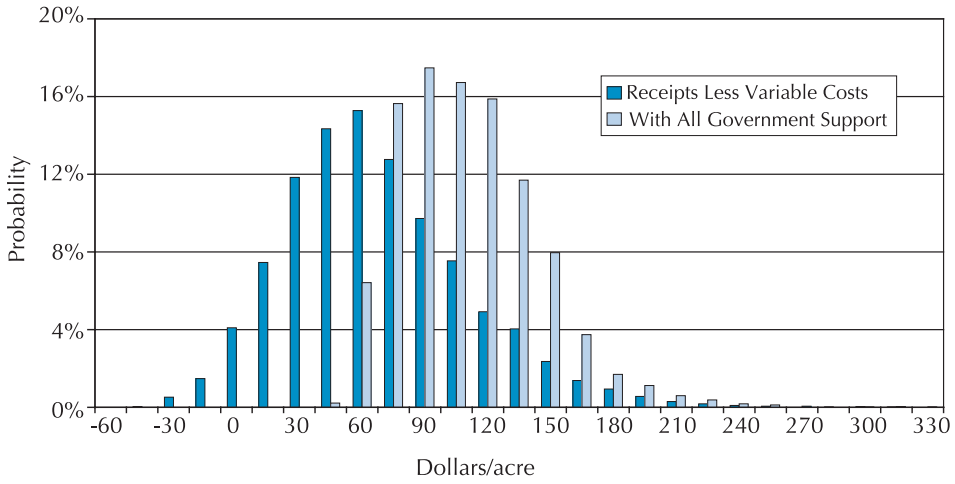

Figure 3. Risk reductions from government programs for wheat

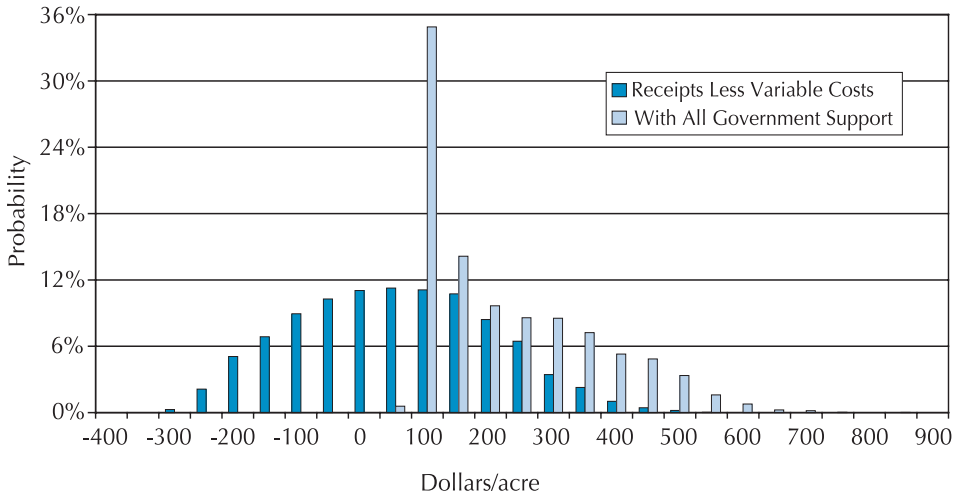

Figure 4. Risk reductions from government programs for cotton

have approximately $163 left over to pay all other expenses, including land, fixed machinery expenses, and management. For a cash renter, land costs would increase variable costs and the entire histogram would shift to the left, which demonstrates the increased risk that cash renters face relative to owner-operators.

Most other U.S. crop farmers face relatively more risk than this corn farmer. Iowa corn farmers have the advantage of highly productive soils and a natural hedge between price and yield. When yield is low, the price is likely to be higher than expected, thus buffering the negative impacts of low yields. And low prices are likely caused by a bumper crop in Iowa, which helps insulate Iowa corn farmers from financial trouble.

Impact of Government Programs and Crop Insurance

Now let's look at the effects of government programs on the financial risks of this farm. The effects of all the programs are revealed by comparing the distribution of market plus government receipts to the distribution shown in Figure 1.

Figure 2 shows the aggregate effect of these programs on a farmer's risk. As can be readily seen, the amount of risk that this farmer faces is now significantly reduced and the expected returns over variable costs are dramatically increased. Average net returns increase 46 percent to about $239/ac with the programs in place. Perhaps the best way to characterize the effects of the programs is that with the programs in place there is now less than a one-in-six chance that total revenue will fall below $163/ac, which is the average revenue without the programs. As shown in Figure 2, there is no chance that farmers in Boone County will not be able to cover their non-land variable costs. It is in this sense that we can speculate that corn farming in Boone County has become "risk free."

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The Picture for Wheat and Cotton

Figures 3 and 4 depict pictures of risk for a wheat farmer in Reno County, Kansas, and a cotton farmer in Tallahatchie County, Mississippi. The pictures for wheat and cotton are similar to that of corn but there are some significant differences. Without government programs, wheat producers in this Kansas County have a small probability of negative returns. Payments and crop insurance subsidies increase the average return to wheat farming by 72 percent. This compares to the 46 percent increase for the corn farmer. The probability that returns over variable costs fall below $60—which is the average return with no programs—is approximately 7 percent. Thus, if we define risk as the probability that returns over variable costs are less than expected returns under no government programs, then the programs combined with crop insurance have essentially reduced the risk for wheat farming to near zero.

The impact from government programs is even more dramatic for cotton. Based on an expected local price of $0.52 per pound (lb), an average yield of 700 lb/ac, and variable costs of $325/ac, the expected market returns over variable costs for our Mississippi cotton farmer are only $39/ac. And the probability that

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Targeting Efficiency in the Conservation Security Program

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The much anticipated implementation rules for the Conservation Security Program (CSP), authorized in the 2002 Farm Security and Rural Investment Act, were unveiled January 2, in the *Federal Register*. In addition to describing the proposed rules, the Natural Resources Conservation Service outlines the challenge they faced in constructing a coherent implementation plan for a program that was initially developed as an entitlement program but later faced funding caps. The magnitude of this challenge is aptly summarized by the USDA's Economic Research Service, which finds that if all of the 1.8 million farms and ranches likely to be eligible for the program were to enroll, the total budgetary cap of $3.77 billion would be completely exhausted in the first sign up.

One of the approaches proposed by USDA to limit the expenditures associated with the program is to "target" conservation funds to watersheds identified as high priority. This is controversial to some because it means that some locations will receive conservation dollars to the exclusion of others. There are other ways in which the proposed rules are targeted: payments will differ in different parts of the country to reflect differences in land rental rates, and farmers with track records in conservation practices will receive higher priority.

We briefly describe here the different ways in which conservation funds can potentially be targeted, the history of targeting in conservation programs, some evidence on the degree to which targeting of environmental funds is efficient, and a few insights on the possible consequences of targeting CSP funds to alternative watersheds in Iowa.

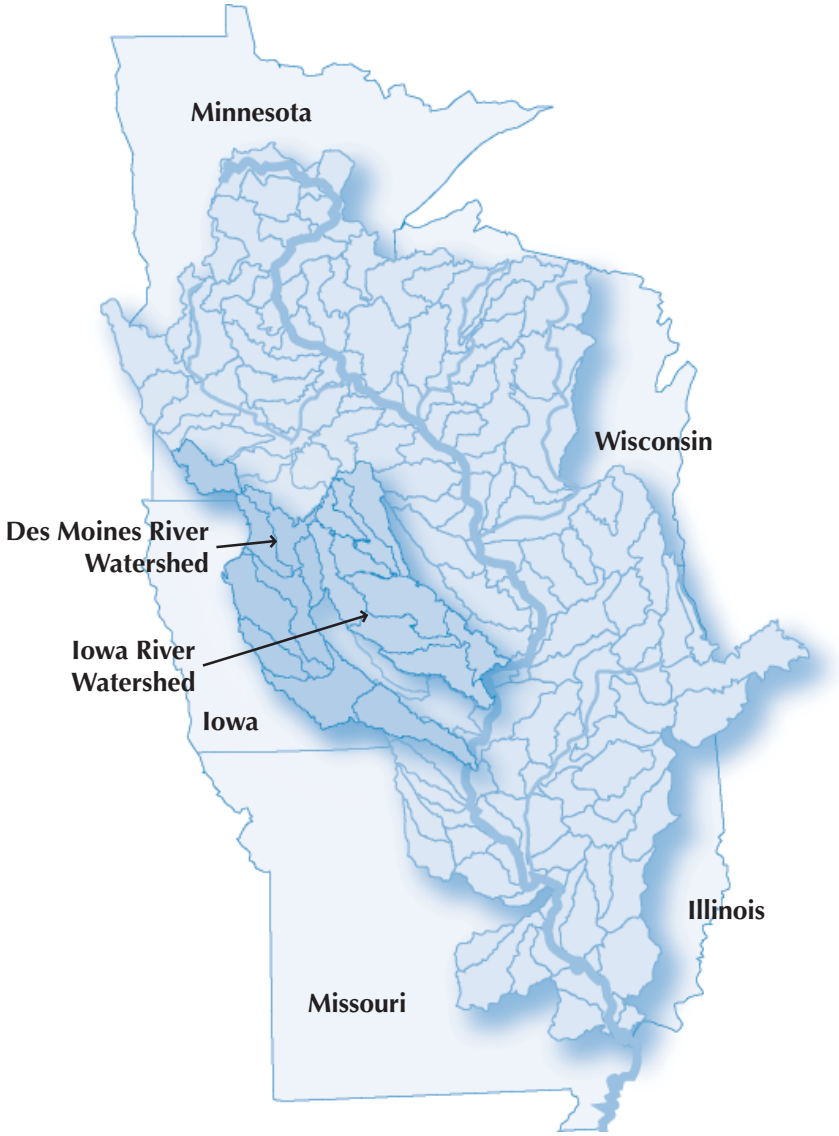

FIGURE 1. DES MOINES RIVER AND IOWA RIVER WATERSHEDS

WHAT IS TARGETING?

The term "targeting" can apply to a variety of payment practices. The common element among these schemes is that not all farmers or ranchers necessarily receive the same payment for a given practice or action. Instead, some criteria are used to differentiate among the sources. Historically, conservation programs in the United States have employed a variety of targeting approaches over the years.

Conservation Reserve Program (CRP) payments initially enrolled land designated as highly erodible. This effectively targets payments geographically based on soil and topographical characteristics. A second way in which CRP has targeted payments is by using a bidding system to enroll farmers into the program who are willing to participate at the lowest cost. This is a form of

cost targeting. The most complete form of targeting used in the CRP has been the use of the Environmental Benefits Index, which considers both the environmental benefits associated with enrolling a parcel of land in the program (items such as water and air quality, wildlife habitat, and soil quality among others) and the costs.

Another significant conservation program that has employed various targeting tools is the Environmental Quality Incentives Program (EQIP). Notably, EQIP has targeted those practices and geographic locations that contribute to environmental benefits that are specific national priorities, defined by the Natural Resources Conservation Service. Interestingly, while this program has historically targeted both cost and geographic priority areas, the 2002 legislation specifically prohibits such targeting.

One relatively new target that the CSP program identifies is producers who have already demonstrated that they are "good stewards." In particular, in the proposed rules, conservation producers will be categorized based on their previous environmental stewardship, and those in the highest categories will receive first priority for funding. This policy has the interesting consequence of targeting funds for environmental improvement to locations where some improvements have already occurred.

The Benefits of Targeting

While the motivation for targeting in the CSP appears largely to be based on the high cost of a nontargeted approach, there is a strong case to be made for the targeting of conservation funds even when conservation budgets are not as strained. The conservation benefits from enrolling a parcel of land in the CRP, EQIP, or the new CSP will differ, often substantially, depending upon the soil characteristics, slope, previous cropping practices, or location of that parcel. For example, creating a small wetland in an area that drains highly nutrient-rich farmland will likely yield substantially greater water quality benefits than placing that wetland where nutrient cleaning benefits will not occur. Likewise, installing a stream buffer on a parcel with highly erosive soils will yield greater erosion benefits than installing such a buffer on flat, low-eroding soils.

In fact, the research to date on the cost effectiveness of targeting conservation funds provides strong support for the benefits of such a strategy. In a 1996 study, Babcock et al. demonstrated that 90 percent of the water erosion benefits from enrolling land in CRP could have been achieved with only half the total CRP budget if the land chosen for enrollment had been targeted specifically for water erosion benefits. Similarly, Feng et al. (2003) demonstrated that at the beginning of CRP, when erosion reduction was a major goal of the program, if payments were targeted at land with the highest erodibility indices, the average erodibility index of enrolled land in Iowa would be more than twice as high as that of the actually enrolled land.

It should be noted that not all forms of targeting will necessarily result in more cost-effective conservation. In fact, as previously noted, the CSP proposal to focus additional environmental improvements on land that is already under some conservation practices may mean that land that would most yield environmental benefits might be passed over in favor of land that is managed by good stewards.

Watershed Targeting in the Conservation Security Program

While previous research indicates that targeting is often very cost effective, generating significantly more environmental benefits with a fixed budget than would occur if funds were disbursed indiscriminately, this does not necessarily mean that the

Continued on page 10

Table 1. Scenario results for the Iowa and Des Moines River Watersheds

(1) Scenario	(2) Annual Average Baseline Sediment (10^6 mt*)	(3) Percentage Sediment Reduction	(4) Sediment Reduction per Acre Converted to Conservation Tillage (mt/acre)	(5) Total Cost of Sediment Reduction (10^6 dollars)	(6) Average Cost of Sediment Reduction (dollars/mt)
Iowa River in Conservation Tillage	5.00	5.8	0.108	33.4	115.2
Des Moines River in Conservation Tillage	2.85	5.7	0.067	26.3	161.9

*mt = metric tons

Agricultural Situation Spotlight

Agricultural Price Swings and Iowa's Economy

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Over the past few months, we have seen tremendous variability in commodity prices. Soybean futures prices have increased by roughly 50 percent since mid-July, spurred on by lower-than-expected production and an ever-tightening supply. Cattle futures prices have fallen by nearly 20 percent since the announcement of the bovine spongiform encephalopathy (BSE) case in Washington. But what do these price swings mean for Iowa's agricultural and overall state economy?

One way to look at the impacts is through the values of production for Iowa's major agricultural products. The big four commodities (corn, soybeans, hogs, and cattle) account for roughly 90 percent of all agricultural cash receipts in Iowa. Table 1 shows the values of production for these commodities (2003-04 figures are projections). On average, the corn crop provides 38 percent of total value, followed by hogs at 26 percent, soybeans at 24 percent, and cattle at 12 percent.

The projections include the price increase for soybeans but were computed before the BSE announcement. But as is evident by a comparison of the 2002 and 2003 values, the price increase of 2003 was more than offset by the drop in soybean production. However, it is not always the case that prices and production move in opposite directions (at the state level). The increase in soybean production values between 2001 and 2002 can be attributed to increases in both prices and production. Tables 2 and 3 show historical and projected marketing year average prices and production levels for corn, soybeans, cattle, and hogs.

Table 1. Iowa's values of agricultural production

Year	Corn	Soybean	Cattle	Hog	Total
			(billion $)		
2000	3.02	2.09	1.07	2.68	8.85
2001	3.16	2.09	1.13	2.75	9.13
2002	4.42	2.67	1.05	2.02	10.16
2003	3.99	2.48	1.30	2.39	10.17
2004 (pre-BSE)	3.99	2.39	1.26	2.50	10.13
2004 (post-BSE)	3.99	2.39	1.01	2.50	9.88

Table 2. Agricultural prices for Iowa

Year	Corn	Soybean	Cattle	Hog
	($/bushel)		($/cwt)	
2000	1.75	4.49	61.63	41.29
2001	1.90	4.35	70.06	42.90
2002	2.25	5.40	57.55	30.28
2003	2.09	6.92	75.10	35.80
2004 (pre-BSE)	2.11	5.01	74.13	37.31
2004 (post-BSE)	2.11	5.01	59.30	37.31

Table 3. Iowa's agricultural production levels

Year	Corn	Soybean	Cattle	Hog
	(million bushels)		(million pounds)	
2000	1,728	465	1,730	6,479
2001	1,664	480	1,616	6,400
2002	1,964	495	1,818	6,681
2003	1,908	359	1,729	6,681
2004 (pre-BSE)	1,890	477	1,695	6,700
2004 (post-BSE)	1,890	477	1,695	6,700

The projections for 2004 show prices holding steady for corn, a large drop in the prices of soybeans and cattle, and a slight increase in prices for hogs. Corn production and prices are projected to be near 2003 levels. While Iowa soybean production is expected to rebound in 2004, soybean prices may fall back to 2002 levels. Both hog production and prices are expected to rise in 2004. Before the BSE announcement, cattle production and prices were expected to maintain near 2003 levels. However, even with a 20 percent reduction in price (following the futures market), Iowa cattle production values for 2004 would be near

2002 levels and the total value of production for the four commodities would approach $9.9 billion, far exceeding the production values for 2000 and 2001.

But looking at production values does not tell the whole story as far as agriculture's impact on Iowa's economy. Oftentimes, when you hear news reports on the size of Iowa's economy, it is stated in terms of the "gross state product" (GSP). The GSP, much like the gross domestic product (GDP) for the nation, is a measurement of the "values added" in production by the labor and resources contained within the region. Values added is the difference between the value of the output from production and the value of intermediate inputs (output from other production sources) used in the creation of the output. For example, the values added in livestock production is the difference between the livestock value and the value of such inputs as feed, machinery, and veterinary services used to raise the livestock.

The Bureau of Economic Analysis, an agency within the U.S. Department of Commerce, tracks values added, GSP, and GDP. Values added can be obtained for on-farm agricultural production, agricultural services, food production (for both human and animal consumption), manufacturing, other services, and so on. As Figure 1 shows, the GSP due to on-farm agricultural production has remained fairly stable since 1977. Adding in the values added due to agricultural services and food production doubles the impact of agriculture on Iowa's economy. However, these direct impacts are somewhat small in comparison to Iowa's total economy. Since the late 1970s, Iowa economy has tripled in size, from just over $25 billion in 1977 to $90 billion in 2001. Production agriculture's share of the gross state product has fallen from 14 percent in 1978 to under 3.25 percent in the last few years. The combination of agricultural production, services, and food production accounts for only 8 percent of Iowa's GSP.

. . . in light of the BSE case, it is important to note that the large price swings we see in agriculture have smaller effects on Iowa's overall economy than might be anticipated by the general public, especially when the price swings are viewed as temporary movements in the market.

For Iowa, the data for on-farm agricultural production indicates that roughly 30 percent of the production value is considered as values added. Using this as a rough guide to production agriculture's direct impact on the State's economy, the consequences of the price downturn in cattle due to BSE are smaller than might be expected. Based on a 20 percent price drop, Iowa cattle production values would fall by $250 million. Using the 30 percent values-added relationship, this would translate into a $75 million drop in gross GSP from on-farm production. That is less than one-tenth of 1 percent of total GSP.

The point here is not to say that agriculture is not a major contributor to Iowa's economy. Estimates of agriculture's overall impact (direct and indirect through related industries) range from 15 to 25 percent of the state's total GSP. Rather, in light of the BSE case, it is important to note that the large price swings we see in agriculture have smaller effects on Iowa's overall economy than might be anticipated by the general public, especially when the price swings are viewed as temporary movements in the market. ◆

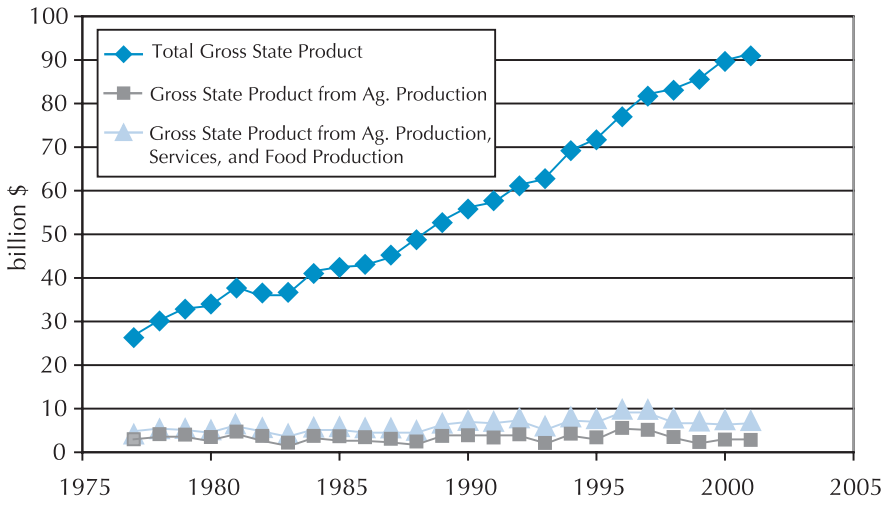

Figure 1. Iowa's total gross state product and agriculture's direct share

The Expanding U.S. Market for Fresh Produce

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The U.S. Center for Nutrition Policy and Promotion urges consumers to eat between five and nine servings of fresh fruits and vegetables per day. Not all consumers are reaching that goal, but per capita consumption of fresh produce is steadily increasing (see Figure 1). Between 1980 and 2001, per capita consumption of fresh fruits increased by 19 percent and consumption of vegetables (including potatoes) increased by 29 percent. At the same time, new technologies to extend shelf life and new trade agreements have increasingly allowed imports of fresh produce to fill gaps where domestic supplies are too small and domestic products are out of season.

As a result, between 1980 and 2001, fresh fruit imports increased by 155 percent and fresh vegetable imports increased by 265 percent (see Figure 2). In 2001, imports accounted for 38.9 percent of U.S. fresh fruit consumption, up from 24.2 percent in 1980. Fresh vegetable imports accounted for 11.6 percent of U.S. consumption in 2001, up from 5.5 percent in 1980.

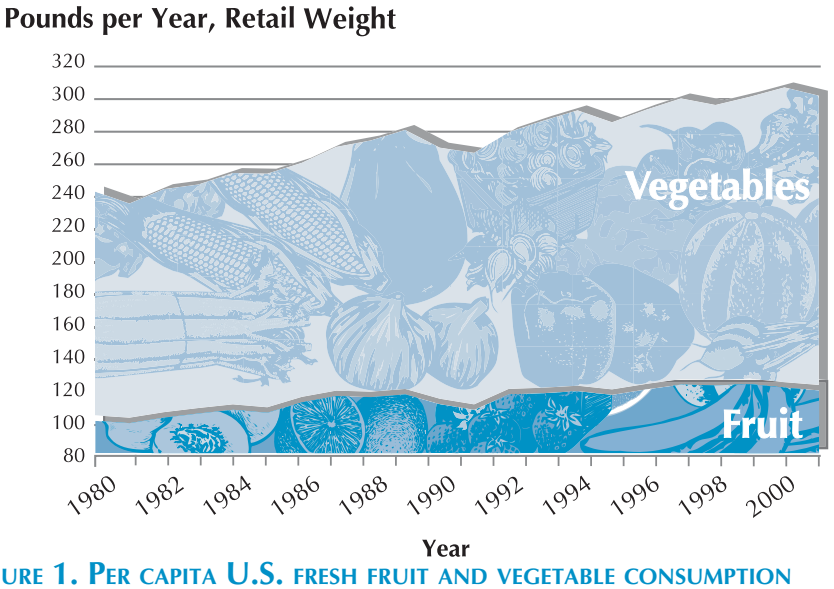

FIGURE 1. PER CAPITA U.S. FRESH FRUIT AND VEGETABLE CONSUMPTION

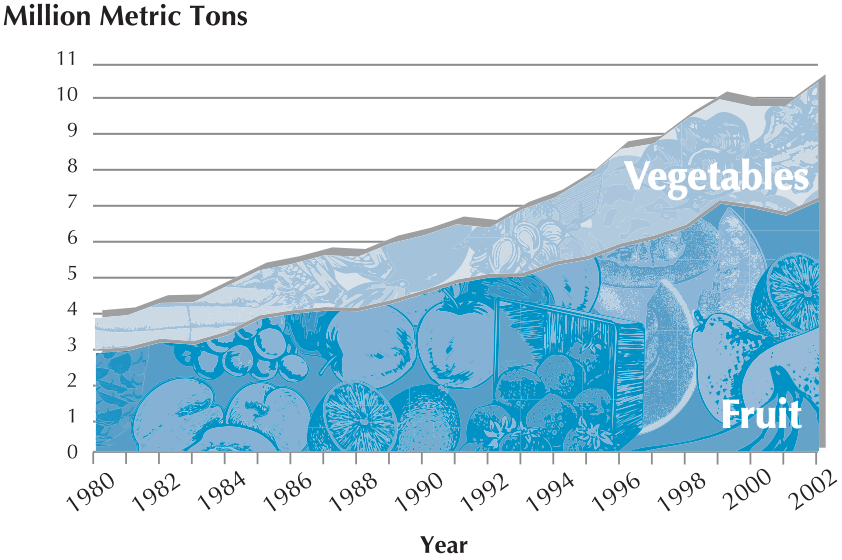

FIGURE 2. U.S FRESH FRUIT AND VEGETABLE IMPORTS

IMPORTS FROM NORTH AND SOUTH OF THE BORDER

As shown in Table 1, the majority of imported produce is comprised of a few products originating from a few countries within the Americas (see Table 1). Costa Rica's tropical climate makes it the largest supplier of fresh fruits. Mexico is the largest supplier of fresh vegetables (including potatoes), in part because of relatively low transportation costs. And although import volumes from Canada are lower than are those from other top suppliers, Canada supplies a surprisingly large volume of vegetables to the U.S. market, in part because of increased greenhouse production.

As expected, produce imports are highly dependent on U.S. production and seasonal fluctuations. For example, bananas account for more than 22 percent of total fresh fruit consumption and for 60 percent of total fresh fruit imports. Because banana production is virtually nonexistent in the United States, imports are not strongly affected by seasonal changes. This contrasts with melon imports, which are the second largest fresh fruit import by volume but highly seasonal. Imports are large in March and April and negligible for July through September.

The USDA forecasts that the trend toward increased consumption of fresh fruits and vegetables will continue. Per capita expenditures on fruits and vegetables are expected to have the highest increases among all types of foods through 2020. These increases will be driven by higher incomes, the large number of aging baby boomers, a gradually increasing population, increasing consumption of ethnic foods, and higher

Table 1. U.S. fresh produce imports by largest suppliers, 2002

Product	Metric Tons	Percentage of Total Imports	Percentage of Product by Country
Total Fruit	7,417,776		
Bananas	4,144,627	55.9	
Ecuador	1,094,600		26.4
Guatemala	968,941		23.4
Costa Rica	914,235		22.1
Melons[a]	680,275	9.2	
Guatemala	213,393		31.4
Costa Rica	174,159		25.6
Mexico	128,106		18.8
Grapes	518,267	7.0	
Chile	399,015		77.0
Mexico	103,175		19.9
Pineapples	405,714	5.5	
Costa Rica	344,731		85.0
Total Vegetables[b]	3,178,567		
Tomatoes	859,502	27.0	
Mexico	723,425		84.2
Canada	100,499		11.7
Peppers	401,159	12.6	
Mexico	322,627		80.4
Canada	41,545		10.4
Cucumbers/Gherkins	394,040	12.4	
Mexico	334,681		84.9
Vegetables, Fresh	351,239	11.1	
Mexico	293,685		83.6
Potatoes	281,890	8.9	
Canada	281,785		99.9
Onions and Shallots	270,243	8.5	
Mexico	157,468		58.3
Canada	55,133		20.4

Source: USDA data.
[a]Excludes watermelons.
[b]Includes potatoes.

levels of education among consumers. Of these factors, higher real income is the most important because consumers can purchase more expensive food products and can pay premiums for desired attributes.

Additional Spending for Quality, Variety

Food choices are moving toward safe, nutritious products, a greater variety of foods, and convenience. Consumer willingness to pay more for safe, high-quality, value-added products will create niche markets that commodity-style imports cannot supply. For vegetables (excluding potatoes), away-from-home consumption is expected to grow more quickly than is at-home consumption, but the proportion of each market held by commodity suppliers is expected to remain almost unchanged. For fruits, consumption at home will increase more than will that away from home. In both cases, a segment of U.S. consumers will pay more for additional variety and quality that commodity production cannot provide.

In determining where to spend their food dollars, consumers are demanding more natural foods. Organic production is growing, and the USDA reports that fresh produce is the top-selling organic category. Also, a desire to "buy local" and a preference for foods produced in an environmentally sound manner are important considerations for some consumers.

Greater Selection Fills the Shelf Space

Consumers are also demanding greater variety. In 1994, small and large supermarkets stocked less than 350 produce items. This year, large supermarkets are expected to stock 558 items, and small supermarkets are expected to stock about 540 items. These data include floral and other nonfresh items, but the majority of the increase is attributable to fresh produce. Supermarkets are delivering greater variety by offering more items, more kinds of a single item, and more further-processed items (for example, pre-cut fruits and vegetables). Packaging can increase the desirability and value of produce by adding convenience (for example, resealable bags), more desirable packaging materials, or a broader selection of sizes.

The sheer size of the U.S. market for fresh fruits and vegetables dictates that commodity-type products will continue to dominate the market and that the percentage of the market supplied by imports will continue to increase. In a growing portion of the market, however, consumers will be willing to spend more money on higher-quality produce. As a result, growing niche markets for noncommodity products are expected to provide greater opportunities for both foreign and domestic producers to increase the farm value of fresh produce. ◆

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market returns will be greater than variable costs is only 54 percent. Government programs increase expected returns by 516 percent to $200/ac. And the probability that returns over variable costs fall below expected revenue with no government programs is zero. Thus, government has taken the risk out of cotton farming.

U.S. crop producers largely have obtained what they sought: risk-free farming courtesy of government programs. This conclusion implies nothing about the relative merits of the various programs or whether the programs should be modified. But the programs do create the incentive for farmers and landlords to focus on growing the commodities that are supported by farm programs. Furthermore, an increased incentive to plant those hybrids and varieties that have the highest yields and lowest costs is what we would expect from a program designed to meet the interests of the most efficient producers of commodities. The programs would look quite different had the durum wheat and white corn producers been instrumental in their design. ◆

"Targeting" Efficiency in the Conservation Security Program
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targeting of watersheds will be equally beneficial.

In an attempt to provide some insight into the potential importance of targeting funds to various watersheds, we employed a water quality model, the Soil and Water Assessment Tool, to simulate adoption of conservation tillage (one of the practices included in the CSP) in the Des Moines River Watershed and the Iowa River Watershed. We combined this model with an economic model predicting the costs of obtaining adoption of conservation tillage in these watersheds based on a payment program like the CSP. To highlight the potential consequences of targeting, we consider two scenarios: full adoption of conservation tillage in the Des Moines River Watershed with no additional adoption in the Iowa River Watershed and the opposite adoption pattern (no new adoption in the Des Moines River and full adoption in the Iowa River Watershed).

Table 1 shows the levels of sediment (based on a 20-year projected average) and the estimated costs at the watershed outlets. As columns 1-3 indicate, the estimated percentage reduction in sediment erosion between the two scenarios is about the same (about 6 percent), but the original level of sediment load is much higher in the Iowa River Watershed than in the Des Moines River Watershed. Thus, the total sediment load reduction is about twice as high by targeting the Iowa River Watershed. This is consistent with column 4, which reports the average sediment load reduction per acre of land converted to conservation tillage.

However, the costs of adoption can vary significantly with targeting and need to be considered in assessing the consequences of targeting. The median cost of adopting conservation tillage in the two watersheds is about 20 percent higher in the Iowa River Watershed (we estimate the median costs of adoption to be $11/acre in the Des Moines River Watershed). While the total cost of sediment reduction is higher in the Iowa River Watershed, the per ton cost of sediment reduction is significantly lower (see columns 5 and 6). Targeting the Iowa River Watershed results in a higher overall reduction in sediment at a lower average cost per ton than does targeting the Des Moines River Watershed.

This particular example is only indicative of the different outcomes that could occur under various targeting mechanisms. However, the results of this simple simulation suggest that by targeting different watersheds, as proposed in the CSP, the Natural Resources Conservation Service will significantly affect the location, degree, and cost effectiveness of water quality improvements. Details of this research and other studies focusing on the consequences of targeting and conservation programs can be found at www.card.iastate.edu/environment/.◆

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