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AGRICULTURAL OUTLOOK

Managing Farm Risk: Issues and Strategies

Risk is an unavoidable element in the business of agriculture. Production can vary widely from year to year due to unforeseen weather and market conditions, causing wide swings in commodity prices. But risk, while inevitable, is often manageable.

Risk management involves choosing among alternatives for reducing risks that threaten the economic success of a farm business. The array of risk management strategies available to farm operators includes crop diversification, controlling cash flow, production contracting, forward pricing, and acquiring crop and revenue insurance.

For eligible producers of major field crops, income support provided in the 1996 Farm Act supplements the arsenal of risk management strategies, primarily by providing fixed annual "contract" payments that decline over the period 1996-2002, as well as loan deficiency payments when crop prices drop below certain levels. Recently, depressed global commodity prices have pressured farm income as contract payments declined. In response, Federal emergency assistance packages were enacted that included "market loss" and crop disaster payments, and crop insurance premium discounts.

In addition, Congress continues to examine legislative alternatives to address the issues of commodity yield and price swings and income support for farm households. Against the backdrop of concern among policy makers, USDA's Economic Research Service has examined the nature of farm business risk and explored the effectiveness of various risk management strategies. Throughout 1999, *Agricultural Outlook* published articles reporting on this work. Reprinted here, the articles address the following questions:

- Do management/financial strategies used by farmers vary by type and size of farm?
- How do prices of agricultural commodities vary seasonally and from year to year?
- How effective for risk reduction are combinations of crop and revenue insurance products and forward pricing strategies?
- What recent steps has government taken to broaden the array of crop and revenue insurance options for farmers? What are the costs to the government?
- How do factors such as insurance price and farmers' "risk type" affect decisions on purchasing insurance?
- Would tax-deferred savings accounts be effective tools in managing risk?

The answers to such questions will likely be useful to policymakers, educators, producers, and others who monitor risk management developments and strategies.

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Risk Management

Jack Harrison

Farmers Sharpen Tools To Confront Business Risks

As in any industry, risk is a part of the business of agriculture. With farm income currently under pressure from declining farm prices, USDA's Economic Research Service is exploring the subject of risk management in agriculture. This article, the first in the series, describes a variety of management techniques farm operators use to survive swings in weather, markets, and the economy. Other topics in the series include USDA's farm risk initiatives and an analysis of the effectiveness of different crop and revenue insurance products.

Farmers face an ever-changing landscape of weather, prices, yields, government policies, global competition, and other factors that affect their financial returns and overall welfare. With the shift toward less countercyclical government intervention following passage of the 1996 Farm Act came recognition of the need for a more sophisticated understanding of farm risk and risk management. Risk management strategies can help mitigate the effects of swings in supply, demand, and prices, so that farm business returns can be closer to expectations.

Risk management is, in general, finding the combination of activities most preferred by an individual farmer to achieve the desired level of return and an acceptable level of risk. Risk management strategies reduce risk within the farming operation (e.g., diversification or vertical integration), transfer a share of risk outside the farm (e.g., production contracting or hedging), or build the farm's capacity to bear risk (e.g., maintaining cash reserves or evening out cash flow). Using risk management does not necessarily avoid risk altogether, but instead balances risk and return consistent with a farm operator's capacity to withstand a wide range of outcomes.

Although farms vary widely with respect to enterprise mix, financial situation, and other business and household characteristics, many sources of risk are common to all farmers, ranging from price and yield risk to personal injury or poor health. But even when facing the same risks, farms vary in their ability to weather shocks. For example, in an area where drought has lowered yields, falling prices resulting from large worldwide production could have devastating consequences for local farm incomes. With such a downturn, some bankruptcies are likely to occur, and producers who are highly leveraged and have small financial reserves or lack off-farm income would be most vulnerable.

What do farmers themselves say about the risks they face? USDA's 1996 Agricultural Resource Management Study (ARMS), conducted in the spring of 1997 (about a year after passage of the 1996 Farm Act), asked producers how concerned they were that certain types of risk could affect the viability of their farms. Three risk factors of greatest concern to farm operators were uncertainty regarding commodity prices, declines in crop yields or livestock production, and changes in government law and regulation. Issues such as price and yield have historically been a focus of government farm programs. But new policy areas, such as water pollution control and waste management, may well affect future legislation and regulation of agriculture and pose new challenges to operators.

ARMS data show that producers specializing in wheat, corn, soybeans, tobacco, and cotton were generally more concerned about the threat of low yield and/or low price than any other risk. Reduced government intervention in markets for program crops (wheat, corn, cotton, and other selected field crops) under the 1996 Farm Act may have heightened producers' uneasiness about price risk.

Producers of other field crops, nursery and greenhouse crops, and poultry expressed greater concern about changes in laws and regulations than about other risks. This perhaps reflects fears that changes in environmental and other policies could require costly compliance by the agricultural sector. Producers of the other field crops may be wary of changes in regulations addressing soil conservation, land use, and tillage practices, while livestock producers may be particularly concerned about regulations related to waste management and the spread of disease.

Livestock producers also expressed concern about their ability to adopt new technology, perhaps because failure to invest in new production techniques could put them at a cost disadvantage to other producers. For farm operators involved in contracts, expenditures necessary to satisfy production requirements imposed by contractors, such as modification of existing livestock buildings, may add to risk.

Risk Management

Price & Yield Swings Pose Primary Risk

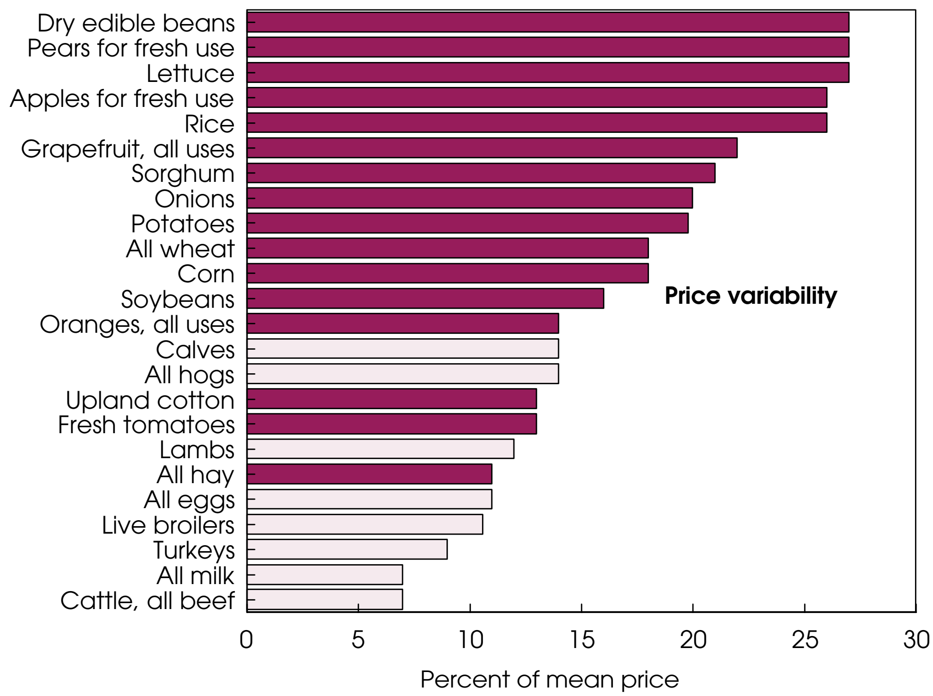
The possibility of lower-than-expected yield is one of the risks identified in the ARMS as a major concern to farmers, particularly those planting major field crops. Yield variability for a given crop varies by geographic area and depends on factors such as soil type and quality, climate, and use of irrigation. Yield variability for corn, for example, tends to be lowest in the central Corn Belt, where soils are deep and rainfall is dependable, as well as in areas that are irrigated. In Nebraska, where much of the corn production is irrigated, yield variability is quite low. Yield variability is also low in Iowa, Illinois, and other Corn Belt states, where climate and soils provide a nearly ideal growing environment for corn production.

In areas less well suited to corn production, yield variability is generally higher, and producers must deal with the prospect of yields that can deviate significantly from planting-time expectations. Risks associated with high yield variability and the resulting income variability can be mitigated by programs such as Federal crop insurance, as well as by diversification and other tools to help spread farm-level risk.

Like yield variability, price variability differs among commodities. In 1987-96, crop prices showed relatively more variability than livestock prices, largely because crop supplies are affected by swings in crop yields while livestock supplies have been more stable—although recent variability in the hog market illustrates that some exceptions exist. Crops that exhibited the highest price variability (deviations exceeding 20 percent above or below the mean) include dry edible beans, pears, lettuce, apples, rice, grapefruit, and grain sorghum. The variability of beef cattle, milk, and turkey prices was less than 10 percent, perhaps reflecting lower production risk and, in the case of milk, the existence of a Federal dairy program.

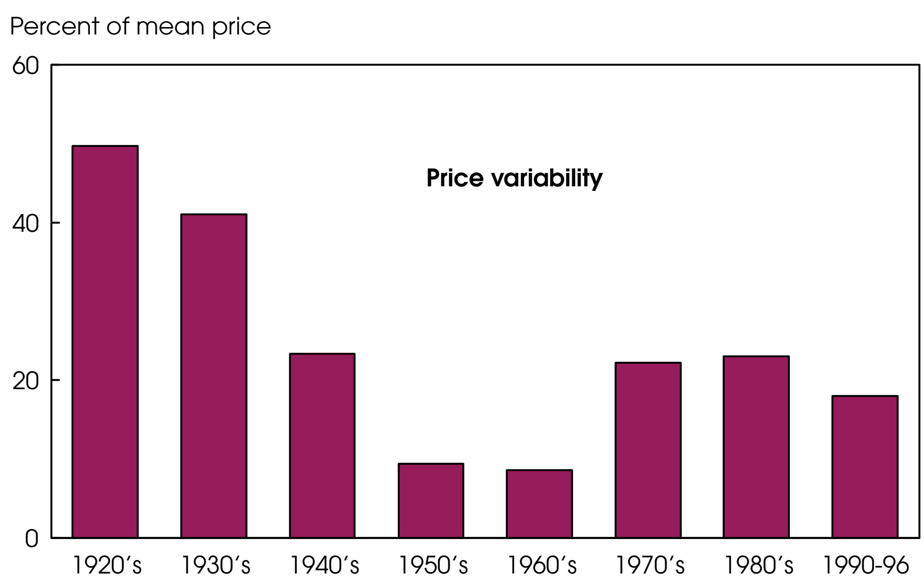
Price variability can change across time depending on year-to-year differences in crop prospects, changes in government program provisions, and shifts in world supply and demand conditions. For exam-

During 1987-96, Price Variability Was Generally Higher for Crops Than for Livestock



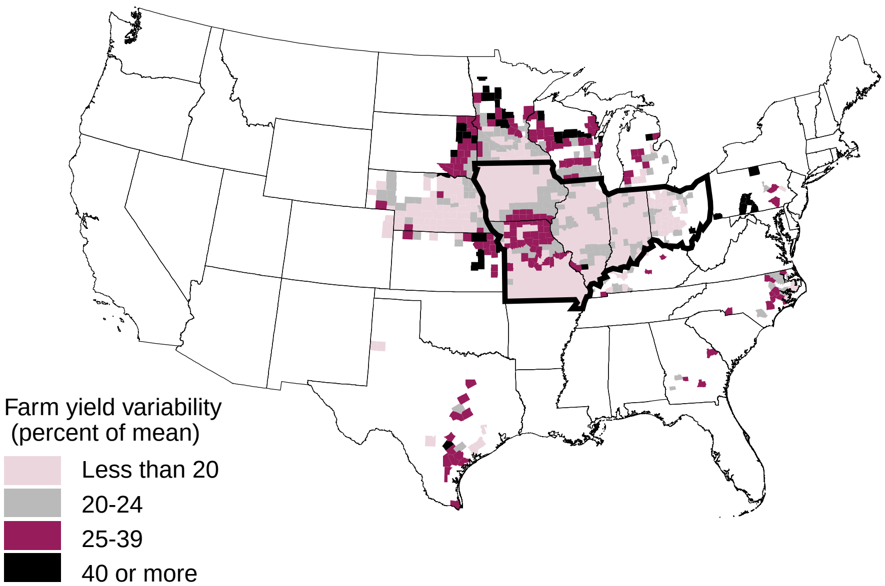
Price variability measures deviation above and below the mean price for the period 1987-96.
Economic Research Service, USDA

Corn Price Variability in the 1990's Is Near the Level of the Past Two Decades



Price variability measures deviation above and below the mean price for each period.
Economic Research Service, USDA

Corn Yield Variability is Generally Lower for Farms in the Heart Of the Corn Belt



Based on farm-level data, 1985-94, and long-term county-level yields. Includes counties with at least 500 acres planted to corn.

Economic Research Service, USDA

ple, corn price variability was quite high during the 1920's and 1930's, due largely to the collapse of grain prices after World War I and very low yields in 1934 and 1936. Corn prices stabilized during the 1950's and 1960's, a period of high government support, stable yields, and consistent demand. Sizable purchases of corn by Russia early in the 1970's affected variability during that decade, while low U.S. yields in 1983 and 1988 contributed to increased corn price variability in the 1980's. Variability returned to near long-term average levels in 1990-96.

"Natural Hedge" May Stabilize Revenues

Price and yield risks faced by a producer in a given situation, as well as the strength of the relationship between price and yield—the price-yield correlation—can influence the effectiveness of different risk management strategies. The stronger the negative correlation (i.e., yield and price moving in opposite directions), the better the "offsetting" relationship (or "natural hedge") works to stabilize revenues.

The price-yield correlation for a commodity tends to be more strongly negative for farms in major producing areas, because yields there are more positively correlated with national yields, and crop yields among farms within a region tend to move together. For example, in a major corn-producing area such as the Corn Belt, corn yields tend to be more positively correlated with a national corn yield, and therefore more negatively correlated with the national corn price. For wheat, where production is more dispersed and U.S. production is a smaller share of the world's crop, the natural hedge is weaker, making incomes more variable for most wheat growers.

When other factors are held constant, the magnitude of a producer's natural hedge has important implications for the effectiveness of various risk-reducing tools. A weaker natural hedge (where low prices more often accompany low yields), for example, implies that forward contracting or hedging in futures is more effective in reducing income risk than when a strong natural hedge exists. In this situation, locking in a sales price for part of the expected crop works to establish one component of the farm's revenue, reducing the likelihood of simultaneously low price and low yield. As a result, hedging can be an effective risk management strategy for farms outside major producing regions.

Deciding how much to hedge is more complicated than just assessing price-yield correlation. Income risk is also a function of price variability and yield variability. Hedging effectiveness declines as yield variability increases, and corn yields are typically more variable outside the Corn Belt. Since yield variability tends to outweigh the impact of price-yield correlation, hedging is generally not as effective in less consistent production areas as in the Corn Belt.

No Single Approach Suits All Farms

While factors such as yield variability, price variability, and price-yield correlation can be used to gauge the likely effectiveness of various risk management strategies, producers' attitudes toward risk are also determinants in selecting strategies. Some farmers are less risk averse than others, and, for example, might feel more comfortable in a highly leveraged situation (e.g., carrying a large mortgage) than would others. Similarly, producers may differ in their preferences for risk management tools, some perhaps feeling more at home with forward contracting with a local elevator while others may turn to hedging to manage their risks.

Because farmers face different degrees of variability and differ in their attitudes toward risk, there can be no single approach to suit all farms. Overall, farmers appear to be relying increasingly on forward contracting and other risk management tools to reduce their farm-level risks, due in part to the recent trend toward reduced government intervention in farming. Even so, the 1996 ARMS indicates that keeping cash (or liquid assets) on hand for handling emergencies and for taking advantage of good business opportunities was the number-one strategy used by farms of every size, every commodity speciality, and in every region.

Farm size apparently plays a role in choice of risk management strategy. The ARMS found that operators with annual gross sales of $250,000 or more were more likely than smaller operators to use hedging, forward contracting, and

A Selection of Strategies for Mitigating Risk

Farmers have many options in managing the types of risks they face. For example, producers may 1) plant short-season crop varieties that mature earlier in the season to beat the threat of an early frost; 2) install supplemental irrigation in an area where rainfall is inadequate or unreliable; or 3) use custom machine services or contract/hired labor to plant and harvest quickly during peak periods.

Most producers use a combination of strategies and tools, because they address different elements of risk or the same risk in a different way. Following are some of the more widely used strategies.

- *Enterprise diversification*—assumes returns from various enterprises do not move up and down in lockstep, so low returns from some activities would as a result likely be offset by higher returns from other activities. Diversification can even out cash flow. According to USDA data, cotton farmers are among the most diversified in the U.S., while poultry farms, with poultry and poultry products accounting for 96 percent of the value, on average, of their production, are the least diversified.
- *Vertical integration*—generally decreases risk associated with the quantity and quality of inputs (or outputs) because the vertically integrated firm retains ownership control of a commodity across two or more levels of activity. Vertical integration also diversifies profit sources across two or more production processes. In farming, vertical integration is most common for turkeys, eggs, and certain specialty crops.
- *Production contracts*—guarantee market access, improve efficiency, ensure access to capital, and lower startup costs and income risk. Production contracts usually detail inputs to be supplied by the contractor, the quality and quantity of the commodity to be delivered, and compensation to be paid to the grower. The contractor typically provides and retains ownership of the commodity (usually livestock) and has considerable control over the production process. On the downside, production contracting can limit the entrepreneurial capacity of growers, and contracts can be terminated on short notice.
- *Marketing contracts*—set a price (or pricing mechanism), quality requirements, and delivery date for a commodity before harvest or before the commodity is ready to be marketed. The grower generally retains ownership of the commodity until delivery and makes management decisions. Farmers generally are advised to forward price less than 100 percent of their expected crop until yields are well assured to avoid a shortfall that would have to be made up by purchases in the open market.
- *Futures contracts*—shift risk from a party that desires less risk (the hedger) to one who is willing to accept risk in exchange for an expected profit (the speculator). Farmers who hedge must pay commissions and forego interest or higher earning potential on money placed in margin deposits. Generally, the effectiveness of hedging in reducing risk diminishes as yield variability increases and the relationship (correlation) between prices and yields becomes more negative. Hedging can reduce, but never completely eliminate, income risk.
- *Futures options contracts*—give the holder the right, but not the obligation, to take a futures position at a specified price before a specified date. The value of an option reflects the expected return from exercising this right before it expires and disposing of the futures position obtained. Options provide protection against adverse price movements, while allowing the option holder to gain from favorable movements in the cash price. In this sense, options provide protection against unfavorable events similar to that provided by insurance policies. To gain this protection, a hedger in an options contract must pay a premium, as one would pay for insurance.
- *Liquidity*—involves the farmer's ability to generate cash quickly and efficiently in order to meet financial obligations. Some of the methods that farmers use to manage liquidity, and hence financial risk, include: managing the pace of investments (which may involve postponing machinery purchases), selling assets (particularly in crisis situations), and holding liquid credit reserves (such as access to additional capital from lenders through an open line of credit).
- *Crop yield insurance*—provides payments to crop producers when realized yield falls below the producer's insured yield level. Coverage may be through private hail insurance or federally subsidized multi-peril crop insurance. Risk protection is greatest when crop insurance (yield risk protection) is combined with forward pricing or hedging (price risk protection).
- *Crop revenue insurance*—pays indemnities to farmers based on revenue shortfalls instead of yield or price shortfalls. As of 1999, five revenue insurance programs (Crop Revenue Coverage, Income Protection, Revenue Assurance, Group Risk Income Protection, and Adjusted Gross Revenue) were offered to producers in selected locations. These programs are subsidized and reinsured by USDA's Risk Management Agency.
- *Household off-farm employment*—may provide a stream of income to the farm operator household that is more reliable and steady than returns from farming. In essence, household members working off the farm is a form of diversification. In 1996, according to USDA's ARMS data, 82 percent of all farm households reported off-farm income exceeding farm income. In every sales class (including very large farms), at least 28 percent of the associated farm households had off-farm income greater than farm income.

What Steps Would Farmers Take to Manage Financial Difficulties?

	Small farms*		Large farms**		
	Less than $50,000	$50,000-$249,999	$250,000-$499,999	$500,000 or more	Total U.S.
	Percent of farms				
Management/financial strategy:					
Restructure debt	24	48	46	49	30
Sell assets to reduce debt	31	28	31	29	30
Use more custom services	7	18	17	20	10
Scale back farm business	26	23	20	24	25
Diversify into other farm enterprises	12	23	21	21	15
Spend more time on management	19	38	47	45	24
Use advisory services	19	22	28	26	20
Adjust operating costs	34	54	59	57	40
Improve marketing skills	30	47	53	53	35

*Annual gross sales under $250,000. **Annual gross sales $250,000 or more.
Source: 1996 Agricultural Resource Management Study, USDA

Economic Research Service, USDA

virtually all other types of risk management strategies. In contrast, operators with sales under $50,000 were less likely to use forward contracting or hedging, and fewer reported using enterprise diversification to reduce risk.

The ARMS data also indicated that producers in the Corn Belt and Northern Plains were somewhat more likely to use risk management strategies than those in the Southern Plains, Northeast, and Appalachia. About 40 percent of producers in the Corn Belt and Northern Plains regions used forward contracting in 1996 and about 25 percent used hedging in futures or options.

Farm legislation also affects adoption of risk management strategies. About one-third of producers nationwide reported receiving direct government commodity payments in 1996. Of these, between 5 and 8 percent (1-3 percent of all U.S. farmers) indicated they had added or increased use of at least one risk management strategy or tool (forward contracting, hedging, insurance, or other strategy) in 1996 in response to provisions of the 1996 Farm Act.

A period of financial stress may induce an operator to shift risk management strategies. The 1996 ARMS questioned farmers about production, marketing, and financial activities they might undertake if faced with financial difficulty. A large proportion of producers with sales of $50,000 or more indicated they would adjust costs, improve marketing skills, restructure debt, and spend more time on management decisions.

Producers with sales under $50,000 (who generally receive a substantial share of household income from off-farm sources) also responded that they would adjust costs when faced with financial difficulties. But small-farm operators would be relatively more likely than larger operators to sell farm assets or scale back operations. Further, small-scale producers were much less likely to spend more time on management or on improving their marketing skills.

When individual efforts to deal with financial stress fail and large numbers of farms face significant financial loss, the Federal government has often stepped in with assistance to agriculture in the form of direct payments, loans, and other types of aid. In 1999, for example, the agricultural appropriations act authorized emergency financial assistance to farmers who suffered losses due to natural disasters. Under this legislation, farmers were eligible for payments either for losses to their 1998 crop, or for losses in any 3 or more crop years between 1994-98. Farmers with crop insurance received slightly higher payments than those without, and those receiving emergency benefits were required to buy crop insurance (if available) in 1999 and 2000. In addition, the legislation provides an incentive for purchasing higher levels of crop insurance coverage in 1999 by earmarking an estimated $400 million to subsidize farmers' insurance premiums. The 2000 agricultural appropriations provided crop loss assistance and $400 million to continue through 2000 the incentives for purchasing high levels of crop insurance.

Such assistance is undoubtedly critical for producers facing financial difficulty. However, it raises questions as to how the potential for direct payments in times of disaster affects producers' decisionmaking with regard to tools and strategies that can help them manage risk and perhaps avoid financial stress. Linking receipt of government assistance to adoption of a risk management strategy, namely the purchase of crop insurance, encourages producers to gain experience with a program that can provide protection in crisis years in the future. Understanding the risks faced in farming and the use of different tools by producers can lead to new strategies and educational approaches to cut risk and can perhaps help reduce the incidence of farm financial stress. AO

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Farm Structure

More Farmers Contracting To Manage Risk

Almost a third of crops and livestock produced by American farmers was grown or sold under contract in 1997, according to USDA's Agricultural Resource Management Study (ARMS). Departing from a tradition of independent farm operators who have complete control over production and marketing decisions, contracting is a growing trend in American agriculture (*AO* May 1997). Today, more than 1 in 10 farm operators report income from contractual arrangements.

Contracting offers farm operators the advantages of reducing risks of price swings, sharing production costs, and stabilizing income. For contractors (primarily processors and packers), these arrangements assure a ready supply of uniform, high-quality farm products and ease inventory management problems.

Contracts—either written or oral agreements—will generally spell out the parties' understanding of how a commodity is to be produced and/or marketed, including specifications for quantity, quality, and price. Marketing contracts are commonly used for crops, while production contracts are more prevalent in the livestock industry.

Under a *marketing contract*, a price (or pricing mechanism) is established for a commodity before harvest or before the commodity is ready for marketing. Most management decisions remain with the grower, who retains ownership of both production inputs and output until delivery. With a marketing contract, the farmer assumes all risks of production but shares price risk with the contractor.

A *production contract* details who supplies the necessary production inputs—the contractor or the farmer (contractee)—as well as the quality and quantity of a particular commodity and the compensation due the farmer for services rendered. Under livestock production contracts, the farmer is paid to provide housing and care for the animals until they are ready for market, but the contractor actually owns the animals.

Although cash markets still dominate the agricultural sector, nearly $60 billion (31.2 percent) of total production was covered by contracts. Commodities produced under marketing contracts accounted for 21.7 percent of the total U.S. value of production, while those under production contracts accounted for 9.5 percent. In 1997, 9 percent of farmers sold at least part of their output through marketing contracts, and 2.2 percent had some income from production contracts.

Between 1991 and 1997, the share of commodities produced under marketing contracts increased from 16 percent to 22 percent of total U.S. value of production. The production contract share of the total has varied between 10 and 15 percent, with no clear trend.

Topping the list of crops produced under marketing contracts were fruits and vegetables, with $11 billion sold through contract, 40 percent of the value of all fruits and vegetables produced. Other crops with large shares of production value under marketing contracts were cotton ($1.9 billion, or 33 percent); corn ($1.7 billion, or 8 percent); soybeans ($1.7 billion, or 9.4 percent); and sugar beets ($973 million, or 82 percent). Just under 10 percent of the value of cattle production was sold under marketing contracts, compared with more than 60 percent of the value of dairy products.

Production contracts are more likely to be used for livestock. Poultry and poultry products accounted for over 50 percent of the total value of commodities under production contracts, and cattle and hogs another 41 percent. Within the poultry category, 70 percent of the commodity value of production was produced under production contracts. In contrast, 33 percent of the value of production of hogs and 14 percent of cattle were covered by production contracts.

While farms of all types and sizes engage in contracting, two-thirds of farms with contracts (marketing and/or production) in 1997 were small family farms (sales under $250,000). However, larger family farms (sales $250,000 and over) and nonfamily farms accounted for more than three-fourths of the value of products grown and sold under contract.

Typology of U.S. Farms

Small family farms (annual sales under $250,000)

Limited-resource: Operator household income under $20,000, farm assets under $150,000, and gross farm sales under $100,000. Limited-resource farmers may or may not report farming as their major occupation, or they may be retired.

Retirement: Operators report they are retired (excludes limited-resource farms).

Residential/lifestyle: Operators report primary occupation other than farming (excludes limited-resource farms).

Farming occupation/lower-sales: Operators' primary occupation is farming; gross farm sales are under $100,000 (excludes limited-resource farms).

Farming occupation/higher-sales: Operators' primary occupation is farming; gross farm sales are $100,000-$249,999.

Larger family farms

Large: Gross farm sales $250,000-$499,999.

Very large: Gross farm sales $500,000 or more.

Nonfamily farms

Nonfamily corporations or cooperatives, as well as farms run by hired managers.

Two-thirds of Farms with Contracts Are Small...

	Small family farms					Larger family farms		Nonfamily farms	All farms
	Limited-resource	Retirement	Residential/ lifestyle	Farming/ lower-sales	Farming/ higher-sales	Large	Very large		
Farms:									
All farms (number)	195,572	304,293	811,752	396,698	178,210	79,240	45,804	37,816	2,049,384
All farms (percent)	9.5	14.8	39.6	19.4	8.7	3.9	2.2	1.8	100.0
Farms with contracts (percent)	2.5	9.0	13.9	20.2	21.4	16.5	12.7	3.8	100.0
Value of production:									
Total ($ million)[1]	1,615.5	4,378.2	13,126.7	19,971.5	35,249.7	30,230.7	59,582.5	27,569.3	191,724.0
Contract value($ million)	137.4	542.9	1,758.3	4,678.6	6,834.6	8,421.3	26,409.1	11,043.2	59,825.5
Production contracts ($ million)	d	147.2	524.4	943.2	970.7	3,012.6	8,762.3	3,843.8	18,215.7
Marketing contracts ($ million)	d	395.6	1,233.9	3,735.4	5,863.9	5,408.7	17,646.9	7,199.4	41,608.8
Share of contract value (percent)	0.2	0.9	2.9	7.8	11.4	14.1	44.1	18.5	100.0
... but Larger Farms Are More Likely to Use Contracting									
Percent of farm type with:									
Production and/or marketing contracts	2.9	6.7	3.9	11.6	27.2	47.2	62.9	23.1	11.1
Production contracts[2]	d	0.8	0.7	1.9	4.9	13.3	20.0	2.2	2.2
Marketing contracts[2]	d	5.9	3.3	9.8	23.1	36.2	45.8	21.6	9.2
Percent of value of production under contract	8.5	12.4	13.4	23.4	19.4	27.9	44.3	40.1	31.2

1. Survey-based estimates exclude Alaska and Hawaii and do not represent official USDA estimates of farm sector activity. 2. Includes some farms that have both production and marketing contracts.
d - Data insufficient for disclosure.
Source: 1997 Agricultural Resource Management Study, USDA.

Economic Research Service, USDA

Larger family farms were more likely to use contracting than small family farms— 53 percent compared with 8 percent. Larger farms were also more likely than other farms to use production contracts instead of marketing contracts. Larger family farms accounted for 65 percent of the total value of commodities produced under production contract, while nonfamily farms accounted for 21 percent and small family farms for the remaining 14 percent.

Farms with marketing contracts—9 percent of all farms—outnumbered those with production contracts by 4 to 1. While small farms made up almost 70 percent of the farms engaged in marketing through contracts, they accounted for only 27 percent of the total value of production sold under marketing contracts.

Dairy products marketed by small farms under contract were valued at $6.3 billion, or more than half of the marketing contract value of production on small farms. Small family farms sold $1.6 billion of fruit and vegetables through marketing contracts—20 percent of the value of all fruit contract marketings and 5 percent of the value of all vegetable contract marketings. Other crops raised on small farms and marketed through contracts include soybeans, cotton, and corn, but contracted value of these commodities totaled just $1.4 billion.

Larger family farms sold 70 percent of their total value of dairy products through marketing contracts, as well as 66 percent of their fruit and 38 percent of their cotton. Other crops grown under marketing contract on larger family farms include vegetables, corn, and soybeans. Commodities under marketing contracts on nonfamily farms were predominantly fruits, cattle, and dairy products.

As government programs become more market-oriented, all farm operators will need to continue developing their risk management skills in order to protect their operations from high debt levels and unpredictable price swings. Contracting is likely to be a part of farmers' efforts to reconcile production preferences with expected conditions in the marketplace, locking in purchasers for their products, sharing costs with investors, and ensuring compensation for their labor.

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For more information on family farms

Structural and Financial Characteristics of U.S. Farms, 1995: 20th Annual Family Farm Report to the Congress

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Risk Management

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Assessing Agricultural Commodity Price Variability

Price variability is a component of market risk for both producers and consumers. Although there is no consensus as to what constitutes too much commodity price variability, it is generally agreed that price variability that cannot be managed with existing risk management tools can destabilize farm income, inhibit producers from making investments or using resources optimally, and eventually drive resources away from agriculture.

Market price volatility that is not offset by application of risk management strategies can lead to sudden and large income transfers among various market participants. For example, grain producers with high variable costs or significant debt may face increased financial stress because of unexpected downward swings in prices and income, and may be unable to repay creditors. Input suppliers, farm lenders, processors, and producers in both the grain and livestock sectors may see their business costs rise and may pass those higher costs on to consumers. And insurance companies trying to set actuarially sound revenue insurance rates when faced with increases in price variability must raise premiums charged to farmers in order to maintain actuarial soundness (*AO* August 1999).

Counterbalancing society's interest in the farm sector's ability to manage price risk is an equally important interest in preserving a "natural" degree of price variability. Price changes trigger supply and demand adjustments that make markets work more efficiently. Thus, society has an interest not only in helping market participants manage price risk via appropriate risk management tools, but also in allowing markets to function efficiently.

An improved knowledge of the patterns of commodity price variability and the forces behind it would aid policymakers in providing a policy environment conducive to good risk management practices and would help farmers to better understand and manage their price risks. USDA's Economic Research Service (ERS) has undertaken research designed to identify trends or patterns in price movements and variability over time—nominal and inflation-adjusted—and across agricultural commodities. The research also explores factors influencing price variability, such as strong seasonal patterns in production, market supply and demand conditions, and government policies.

How Market Conditions Affect Price Variability

Agricultural commodity prices respond rapidly to actual and anticipated changes in supply and demand conditions. Because demand and supply of farm products, particularly basic grains, are relatively price-inelastic (i.e., quantities demanded and supplied change proportionally less than prices) and because weather can produce large fluctuations in farm production, potentially large swings in farm prices and incomes have long been characteristics of the sector and a farm policy concern.

The *supply elasticity* of an agricultural commodity reflects the speed with which new supplies become available (or supply declines) in response to a price rise (fall) in a particular market. Since most grains are limited to a single annual harvest, new supply flows to market in response to a postharvest price change must come from either domestic stocks or international sources. As a result, short-term supply response to a price rise can be very limited during periods of low stock holdings, but in the longer run expanded acreage and more intensive cultivation practices can work to increase supplies. When prices fall, the cost of storage relative to the price decline helps producers determine if commodities that can be stored should be withheld from the market.

Similarly, *demand elasticity* reflects a consumer's ability and/or willingness to alter consumption when prices for the desired commodity rise or fall. This willingness to substitute another commodity when prices rise depends on several factors, including number and availability of substitutes, importance of the commodity as measured by its share of consumers' budgetary expenditures, and strength of consumers' tastes and preferences. Since the farm cost of basic grains generally comprises a very small share of the retail cost of consumer food products (e.g., wheat accounts for a small share of the price of a loaf of bread and corn represents a fraction of the retail cost of meat products), changes in grain prices have little impact on retail food prices and therefore little impact on consumer behavior and corresponding farm-level demand.

Increasing demand for grains for *industrial use*, whether from processing industries or from rapidly expanding industrial hog and poultry operations, further reinforces the general price inelasticity of demand for many agricultural commodities. Industrial use of grains generally is not sensitive to price change, since industrial users usually try to utilize at least a minimal level of operating capacity year round. Also, in most cases, as with retail food prices, the price of the agricultural commodity represents a small share of overall production costs of agriculture-based industrial products.

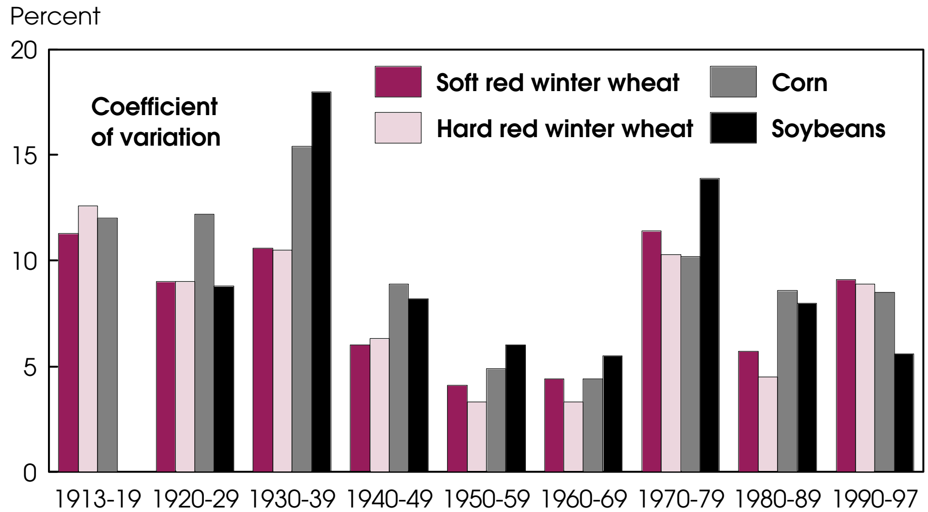
However, feed demand for grain, particularly for cattle feeding in the Southern and Northern Plains states, is far more sensitive to relative feed grain prices, since similar feed energy values may be obtained from a variety of different grains. Cattle feeders in these states are quick to vary the shares of different grains in their feed rations as relative prices change.

In general, elasticities of demand and supply for agricultural products are both low but not uniform or consistent across commodities. For example, there are several characteristics unique to wheat production in the U.S. that suggest greater supply and demand elasticity (and, since supply and demand respond somewhat faster, less dramatic price swings) relative to other field crops in the face of external supply and demand shocks—e.g., crop failure in a competing exporter country or financial crisis in a major purchasing country.

First, U.S. wheat production is marked by two independent seasons, winter and spring, with planting periods nearly 6 months apart. If it becomes apparent that winter wheat production is substantially below market expectations due to prevented plantings or weather-related declines in expected yield, some potential production losses can be offset by increased spring wheat plantings.

Second, the potential for surplus wheat production to enter agricultural markets from a large number of competing wheat exporter nations (principally Canada, Argentina, Australia, the European Union, and occasionally Eastern Europe) increases the supply responsiveness of wheat beyond that of other major grains. In addition, since two major U.S. wheat export competitors are located in the Southern Hemisphere and their production cycle runs opposite that of the U.S., still greater elasticity of supply in international markets is possible.

Cash Price Variability Was Greatest Before World War II and in the 1970's



Based on prices at major terminal markets. Soybean price data for 1913-19 not available. The coefficient of variation (CV) is a measure of price variability. CV = (dispersion of monthly inflation-adjusted average cash price over the season divided by mean of monthly average cash price over the season) multiplied by 100.
Source: Constructed by ERS using monthly average cash price data from Bridge News Service and USDA's Agricultural Marketing Service and the all-urban CPI deflator from the Bureau of Labor Statistics.

Economic Research Service, USDA

Argentina and Australia have the opportunity to expand planted wheat acreage in response to supply and demand circumstances in the U.S. within the same marketing year, dampening the potential year-to-year variability of prices in the U.S. market. While this potential additional supply limits price rises, it may actually deepen price declines because high storage costs and limited storage capacity frequently push surplus production into international markets even when prices are low.

Third, wheat can serve dual functions as either food or feed. The feed potential of wheat can have a dampening effect on price variability, either by introducing an additional source of demand that prevents prices from falling too low or by shutting off that same demand source when prices rise too high relative to other feed grains.

Fourth, most government-assisted export programs have been directed at wheat and have had a potential dampening effect on price variability in much the same manner as feed demand—they introduce an additional source of demand that moves opposite to prices. Because export programs are funded to deliver a fixed *value* of commodities, the *volume* of U.S. program grain exports rises during periods of excess supply and relatively lower prices, but falls when supplies are tighter and prices higher.

Similarities Common in Commodity Price Movements

In examining long time series of monthly average spot market prices for corn, oats, soybeans, and several classes of wheat from major terminal markets, ERS has found strong similarities in nominal and inflation-adjusted price movements and variability over time and across agricultural commodities. Price movements of corn, oats, and most wheat classes are similar mainly because of their substitutability in livestock feeding, but their market-year price volatility shows greater differences because the

Risk Management

Wheat Price Is More Highly Correlated With Corn Price Than With Soybeans. . .

	Wheat			Corn	Soybeans
	Soft red winter	Hard red winter	Hard amber durum		
	Correlation coefficient for price				
Wheat:					
Soft red winter	**1.00**	0.99	0.87	0.90	0.71
Hard red winter	0.99	**1.00**	0.90	0.90	0.71
Hard amber durum	0.87	0.90	**1.00**	0.81	0.62
Corn	0.90	0.90	0.81	**1.00**	0.72
Soybeans	0.71	0.71	0.62	0.72	**1.00**

. . .but Grain Price Variability Is Less Highly Correlated Than Grain Price

	Wheat			Corn	Soybeans
	Soft red winter	Hard red winter	Hard amber durum		
	Correlation coefficient for price variability				
Wheat:					
Soft red winter	**1.00**	0.94	0.71	0.46	0.39
Hard red winter	0.94	**1.00**	0.71	0.53	0.35
Hard amber durum	0.71	0.71	**1.00**	0.22	0.30
Corn	0.46	0.53	0.22	**1.00**	0.39
Soybeans	0.39	0.35	0.30	0.39	**1.00**

Prices are inflation-adjusted monthly spot market prices during various time periods, 1913-98. The correlation coefficient indicates similarity between two sets of variables: a coefficient of plus one (+1) indicates a perfect positive relationship, minus one (-1) a perfect negative relationship, and zero no relationship.
Price variability is coefficient of variation (CV) for market-year inflation-adjusted monthly spot market prices. CV = (dispersion of monthly inflation-adjusted average cash price over the season divided by mean inflation-adjusted monthly average cash price over the season) multiplied by 100.
Sources: Spot market prices from USDA's Agricultural Marketing Service; daily cash settlement prices from the Chicago Board of Trade; and monthly average settlement prices from Bridge News Service.

Economic Research Service, USDA

commodities differ in their response to supply and demand shifts.

Nominal prices for these commodities, as reported by USDA's Agricultural Marketing Service, have shown a general upward trend since the early 1930's, interrupted by nearly two decades of fairly stable prices in the 1950's and 1960's. This period of relative stability ended with a dramatic price spike in the early 1970's, a tumultuous period marked by an unexpected surge in world grain demand and trade, coupled with poor harvests and rapid, dynamic macroeconomic changes (*AO* September 1996). Since the mid-1970's, nominal prices appear to have both a higher mean level and greater variability. The past three seasons (1996-98) have witnessed a precipitous plunge in nominal prices from the May 1996 spike when corn and two of the high-protein wheat classes—hard red winter and hard red spring—attained record-high monthly average spot market prices.

When monthly average price data are adjusted for inflation, a different pattern emerges—declining real prices since the late 1940's, interrupted by the dramatic upward spike in prices of the early 1970's. The pattern of inflation-adjusted price variability is less clear than the pattern of nominal price variability, but it suggests that prices were more variable during the three pre-World War II decades than since.

A common statistic for measuring the variability of a data series is the coefficient of variation (CV), which expresses the dispersion of observed data values as a percent of the mean. Since the CV is unit-free (a percent), it facilitates comparison of price changes in different directions, across different periods of time, and for different commodities. Marketing-year CV's calculated from each commodity's inflation-adjusted series of average monthly spot prices reflect the price volatility that occurred *within* each marketing year. The nature and degree of this within-year price variability affect decisions on the mix and level of farm activity, as well as on risk management and marketing strategies.

On the other hand, comparison of CV's *across* market years provides an indication of a commodity's longrun price variability. Such across-year price variability influences firm expansion and capital-asset acquisition decisions, and has a direct bearing on a firm's economic viability. In addition, the longrun variability of commodity prices across marketing years reflects the risk environment for agriculture relative to other sectors.

A shortcoming inherent in using historical averages as a forecast of price volatility is that such estimates fail to fully incorporate current market information. For example, prices are likely to be more volatile than the historical average during a year that begins with very low carryin stocks.

The degree of variability in commodity prices is traditionally believed to depend heavily on stock levels and on the nature and frequency of unexpected shifts in demand and supply. Thus, essentially all market forces affecting commodity price formation could potentially come into play in determining price variability. Such forces include own supply (carryin stocks, production, and imports), supply of substitute crops (depending on end use), and aggregate demand (domestic mill, feed, seed, and industrial use, and exports). Own supply and supplies of competitor crops are directly affected by weather, acreage, government policy, and international trade factors. Demand is directly affected by price, income, shifts in tastes and preferences for end uses, and population growth. Grain and seed characteristics—i.e., type, quality, protein content, and color—are also key factors in price formation.

The possibility of substitution in use is critical in determining strength of correlation between different commodity prices. For example, inflation-adjusted spot market prices for three winter wheat classes—soft red, hard red, and soft white winter—and hard red spring wheat are highly correlated, because they offer some similar characteristics to end users. Hard amber durum, on the other hand, with its high protein level and specific milling and end-use qualities, offers the least opportunity for substitution with other wheat classes and, as a result, tends to have slightly lower price correlations with other wheat classes.

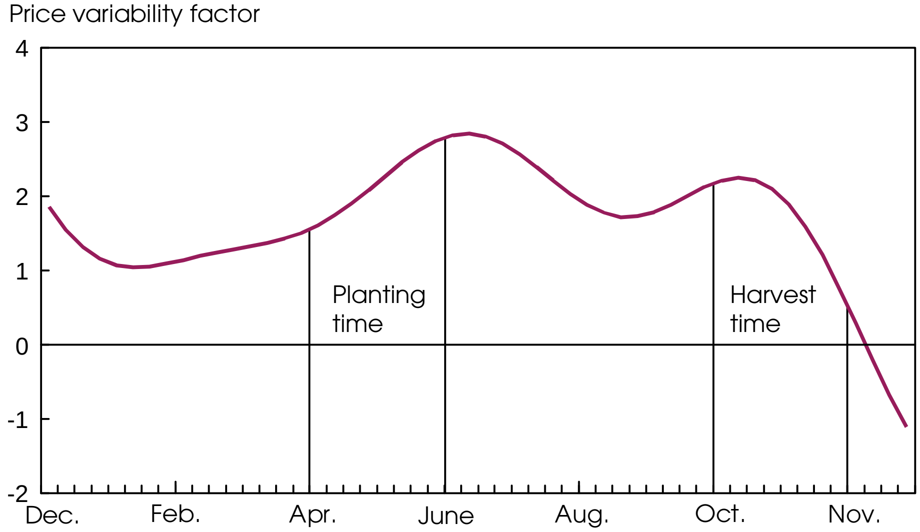
Price correlations among corn, oats, and wheat, although somewhat lower, are still very strong and likely reflect their substitutability in feed markets. Price correlations between these grains and soybeans are lower yet. Soybean prices are principally derived from demand for its joint products—oil and meal. Soybean meal is generally included in feed rations as a protein source, but may compete directly with other grains in feed rations as an energy source, depending on relative prices. However, soybean oil—used principally as a food with some minor industrial uses—has limited substitutability with grains (corn oil being the major exception), thereby weakening the soybean-grain price correlation.

Correlations of market-year price CV's for corn, oats, wheat classes, and soybeans are sharply lower compared with price-level correlations. This suggests that while general price levels for most grains and soybeans may be influenced by or move in tandem with many of the same forces, commodity price variabilities are more distinct and less strongly related to each other, due likely to disparities in their respective supply and demand responsiveness to price changes.

Strong Seasonal Pattern for Within-Year Price Volatility

The principal difficulty in analyzing within-year price variability is that while prices can be routinely observed for almost any time period (e.g., year, month, week), the economic supply and demand factors that likely influence price movements are generally reported only on a monthly or quarterly basis. Research conducted jointly by ERS and North Carolina State University attempted to circumvent this problem by transforming monthly and quarterly data into weekly data representations. These were used to assess the importance of relevant market information in forecasting *within-year* price variability (measured as a rate of change) of settlement prices for the Minneapolis Grain Exchange's September wheat futures contract and the

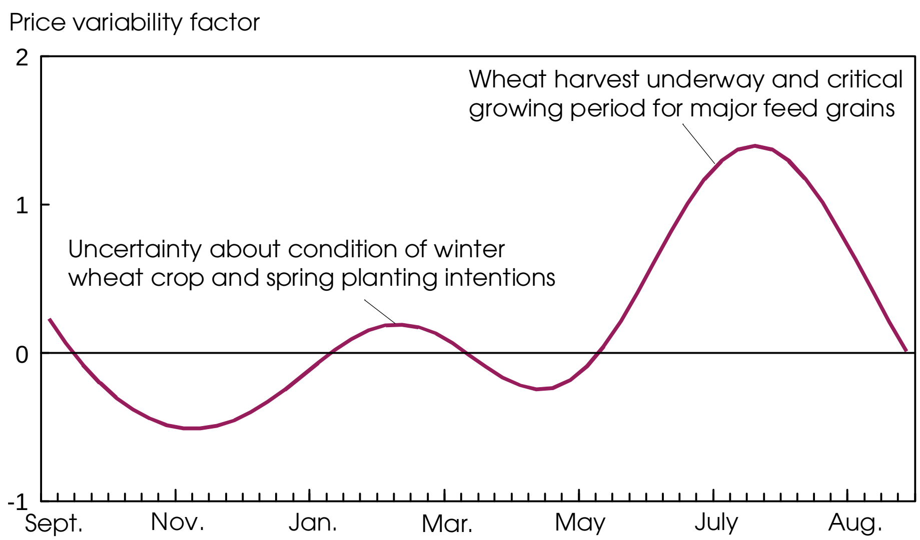
Corn Price Variability Rises During Planting Time and Ebbs During Harvest



Price variability factor indicates weekly deviation from expected (or forecast) price variability measured over the entire time period. Zero indicates price variability during that week is the same as expected price variability over the entire time period. Seasonal volatility estimated by an economic model of volatility using weekly Chicago Board of Trade December corn futures contract prices, 1986-97.
Source: USDA's Economic Research Service and North Carolina State University.

Economic Research Service, USDA

Wheat Price Variability Peaks When Uncertainty Is Greatest



Price variability factor indicates weekly deviation from expected (or forecast) price variability measured over the entire time period. Zero indicates price variability during that week is the same as expected price variability over the entire time period. Seasonal volatility estimated by an economic model of volatility using weekly Minneapolis Grain Exchange September wheat futures contract prices, 1986-97.
Source: USDA's Economic Research Service and North Carolina State University.

Economic Research Service, USDA

Are Prices More Volatile in Recent Decades Than Earlier?

An examination of the historical record of wheat, corn, oat, and soybean prices during 1913-97 indicates the following patterns:

- Wheat prices tend to be less variable than prices for oats, corn, or soybeans over the entire period and during most selected subperiods. The most notable exception is the 1990-97 period when wheat price variability was above average while soybean and oat variability were below the average for the entire period.
- All five wheat classes, plus corn and soybeans, exhibited dramatic increases in price variability during the 1971-75 period.
- Price variability for all commodities is noticeably higher in the post-1970's era (1976-97) than during the pre-1970's period (1951-70).
- Price variability in the post-1970's period (1976-97) is slightly lower than variability during the 1913-50 period.

Studying such a long price series gives greater perspective to current levels of price variability and suggests that perhaps an anomaly with respect to price variability occurred during the 1950's and 1960's, when heavy government involvement in agricultural commodity markets—including large government stockholdings of wheat and feed grains—coupled with low absolute levels of world trade (relative to the post-1971 period) contributed to artificially stable prices.

Chicago Board of Trade's December corn futures contract during the 1987-96 period.

Futures prices play a critical role in facilitating seasonal market operations, because they provide a forum for forward contracting, as well as a central exchange for domestic and international market supply and demand information. Regional and local grain elevators rely on futures commodity exchanges for hedging grain purchases and generally set their grain offer prices at a discount (in areas of surplus production, such as the Corn Belt) or at a premium (in deficit production areas, such as North Carolina) to a nearby futures contract. As a result, cash prices and futures contract prices are strongly linked—i.e., both prices contain much of the same information about variability.

Both corn and wheat futures contract prices display distinct patterns of seasonal variability. For the December *corn* contract, a strong variability peak occurs in June when there is a great deal of uncertainty surrounding the true extent of plantings and likely yield outcomes for corn and other spring-planted crops. Much of the acreage uncertainty is resolved with release of USDA's June 30 *Acreage* report, while yield uncertainty is resolved in July after corn pollination has occurred. A second, weaker peak occurs in October and corresponds with the arrival of new information during the peak corn harvest period. The seasonal component of corn price volatility then declines rapidly prior to contract expiration.

This pattern suggests that the bulk of relevant information is synthesized by the corn market during the critical summer growing months when estimates of acreage and yields are largely determined. Supply news then tends to dominate markets into the fall harvest, with little new information added during the period immediately preceding contract expiration.

The seasonal pattern for September *wheat* futures contract price variability also shows two peaks, the first a weak early-season peak occurring in January-March, a time of substantial uncertainty about the true condition of the winter wheat crop and farmers' spring planting intentions. Much of the uncertainty is resolved with USDA's release of its March 28 *Planting Intentions* report.

A second, much stronger peak in variability occurs in late July and corresponds with the conclusion of winter wheat harvest and the critical growing period for the major feed grains and spring wheat. Domestic prices for the U.S. wheat crop also depend heavily on international supply and demand conditions, and some key market information governing international developments does not reach the market until midsummer when USDA begins forecasting major international crop production. Following the July harvest-time surge, the seasonal variability then declines rapidly prior to contract expiration.

The volatility of corn and spring wheat futures prices also shows a strong negative relationship with growing conditions—better-than-average growing conditions are associated with lower price variation. However, corn and wheat prices differ in the association of variability with many of the remaining supply and demand factors studied. This is likely due to differences in their respective supply and demand responsiveness to price changes.

For corn, increases in expected U.S. domestic demand—published monthly in USDA's *World Agricultural Supply and Demand Estimates (WASDE)* report—had a positive influence on price volatility, but changes in actual levels of corn stocks—estimated quarterly by USDA—did not appear important, probably because corn supply is estimated from a single annual crop, and because changes in stocks are primarily a residual of often offsetting changes in other market forces and therefore tend to move slowly between harvests.

For wheat, changes in expected exports and domestic demand for all wheat showed no influence on spring wheat price volatility, while increases in actual all-wheat private stocks had a dampening effect on volatility. Lack of a strong relationship between demand factors and spring wheat price volatility is likely explained by winter wheat dominance of U.S. wheat exports, by the shifting importance of wheat as government food donations versus commercial export sales, and by the interplay of food-feed markets.

The study found that the level of day trading (day traders enter and exit the market with no outstanding balance at the end of the trading day) at each commodity exchange correlated positively with both corn and spring wheat price variability, likely because day trading allows prices to adjust to information more quickly. On the other hand, market concentration—

measured using Commodity Futures Trading Commission “commitment of traders” data on holdings of the four largest traders—had a negative influence on spring wheat price volatility, suggesting that the action of large traders in highly concentrated markets may decrease the volatility of wheat prices.

Forces Driving Across-Year Price Variability

In joint research to investigate determinants of *across-year* price variability, ERS and North Carolina State University constructed within-year CV’s from monthly average cash prices at major terminal markets during 1944-97 for Chicago/St. Louis soft red winter wheat, Chicago corn, and Chicago/Central Illinois soybeans. Each CV reflects the price variability that occurred during a market year. Then these market-year CV’s were examined in light of year-to-year changes in major supply and demand factors.

As expected, output price variability for all three commodities was found to be negatively correlated with the level of stocks relative to total disappearance; a ready supply available from stocks tends to make prices less sensitive to new market information. However, as in the within-year study, corn, soybean, and wheat price CV’s exhibited key differences in their association with most of the remaining supply and demand factors studied, likely because of differences in their supply and demand responsiveness to price changes.

Since increases in production tend to dampen both prices and price variability by contributing to an increase in total supply relative to market demand, any change in acreage and yield (both of which have positive associations with production) is expected to have a negative, indirect effect on price variability through the influence on production. Change in yield shows a strong negative relationship with corn price variability, but no relationship with soybean and wheat CV’s. Wheat’s dual seasons (winter and spring) within a single crop year and broad geographic diversity of production likely diminish the influence of a single weather pattern on the aggregate wheat market. Change in harvested acres is negatively related to wheat price variability, but not to corn or soybean price variability.

Change in demand, on the other hand, is expected to be positively associated with price variability since increases in demand, whether domestic or international, draw down total supplies and stocks, and decreases in demand have the opposite effect. This was confirmed by a positive association between corn price variability and both domestic use and exports.

However, wheat price variability showed no relationship to change in domestic use and was negatively related to change in exports. The negative effect of wheat exports on price variability tends to confirm the smoothing effect of government export assistance programs, and suggests that U.S. wheat exports act as a residual source of supply to world markets when domestic prices fall low enough. The offsetting roles of food and feed usage in wheat price volatility—positive for widespread changes in domestic use for milling and other food and industrial uses, but negative (and offsetting) when acting as a residual outlet to feed markets—result in a net neutral effect.

Similarly, changes in the general level of input prices are expected to have positive associations with price variability indirectly via their negative influences on production and total supply. For example, rising input prices tend to dampen production and, in turn, may raise price variability. However, no relationship was found with corn and wheat price CV’s. Instead, soybean price variability showed a negative association with changes in input prices, suggesting that soybean cost savings relative to corn and wheat played a role (*AO* May 1999). As input prices rise, producers favor soybeans because soybean production costs are relatively lower, resulting in greater acreage, more production, and lower soybean price variability.

Government policy influences are inherent in nearly all related supply and demand variables. Several government program initiatives (including some that preceded the 1996 Farm Act) were studied to directly measure the influence of loan rates, expected deficiency payments (which were intended to stabilize income but often had the unintended consequence of limiting substitution in production because of associated acreage restrictions), and acreage reduction programs (which were designed to reduce supply by removing acreage from production). Results hint at some effects on commodity price variability for wheat and soybeans from acreage constraints and price support programs, but no government policy variable was found to influence corn price variability.

While far from conclusive, these results suggest that past government programs had a tendency to produce higher levels of price variability, at least for wheat and soybeans. In every case where a government policy variable was found to be important, it had a positive association with price variability. At first glance, this effect may seem surprising. However, policies that are intended to stabilize producer incomes—a central goal of past policy—are apparently likely to increase the volatility of market prices if they distort production and marketing arrangements.

Since the 1996 Farm Act, government policy has shifted away from potentially price-destabilizing direct intervention in agricultural production processes and markets. Instead, USDA’s Risk Management Agency has been working to provide the necessary tools and information for farm operators and other participants in agricultural markets to better understand and manage risks associated with producing and selling agricultural commodities. Although effective techniques for managing inter-year price risk remain elusive, a variety of management tools—e.g., futures and options contracts, and various crop and revenue insurance products (*AO* April 1999)—exist for managing within-year price risk. AO

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Risk Management

Chicago Board of Trade

Insurance & Hedging: Two Ingredients for a Risk Management Recipe

The past few years have seen a proliferation of market-based mechanisms available to agricultural producers for managing yield, price, and revenue risks. Making the right choices is becoming more complicated. Yet the fundamentals for making good risk management choices remain the same: 1) understanding the farm's risk environment, 2) knowing how the available risk management strategies work and which risks they address, and 3) selecting the strategy or combination of strategies that will provide the protection that best suits the farm's and the operator's individual circumstances.

USDA's Economic Research Service (ERS), using data from the Department's Risk Management Agency (RMA) and National Agricultural Statistics Service (NASS), has identified general conditions underlying farm-level risk management behavior in the U.S., how conditions relate to the performance of different risk management strategies, and why certain risk management strategies work better than others at reducing farm-specific risk across a range of different risk environments. This research has focused on three field crops with the highest acres planted—corn, soybeans, and wheat—but it provides a useful guide for risk management for other major field crops as well.

Defining a Farm's Risk Environment

Within a single crop year, once crop decisions have been made and resources have been allocated to production agriculture, the farm's principal risk lies in the uncertainty of the revenue generated by the production process. Farm revenue uncertainty, particularly the component related to field crop production, is principally a function of yield and price uncertainty, as well as the correlation between price and yield.

Weather is the principal cause of yield uncertainty. Within any given agro-climatic setting—characterized by weather pattern, soil type and fertility, growing season, day length—variability of yield is attributable mainly to factors such as temperature, cloud cover, and timeliness and amount of precipitation.

Price uncertainty for farmers combines two elements. Price-level uncertainty is the consequence of imperfect information about future domestic and international supply and demand conditions. Basis uncertainty—uncertainty about the difference between a commodity's local cash price and its nearest futures contract price—derives from uncertainty about future commodity movements and hauling costs. The tendency for price and yield to change in opposite directions provides a "natural hedge" which tends to stabilize farm revenues over time, particularly in major producing areas (*AO* March 1999).

Farmers' attitudes towards risk can vary greatly and are a key determinant in selecting risk management strategies. A farmer with a strong aversion to risk will be willing to pay more for a given level of risk reduction than a farmer with a weaker aversion to risk. An operator's overall level of wealth can also have a strong bearing on risk decision making. In general, at higher levels of wealth an individual is more willing to undertake a given level of risk—a phenomenon called decreasing absolute risk aversion—but there are exceptions to this rule. The preferred or optimal risk management strategy may also vary because of other management objectives, such as profit maximization or enterprise growth. In addition, lenders may strongly suggest or even require use of risk management tools to protect their stake in the farm's production outcome.

The Mechanics of Crop & Revenue Insurance

The array of crop and revenue insurance policies and coverage levels available to U.S. farmers has been rapidly expanding over the past few years. In spite of the growing complexity of agricultural insurance programs, the majority of policies actually sold can still be fairly well represented by two generic types of agricultural insurance: standard yield-based crop insurance and revenue insurance.

The largest share of farm coverage continues to be traditional yield-based crop insurance, although revenue insurance coverage is rapidly gaining. Traditional yield-based crop insurance—referred to as multiple peril crop insurance (MPCI)—includes both the minimum catastrophic coverage (CAT) which insures against severe losses and whose premiums are fully subsidized by the Federal government, and higher levels of coverage—called "buy-up" coverage—with partially subsidized premiums. Revenue insurance policies include Income Protection, Revenue Assurance, and Crop Revenue Coverage. All three of these revenue insurance programs receive partial subsidization of premiums by the Federal government.

Two time periods are relevant in calculating insurance program prices. The first is planting time, when a *Projected Price* is used to set insurance premium rates and price elections, and to value coverage levels. The second is harvest time, when the *harvest-time futures price* is used to value the farm's production whether sold or stored.

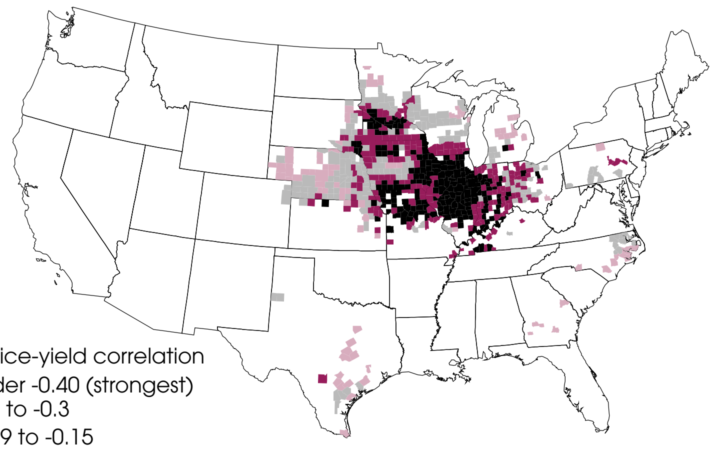
For yield-based insurance purposes, RMA establishes a Projected Price about 3 months before the insurance signup period for each commodity. This yield-based-insurance version of the Projected Price is not derived solely from a futures market price average, but is a forecast of the season-average price that incorporates additional market information.

For revenue insurance valuation, the Projected Price is the average of the daily settlement prices of the harvest-time futures contract during the month preceding program signup. For the price at harvest time, the average closing price of the harvest-time futures contract during the month prior to the contract's expiration is used. For example, the Projected Price for a corn revenue insurance contract is the February average closing price of the Chicago Board of Trade's (CBOT's) December corn contract. And the harvest-time futures price for the December corn contract would be the average daily settlement price during November.

Yield-based crop insurance (MPCI) pays the operator an indemnity if the actual yield falls below a yield guarantee, but MPCI does not offer price protection. Under MPCI, the producer pays a processing fee for minimum CAT coverage and a premium for buy-up coverage to obtain partial protection against yield loss only. The *yield guarantee* is determined by multiplying the producer's average

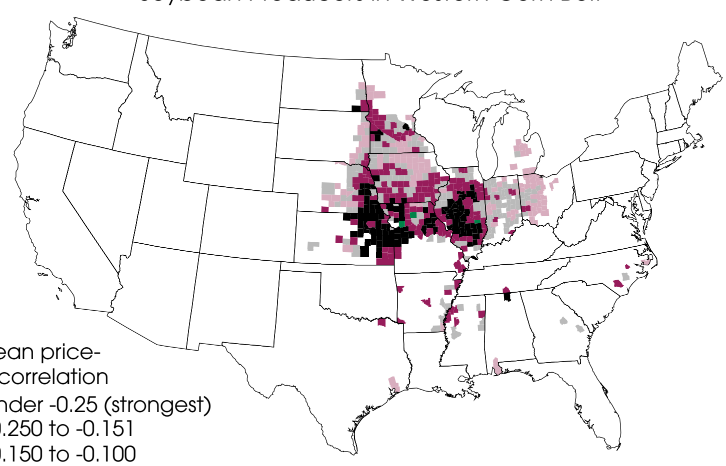
Offsetting Price-Yield Relationship, a Key Factor in the Farm Risk Environment, Varies by Region and Commodity

Corn Producers in Iowa, Illinois, and Indiana



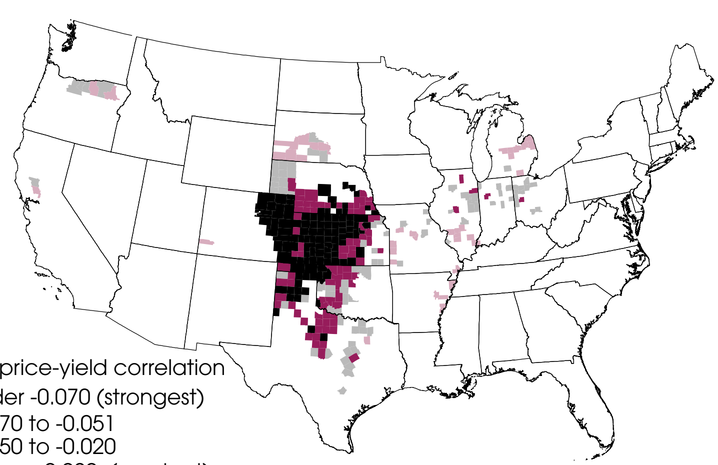
Corn price-yield correlation
- Under -0.40 (strongest)
- -0.4 to -0.3
- -0.29 to -0.15
- Above -0.15 (weakest)

Soybean Producers in Western Corn Belt



Soybean price-yield correlation
- Under -0.25 (strongest)
- -0.250 to -0.151
- -0.150 to -0.100
- Above -0.10 (weakest)

Winter Wheat Producers in Central Southern Plains



Wheat price-yield correlation
- Under -0.070 (strongest)
- -0.070 to -0.051
- -0.050 to -0.020
- Above -0.020 (weakest)

Price-yield correlation indicates strength of offsetting relationship between price and yield movements--the more negative, the better the "natural hedge" works to stabilize revenue. Based on annual county-level data, 1974-94.

Economic Research Service, USDA

Risk Management

historical yield—referred to as the actual production history (APH)—by the coverage level. Coverage levels range from 50 to 75 percent (expanded to 85 percent in some areas for 1999) of the APH yield, and from 60 to 100 percent of the Projected Price.

Example of crop insurance:
Suppose a corn producer has an APH yield of 150 bushels per acre, the Projected Price is $2.50 per bushel, and the producer selects 75-percent APH coverage with 100-percent price coverage—referred to as the *elected price*. The producer's yield guarantee is 112.5 bushels per acre (75 percent of 150 bushels). An actual yield below 112.5 bushels will result in an indemnity payment to the producer equal to the elected price of $2.50 times the difference between the yield guarantee and the actual yield, even if the harvest-time price rises above the Projected Price. However, if the actual yield does not fall below the yield guarantee, even if the harvest-time price falls below the Projected Price, the operator gets no indemnity. Thus MPCI partially insures against production risk, but does not insure against price risk.

Revenue insurance—e.g., Income Protection and the standard Revenue Assurance programs—protects farmers against reductions in gross income when a crop's prices or yields decline from early-season expectations. The *revenue guarantee* equals the product of the farmer's APH yield, the Projected Price, and the coverage level selected by the producer. A producer receives an indemnity when the actual yield, multiplied by the harvest-time futures price, falls below the revenue guarantee. Since revenue insurance coverage is generally available at a maximum of 75 percent (85 percent in some designated counties), it provides only partial protection against both price and yield risk, and is less effective at reducing risk when the natural hedge is strong.

Revenue insurance with replacement coverage protection is available to farmers via the Crop Revenue Coverage program or the Revenue Assurance program when purchased with an increased price guarantee option. The added replacement coverage protection (RCP) feature offers a revenue guarantee that depends on the higher of the price elected at signup or the harvest-time futures price. Thus, the producer's revenue guarantee may increase over the season, allowing the producer to purchase "replacement" bushels if yields are low and prices increase during the season. Replacement coverage complements forward contracting or hedging by partially ensuring that the farmer can buy back futures contracts or deliver on cash contracts when yields are low and harvest-time prices are high. Producers are still subject to basis risk, and only partial coverage (up to 85 percent in designated counties) can be obtained.

In general, the revenue guarantee of revenue insurance with RCP equals the product of the producer's APH yield, the coverage level selected, and the higher of the early-season Projected Price or the harvest-time futures price. Indemnity payments are triggered when the harvest-time revenue, based on the harvest-time futures price, falls below the revenue guarantee. Thus, revenue insurance with RCP also provides only partial protection against yield and price risk, and is less effective when the natural hedge is strong, because high prices offset low yields and revenue is more likely to stay at least somewhat above the guarantee.

The premium for revenue insurance with replacement coverage is more expensive than for revenue insurance without RCP, partly because the replacement cost protection provides greater price protection. Also, premium differentials increase when producers are permitted to subdivide their acreage into "units," such as by section and irrigated/nonirrigated status (as under CRC), rather than basing the premium on a producer's total acreage in a county (as under Income Protection).

Under 75-percent coverage, the standard revenue insurance guarantee for a corn producer with an APH yield of 150 bushels and a projected harvest-time price of $2.50 is $281.25 per acre. A revenue insurance policy with RCP (under 75-percent coverage) has $281.25 as an initial minimum revenue guarantee, but this guarantee may increase if market prices rise during the growing season. If a low or normal yield and low harvest-time price cause the market value of the crop to fall below the revenue guarantee, revenue insurance policies with or without RCP will pay the same indemnity. However, if the low yield is accompanied by a high harvest-time price, revenue insurance with RCP will pay an indemnity, while policies without RCP will pay a lower or no indemnity.

What Is Forward Pricing?

Forward pricing involves setting the price, or a limit on price, for a product to be delivered in the future. Forward pricing strategies include contracts such as cash forward, futures, options, delayed pricing, basis, minimum price, and maximum price (for feed purchases). Three general types of forward pricing strategies—a cash forward sale, a futures hedge, and a put option hedge—are described here for comparison with the risk-reducing power of crop and revenue insurance programs.

A ***cash forward sale*** is a contract between a seller (e.g., a farmer) and a buyer (e.g., an elevator) requiring the seller to deliver a specified quantity of a commodity to the buyer at some time in the future for a specified price or in accordance with a specified pricing formula. Most crop growers sell forward at a fixed or "flat" price based on an observed futures price quote. Some farmers use basis contracts that specify a "set" price difference relative to the futures price to be applied at delivery time. Some use "hedge-to-arrive" contracts that fix the futures price component and leave basis to be determined at delivery time. Cash forward contracts eliminate both price-level and basis risk by locking in a local cash market price for the quantity under contract, but any production in excess of the hedged amount is still subject to routine market price risk.

Example of a cash forward sale:
Suppose that a corn producer has planted 100 acres of corn with an APH yield of 150 bushels per acre. At planting time, the projected harvest-time price is $2.50 per bushel, the local cash price is $2.38, and the basis is $0.12. The producer agrees to forward contract the farm's entire expected corn production of 15,000 bushels at a price of $2.38, for an expected revenue of $35,700. If the price at harvest-time is $1.80, the operator still gets $35,700 for the crop, $8,700 above the cash market. However, if the producer harvests only 85

bushels per acre, even though the futures price rises to $3.50 (local cash price $3.38 with constant basis), the net revenue under this contract will fall to $13,730 ($35,700 less $21,970) because the operator has to purchase the shortfall (6,500 bushels @$3.38) in the cash market. This outcome illustrates the income risk associated with yield risk when an operator forward contracts 100 percent of the expected production at planting time based on the projected harvest-time price.

Hedging is designed to reduce price-level risk prior to an anticipated cash sale or purchase. A ***futures hedge*** involves the sale (short hedge) or purchase (long hedge) of ***futures contracts***—standardized contracts traded on a commodity exchange—as a temporary substitute for an intended sale or purchase on the cash market. The futures contract is later bought (sold) to eliminate the futures position as the actual commodity is sold (bought). Crop growers are generally short hedgers against crops they intend to sell later in the season.

For example, every corn futures contract traded on the Chicago Board of Trade (CBOT) calls for delivery of 5,000 bushels of No. 2 yellow corn during one of five designated delivery months each year. Hedging requires relatively little investment, because only a small portion of the futures contract's face value is required as a margin good-faith deposit to guarantee performance of the contract. Hedging also provides flexibility, since the hedger can eliminate a position in the futures market by simply contracting for an equal number of offsetting contracts. Still, the primary advantage of a futures hedge is the elimination of the price-level risk of an existing cash position by locking in a price.

A producer can hedge by selling futures contracts—short hedge—covering part or all of anticipated output. For example, a corn grower could sell 10,000 bushels of December corn futures in May to hedge an expected 20,000-bushel corn crop. Such a hedge normally is lifted by buying an equal number of futures contracts as the cash commodity is sold. Since near-parallel movements in cash and futures prices during the period of the hedge tend to offset each other, any losses (gains) in the cash market are made up by gains (losses) in the futures market.

Any contract, cash or futures, that tends to fix the price prevents the seller from gaining from subsequent price increases as well as losing from subsequent price declines. Moreover, forward pricing contracts contain an element of nonperformance or production risk—if the quantity actually produced turns out to be less than the contracted quantity and the price at delivery lies above the contracted price, the producer must make up the shortfall at a loss. Thus, risk is minimized by forward pricing only part of a crop until yield is assured.

Finally, hedging replaces price risk with basis risk—uncertainty about the price difference between the futures contract and the cash market—and if the basis is wider than was expected when the futures position was entered, the producer's preliminary price guarantee is reduced by the change in the basis. Basis risk is absent for hedgers who can make delivery against their futures contracts, but the cost of making delivery exceeds the loss on the basis in most cases.

The holder of a futures contract also incurs the risk of additional payments (margin calls) necessary to maintain that contract position when the quoted price for the futures contract changes against the short position. Unexpected additional payments could result in a strain on the farm's cash flow and/or credit reserves, particularly if eventual losses in the futures market cannot be offset by actual cash sales into the higher price cash market due to a production shortfall.

Hedging in futures offers farmers many of the benefits of forward contracting, but requires establishing an account with a certified broker, placing orders with the broker, and being prepared to meet margin calls during periods of adverse price movements. Consequently, most farmers prefer to access futures markets indirectly by forward contracting with their local elevator.

Example of direct use of the futures market (transferring price-level risk but not basis risk or yield risk):

Suppose a corn producer planted 100 acres of corn with an expected yield of 150 bushels per acre. At planting time, a December corn futures contract is trading at $2.50 per bushel, the local cash price is $2.38, and the basis is $0.12. The producer sells two December corn futures contracts on the CBOT (equivalent to 10,000 bushels of corn) at a price of $2.50 per bushel.

At harvest-time, if actual yield equals expected yield and the basis remains constant but prices fall, say futures to $2/bushel and local price to $1.88/bushel, the operator's total revenue, ignoring transaction costs, would still be $33,200 —$5,000 profit from futures trading (sell 10,000 @ $2.50 and buy 10,000 @ $2) plus $28,200 (15,000 @ $1.88) from sale to the local elevator. If the basis widens because the local price falls faster than the futures price, the gains from hedging would remain the same, but total revenue would be lower. However, if yield falls, say to 85 bushels/acre, even if harvest-time prices rise, say futures to $3.50 and local to $3.38 so the basis is constant, the $10,000 loss from hedging (sell 10,000 @ $2.50 and buy 10,000 @$3.50) would more than offset the return from the higher local price (8,500 @ $3.38 = $28,730), bringing net revenue down to $18,730, again ignoring transaction costs.

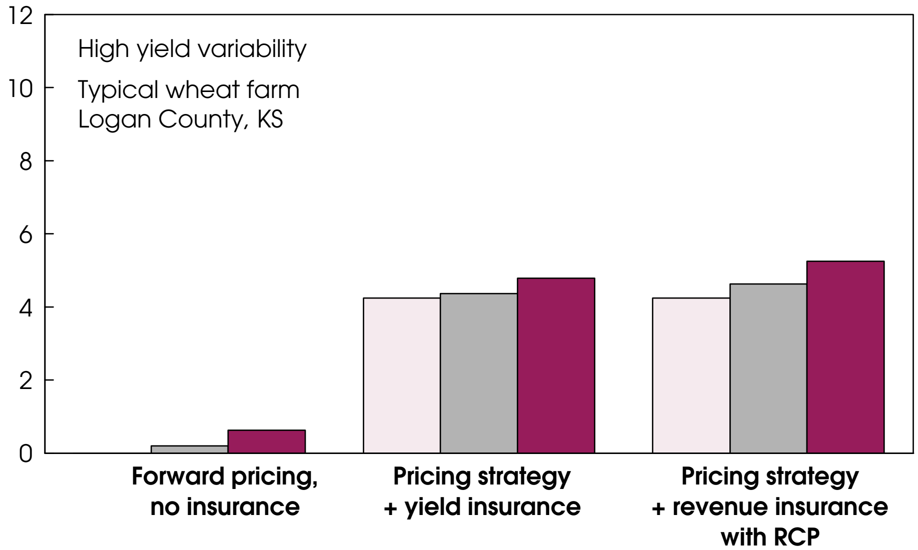
A ***put option*** is the right, but not the obligation, to sell a specified number of futures contracts at a designated price (called the strike price), at any time until expiration of the option. Hedging with a put option is very similar to buying price insurance in that the buyer/farmer pays a premium to the seller/grantor of this option to protect against a fall in price. The put option eliminates downside price-level risk by giving the buyer the right to enter into a short position in the futures market at the strike price if the option is exercised, even if futures prices fall below the strike price. The farmer who hedges by buying a put option knows the premium in advance and is not subject to margin calls as is the futures hedger. And the put option holder stands to gain if the futures price rises by more than the cost of the premium—if prices rise, the farmer can simply choose not to exercise the put option and instead sell in the higher priced cash market.

Risk Management

With Prices Moving Strongly Opposite Yield . . .

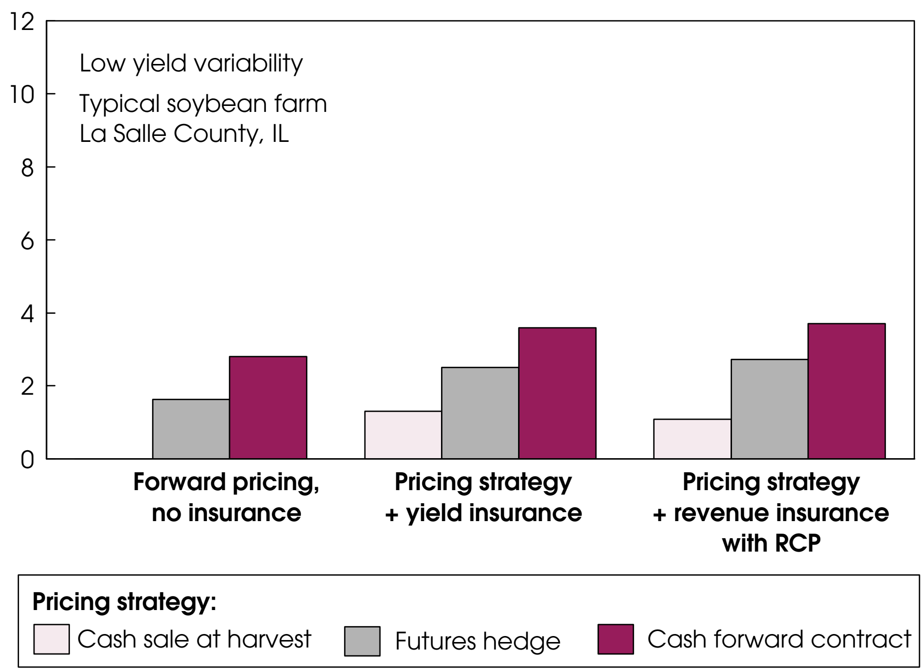
Insurance Provides More Risk Reduction Than Forward Pricing When Yield Variability Is *High*

$/acre in risk reduction value*



Forward Pricing Outperforms Insurance When Yield Variability Is *Low*

$/acre in risk reduction value*



* Risk reduction value is the certainty equivalent gain--estimated value to the operator of reducing risk by adding one or more risk management strategies.

RCP = Replacement coverage protection.

Price-yield correlation indicates strength of the offsetting relationship between price and yield movements--the more negative (opposite), the better the natural hedge works to stabilize revenue.

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As with a futures hedge, a put option hedge is subject to both production risk and basis risk, since ultimately, any futures position entered into upon the exercise of a put option will likely be liquidated and the grain sold into cash markets. But unlike a futures contract hedge, the premium is forfeited upon payment even if the put option is never exercised.

Example of a put option:
Consider again the example of the corn producer with 100 acres planted to corn and an expected yield of 150 bushels per acre. At planting time a December corn futures contract is trading at $2.50 per bushel, the local cash price is $2.38, and the basis is the difference or $0.12. The producer buys two put options based on the CBOT December corn futures contract (equivalent to 10,000 bushels of corn) with a strike price of $2.50 per bushel and a premium of $0.16 per bushel or $1,600.

At harvest-time the December corn contract price is down to $2 per bushel, and the local price is $1.88 (basis is constant). If the harvested yield is the 150 bushels per acre expected yield and the producer wants to finalize marketing decisions on November 1, by exercising the put option at $2.50 and immediately offsetting the short position in the futures market by buying two December corn contracts at $2, the producer realizes a gain of $0.50/bushel, or $5,000. Selling the harvested corn locally for $1.88/bushel, total revenue (ignoring broker's fees and transaction costs) is $31,600 (15,000 bushels @ $1.88 plus $5,000 minus the $1,600 premium).

Optimal Hedge Ratio Varies Across Pricing Strategies

To price forward, a farmer must choose not only the type of contract—cash, futures, or options—but also the share of the expected crop to hedge. For the farmer, the optimal proportion (in a risk-reducing sense) of the expected crop that should be forward priced—called the optimal hedge ratio—depends on the extent of basis and production risk faced by the producer.

While forward pricing in either the cash, futures, or options markets eliminates price-level risk, it fails to eliminate production risk, and cash forward contracting alone eliminates basis risk. Basis risk generally is small relative to price-level risk, but can be important, particularly at locations distant from the futures delivery points.

The production risk associated with a forward pricing contract depends on a farm's yield variability. As yield variability increases, optimal hedge ratios decrease and the risk-reducing effectiveness of a hedge declines. In the presence of high yield variability, the probability of having insufficient crop to deliver on a forward contract is high and the associated risk lowers the effectiveness of forward contracting.

Yield variability can be only partially offset by crop or revenue insurance, since coverage levels are generally limited to 75 percent, so the optimal hedge ratio will vary with both the availability and type of insurance coverage. Further, since yield protection permits a higher optimal hedge ratio, and because crop and revenue insurance do not fully eliminate production risk, combinations of forward pricing and insurance generally result in lower risk than either alone.

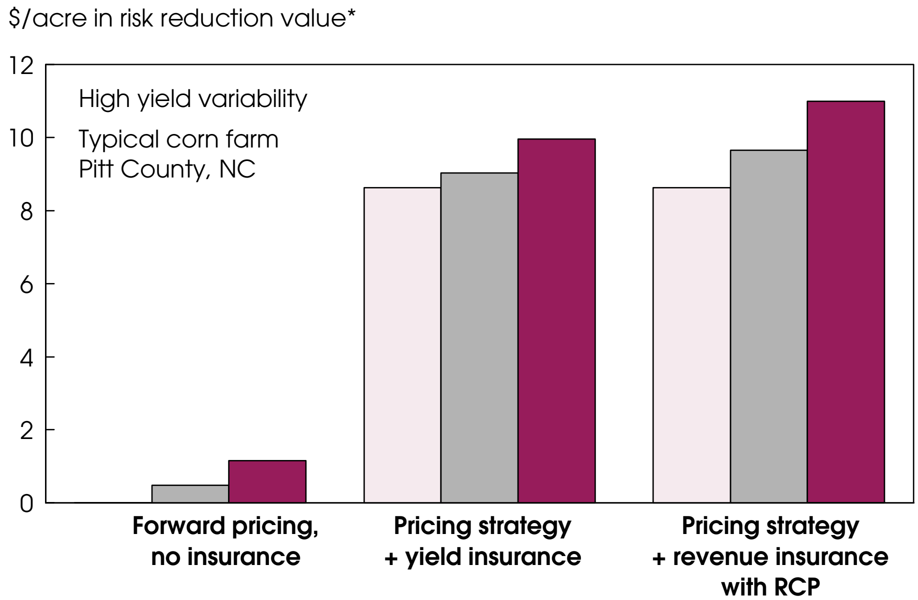
Combination of Strategies Depends on Risk Environment

ERS used historical data to construct representative corn, soybean, and wheat enterprises for a variety of risk environments—i.e., across ranges of yield variability and price-yield correlations—to analyze the risk reducing effectiveness of different crop and revenue insurance programs and forward pricing strategies in different risk environments. The level of risk aversion and wealth for a given enterprise is held constant across risk management strategies, and all enterprises are assumed to minimize risk per acre of the crop produced.

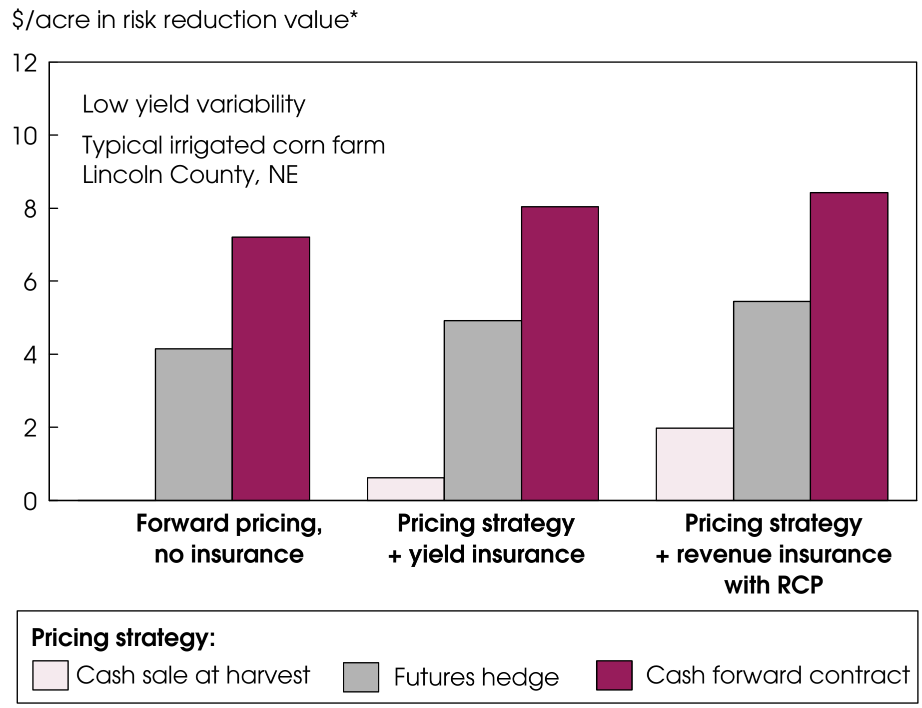
The estimated certainty equivalent income—the income an individual is willing to receive with certainty in lieu of undertaking a risky prospect—associated with a straight cash sale at harvest (no insurance, no forward contracting) is the baseline scenario against which all other risk management strategies are evaluated. Certainty equivalent gains/losses—the

With Weak Price-Yield Correlation . . .

Insurance Surpasses Forward Pricing in Reducing Risk When Yield Variability Is *High*



Forward Pricing Is the More Effective Strategy When Yield Variability is *Low*



* Risk reduction value is the certainty equivalent gain--estimated value to the operator of reducing risk by adding one or more risk management strategies.

RCP = Replacement coverage protection.

Price-yield correlation indicates strength of the offsetting relationship between price and yield movements--the more negative, the better the natural hedge works to stabilize revenue.

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estimated value of gains/losses in risk reduction—are then calculated to reflect the differences in revenue risk reduction and costs (e.g., premiums) over the different strategies.

Federal subsidies are not included, in order to compare the pure risk reduction effectiveness of crop and revenue insurance programs and forward pricing strategies, independent of government influence. The incorporation of Federal insurance premium subsidies per acre would be a direct addition to certainty equivalent income for the relevant risk strategies. Using this framework, some general relationships emerge between revenue variability and risk management.

For a farm with high yield variability and a weak natural hedge, crop yield or revenue insurance alone provides substantial revenue risk reduction. Forward pricing combined with insurance—crop yield or revenue insurance—further reduces risk, although the gains are small relative to the risk-reduction gains of insurance alone. Forward pricing alone—without crop yield or revenue insurance—provides relatively little risk reduction, because price variability contributes less to revenue variability than does yield variability in this example. Without crop yield or revenue insurance, the revenue risk stemming from yield variability greatly reduces the effectiveness of forward pricing. How-ever, as the natural hedge strengthens, the risk reduction provided by insurance weakens, even when yields remain highly variable, and forward pricing remains fairly ineffective as a risk transfer tool.

When yields are relatively less variable, crop yield insurance alone affords some risk reduction, but provides much greater risk reduction when combined with forward pricing, particularly forward cash contracting. Since price variability predominates when yield variability is low, cash forward contracting, which eliminates both price-level and basis risk, is a very attractive option to a producer whose primary concern is minimizing risk.

With low yield variability and a strong natural hedge, forward pricing strategies are more effective than either crop or revenue insurance. Under a strong natural hedge, low yields are generally associated with high prices, thus moderating overall revenue variability, even without insurance or forward pricing. Still, crop or revenue insurance, when combined with forward pricing, can provide additional marginal risk reduction.

When low yield variability coexists with a weak natural hedge, forward pricing alone easily outperforms crop yield and revenue insurance in reducing risk, because price variability plays the dominant role in determining revenue variability, and because of the weaker relationship between the on-farm yield and the aggregate market price. Still, additional marginal gains in risk reduction can be obtained by combining crop or revenue insurance with forward pricing.

In summary, ERS findings indicate that:

- Price variability faced by growers of a given crop is approximately the same across the country, and basis risks are relatively small, so differences in revenue variability between farms are caused primarily by differences in yield variability and price-yield correlation.
- Yield variability is generally proportionally higher than price variability at the farm level. As yield variability increases, optimal hedge ratios decrease and the risk-reducing effectiveness of hedging declines. Partially offsetting yield variability with crop or revenue insurance raises the optimal hedge ratio.
- Price-yield correlations are generally negative in major growing areas, particularly for corn. Since a farmer's revenue risk diminishes as price-yield correlation becomes more negative, crop or revenue insurance purchased with low coverage levels may be superfluous in the face of a strong natural hedge. Also, optimal hedge ratios decrease as farm price-yield correlation becomes more negative.
- Price correlation between farms is generally higher than yield correlation.
- The risk-reducing effectiveness of hedging increases as correlation between farm and futures price increases. In other words, the more closely the futures market price mirrors the farm price, the better it works for hedging risk.
- Combining forward pricing with insurance generally results in lower risk than either alone. With high yield variability, the difference among the forward pricing strategies is slight, but with low yield variability—where price variability contributes a larger share to revenue variability—the difference may be significant. When used in combination with a given type of insurance, cash forward contracting provides the greatest risk reduction for a risk-minimizing producer. AO

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The *Agricultural Outlook* risk management series continues in 2000

Next installment: How additional crop insurance subsidies affect insurance purchases

Risk Management

Risk Management Agency

Recent Developments in Crop Yield & Revenue Insurance

As policymakers consider strengthening the farm safety net, crop insurance is once again in the spotlight. Among the questions being asked: How well does the current array of crop insurance products and coverage levels match the risk management needs of producers? How much does insurance help producers in extended periods of low prices or with multiple-year crop losses? How can the government work effectively with the private sector to develop and deliver insurance?

Although overall participation has declined from its peak in 1995 and questions remain about the adequacy of coverage, crop insurance, which includes yield-based as well as revenue insurance products, is used by many growers. In 1998, growers paid about $900 million in crop insurance premiums for about $28 billion in guarantees on about 180 million acres of crops. About two-thirds of planted acreage of corn, soybeans, and wheat was covered by crop insurance.

Crop insurance provides protection from a broad range of perils that can lead to yield or revenue shortfalls. The type of protection depends on the type of insurance. For instance, multiple-peril crop insurance (MPCI) protects against yield shortfalls that are due to drought, flooding, frost, plant disease, insect infestation, and other natural hazards beyond a grower's control. Revenue insurance provides a degree of price protection—not just yield protection as under MPCI—covering sharp drops in expected revenue, which may result from yield or price declines or a combination of the two.

Although growers obtain insurance through private companies and their agents, the Federal government plays a prominent role in the provision of crop insurance. During 1995-98, USDA's Risk Management Agency (RMA), which administers programs of the Federal Crop Insurance Corporation (FCIC), has spent about $1.2 billion per year, on average, for premium subsidies, administrative and operating subsidies, and net underwriting losses. RMA promotes crop insurance participation through educational and other outreach activities and—along with the insurance companies—develops new products. FCIC and RMA also oversee the provision of crop insurance, setting and approving premium rates and policy provisions, ensuring that companies can cover potential underwriting losses, and approving privately developed insurance products for subsidies and underwriting protection.

Crop Insurance: A Widening Array of Coverage

Since the early 1990's, the variety of insurance products, guarantee levels, and crops included in the Federal crop insurance program has grown substantially. Insurance product choices have expanded from a single offering—individual-farm yield insurance called Actual Production History-Multiple Peril Crop Insurance (APH-MPCI)—to include area-yield insurance and a variety of crop revenue insurance products. The range of guarantee levels has been enhanced by pilot programs to increase maximum guarantees available in some areas of the country and by the provision, at low cost to producers, of a minimum level of insurance coverage called CAT (short for catastrophic). The list of crops for which insurance is available has grown from about 50 in the early 1990's to more than 70 currently, including several types of fruit and nut trees, grapes, nursery stock, and rangeland.

In addition to the growing array of coverage options available under the Federal programs, private insurance companies, agents, and brokers have developed a variety of supplemental insurance products and have bundled crop insurance with other risk management products. Examples of supplemental products, for which producers pay additional premiums, include those that increase the price at which insurance indemnities would be paid. Purely private insurance against hail and fire damage continues to be widely available. In 1998, producers in 46 states paid about $550 million in crop-hail premium. About 60 percent of the crop-hail coverage was for corn and soybeans.

While traditional APH-MPCI still accounts for the bulk of the Federal crop insurance business, new types of insurance, particularly revenue insurance, have attracted considerable interest. Revenue insurance products—*Income Protection* and *Crop Revenue Coverage*—first became available for a few crops in selected areas in the 1996 crop year. *Revenue Assurance* was added in the 1997 crop year and *Group Risk Income Protection* and *Adjusted Gross Revenue* were added for the 1999 crop year. Since the introduction of revenue insurance, more crops and more areas have been

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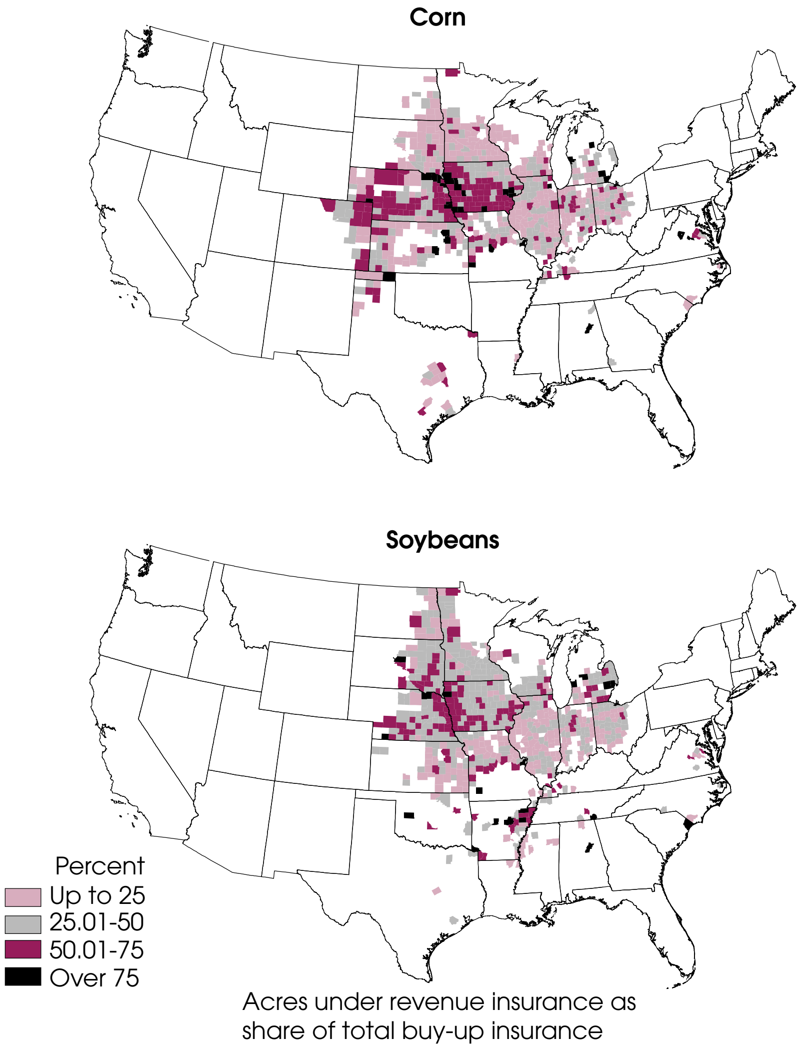
In Many Counties, Revenue Insurance Accounts for More Than A Quarter of the Area Insured at Buy-Up Level



Total includes all yield and revenue insurance above the basic or catastrophic level. Shaded areas are counties with at least 1,000 acres of the crop covered by buy-up insurance in 1998 (revenue and yield).
Source: Estimated by ERS from USDA Risk Management Agency data.

Economic Research Service, USDA

added, and revenue insurance has come to cover a substantial portion of insured acreage in some areas. Not all insurance products, however, are available in all areas.

Revenue insurance has been especially popular for corn and soybeans, crops that were the initial focus of the privately developed Revenue Assurance and Crop Revenue Coverage. In 1998, revenue insurance products accounted for about one-third of the corn and soybean acreage insured above the CAT level. Revenue insurance covered more than 50 percent of corn acreage insured above the CAT level in Iowa and 45 percent in Nebraska, and reached nearly 50 percent of the above-CAT insured acreage for soybeans in these two states. Although wheat accounts for a smaller portion of the overall crop revenue insurance business than corn or soybeans, revenue insurance policies cover a considerable share of wheat acreage in several states. In Kansas, Michigan, Nebraska, and Texas, more than one-quarter of wheat acreage insured above the CAT level was covered by revenue insurance in 1998.

Revenue insurance choices continue to expand, with two new products being introduced in 1999. Group Risk Income Protection (GRIP) adds a revenue component to the Group Risk Plan (GRP) area-yield insurance. Coverage is based on county-level revenue, calculated as the product of the county yield and the harvest-time futures market price. GRIP is available for corn and soybeans under a pilot program in selected counties in Iowa, Illinois, and Indiana where GRP is offered.

Adjusted Gross Revenue (AGR), the second new revenue insurance product, offers coverage on a whole-farm rather than on a crop-by-crop basis. AGR bases insurance coverage on income from agricultural commodities reported on Schedule F of the grower's Federal income tax return. AGR targets producers of crops—particularly specialty crops—for which individual crop insurance programs are not presently available. Producers who obtain AGR must obtain crop-by-crop coverage to insure crops for which such individual plans are available. In these cases the AGR whole-farm liability and premium are adjusted. AGR is being offered as a pilot program in selected counties in Florida, Maine, Massachusetts, Michigan and New Hampshire.

In addition to the growth in variety of insurance plans, the range of insurance guarantees, which are calculated as the product of expected yield or revenue and percentage coverage level, has been expanded. Crop insurance coverage levels—percentages of expected yield—generally range from 50 percent for CAT to a maximum of 75 percent, increasing at 5-percent intervals. Under 75-percent coverage, for example, the grower would absorb up to a 25-percent loss in expected yield or revenue, while the insurer would pay for losses above 25 percent.

At the high end, FCIC/RMA has increased the maximum coverage level available for some crops in some areas, giving growers the option of purchasing insurance at higher coverage levels, at higher premium costs. At the low end, the provision of low-cost CAT coverage has already increased insurance participation.

Under pilot programs in 1999, FCIC/RMA increased the maximum coverage level available for selected crops in selected areas from 75 percent to 85 percent. One pilot targeted areas where many growers have historically insured at the maximum level and where losses have been infrequent; another focused on areas where recent low yields may have reduced the yield or revenue history on which guarantees are calculated. The maximum coverage level for individual yield and revenue coverage was raised to 85 percent in pilot programs for corn and soybean growers in 66 counties in Illinois, Indiana, and Iowa and for wheat growers in 20 counties in Idaho, Oregon, and Washington. In addition, the maximum coverage was increased to 85 percent for spring wheat and barley in Minnesota, North Dakota, and South Dakota. Higher coverage levels are more costly; the premium rate for 85 percent coverage is generally about 60 percent higher than the premium rate for 75 percent coverage, and the additional premium is unsubsidized.

While maximum coverage level has been a concern of some growers, others have focused on the effectiveness of the CAT coverage level. CAT is a low coverage level—50 percent of expected yield indemnified at 55 percent of expected price—for which producers pay a flat fee of $60 per crop. Despite the low cost of CAT to producers, many have questioned whether it provides valuable insurance coverage. The yield trigger, 50 percent of expected yield, has been criticized as too low to provide a benefit except in rare cases, and the maximum possible indemnity, less than 30 percent of the expected value of a crop, has been criticized as inadequate. However, CAT was never intended to provide substantive coverage, just benefits roughly the same as those under previous ad hoc disaster programs.

CAT is a basic coverage level that was introduced under the Federal Crop Insurance Reform Act of 1994. The crop insurance reform, which required participants in farm programs to obtain crop insurance in 1995 and which raised premium subsidies for coverages above CAT, was designed to increase crop insurance participation and reduce the need for ad hoc disaster assistance. In 1995, the first year of reform, total insured acreage doubled to about 80 percent of eligible acres (due largely to linkage with farm program benefits), and CAT accounted for the bulk of the expansion.

A Brief Legislative History of Crop Insurance

1980—Federal Crop Insurance Act

* Crop insurance intended to replace disaster payments as primary form of crop yield risk protection
* Insurable crops and areas greatly expanded
* Premium subsidy instituted, at up to 30 percent of total premium
* Private insurance companies and agents may sell and service crop insurance

1988-94—ad hoc disaster assistance

* Enacted each year partly in response to low insurance participation
* Disaster assistance recipients were required to obtain crop insurance in the subsequent year

1990—Food, Agriculture, Conservation, and Trade Act (1990 Farm Act)

* Premium rate increases mandated to reduce excess losses
* Target loss ratio established for all crop insurance
* Actions to control fraud are mandated
* Private insurance companies to bear increased share of underwriting risk
* FCIC authorized to reinsure and subsidize privately developed products

1994—Crop Insurance Reform Act

* Restrictive legislative procedures instituted for enacting disaster assistance
* Participants in farm programs must obtain crop insurance
* Catastrophic coverage level (CAT) introduced
* Premium subsidies for coverage levels above CAT are increased
* Non-insured Assistance Program (NAP) created for crops not covered by insurance

1996—Federal Agriculture Improvement and Reform Act (1996 Farm Act)

* Requirement that participants in farm programs obtain crop insurance is ended
* Pilot revenue insurance program is mandated

1998—Emergency assistance, included in 1999 Agricultural Appropriations Act

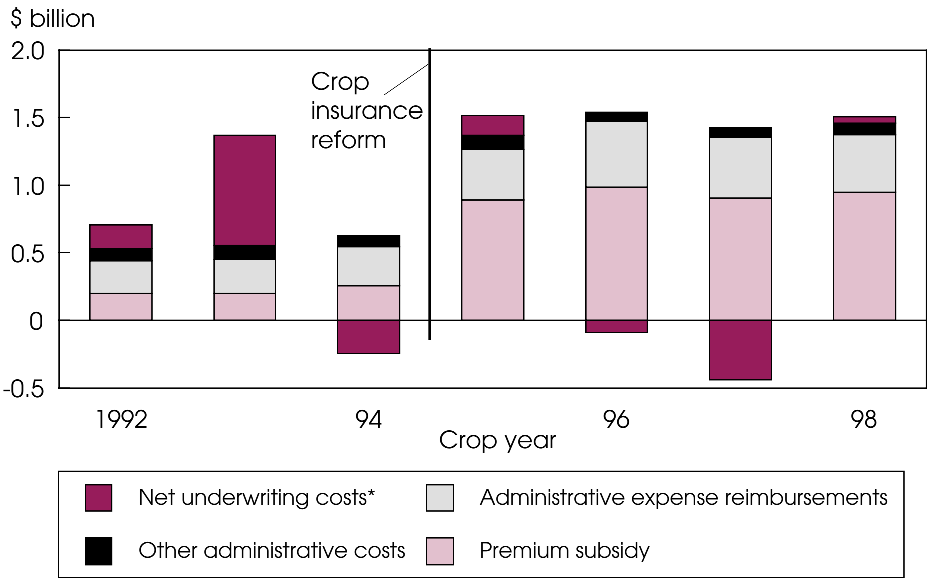
* Crop-loss disaster assistance payments to producers authorized for single-year (1998) or multiple-year (3 or more years between 1994 and 1998) crop losses; payments slightly higher for those who had obtained crop insurance
* Additional premium subsidies authorized for buy-up coverage in 1999, limited to total of $400 million
* Recipients of emergency assistance who did not have 1998 crop insurance must obtain crop insurance, where available, for 1999 and 2000 crop years

1999--Emergency assistance, included in the 2000 Agricultural Appropriations Act

* Crop-loss disaster assistance similar to single year crop loss disaster assistance program of 1998
* Additional premium subsidies authorized for buy-up coverage for 2000, limited to $400 million total

Risk Management

Government Costs of Federal Crop Insurance Increased Following 1994 Reform



*Appears as a negative value if premiums received exceed indemnities paid (i.e., a gain rather than an expense). Other administrative costs include Risk Management Agency salaries and operating expenses.
Source: Risk Management Agency, USDA.

Economic Research Service, USDA

Since implementation of the 1996 Farm Act, which significantly changed farm programs and eliminated the crop insurance requirement, CAT participation has dropped dramatically. While overall insured acres have declined about 15 percent (average net acres insured for 1997 and 1998, compared with 1995 and 1996), acres insured above the CAT level have increased by about 7 percent, and CAT acres have dropped about 40 percent.

The Value of Crop Insurance

The current array of crop insurance products is designed to protect against shortfalls in yields or revenues that occur during a single growing season. Insurance guarantees are set at planting, based on expectations about the eventual levels of yields or revenues. By reducing or eliminating the chances of sharply lower income as a result of losses from a particular commodity, crop insurance can be a valuable risk management tool. The risk protection that it provides can, for example, facilitate access to operating loans by offering some financial security to a lender.

For insurance purposes, expected yields are based on yield histories, and the annual expected yield for a crop is usually calculated as the average yield over the previous 4-10 years, depending on data availability. While in most cases these actual production histories provide reliable indications of the likely yield under normal conditions, they can produce distorted pictures.

If yields for a farm over a 4- to 10-year period differ significantly from yields based on a longer history, premiums will not be consistent with long-term expected losses. If yields are too high due to a few good years, the premium will be lower than needed over the long term and vice versa. By the same token, if recent historical yields differ from current expectations of the grower, he or she may consider the guarantees too high or too low.

Under crop insurance rules, expected yield, and hence insurance guarantee, can fall if a producer's yield declines over time. This potential for declining guarantees has led to questions about the effects of repeated crop losses. In the Northern Plains, for instance, several years of poor weather and plant diseases have hampered crop production for some but not all producers, reducing the historic yield and leading to complaints that insurance based on actual production history no longer offers effective yield guarantees.

FCIC/RMA authorized a pilot program in early 1999 that may help some growers overcome the declining guarantee problem. In exchange for a higher premium, growers can choose to use 90 or 100 percent of a transitional or T-yield instead of the recent actual yields on the farm as the basis for the insurance guarantee. (T-yields are based on Farm Service Agency program or county-level yields and other data and are usually used in the Federal crop insurance program to set insurance guarantees when a producer is unable to provide records of farm-level actual production history.) This "Yield Floor Option" is available in 1999 for barley and spring wheat in Minnesota and North and South Dakota.

In addition, provisions for multiple-year crop loss payments are included in the Crop Loss Disaster Assistance Program, implemented under the 1999 Agricultural Appropriations Act. Under the disaster program, producers could apply for payments from USDA in addition to crop insurance indemnities they may have received. The program allowed producers to file for payments based on either a single loss in 1998 or on multiple crop losses between 1994 and 1998. Although producers who did not have crop insurance could also receive benefits, those with crop insurance received greater payments. And all producers receiving benefits who did not have crop insurance in 1998 were required to obtain crop insurance, where available, in 1999 and 2000.

Crop insurance, particularly revenue insurance, provides protection from sharp drops in prices over each growing season. The products provide little protection against declines in prices that occur between growing seasons and over several seasons. Prices, or formulas for establishing prices, are determined when insurance guarantees are set at planting. In the case of MPCI yield coverage, RMA estimates an expected price. Revenue coverage uses prices of futures contracts with delivery dates near harvest time. Both of these procedures keep the value of insurance consistent with the expected value of the crop in that year.

Multiple-year insurance contracts may offer a means of moderating the drops in insurance coverage that can follow from several losses or from declines in prices. But guarantees fixed for several years at a time would have the potential to distort production if they exceed the market value of the crops and undermine the actuarial integrity of the insurance program. Multiple-year contracts could also be much more costly than annual crop insurance contracts.

The Government-Private Crop Insurance Partnership

Expansion in the Federal crop insurance program since the early 1990's has been accompanied by expansion in the role of private insurance companies. The companies have developed new products, notably Revenue Assurance, Crop Revenue Coverage, and Group Risk Income Protection, and have borne an increasing amount of underwriting risk. Still, the Federal government provides substantial support and direction to the program. In products approved by the FCIC board of directors, it provides premium subsidies to producers in order to encourage participation, expense reimbursements to the companies to cover costs of selling and servicing policies, and underwriting risk protection to the companies.

Government involvement in providing crop insurance is explained in part by several "market failure" arguments. One such argument is that natural disasters associated with crop production tend to affect many producers in an area at the same time, so pooling risk on a sufficient scale is difficult for most private insurers. Another argument suggests that purely private markets for crop insurance would fail because other producer responses to risk—diversification, borrowing, drawing on savings—reduce the value of the additional protection provided by insurance, making insurance unattractive when offered at competitive market prices.

How Federal Crop Insurance Is Delivered

USDA's Risk Management Agency (RMA) is charged with the administration of crop insurance programs for the Federal Crop Insurance Corporation (FCIC). FCIC/RMA regulates and promotes insurance program coverage, sets standard terms—including premium rates—of insurance contracts, ensures contract compliance, and provides premium and operating subsidies. Crop insurance policies are delivered—sold, serviced, and underwritten—by private insurance companies. Insurance companies also develop new insurance products that are approved for subsidies and reinsurance by FCIC and offer private coverages (without FCIC support) that supplement Federal crop insurance.

About 18 insurance companies delivered crop insurance in 1999. The companies' insurance portfolios vary in size and scope. The four companies with the largest amounts of crop insurance account for about two-thirds of the volume of total premium, and each delivers insurance in about 40 states. While these companies have large and widely spread portfolios, other companies deliver smaller amounts of crop insurance over smaller areas. Most of the companies with small crop insurance portfolios deliver in five or fewer states, and tend to operate in low-risk states.

Companies compete for crop insurance business through insurance agents who sell and service the policies. Most of the nation's 18,000 crop insurance agents are independent agents who may sell insurance for more than one company. Others are captive agents, selling for only one company. An agent is usually paid a sales commission by a company proportional to the premium of the policy sold. Loss adjusters for claims are employees or contractors of the insurance companies.

Insurance underwriting gains or losses arise as total premiums (producer premiums and premium subsidies) are used to offset indemnities paid. In the crop insurance program, private companies share the underwriting risk with FCIC by designating their crop insurance policies to risk-sharing categories, called reinsurance funds. Because each of the funds allows different levels of risk sharing—potential underwriting losses when indemnities exceed premiums and gains when premiums exceed indemnities, the proportion of losses paid or gains earned varies by government fund.

Companies that qualify to deliver crop insurance must annually submit plans of operation for approval by FCIC/RMA. A plan of operation provides information on the ability of the company to pay potential underwriting losses and on the allocation of the company's crop insurance business to the various risk sharing categories or reinsurance funds.

Based on the policies designated to each reinsurance fund, companies retain or cede to FCIC portions of premiums and associated liability (potential indemnities). FCIC assumes all the underwriting risk on the company-ceded business and various shares of the underwriting risk on the retained business, determined by the particular category and level of losses. Companies can further reduce their underwriting risk on retained business through private reinsurance markets.

In addition to underwriting returns, the companies are paid a subsidy by FCIC for administrative, operating, and loss adjustment costs. The rates of administrative and operating subsidy vary by the type of crop insurance and level of coverage and are applied to the total premium of each type of insurance sold. The levels of administrative and operating subsidy and the terms of the underwriting risk-sharing are specified in the Standard Reinsurance Agreement (SRA), which applies to all companies delivering FCIC-reinsured policies. The 1998 SRA specifies the subsidy for APH-MPCI at the CAT level at 11 percent (for loss adjustment). For buy-up APH-MPCI and similar coverages, the administrative and operating subsidy is 24.5 percent of total premium; 22.7 percent for GRP; and 21.1 percent for most crop revenue products.

Risk Management

In order to encourage participation in crop insurance, RMA provides subsidies to reduce producer premiums. The amount of the subsidy depends on the type of insurance and the coverage level. For CAT coverage, the premium is entirely subsidized, and the producer pays only a processing fee. For what has been the most popular "buy-up" (above CAT) coverage level—65 percent of yield at 100 percent of price—the subsidy has been about 42 percent of the total premium. As a further incentive to purchase crop insurance, the Secretary of Agriculture authorized up to an additional $400 million in premium subsidies for 1999 buy-up coverage. The additional funds, part of the emergency assistance package passed by Congress in 1998, reduced producer-paid premiums by about 30 percent. In addition, the 2000 agricultural appropriations included $400 million in premium subsidies for buy-up coverage in 2000, which is estimated to reduce premiums by 25 percent.

Under most private insurance, the premiums include administrative costs as well as the costs of expected indemnities. Under the crop insurance program, total premiums—producer-paid plus government subsidies—are designed to cover only expected indemnities. For this reason, FCIC/RMA separately provides administrative subsidies to insurance companies to cover the costs of selling and underwriting policies, adjusting losses, and processing policy data. Because administrative costs vary by type of insurance, the subsidy amount is designed to match reimbursement to differing workloads.

The administrative subsidy, like the producer premium subsidy, is generally highest (in dollar amount) for individual farm APH-MPCI buy-up coverage and lowest for GRP area-yield insurance. The APH-MPCI subsidy is high because of the costs of establishing individual farm yield histories and guarantees and adjusting losses on an individual basis. The GRP subsidy is low because it requires no fieldwork to adjust losses.

The underwriting exposure—potential gains or losses—of private crop insurance companies has grown considerably. Underwriting gains or losses arise as premiums are used to offset indemnities paid. In the crop insurance program, private companies share the underwriting risk with FCIC. The companies' crop insurance business is reinsured by FCIC under the Standard Reinsurance Agreement (SRA). The companies can obtain additional reinsurance in commercial markets. In 1992, the companies' total capital at risk—maximum possible losses after FCIC reinsurance—was about $227 million. Since then, as risk-sharing provisions of the SRA have been renegotiated and the size of the crop insurance business has grown, the companies' total capital at risk has grown to about $1.5 billion.

With the exception of 1993, growing conditions have been generally favorable since 1992 and company underwriting gains have been sizable. Underwriting gains totaled approximately $1.1 billion over 1992-98, an average of about $155 million per year. The average, however, masks wide variation among areas, companies, and years. For instance, net underwriting gains in 1997 were $352 million, while yield losses due to floods in 1993 were responsible for net underwriting losses of $84 million. While the potential for underwriting gains is large, the private companies are also exposed to large potential losses. For example, had the 1988 drought occurred in 1998, when more acres were insured and the companies' risk exposure was larger, it is estimated that net underwriting losses would have exceeded $450 million.

Since the early 1990's, the Federal crop insurance program has expanded in the scope and variety of risk protection offered to producers. A major reform added a low level of coverage, and combined with premium subsidies and linkage to other farm programs in 1995 dramatically increased insurance coverage. Maximum coverage levels that producers can purchase have been raised under pilot programs for some crops in some areas of the country. Revenue insurance products have been developed and have captured significant shares of the crop insurance business.

At the same time, private insurance companies have played a larger role in delivering crop insurance, developing new products, and sharing underwriting risk. Nonetheless, questions remain about the effectiveness of the coverage available under the crop insurance program in assisting producers in managing the economic risks in farming, and crop yield and revenue insurance are likely to be the focus of policy decisions about strengthening the farm safety net. AO

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Risk Management

Jack Harrison

Demand for Yield & Revenue Insurance: Factoring In Risk, Income & Cost

Rapid expansion has occurred in the number of federally backed insurance products offered to farmers since the 1996 farm legislation. Although federally subsidized insurance has been a part of the government's farm program for over a half century—yield-based insurance was available as early as 1938 for selected crops in selected locations—crop insurance was not widely accepted by farmers until recently. Prior to 1996, commodity programs shielded agriculture from some of the risks stemming from weather and markets, lessening the need for crop insurance. Some researchers also cite the frequent use of Federal ad hoc disaster assistance payments as a disincentive to purchasing crop insurance (*AO* August 1999).

However, the demand for crop insurance increased in the last few years due to higher Federal insurance premium subsidies, as well as the introduction of several new revenue insurance products that increase farmers' choices and that some operators find more attractive than crop-yield insurance alone. The array of insurance products currently available to producers is growing, and their use as a risk management tool is widening.

In Iowa, for example, three revenue insurance products—Crop Revenue Coverage (CRC), Income Protection (IP), and Revenue Assurance (RA)—were first offered in 1996-97. Also available were the more traditional yield-based products—Multiple Peril Crop Insurance (MPCI), which includes a minimum catastrophic coverage (CAT), and the Group Risk Plan (GRP). (See page 28 for descriptions of insurance products.) After just 3 years, acreage covered under the revenue insurance products accounts for more than half of insured acres for corn and soybeans in Iowa.

In 1999, revenue insurance choices for U.S. farmers expanded with the introduction of two new products. Group Risk Income Protection (GRIP) adds a revenue component to GRP area-yield insurance, and Adjusted Gross Revenue (AGR) offers coverage on a whole-farm rather than crop-by-crop basis (*AO* May 1999).

At issue with regard to farmers' participation in insurance markets are a number of questions. What factors are driving farmers toward these new risk management tools? How do farmers decide among different insurance products? Can the increase in farmers' demand for insurance, especially for the new revenue insurance products, be sustained? Addressing such questions can be a key step in anticipating the demand for yield and revenue insurance products and the potential for growth in a more market-oriented policy environment.

USDA's Economic Research Service (ERS) has examined the demand for yield and revenue insurance products among corn and soybean producers who purchased insurance in Iowa, where a range of insurance products was offered to farmers in 1997. Using 1997 data collected by USDA's Risk Management Agency (RMA), the study analyzed the role of farmers' risk characteristics, farm income level, and the cost of insurance in making decisions on insurance purchases. This is the first attempt to analyze farmers' demand for crop and revenue insurance in the post-1996 Farm Act policy environment, in which farmers are offered multiple insurance products.

The Risk Management Agency maintains records of all individual farmers who buy federally backed crop-yield or revenue insurance from private insurance companies. About 80,000 Iowa insurance records for 1997 contain 10 years of yield history and information on coverage under four insurance plans: MPCI, RA, and CRC at coverage levels of 50 through 75 percent, and GRP at up to 90 percent. IP was not included in the analysis for

About the Demand Model

A Generalized Polytomous Logit (GPL) model is specified and estimated to accommodate the demand for crop insurance where the choice of an insurance product is *discrete*—i.e., farmers make a choice of one distinct product from among several alternative products available to them. The GPL model specification was designed so that all choices for the various insurance products are treated equally without assigning ranks. Further, the model estimation accommodates all choices to be estimated *simultaneously*, allowing every combination of the explanatory variables to be taken into consideration concurrently.

Insurance, in Short

Insurance contracts can be categorized into two types of insurance products: standard yield-based crop insurance and revenue insurance products (*AO* April 1999). Yield insurance products available in 1997 include *Multiple Peril Crop Insurance* (*MPCI*) and *Group Risk Plan* (*GRP*), while revenue insurance products include *Income Protection* (*IP*), *Revenue Assurance* (*RA*), and *Crop Revenue Coverage* (*CRC*). Following is a brief description of how those programs operated in 1997.

MPCI pays indemnities if yield falls below a guaranteed level—determined by a farmer's average historical yield—but offers no price protection. MPCI provides minimum catastrophic coverage (CAT), with premiums fully subsidized by the government, and optional higher (or "buy-up") levels of coverage with partially subsidized premiums.

GRP is tied to county yield rather than to individual farm yield. GRP policies pay indemnities when the county average yield drops below a threshold or guaranteed level, regardless of yield of the individual farmer. GRP buyers can insure up to 90 percent of the expected county yield at up to 150 percent of the expected price.

IP, RA, and CRC protect against lost revenue caused by low yields, low prices, or a combination of both. *IP* and *RA* protect farmers against reductions in gross income when either prices or yields decrease during the crop year from early-season expectations. Indemnity amounts are determined by individual farm yields and harvest-time futures prices. IP offers a single insurance contract per commodity enterprise for the farm per county—e.g., within a county, IP coverage combines all corn fields which a farmer owns or from which at least a share of corn crop earnings is due. RA—available only in selected counties and for selected crops around the nation—allows both basic and an optional field-specific coverage (multiple insurance contracts based on ownership, farming practices, and section of the farm's acreage).

CRC with replacement-coverage protection (RCP) provides partial protection against both yield and price shortfalls, paying an indemnity if a producer's gross revenue falls below a predetermined guarantee level. Since CRC uses the higher of the planting-time price for the harvest futures contract or the actual futures contract quote at harvest in setting the guarantee, the producer's revenue guarantee may actually increase over the season because CRC with RCP allows producers to purchase "replacement" bushels if yields are low and prices increase during the season. Recently, farmers in Iowa were offered RA contracts with a harvest price option that is very similar to CRC except that it imposes no limits on price increases at harvest-time.

lack of sufficient data; only 50 IP corn and soybeans policies were sold in Iowa in 1997. GRIP and AGR did not exist in 1997.

To analyze demand for crop insurance, ERS developed a model based on three explanatory factors that influence a farm operator's decision to buy an insurance contract (type of product and extent of coverage):

- *Risk level* measures the producer's level of yield or revenue risk. Yield risk—based on 10 years of yield records—is calculated as the probability of yield falling below the insurance product's guaranteed level. Similarly, revenue risk—based on 10 years of yield records and corresponding average marketing-year prices—is calculated as the probability of revenue falling below the guaranteed level. The probability measure is based on both the mean and variance of yield or revenue—an indicator of volatility for an individual farm.
- *Level of income* or *size of operation* is an indication of the amount of revenue at risk, along with the operator's ability to pay for insurance or to self-insure against loss. Level of income is defined as the cumulative sum of savings over the past 10 years, using gross revenue and an assumed savings rate of 10 percent. This variable is directly proportional to the size of operation.
- *Cost of insurance*, captured by premium per dollar of liability (maximum potential indemnity or value of the insurance contract if the producer loses an entire crop), is total premium (including subsidy) divided by total liability.

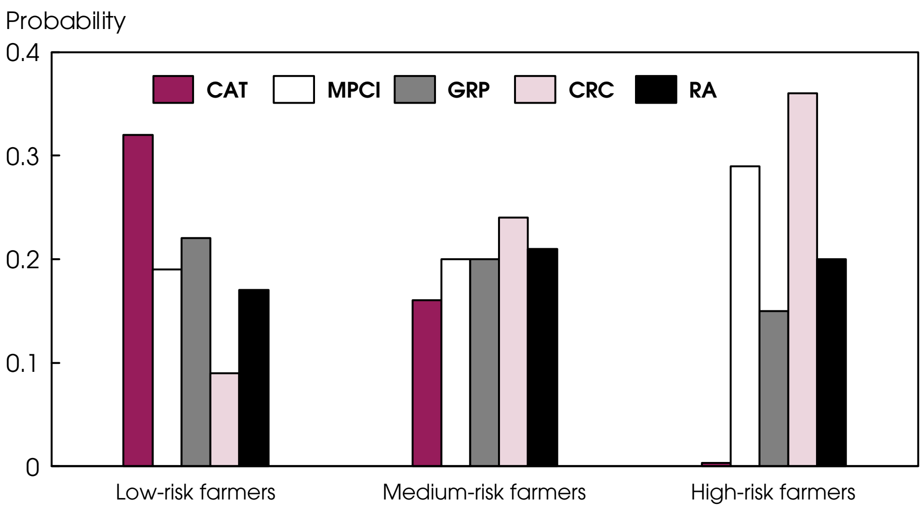
These three factors are categorized into three ranges—low, medium, and high. The model then determines how these factors influence the choice of alternative yield and revenue insurance products.

The results reveal a strong relationship between *risk level* and choice of insurance contract. Farm operators with a higher risk of yield or revenue falling below the guaranteed level are more likely than low-risk farmers to have chosen higher coverage contracts. High-risk farmers, compared with low-risk farmers, are more likely to prefer revenue insurance (CRC and RA) over yield insurance (MPCI). If given a choice between only GRP and MPCI, high-risk farmers are more likely to prefer MPCI, which is based on individual yield history rather than county average yield.

Another way to see how risk and other factors relate to product choice is to calculate odds ratios—the odds of choosing one insurance product versus another. Comparing the odds of choosing CRC, RA, and GRP relative to MPCI for farmers with different risk levels indicates that high-risk farmers are nearly twice as likely as low-risk farmers to choose CRC or RA over MPCI. In general, analysis of the odds ratios indicates that high-risk farmers prefer revenue insurance while low-risk farmers prefer yield insurance.

The link between risk level and choice of insurance product was also explored by calculating the probability of choosing a specific insurance product given the farmers' risk level. The computed probabilities further strengthen the findings that high-risk farmers are more likely to choose

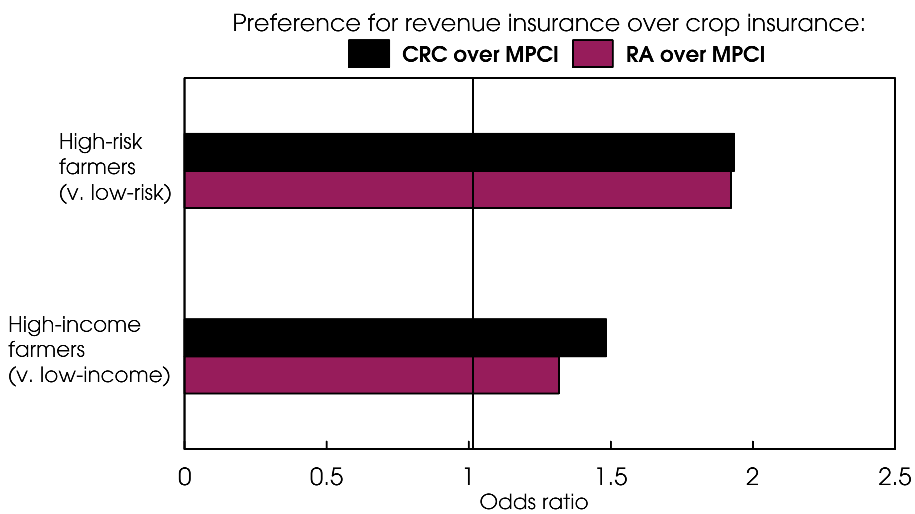
Risk Level Affects Choice of Insurance Product



Probability indicates the likelihood of farmers choosing a particular insurance product.
For example, out of 100 low-risk farmers, 32 are likely to choose CAT and another 19 to choose MPCI above the CAT level.
Crop-yield insurance: CAT = Catastrophic (minimum) crop-yield coverage; MPCI = Multi-peril crop insurance above the CAT level; GRP = Group risk protection.
Revenue insurance: CRC = Crop revenue coverage; RA = Revenue assurance.

Economic Research Service, USDA

Farmers' Level of Risk and Income Affects Likelihood of Choosing Revenue Insurance Over Crop Insurance



Odds ratio = Probability of high-income—or high-risk—farmers choosing CRC or RA over MPCI, divided by probability of low-income—or low-risk—farmers choosing CRC or RA over MPCI.
When odds ratio equals 1, probabilities (numerator and denominator) are the same.
CRC=Crop revenue coverage; RA=Revenue assurance; MPCI=Multi-peril crop insurance.

Economic Research Service, USDA

revenue insurance contracts (CRC or RA), while low-risk farmers are more likely to choose yield contracts (GRP, MPCI, or CAT). High-risk farmers, who have a greater expectation of collecting indemnities, select contracts that would provide greater indemnities in the event of loss and are apparently willing to pay a higher premium to obtain those contracts.

Level of income also influences the type of insurance product a farmer purchases, as well as level of coverage. The results imply that, within the same risk class, high-income farmers are more likely to prefer revenue insurance over yield insurance. For example, the odds of choosing CRC over MPCI by high-income farmers relative to low-income farmers is 1.5, indicating that, within the same risk category, high-income farmers are 1.5 times as likely as low-income farmers to choose CRC over MPCI. Higher income farmers showed a preference for greater coverage, while lower income farmers showed a preference for lower coverage levels, contrary to the initial hypothesis that high-income farmers who could afford to self-insure against some risk loss would purchase less insurance.

Results also indicate that *cost of insurance* affects the decision to buy and the choice of insurance contract (regardless of risk class or income level), which underscores the importance of premium subsidies. Under the current insurance program, nearly 40 percent of producer premiums on "buy-up" coverage are subsidized (depending on the coverage level, and excluding the added 1999 and 2000 premium discounts provided in appropriations legislation). Since the subsidy is a large part of the premium, changes in Federal subsidies are likely to significantly affect the extent of farmers' use of crop insurance.

Study results suggest that by incorporating risk and other characteristics associated with farmers who buy different contracts, it may be possible to structure insurance rates to more closely reflect farmers' risk profiles. Even though the analysis is limited to Iowa corn and soybean producers, the findings provide useful insights into preferences of farmers at various risk levels in choosing among alternative insurance contracts, and the substitutability among contracts, and may facilitate making the agricultural insurance industry more self-sustaining. AO

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Risk Management

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Crop & Revenue Insurance: Bargain Rates but Still a Hard Sell

Risk management in agriculture is aimed, in general, at attaining a desired combination of risk and return. Some producers strive to obtain the highest possible return for an acceptable level of risk, while others may seek to minimize the risk associated with a desired level of return. The ability of different strategies to reduce risk, and the cost of adopting different risk management strategies, varies with each individual situation. But whatever approach is taken, implementation of most risk-reducing strategies involves some tradeoff between expected income and risk exposure.

Federal subsidization of crop and revenue insurance programs alters the tradeoff so that operators may attain significant risk reduction at relatively low cost, while actually increasing expected (i.e., longrun) returns. Yet the rate of participation in insurance programs has remained significantly less than universal, with about 61 percent of eligible acres insured in 1998. This may be because the potential benefit of insurance is largely unrecognized and undervalued, or other factors may be at work in the farm operator's decisionmaking process.

In agriculture, as in most other industries, the activities associated with the highest expected returns are often associated with the greatest level of risk. As a result, a producer may be forced to forego those activities with the most potential for profit in favor of other activities with lower but less risky returns.

For example, corn production might promise a farm the highest net returns per acre if favorable weather is combined with heavy input use. However, unfavorable weather could result in low yields and large losses, and gambling on favorable weather by putting all the farm's acreage into corn may be a perilous undertaking for all but the most financially secure operations. A risk-averse producer confronting this situation may be inclined to opt for lower potential profit by partially diversifying the acreage into soybeans and some other grains with lower input costs (e.g., oats, wheat, or sorghum). If, instead, that risk-averse producer faces price prospects that are particularly poor and off-farm employment opportunities exist, renting out or fallowing a large portion of the acreage and devoting a share of household labor time to earning off-farm wages may be a preferred strategy.

The level of risk an individual is willing or able to bear varies with the person's financial situation, attitude toward risk, availability of other opportunities, and ease of transitioning to alternative activities. A variety of strategies is available to enable agricultural producers to achieve an acceptable balance between expected return and risk.

But some risk-reducing strategies may involve substantially lower expected net returns—for example, diversifying production to grow some commodities where returns per acre may be lower but less variable. On the other hand, competitive risk transfer markets—e.g., futures and options exchanges or agricultural insurance programs provide a means of lowering risk with little change in expected net returns. Purchasing crop or revenue insurance is a risk transfer strategy that can be used to obtain varying degrees of revenue-risk reduction at relatively low cost. A distinguishing feature of this strategy is the Federal subsidies available to crop and revenue insurance market participants.

Subsidies Lower Premiums for Crop & Revenue Insurance

Crop and revenue insurance are low-cost tools to help farmers guard against risk of revenue losses due to yields and prices that fall short of planting-time expectations. Crop yield insurance provides payments to producers when realized yield falls below the producers' insured yield level, whereas crop revenue insurance pays indemnities based on revenue shortfalls that result from yield or price shortfalls (*AO* April 1999).

But unlike most other risk management tools, crop and revenue insurance also provide a special case where income risk is reduced *and* expected returns are increased because of Federal government intervention in premiums charged to farmers. The Federal Crop Insurance Corporation (FCIC) provides subsidies to private companies, eliminating much of the delivery cost and underwriting risk from premiums, and helping to ensure that premiums are a close representation of longrun expected indemnities. In addition, the FCIC subsidizes producer premiums to lower the cost of acquiring insurance so that, in the aggregate, total expected returns over the long term are greater than farmers' total actual premium costs. In other words, a dollar's worth of expected return can be purchased for less than a dollar of premium.

Substantial taxpayer dollars have been expended over the years to make insurance available on a widespread basis and to increase producer participation in insurance programs. Between 1981 and 1998, Federal risk management outlays included $5.7 billion in producer premium subsidies, $3.9 billion in administrative reimbursements to private insurance deliverers (plus another $1.6 billion in other administrative costs), and $3 billion in net underwriting losses which, in the absence of Federal risk sharing, would have been borne by the private companies selling the policies.

Since passage of the 1994 Federal Crop Insurance Reform Act, total insurance-related outlays have averaged nearly $1.4 billion per year, with premium subsidies comprising the bulk of the transfer. The premium subsidy share of those outlays has also increased. The larger outlays are due in large part to a significant rise in participation. Insured acreage peaked at 75 percent of eligible acres in 1995 when participation in crop insurance was mandatory for farmers to be eligible for other Federal program benefits—e.g., deficiency payments. The mandatory participation requirement was dropped for 1996 and subsequent years, and as a result, participation has declined.

Under most private insurance policies:
Total premiums = expected indemnities + administrative costs + profit margin

What makes government-subsidized insurance such a good deal? Under most private insurance programs—e.g., automobile, homeowners, health—premiums are set to include all expected ***indemnities*** (payments made on qualifying losses), plus all the costs of administering the policies, plus a reasonable profit. If premiums fall short of this goal, the company loses money and must either raise premiums or go out of business. Competition among private companies helps to minimize increases in profit margins, keeping premium increases down.

How Are Insurance Premium Rates Set & Subsidies Applied?

An ***insurance premium*** is the amount an individual or business pays for purchase of insurance. For crop and revenue insurance, premiums are generally expressed on a dollars-per-acre basis, but are calculated as a percent of the total liability. ***Total liability*** is the maximum loss exposure of the insurer—the amount of indemnity payment required if yield were to fall to zero.

Because premiums for crop and revenue insurance are designed to cover losses over time, insurers project yield and revenue distributions to show expected losses and payouts at different levels of insurance guarantees. Premium rates are determined by several factors:

- the type of crop, size of insured unit, and coverage level selected;
- the farm's loss experience and APH (actual production history) yield; and
- the county yield and its historical variability.

For a given crop at a given price, premium rates are highest for land where risk of production loss is greatest—i.e., where yields are the most variable.

USDA's Risk Management Agency (RMA) subsidies encourage participation in crop insurance by reducing producer premiums. The amount of the subsidy depends on the type of insurance and the coverage level in accordance with the 1994 Federal Crop Insurance Reform Act. For minimum CAT (catastrophic) coverage—i.e., 50-percent yield coverage at 55 percent of the expected harvest-time price—the premium is entirely subsidized, and a policy may be purchased for a small processing fee. At higher levels of coverage—referred to as "buy-up" coverage—subsidies are calculated in accordance with yield/price rules:

Calculation of "buy-up" coverage subsidy:

- Yield/price guarantees below the 65/100 level (65-percent yield coverage at a 100-percent price coverage election) are subsidized at a rate equivalent to CAT coverage.
- Yield/price guarantees at or above 65/100 level are subsidized at a rate equivalent to a 50/75 guarantee.
- For each of the above two ranges the subsidy is first calculated as a fixed amount, which is then applied to the higher premiums charged for higher coverage levels.

Thus the *subsidy share* of the premium rate declines as coverage rises, with the exception of a kink at the 65/100 coverage break-point where the subsidy share attains a maximum value of nearly 42 percent of the premiums. Premium subsidies are also available for revenue insurance but are based strictly on the yield portion of coverage. As a result, revenue insurance subsidies are generally a lower proportion of total premiums than their yield-based crop insurance counterparts.

Under FCIC-backed crop insurance:
Total premiums = expected indemnities

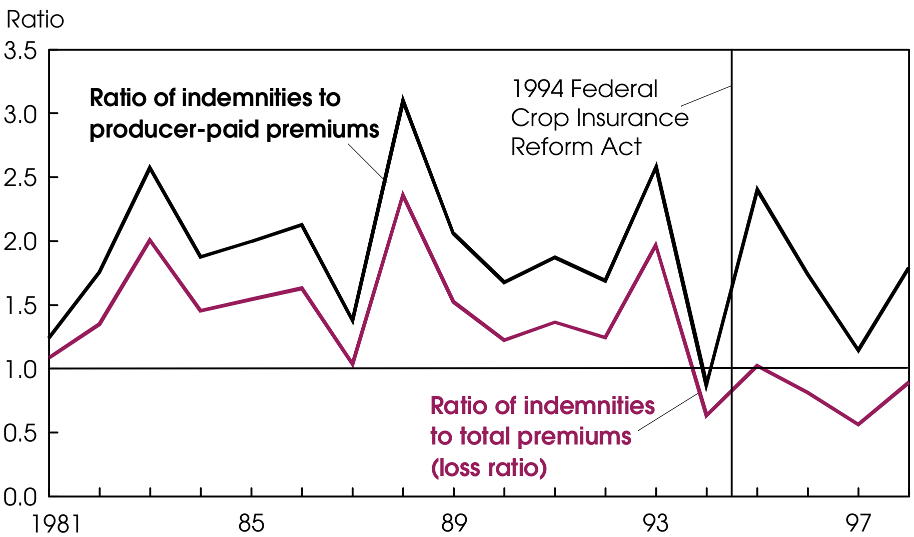
Under the FCIC-backed crop insurance program, government payments to insurance carriers are used to ensure that total premiums are set to cover expected indemnities only, which reduces the premiums paid by farmers. Federal crop insurance subsidies are designed, in large part, to equate premium rates with the long-term chance of loss.

To achieve this objective, USDA's Risk Management Agency (RMA), through the FCIC, subsidizes private insurance companies that sell and deliver crop and revenue insurance, by reimbursing them for the costs of selling and underwriting policies, adjusting losses, and processing policy data. The government also lowers the risk associated with underwriting crop and revenue insurance by sharing the risk of loss (and the possibility of gain) on policies sold by private companies.

To encourage producer participation in agricultural insurance markets, the government also pays a portion of producers' premiums on FCIC-approved policies,

Risk Management

Since the 1994 Reform, Total Crop and Revenue Insurance Premiums Have Generally Exceeded Indemnities Paid Out



Total premiums = Producer-paid premiums plus Federal Crop Insurance Corporation (FCIC) premium subsidy. A longrun average loss ratio of 1.0 implies actuarial soundness--i.e., an insurance program "breaks even" with regard to premiums and indemnities.
Source: Risk Management Agency, USDA.

Economic Research Service, USDA

ranging from 13 to 100 percent depending on the type of insurance and the coverage option chosen. Premium subsidies are based only on the yield portion of federally backed insurance policies. Subsidies on revenue insurance plans are limited to the amount payable if the producer had elected the yield-based coverage. From 1981 to 1994 these subsidies averaged about 25 percent of total premiums. Beginning with the Federal Crop Insurance Reform Act of 1994, government subsidies have averaged about 50 percent of total premiums across all policies—comprised of a 100-percent share of premiums for minimum catastrophic coverage (CAT) and a 40-percent share of premiums for additional yield loss "buy-up" protection.

Under actuarially fair insurance rate setting—where total premiums equal indemnities paid out, and the insurance program "breaks even"—the premium subsidies represent a positive expected benefit to producers who purchase insurance. In other words, with the government paying part of farmers' insurance premiums, expected net returns per acre are greater with insurance than without.

How does this work? If the insurance company writing the policy and the producer buying the policy have equal information about risk, and if the insurance premium is set to correctly reflect that risk, then the premium should exactly equal the expected indemnity. With no government subsidy, the producer would pay the full premium and no expected benefit would ensue beyond being able to transfer some production risk. However, when the government subsidizes a portion of an actuarially fair premium, the producer pays less than the full premium but still can expect to obtain the full indemnity. Thus, a dollar of a farmer's premium returns more than a dollar of expected benefit over the long run.

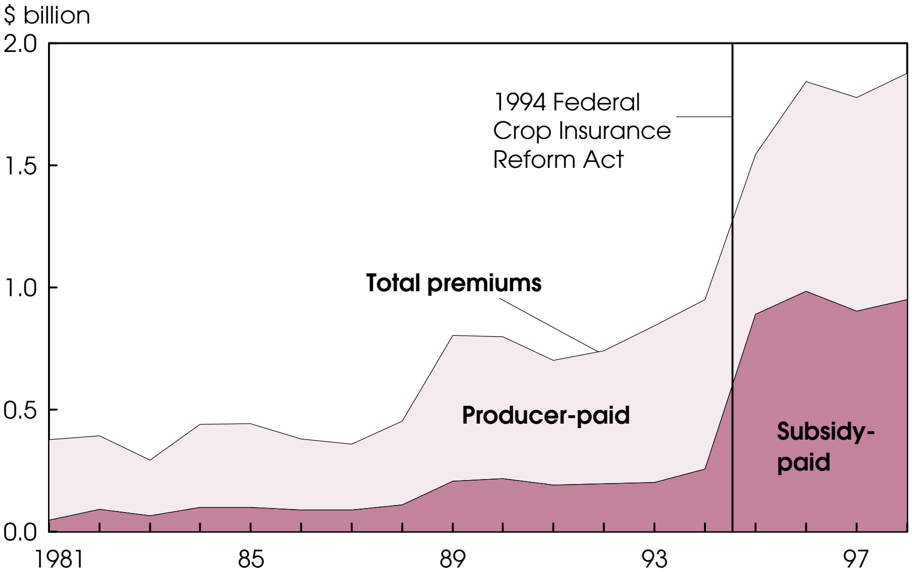
A measure of the actuarial success of premium rating for crop insurance is the ***loss ratio***—total indemnities paid divided by total premiums received. Because rates are set to reflect the longrun chance of loss, actuarial fairness equates to a loss ratio of approximately 1.0. However, in any given year, the loss ratio for a crop in a specific area is unlikely to equal exactly 1.0, due to variations in weather. In a year with extremely unfavorable weather, the sum of crop and revenue insurance policies would be expected to show a loss ratio greater than 1.0, implying net underwriting losses (although reimbursement subsidies to private companies for administrative costs could potentially make up for the losses). In years with more normal weather, a loss ratio less than 1.0 may result, with net underwriting gains.

From 1981 through 1993, annual loss ratios (based on total premiums, including subsidies to producers) exceeded unity, suggesting that ratings on subsidized insurance were not actuarially sound. Since 1990, many features of the FCIC-backed crop insurance program have been improved in an "actuarial" sense. For example, rates have been raised, and more stringent penalties for yield data inadequacies have been imposed on insured farmers. These changes, in combination with several years of moderate weather, have helped to improve loss ratio performance significantly since 1993. In addition, private companies have been asked to bear a greater share of the underwriting risk, while reimbursement for administrative costs has declined.

From the producers' point of view, the relevant ratio is based on actual premiums—the farmers' cost after subtracting the Federal subsidy portion of the premium. The ratio based on the producer-paid premium has exceeded unity in every year since 1981 with the exception of 1994 when it dipped below unity. Since 1995 the national aggregate producer-paid indemnity/premium ratio has averaged nearly 1.77, implying $1 of premium has bought $1.77 of expected indemnity benefit "on average," plus additional unquantified "benefit" from risk reduction.

If federally subsidized crop and revenue insurance is such a good deal, why don't all eligible producers take advantage of it? While the answer to this question is debatable, there are several possible reasons why participation in crop and revenue insurance programs is less then universal (in 1998 about 65 percent of acreage planted to major field crops was insured). A key to understanding these reasons rests on the premise that risk-averse farmers can be expected to purchase correctly rated insurance (where the premium accurately reflects the true risk of loss), and both insurer and insured regard the premium as accurately reflecting risk.

Subsidy-Paid Share of Crop and Revenue Insurance Premiums Increased Sharply in 1995



Premium subsidies are paid by the Federal Crop Insurance Corporation (FCIC).
Source: Risk Management Agency, USDA.
Economic Research Service, USDA

Under this premise, there are several characteristics of crop and revenue insurance programs that help explain less-than-universal participation. First and foremost, it is likely that many farmers simply do not believe expected indemnities exceed their producer-paid share of the premium. These farmers believe (rightly or wrongly) that premium rates fail to reflect their specific situation. In other words, many farmers feel that the premium rates they face (or the processing fee in the case of CAT coverage) overstate their risk of loss. Imperfections in the rate setting scheme probably make this true for some, while others may be poorly informed about the true extent of farm-level risk.

There may also be some misunderstanding or general lack of information concerning how crop and revenue insurance programs work and the advantages they impart. This problem is compounded by the growing array of available insurance products, which strengthens the perception that crop and revenue insurance programs, like many other risk management programs, are too complicated to understand and use correctly.

Other reasons that are frequently cited as contributing to less-than-universal participation in subsidized crop insurance include:

1) An operator's overall level of wealth can have a strong bearing on risk decision-making. For many large commercial operations with substantial equity values, the potential magnitude of a crop loss relative to the equity base may be very small, so the incentive to buy insurance is low.

2) Management objectives such as profit maximization or enterprise growth may supersede risk management goals and diminish the demand for insurance.

3) Many farmers have some ability to reduce yield and revenue risk through the use of alternative strategies—stable off-farm wage opportunities or diversification of on-farm activities—which may be more cost-effective under some circumstances. Some farms may reduce yield risk simply by altering cultivation and crop management practices, at lower cost than the producer-paid share of the premium on a crop insurance policy.

Finally, many researchers have cited the frequent use of Federal ad hoc disaster assistance payments (from 1988 through 1994 and again in 1998 and 1999) as a principal deterrent to purchasing crop insurance. Why pay a premium for something that you would likely get for free?

Do FCIC Subsidies Alter Producer & Carrier Behavior?

The goal of FCIC subsidies is to alter behavior—namely, increase participation in crop and revenue insurance markets. If successful, this contributes to the higher goal of encouraging farmers to reduce their risks, thereby increasing the viability of agriculture and reducing the need for publicly funded disaster assistance programs. But do FCIC subsidies have other consequences? The answer appears to be yes, for several reasons.

First, when viewed as an increase in expected revenue, the subsidy provides not only an incentive to purchase insurance, but also to marginally expand area under crop production, since a producer's total expected return increases with every insured acre.

Second, since premium subsidies are calculated as a percent of total premium, and premiums are higher for production on riskier land, the subsidies are weighted in favor of production on land with the greatest yield variability. As a result, subsidies may encourage production on land that might otherwise not be planted. And to the extent that yield risk varies across both crops and fields, distortions are likely to occur across both regions and commodities.

Third, in the absence of FCIC subsidies, crop insurance premiums would include markups for the insurance companies' administrative costs and profit margin. These added costs could make premium rates prohibitively expensive in high-risk areas. If the higher premium rates discourage participation, such areas would be less attractive markets to private companies selling the policies. To this extent, Federal subsidies increase the likelihood of insurance delivery, and consequently production, in high-risk areas, such as various locations in the Great Plains. AO

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Risk Management

Risk Management Agency

Tax-Deferred Savings Accounts For Farmers: A Potential Risk Management Tool

A program of tax-deferred savings accounts for farmers is among the alternatives currently under consideration by Congress to help farm operators manage their year-to-year income variability. Unlike the income-averaging provision for farmers included in the Taxpayer Relief Act of 1997, which allows farmers to spread above-average income to prior tax years and avoid being pushed into a higher tax bracket, tax-deferred savings accounts would build a cash reserve to be available for risk management. By depositing income into special Farm and Ranch Risk Management (FARRM) accounts during years of high net farm income, farmers could build a fund to draw on during years with abnormally low income. Federal income taxes on eligible contributions would be deferred until withdrawal.

Proposals for tax-deferred risk management savings accounts originally surfaced after passage of the 1996 Farm Act, as a mechanism to encourage farmers to save a portion of the 7-year transition payments. In 1998, as Congress sought to expand the farm safety net and ease stress from recent low prices and regional disasters, it again considered FARRM accounts. A bill to authorize FARRM accounts was introduced in the 1999 Congressional session (H.R. 957, S. 642), and is likely to generate more debate in 2000.

How FARRM Accounts Would Work

Under the current FARRM account proposal, farmers could take a Federal income tax deduction for FARRM deposits of no more than 20 percent of *eligible farm income*—taxable net farm income from IRS Form 1040, Schedule F, plus net capital gains from sale of business assets including livestock but not land. Deposits would be made into interest-bearing accounts at approved financial institutions, and interest earnings would be distributed and taxable to the farmer annually. Withdrawals from principal would be at the farmer's discretion (no price or income triggers for withdrawal), and taxable in the year withdrawn. Meaningful income triggers would be difficult to determine given the nature of taxable farm income and the fact that price levels do not necessarily correlate with farm-level yield or income variability.

Deposits could stay in the account for up to 5 years, with new amounts added on a first-in first-out basis. Deposits not withdrawn after 5 years would incur a 10-percent penalty. FARRM funds would have to be withdrawn if the account holder were disqualified from participating by not farming for 2 consecutive years. Deposits and withdrawals would not affect self-employment taxes.

FARRM account eligibility would be limited to individual taxpayers—sole proprietors, partners in farm partnerships, and shareholders in Subchapter S farm corporations—who report positive net farm income and owe Federal income tax. The program should be relatively easy to administer through the use of existing income tax forms, with reporting requirements similar to those of individual retirement accounts (IRA's). Contributions and distributions from the accounts could be verified by matching income tax returns with records from banks or other financial institutions where the accounts are held.

Although farm sole proprietors make up the largest share of potentially eligible individuals, over two-thirds either report a farm loss or have no Federal income tax liability and therefore could neither participate nor benefit from participation. And actual participation could be significantly less than the number eligible.

Using 1994 Internal Revenue Service (IRS) data, USDA's Economic Research Service estimates that 916,000 farmers would be eligible to contribute as much as $2.8 billion to FARRM accounts each year. Farm sole proprietors account for over two-thirds of eligible participants and three-fourths of potential contributions. But about half of eligible farm sole proprietors would be limited to contributing less than $1,000. Thus, each year only about one of every six sole proprietors could contribute more than $1,000. Contributions for farm partners would also be small—averaging below $2,000—but subchapter S shareholders' contributions could average $4,355.

Basing eligibility for contributions on positive net farm income would direct much of the benefit of FARRM accounts to those relying on farming for more than half their income. About two-thirds of

Sole Proprietors Would Predominate Among FARRM Account Holders...

	Eligible farmers		Maximum potential FARRM deposits		
	Number (1,000)	*Percent*	*$ million*	*Percent of total*	*$ mean deposit*
All	916	100.0	2,830	100.0	3,090
Sole proprietors	626	68.3	2,138	75.5	3,415
Partners	242	26.5	483	17.1	1,995
Subchapter S shareholders	48	5.2	209	7.4	4,355

...But Nearly Three-fourths of Them Could Not Have FARRM Accounts

	Sole proprietors		Maximum potential FARRM deposits		Average income Off-farm	Average income Farm
	Number (1,000)	*Percent*	*$ million*	*Percent*	*$1,000*	
All sole proprietors	2,265	100.0	2,138	100.0	49	*
Ineligible to deposit, due to:						
Negative net farm income	1,422	62.8	0	0	56	-10
No Federal tax owed	217	9.6	0	0	5	8
Eligible to deposit:						
$1-$999	282	12.4	87	4.1	50	2
$1,000-$9,999	305	13.5	1,112	52.0	35	19
$10,000-$19,999	27	1.2	363	17.0	51	69
$20,000 or more	12	0.5	576	26.9	263	246

Eligible farmers are those who report a positive combination of net farm income from Form 1040, Schedule F, plus capital gains from business assets other than farmland, and who owe Federal income tax. Maximum potential deposits estimated as 20 percent of eligible farmers' total net farm income.
* Loss under $500.
Source: Compiled from 1994 IRS Individual Public Use Tax File.

Economic Research Service, USDA

potential contributions by sole proprietors would be concentrated among the one-third of eligible sole proprietors who derive over half their income from farming. A very small share of limited resource farmers—gross farm sales under $100,000 and household income less than $10,000—would be eligible, and their contributions would be rather small.

The amount of money that would be deposited into FARRM accounts and a minimum account balance that would be sufficient to provide risk protection for either farm operations or household living expenses are difficult to estimate. But with over 80 percent of all farmers limited to contributions of less than $1,000 in any given year, and with participation rates expected to be less than 100 percent, most farmers are not likely to accumulate significant reserves. Some producers with low contribution limits may be able to deposit larger amounts in years when farm income is higher. But the 5-year window for building reserves and the generally low level of taxable net farm income combine to reduce the likelihood that most farmers would be able to build balances adequate to self-insure risk exposure.

Although 1994 is the most recent year for which complete data are available, it was not an especially good year for farm income. Examination of the most profitable year during the 1990-94 period (1990) suggests that aggregate potential contributions would have increased by about 25 percent to $3.5 billion. Thus, with 100-percent participation, potential 5-year contributions could range from $14 to $17.5 billion. The official revenue estimate by the Congressional Joint Committee on Taxation suggests that aggregate account balances would be well below this amount as a result of withdrawals and less than full participation.

Looking at data for 1996, a year when both farm prices and government program payments were high, it appears that estimates of eligible participants and total potential contribution amount would not change significantly. Despite a slight increase in total taxable income from farming, the number of farmers with taxable farm income actually dropped by about 30,000. Moreover, the number of farmers and other taxpayers who owe no Federal income tax has since increased, due largely to the child credit and other tax relief measures enacted in 1997 and 1998. As a result, the number of farmers who would be eligible to make contributions if the program is implemented may actually be lower than 1994 data suggest.

Should Benefits Be Targeted?

Without a provision for targeting—specifying who is eligible to participate and where program benefits are expected to be concentrated—most of the benefits of FARRM accounts would go to relatively few farmers, and some would go to individuals who do not rely on farming for their livelihood. The FARRM account proposal currently on the table does not specify a maximum annual contribution or a limit on accumulated balances. About 0.5 percent of farm sole proprietors would be eligible to contribute over $20,000 annually, adding up to more than 25 percent of total sole proprietors' potential deposits. Off-farm income for this group exceeds $250,000, on average, and a small subset of very high-income individuals would be eligible for contributions averaging $50,000. In contrast, many farmers with persistently low farm incomes, highly vulnerable to income swings, would likely be ineligible to contribute or unable to build sufficient FARRM account balances.

Concentrating benefits for individuals at high income levels and excluding low-income farmers may raise concerns about appropriately targeting the program. Targeting could be used to reach a specific group of farmers by capping annual contributions or limiting eligibility based on adjusted gross household income (AGI). For example, restricting eligibility to individuals with AGI under $100,000 would reduce potential contributions by about a third and cut taxpayer cost—from farmers deferring taxes—nearly in half, but would reduce the number of eligible farmers by less than 10 percent.

The 1996 proposal for tax-deferred savings had a targeting provision—a $40,000 annual contribution limit and a 10-year time limit for withdrawals. A Canadian program for farmer tax-deferred savings limits annual contributions and accumulated balances, but has no time limit.

FARRM Accounts Are Intended To Manage Risk, Not Taxes

To meet goals of program efficiency—benefits offsetting costs—and risk management, FARRM accounts must create new savings rather than shift assets or replace existing risk management practices. The cost of the FARRM account program is primarily the decrease in government revenue associated with tax deferral. The benefits are mainly farmers' increased financial stability, and diminished need for government farm program payments or emergency aid payouts.

Creating new savings instead of shifting assets could mean a gain for taxpayers and a stronger risk position for farmers. To enhance farmers' risk management capabilities, new savings have to come from reduced household consumption or from funds that would have been invested in the business, rather than from shifting existing savings, diverting future new savings, borrowing, or depositing taxes deferred by making the contributions. But evidence indicates that most potentially eligible farmers have ample resources to shift funds into FARRM accounts instead of creating new savings.

Information on interest earnings for potentially eligible individuals suggests that contributions from existing liquid assets could fund a large portion—about three-fourths of total potential contributions—in the first year, and over half of eligible farmers have sufficient existing savings to fund FARRM account contributions for several years. Farmers with adjusted gross income above $100,000 are more likely to be able to fund a larger proportion of contributions from existing savings, while eligible farmers with AGI under $50,000 have less existing savings available and are more likely to create new savings if they decide to participate.

Canada Already Has a Savings Plan for Farmers

Risk management savings accounts are not without precedent. In 1991, Canada began the Net Income Stabilization Account (NISA) program to encourage farmers to save for self-insurance (*AO* May 1995). The farmer's contribution earns a 3-percent interest rate bonus and is supplemented by a matching government contribution. Unlike the U.S. proposal, a farmer's NISA contribution is not tax-deferred, but government contributions and interest earnings are not taxed until withdrawal. Annual farm contributions are limited to 20 percent of the year's sales, and deposits eligible for government matching are limited to the smaller of $7,500 or 3 percent of eligible farm sales—gross sales of most primary commodities minus purchases of those commodities, such as seed and feed. NISA has no time limit on deposits, but account balances may not exceed 1.5 times the farm's 5-year average sales.

Analysis of the NISA provision that allows withdrawals only when income falls below an established threshold suggests that rules for withdrawal can create obstacles to effective use of funds. Administrative delays in availability of funds to farmers reduce the program's usefulness as a source of emergency funding. This partially explains why many Canadian farmers who became eligible for withdrawals did not actually take funds from their accounts.

USDA's 1994-95 Agricultural Resource Management Study reveals that a majority of households associated with farms that have gross sales of $50,000 or more already keep liquid assets to meet unexpected expenses. If those liquid assets were moved into FARRM accounts, the household would benefit from tax deferral without incurring significant restrictions on availability of funds, but would not enhance their ability to manage risk.

Research on IRA's, similar in concept to FARRM accounts, documents a significant amount of asset shifting rather than new saving. The FARRM program provision that requires a contribution to be withdrawn within 5 years effectively limits the amount of income that can be accumulated in the account and prevents a FARRM account from becoming an additional retirement savings plan. But asset shifting could be even more prevalent for FARRM accounts than for IRA's because FARRM accounts remain liquid and, without price or income triggers that must be reached to allow withdrawals, FARRM accounts do not lock the money into long-term reserves. In addition, FARRM funds are not required to remain on deposit for a minimum time and, like IRA's, contributions prior to April 15 would apply to the preceding tax year, so depositing funds in FARRM accounts for a short period could provide a 1-year income tax deferral.

A program of tax-deferred risk management accounts has the potential to encourage farmers to provide their own safety net by saving money from high-income years to withdraw during low-income years. Taxpayers could benefit if farmers' additional financial diversification and liquidity reduce the need for continued income support programs or ad hoc farm disaster relief. Nonetheless, there are several potential limitations to the program's effectiveness. These include: 1) low levels of taxable farm income that could preclude most farmers from building meaningful account balances—particularly those most in need of risk management tools, such as limited resource and beginning farmers; 2) concentration of program benefits among operators with large farms and relatively high off-farm income; and 3) funding of FARRM accounts with farmers' existing liquid assets instead of new saving. AO

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