Rethinking Price Supports and Insurance:

HOW RISKY IS MARKET RISK?

Current farm price support policy, as well as crop insurance concepts, seek to protect farmers in part from risk inherent to the market. However, research indicates that market risk doesn't hurt farm income, suggesting that a fresh look at policy assumptions may be in order.

BY CARL R. ZULAUF

The risk of farming is an often-cited rationale for publicly subsidized insurance and income support programs for farmers. However, this article argues that, for major U.S. field crops, the important risk of yield variability does not create a systemic risk in cash receipts per acre (price times yield). Systemic risk is the risk inherent to the market. The other type of risk is idiosyncratic risk, or risk that is unique to an individual in the market. The available evidence indicates that yield-related systemic risk has little impact on cash receipts per acre. If true, this has implications for crop insurance and farm income support policies.

Evidence

Farmers base planting decisions on the expected cash receipts from producing and selling a crop. This in turn depends on the price and yield expected at harvest. Risk arises because the cash receipt realized at harvest may deviate from the cash receipt expected at the time of planting.

Figure 1 presents data on expected cash receipts per acre and realized cash receipts at the national level for corn, cotton, oats, and soybeans over the 1974-2001 crop years. These four crops accounted for 52 percent of U.S. acres planted to crops excluding fruits and vegetables in 2001. Each of the four crops is planted in the spring, and is traded on futures markets. The futures market is used to obtain an estimate of expected national prices at harvest during spring planting. The expected value of cash receipts per acre is obtained at planting time by multiplying expected price by expected yield. Harvest cash receipt per acre is obtained by multiplying realized price by realized yield at harvest.

The two cash receipt values track each other fairly closely. In particular, significant national drought years, such as 1974, 1980,

1983, and 1988, are indistinguishable from other years: they do not show crippling losses in realized income. Figure 1 suggests that declines in national yield do not result in a decline in cash receipt per acre at the national market level. In other words, systemic (market-related) risk appears to be negligible.

To further investigate this suggestion, a regression line is estimated between the spring-to-harvest change in price (dependent variable) and the spring-to-harvest change in average U.S. yield (independent variable). A decline in yield from spring to harvest means production declines from its expected level. As a result, price should increase. In contrast, price should decrease if yield increases from spring to harvest. The estimated regression lines confirm this expected negative relationship. Specifically, each estimated slope coefficient is negative and significantly different from zero at the commonly-used 95 percent statistical confidence level (see Table 1).

By measuring the change in price and change in yield in natural logarithms, one can interpret the estimated slope coefficients as the elasticity of the change in price with respect to the change in yield. One important finding this perspective yields is that none of the estimated elasticities (slope coefficients) differ statistically from -1.0 at the 95 percent confidence level.

An elasticity of -1.0 implies that, on average, the product of the two variables that are used to determine the elasticity does not change when the value of one of the variables changes. The change in one variable is offset by a change in the other.

This analysis implies that, on average, U.S. cash receipt per acre does not change between spring and harvest even when U.S. average yield changes. The change in average yield and change in average price offset one another. The preceding implies that systemic yield risk does not create a systemic cash receipt risk. The analysis has important implications for public policies toward both crop insurance and farm income support.

Implications for Crop Insurance

Private insurance that contains a factor for systemic risk will fail because many policy holders will collect when the systemic event occurs (Goodwin, 2001: Mahul, 2001; and Miranda and Glauber, 1997). For example, during a major U.S. drought, many farmers collect on crop yield insurance because their actual yield falls well below the yield guaranteed by the policy. Insurers can often manage this systemic risk by using the reinsurance market, but this increases the cost of the insurance policy. Public subsidies are another option, but a third option also exists: creating insurance products that eliminate systemic risk. This approach seems especially warranted for yield insurance for major U.S. field crops because, as explained earlier, the systemic yield risk does not carry an associated risk to farm income.

A potential approach to removing systemic risk is to pay indemnities based on the difference between the change in an individual farmer's yield, and the change in average U.S. yield between planting and harvest, rather than paying indemnities based on the change in the individual farmer's yield. For example, if average U.S. yield declines by 25 percent, an individual farmer could collect only if his/her yield declined by more than 35 percent, assuming a 10 percentage point deductible. By analogy, revenue-difference insurance also could be created to eliminate the systemic risk of changes in average U.S. cash receipt per acre. While changes in national yield do not create systemic receipt risk, changes in market demand may.

Table 1.

Slope Coefficient (Elasticity) of the Spring-to-Harvest Change in Price against Spring-to-Harvest Change in U.S. Average Yield, Selected Crops, 1974-2001.

Crop	Slope Coefficient (Elasticity)
Corn	-0.93
Cotton	-0.67
Oats	-1.61
Soybeans	-1.05

Removing systemic risk substantially reduces the chance of a huge payout year. Zulauf used county-level yield figures to determine that 1,041 corn-producing counties would have collected an average indemnity of $32 per acre during the severe 1988 drought with a simulated yield-level insurance program similar to Multiple Peril Crop Insurance and assuming 90 percent coverage (10 percent deductible). In contrast, only 426 counties would have collected an average indemnity of $8 per acre under a simulated yield-difference insurance program with the same 10-percentage-point deductible. Removing systemic risk reduces substantially the year-to-year variation in indemnities.

By eliminating systemic yield risk, difference insurance raises the possibility that private crop insurance may be viable. Other problems with crop insurance, notably adverse selection and moral hazard, may still be present. However, these two problems, which are created by inadequate information, exist for most, if not all, private insurance products. Companies develop procedures to control for them, such as by increasing premiums or excluding individuals with a history of high indemnities. Because of public subsidies for crop insurance, it is difficult to ascertain whether private companies could control adverse selection and moral hazard if viable private

crop insurance products existed. Removing the systemic risk in crop insurance products would be an important step in answering this question, and in determining whether private crop insurance is viable.

Implications for Farm Income Support Policy

The finding that systemic yield risk does not translate into a systemic cash receipt risk implies that using price targets, including marketing loan rates, as farm income support instruments creates a systemic income risk for crop farmers. Suppose that market price per bushel is below the price target during spring, and national yield declines over the growing season. If market price increases, but remains below the price target, total revenue to the grower declines. Since government payments depend on the difference between the price target and market price, the higher market price means government payment per acre declines from spring to harvest. The decline in government payment implies that income per acre declines as national yield declines because, on average, U.S. per acre cash market receipt, or price times yield, does not change between spring and harvest when national yield changes. Thus, price target support programs create a systemic risk that did not exist before the price target program was implemented.

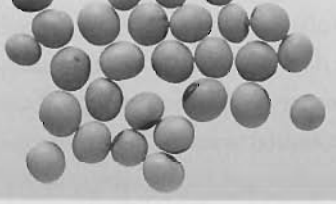
This problem casts doubt on the desirability of using price targets to deliver income support to farmers. In contrast, fixed per acre support payments do not create a systemic income risk because they do not change when yields change.

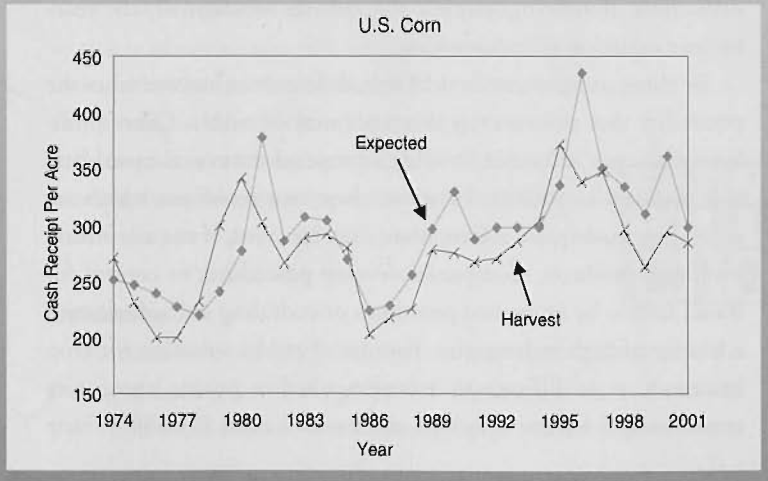
The discussion implies that it is probably no coincidence that ad hoc disaster assistance first appeared in the mid-1970s following the adoption of target prices in the 1973 Farm Bill and that Congress continues to provide it whenever national yield disasters occur. Ad hoc disaster assistance can be seen as a response to the systemic income risk created by price target programs. Replacement price provisions in crop insurance products also can be seen as a response to the systemic income risk created by price target programs. The ability to substitute a higher price at harvest for a lower price at planting in determining insurance indemnity offsets at least part of the loss of government payments resulting from decreasing national yields.

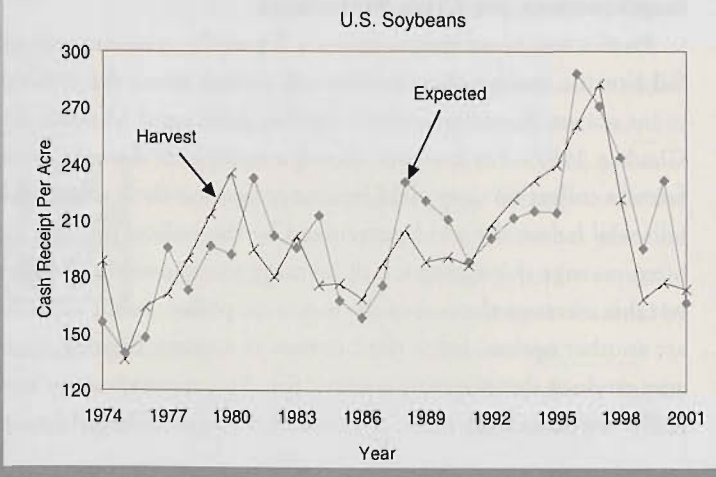
Concluding Implication

The preceding two implications suggest a third, broader implication. Specifically, the interactions between farm income support programs and farm risk programs should be analyzed with the goal of creating

Figure 1. Expected cash receipts







an integrated farm safety net that generates positive, not negative synergies. In other words, the Farm Bill and crop insurance legislation should be merged into a coordinated policy.

Technical Appendix on Procedures

Considerable evidence exists that U.S. farmers use futures prices in forming price expectations. Thus, ignoring the basis (difference between cash and futures prices), price of the harvest-time futures contract at planting can be used as a proxy for expected price at harvest. Harvest-time futures contracts used in this analysis were September for oats, November for soybeans, and December for corn and cotton.

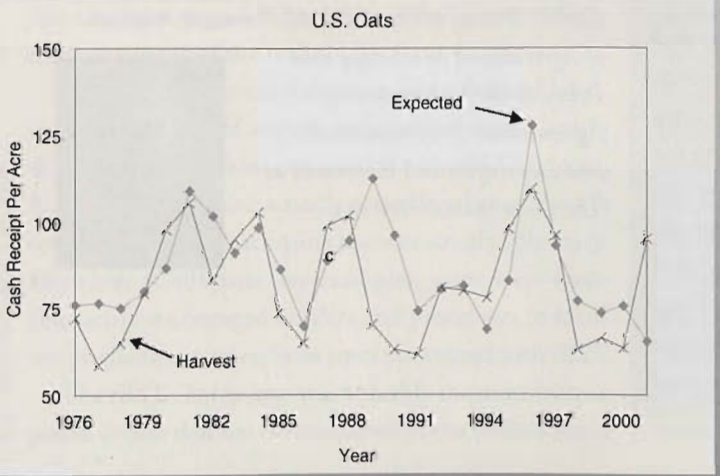
Including the basis in the analysis, (using cash price instead of futures price) should not explain why the slope coefficients (elasticities) are close to -1.0. The reason is the relationship between the basis at harvest and size of production. During short production years, the cash price at harvest tends to be higher than normal relative to the futures price at harvest in order to discourage consumption. In contrast, during large production years, the cash price at harvest tends to be lower than normal relative to the futures price at harvest in order to encourage stock holding. Thus, significant changes in yield relative to expected yield will tend to cause greater changes in cash price than futures price. Hence, including the basis in the analysis should result in a more negative slope coefficient.

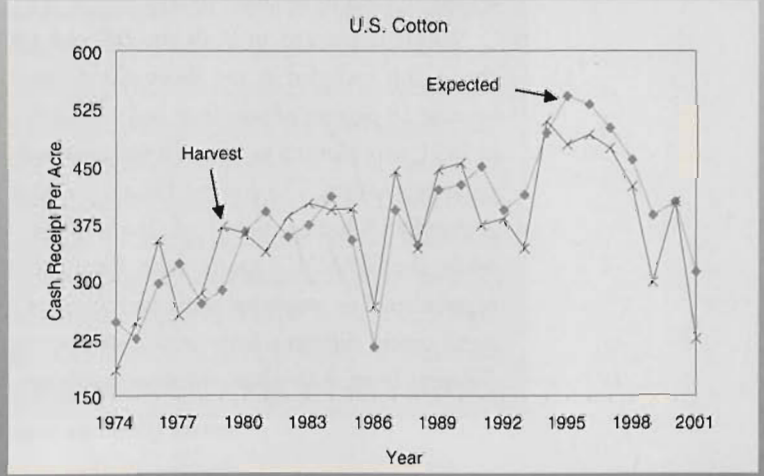
Research on futures and other speculative markets consistently finds that they quickly incorporate new public information into prices. Thus, the collection of futures prices was keyed off the U.S. Department of Agriculture's World Agriculture Supply and Demand Estimates (WASDE). WASDE is a widely followed information benchmark for supply and demand of major U.S. field crops. Keying the analysis off WASDE allows the identification of the supply-demand expectations being used by the market.

The spring price was the first closing futures price not at the daily price limit following the release of the first new crop estimates in WASDE. This WASDE was released in late April/early May. The price at harvest was the first non-limit futures close after the release of the September WASDE for oats and November WASDE for corn, cotton, and soybeans. Using the first non-limit closing price gives the futures market time to fully incorporate into price any new information contained in the WASDE report.

Yields were taken from the WASDE reports. However, except for a few scattered years prior to the 1993/94 crop year; expected yields were not reported in

ompared with actual harvest





the spring WASDE. For these situations, expected yield was estimated as the average of U.S. yields for the five previous crop years minus the high yield and low yield.

The regression analysis is not conditioned on other factors that can cause price to change between spring and harvest, such as changes in demand and harvested acres. The objective of this analysis is to draw implications for crop insurance and income support programs. An unconditioned analysis is appropriate because neither the price election for yield insurance, calculation of price for revenue insurance, nor determination of government pay rate for income support is conditioned on what factor causes market price to change. Payment equals yield times price or government pay rate, regardless of why price is the level it is.

The existence of government programs could have influenced the findings of this analysis. To the author's knowledge, the parameters of government programs for a given year were not changed between spring and harvest over the period of analysis. Government program parameters were changed between crop years; however, these changes were made before the spring dates used in this analysis and thus would have been incorporated into the price of the harvest-time futures contract. While changes in government programs between crop years could not explain the observed spring-to-harvest changes in price, it is likely that the existence of government programs affected the underlying price determination process. For example, the nonrecourse loan program tended to place a floor on price while public stock programs tended to place a ceiling on price. Thus, these two programs limited the ability of market price to change. However, because of this impact, nonrecourse loan and public stock programs would have caused the estimated elasticity of price with respect to yield to be closer to zero.

Wheat is planted in both the fall and spring, and thus is not included in the above discussion. However, because 18 percent of non-fruit and vegetable crop acres in 2001 were planted to wheat, it was analyzed using the same procedures. The harvest futures contract was the September Chicago Board of Trade wheat contract; while the WASDE reports were for April/May and September. The estimated slope coefficient of -0.92 was significantly different from zero, but not significantly different from -1.0. Thus, the same result was obtained for wheat as for corn, cotton, oats, and soybeans.

The regression results were examined for statistical problems. The only problem found was that the Durbin-Watson statistic revealed positive autocorrelation for oats. The Cochrane-Orcutt procedure was used to correct for the positive autocorrelation.

Additional details of the analytical procedures are discussed in Zulauf (2002).

Editors Note:

An earlier version of this article appeared in Tweeten, Luther, and Stanley R. Thompson. *Agricultural Policy for the 21st Century.* Ames: Iowa State University Press, 2002. The article here is published by permission.

For More Information

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