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DROUGHTS AND FARM POLICY

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DROUGHTS AND FARM POLICY

Droughts are of economic interest not because of the physical damage they cause, but because of the financial consequences that result from the physical damage. This distinction is not trivial, as physical damage may not result in economic loss. In an article recently published in *Agricultural Policy for the 21st Century* (Iowa State University Press (ISUP)) and adapted for a forthcoming article in *CHOICES,* I discuss an empirical finding that the price flexibility obtained by regressing the spring-to-harvest change in harvest futures price on the spring-to-harvest change in average U.S. yield has not differed significantly from -1 over the period beginning with the 1974 crop year for corn, cotton, oats, soybeans, and wheat. This finding implies that, on average, the product of market-level price and market-level yield, i.e., average U.S. per acre cash receipt, does not change as average U.S. yield changes from spring to harvest. The procedures are discussed briefly in the appendix.

Risk is conventionally divided into (1) systemic risk, or risk at the market level, and (2) idiosyncratic risk, or risk unique to the individual. Thus, the above finding can be interpreted as implying that, on average, systemic U.S. yield risk does not translate into systemic U.S. cash receipt risk. In other words, on average the so-called "natural hedge" between U.S. average price and U.S. average yield was perfect over the last quarter century for these five major U.S. field crops. Until recently researchers have focused on understanding idiosyncratic farm-level risk. However, understanding systemic risk is also important, especially for policy. In the following sections implications for U.S. farm income supports and crop insurance are discussed. I also briefly discuss how the west may be an exception to the perfect natural hedge and how policy can account for this differential.

Implications for Crop Insurance

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[1] Note from the author:

This paper is based in part on an analysis presented in "Income Variability of U.S. Crop Farms and Public Policy," *Agricultural Policy for the 21st Century*, edited by Luther Tweeten and Stanley R. Thompson, Iowa State Press: 2002, pages 91-108. It also is adapted from "Rethinking Price Supports and Insurance: How Risky is Market Risk," *Choices*, Summer 2002, pages 10-14.

The author thanks Paul Barkley, Barry Goodwin, Dana Hoag, Constance Jackson, Allan Lines, Matt Pullins, Luther Tweeten, and anonymous reviewers for their comments on earlier drafts.

Note from the editors:

We asked Dr. Zulauf to expand on his earlier two articles for the WEF because of the relevance of his article to the recent drought. Of particular interest is how the west may be an exception to his national systemic risk findings and how his policy suggestion might affect western farmers and ranchers.

Recent research has pointed out that the existence of systemic risk means that private insurance is prone to fail because many policy holders will collect when the systemic event occurs—e.g. during wide-spread drought, many U.S. farmers collect on crop yield insurance (Goodwin, 2001: Mahul, 2001; and Miranda and Glauber, 1997). For example, American Agrisurance, the largest U.S. crop insurer, was recently taken over by the Nebraska Insurance Department and the U.S. Department of Agriculture's Risk Management Agency (Barnaby, 2002). While a full assessment has not been completed, one factor appears to be the substantial number of policyholders affected by drought and other abnormal growing conditions in 2002 (Wiesemeyer, 2002).

Private insurers manage systemic risk by diversifying their portfolio and using the international reinsurance market, but these managerial responses usually generate higher costs. Public subsidies are another option. However, a third option is to create insurance products that remove the systemic risk. This approach seems especially warranted for yield insurance for major U.S. field crops because systemic yield risk does not carry an associated systemic per acre cash receipt risk.

In the ISU and *Choices* articles, I propose such an insurance product, yield-difference insurance. Yield-difference insurance would pay an indemnity based on the difference between the change in yield on an individual farm insurance unit and the change in average U.S. yield between planting and harvest. For example, average U.S. corn yields declined by nine percent between the May and November 2002 *World Agriculture Supply and Demand Estimates* (*WASDE*). Under yield-difference insurance, an individual corn insurance unit would collect only if its yield declined by more than 34 percent, assuming a 25 percentage point deductible.

Fewer farmers collect smaller indemnities under yield-difference insurance than under conventional Multiple Peril Crop Insurance when widespread abnormal growing conditions affect national average yield (Zulauf, 2002). By substantially reducing the probability of large payout years, yield-difference insurance may be viable as private insurance because the capital requirement needed to maintain viability in years with widespread abnormal growing conditions is sharply reduced. Or, society may choose to continue public subsidies, but at lower levels.

Adoption of yield-difference insurance will allow insurance companies to focus on helping farmers manage idiosyncratic yield risk. In particular, yield-difference insurance will increase indemnity payments when national yield increases between planting and harvest. To illustrate, a 15 percent decline in an individual farmer's yield when national yield increases by 10 percent is as financially damaging as a 25 percent decline in individual yield when national yield does not change. Thus, yield-difference insurance should better match insurance indemnities with financial damage resulting from declines in idiosyncratic yields between planting and harvest.

Improvement in the efficacy of crop insurance should benefit all producers, but particularly those with the highest idiosyncratic cash receipt risk. For most field crops, idiosyncratic cash receipt risk is likely to be higher in the U.S. West than in other regions. For example, Harwood, Heifner, Coble, Perry, and Somwaru (1999, pp. 13) find that county level yield-price correlations for corn over the 1974-1994 period are more negative in the Corn Belt and less negative for non-core regions, such as the Great Plains, South, and East.

While the preceding discussion has focused on yield insurance, it is important to note that revenue insurance has a systemic risk associated with leftward shifts in domestic and international demand. A leftward shift in market-level demand causes market-level price to decline, which translates into a decline in local prices. A large enough decline in market demand can lead to widespread claims against revenue insurance. To illustrate the potential importance of this systemic risk, four times since 1990 U.S. average yield stayed the same or increased between spring and harvest while U.S. average cash receipt per acre declined by more than 20 percent for one of the five crops analyzed in this study. Reason for the decline in cash receipt per acre was a substantial decline in the harvest futures price. These observations and associated decline in U.S. average cash receipt per acre were: (1) oats, -42 percent in 1990; (2) cotton, -33 percent in 2001; (3) corn, -25 percent in 1996; and (4) wheat, -24 percent in 1994.

Implications for Farm Income Supports

While droughts do not cause a systemic per acre cash receipt risk, the increasing prices that result from widespread droughts interact with price target programs, including marketing loans, to create a systemic per acre income risk. This situation occurs when the harvest-time price expected at harvest is less than the price target. The 2002 corn crop illustrates this situation. Using the May and November 2002 *WASDE* estimates for U.S. corn production and the midpoint estimate for average U.S. cash price and assuming the average harvest basis for recent years, projected cash receipts for U.S. corn increased by 12 percent, from $19.4 to $21.6 billion, from May to November. A 23 percent increase in price more than offset a nine percent decline in production. In contrast, when expected loan deficiency and counter-cyclical payments are included, projected gross income decreased from $23.4 to $21.6 billion, or by eight percent.

The preceding discussion implies that a rationale for *ad hoc* disaster assistance is to compensate farmers for the systemic income risk that price target programs create when widespread drought occurs. This implication raises questions regarding the efficacy of price target programs since they can create the need for another government program. On the other hand, price target programs generally will stabilize income when a leftward shift in demand or higher than expected production (i.e., rightward shift in supply) causes market price to decline and price is below the price target. Furthermore, price target programs generally will increase farm income if production is higher than expected (i.e., supply shifts right) and price declines below the price target. In short, impact of price target programs on farm income depends on the situation: they may reduce farm income, stabilize it, or increase it.

A reviewer raised an important observation: farm policy appears concerned with year-to-year variation in farm income. Thus, what is the relationship between year-to-year changes in U.S. average cash price and yield? To address this question, the same type of regression equation discussed in the appendix was estimated, except that the variables were change in average U.S. yield and change in average U.S. cash price between adjacent crop years. The results are presented in Table 1.

Except for cotton, the results are similar to the results reported in the ISU and *Choices* articles for the regression of change in harvest futures price against change in average U.S. yield between spring and harvest. Specifically, the slope coefficient does not differ from -1. Thus, for corn, oats, soybeans, and wheat; on average, year-to-year variation in U.S. average yield does not cause average U.S. cash receipt per acre to change from year to year.

Table 1. Regression of Crop Year-to-Crop Year Change in ln U.S. Average Cash Price against Crop Year-to-Crop Year Change in ln Average U.S Yield, 1974-2002.

Crop	Slope Coefficient	R^2
Corn	-0.74	0.46
Cotton	-0.28*	0.06
Oats	-1.18	0.41
Soybeans	-1.17	0.61
Wheat	-0.99	0.19

* Significantly different from -1 at the 95 percent level of confidence.
Source: Original calculations using data from the US Department of Agriculture

A Suggested Integrated Farm Policy

The preceding discussion suggests the need to rethink farm income and risk policies. One possible set of integrated farm policies is described below.

(1) Yield-difference insurance should replace Multiple Peril Crop Insurance. Furthermore, government should progressively lower public subsidies to determine if private yield-difference insurance can be viable.

(2) If society decides that farmers should receive public subsidies, potentially economically justifiable subsidies include those based on (1) positive environmental amenities provided but not compensated by the private market, (2) marginal social savings achieved by using subsidy payments to reduce negative environmental externalities rather than alternative mechanisms such as command and control, and (3) lack of viable private insurance for price risks caused by demand factors. As noted above, private insurance for price risks caused by demand factors is not likely to be viable because leftward shifts in demand create systemic price/income risk. In the author's opinion, private yield-difference insurance and the offsetting changes in market price and market yield can address the income risks created by changes in yield.

Potential public policy mechanisms for providing protection against risks caused by adverse changes in demand are price target programs and subsidized insurance products. Note risk will need to be separated into supply and demand causes, with subsidies provided only for risks associated with demand. For example, an initial step in pricing an insurance product for adverse changes in demand could be to reduce the put option premium on the harvest contract by an amount that can be attributed to the risk of price decline associated with changes in U.S. average yields. An important caveat to this recommendation is that, while separation of risk into supply and demand causes is theoretically possible, it will be difficult to implement empirically.

(3) Crop insurance indemnities and price target payments should be based on a moving average of recent realized yields, including those on which crop insurance is collected. These tie-ins will reduce moral hazard and adverse selection associated with crop insurance. The reason is that cheating on current year's yield to maximize current crop insurance indemnities will reduce future insurance indemnities and/or farm program payments.

I readily acknowledge (1) that other policy combinations exist and are feasible, (2) that each proposal has problems and will create other problems, and (3) that additional research is needed on the relationship between changes in average U.S. price and yield, including analyses for other crops. But, I hope this set of proposals encourages dialogue, criticism, debate, and creativity that will lead to a truly integrated farm safety net which in an economically justifiable way addresses the idiosyncratic risk needs of individual farmers while recognizing the importance of systemic market risk.

Appendix on Procedures

The estimated regression equation was:

$$[\ln(F_{H,H}) - \ln(F_{H,S})] = \alpha + \beta\,[\ln(Y_H) - \ln(Y_S)] + \varepsilon,$$

where $[\ln(F_{H,H}) - \ln(F_{H,S})]$ is the change between spring (S) and harvest (H) in the natural logarithm (ln) of the price of the harvest futures contract (F_H), and $[\ln(Y_H) - \ln(Y_S)]$ is the change between spring and harvest in the natural logarithm of average U.S. yield (Y). Harvest futures contracts were September for oats and wheat (Chicago Board of Trade), November for soybeans, and December for corn and cotton.

Spring price was the first closing harvest futures price not at the daily price limit following release of the first new crop estimates in the U.S. Department of Agriculture's *World Agriculture Supply and Demand Estimates* (*WASDE*). This release occurred in late April/early May. Harvest price was the first non-limit close following release of the September *WASDE* for oats and wheat, and the November *WASDE* for corn, cotton, and soybeans. If available, yields were taken from *WASDE.* Except for a few scattered years prior to the 1993 crop; the spring WASDE did not forecast yields. For these years, expected yield equals the average of U.S. yields for the five previous years excluding the high and low yields.

For additional details on the analytical procedures, see Zulauf (2002).

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