CROP INSURANCE RESEARCH NEEDS: COMMENTS

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Researchers involved in Regional Research Project S-180 are indebted to Rob King for doing an outstanding job of summarizing crop insurance research needs. He identifies three important areas for future research: (1) farm decision analysis, (2) policy analysis at the aggregate level, and (3) effective crop insurance program management within the Federal Crop Insurance Corporation (FCIC). Each of these research areas may fit under one or more of the objectives of our project. In addition, he argues that we need to develop effective ways to help farmers evaluate crop insurance alternatives as part of an overall risk management strategy. Little research has been done on the interactions between the crop insurance decision and other production, marketing and financial risk management strategies. As the number of alternatives considered increases the complexity of the firm-level risk model increases, perhaps exponentially. The environment in which farm producers operate is extremely complex. Regardless, we must move toward more comprehensive analyses of production, marketing and financial interactions in a dynamic environment.

Rob suggests a number of research areas and hypotheses to be tested. Research areas include the interactions among price and yield producing activities, variations in yield distributions among farmers in an area, relationships among subjective and empirical probabilities and risk preferences, research toward the design of improved normative risk models, analyzing aggregate impacts of alternative crop insurance policies with positive risk models, analyzing and predicting program participation, setting and adjusting the insurance rates and premiums, and individual program adjustments. Each of these areas certainly deserve our serious attention.

The latter research areas, identified above as setting and adjusting insurance rates and premiums and individual program adjustments, provide a point of departure and an opportunity to discuss some additional crop insurance research just completed in Oklahoma. Following a brief review of this research, additional attention will be focused on Rob's comments.

Oklahoma Crop Insurance Study

This research is reported more completely in an M.S. thesis recently completed by Kevin Jeter at Oklahoma State University. The study involved an evaluation of the impact of all-risk crop insurance and government program participation on farms in three Oklahoma counties. Typical or representative farms are identified in three areas of Oklahoma for which yield variability differences were

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expected to be substantial. In the study, it was hypothesized that differences in price and yield variability, the incidence of crop insurance payments and the cost of premiums, and the incidence of deficiency and disaster payments, might suggest widely different crop insurance - government program participation decisions by producers in different parts of the state.

The purposes of the research included: (1) developing a set of whole farm situations in different parts of the state and simulating them in a stochastic environment over a 10-year period (2) determining the effects of participation in all-risk crop insurance, deficiency and disaster programs and various program combinations on economic performance at the firm level in each area (3) evaluating changes in the per acre Federal Crop Insurance (FCI) premium rates for each insurable crop in each of the three counties over the 10-year period.

Study Areas

The first study area was Jackson County in the southwestern part of the state of Oklahoma. Primary crops grown in the area include dryland wheat, dryland cotton, and dryland grain sorghum. The second study area was Wagoner County in the eastern part of the state. The eastern part of the state has a much higher rainfall pattern and dryland soybeans, wheat and hay production dominate production in Wagoner County. The third study area, Texas County in the Oklahoma Panhandle, was selected because it is very arid and substantial irrigation exists in the area. Irrigated crop production including irrigated corn, irrigated grain sorhgum and irrigated alfalfa, dominates the area. Dryland wheat and dryland grain sorghum are also produced on substantial acres in the county. Representative farms were developed for each of the three counties. The organization of production on these farms was selected to represent typical acreages of the crops produced in each county.

The Model

A whole farm simulation model was used in the analysis. This model was originally developed by Hardin to analyze capital investments in a stochastic environment.[1] The model was modified to consider all-risk crop insurance and government program participation. A given production organization was specified for each representative farm situation and simulated under conditions of stochastic yields and prices over a 10-year period. Each simulation contained participation in all-risk crop insurance, the deficiency payments program, the disaster payments program, or a combination of the above. Results were analyzed in terms of difference in ending net worth, the chance

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[1] This model has been reported in the literature (Hardin, Hardin and Walker) and has been used in previous risk management research (Dean; Jeter; Mapp, et al.; Walker, et al). No attempt will be made here to discuss model, structure, data requirements or modifications made for this analysis. Interested readers are referred to Hardin and to Jeter.

of firm failure (bankruptcy), and coefficients of variation for ending net worth. The beginning percent equity of the farms analyzed average about 40 percent. Thus, the analysis focused primarily on relatively high leverage, high risk farm situations.

Price and Yield Variability

Stochastic prices and yields used in the analysis were based on subjective interpretations of historical price and yield data. A historical price series was developed based on seasonal average prices for Oklahoma crops for the period 1965-1980. These prices were deflated using the GNP price deflater and converted to current (1982) dollars. Historical yield series were based on county average yields per harvested acre for the period of 1975-1980 for the appropriate county. A longer data series could have been developed for dryland crops, but irrigation data were not reported prior to 1975.

Triangular probability distributions were constructed for prices with the modal (most likely) price being the historical average in current dollars and maximum and minimum prices being two standard deviations above and below the modal value, except for crops which are eligible for deficiency payments. For deficiency payment crops, the minimum price was one standard deviation below the mode. For yields, the modal value was the historical county average for each crop. Maximum yields were 2.5 standard deviations above the mode. Minimum yields were typically specified as the yield below which harvesting of the crop would not occur. These subjective yield evaluations were made following discussions with area farmers and farm management specialists.

The historical price and yield data were used to establish correlation coefficients so that yields and price could be generated with the appropriate correlations. That is, the random yields generated by the model for the crops in each county were appropriately correlated. Also the prices generated by the model were appropriately correlated. However, the yield and price distributions in each county were assumed independent.

Alternatives Analyzed

The alternatives analyzed included participation in the government deficiency payments program, participation in the disaster payments program (even though the disaster payment program has essentially been eliminated), and participation in Federal all-risk crop insurance. For all risk crop insurance, three guarantee levels and three price elective options were analyzed for the insurable crops appropriate for each study area. The deficiency, disaster, and FCI options were evaluated independently and a number of combinations of these programs were also analyzed.

Results

In Jackson County, the combination of deficiency and disaster payment program participation resulted in the highest average ending

net worth and the lowest coefficient of variation of ending net worth. Of course, with the elimination of the disaster payment program, this combination is no longer a relevant option. The second best alternative involved participation in only the deficiency payment program. The deficiency payment program resulted in a lower mean ending net worth and a higher coefficient of variation of ending net worth than the deficiency - disaster program combination. The third best alternative in Jackson County involved in participating in no government programs. Actually, participating in no government programs and the best of the Federal all-risk crop insurance alternatives gave comparable results. No government program participation had about the same mean ending net worth as the 50 percent yield guarantee and low price elective FCI option, but slightly higher relative variability than the FCI option. Among the nine Federal crop insurance options evaluated in Jackson County, the 50 percent yield guarantee and low price elective combination provided the highest mean ending net worth. The coefficient of variation was not substantially different across the nine options.

In Wagoner County, the option providing the highest mean ending net worth and the lowest coefficient of variation involved participating in no government programs. This result, which may be surprising to some, apparently occurred because participation in government programs involved setting aside productive acres which reduced income to the individual producer. Participation in Federal all-risk crop insurance involved purchasing insurance premiums which exceeded the indemnity payments, reduced income, and reduced mean ending net worth. With the low equity operator analyzed, lower incomes created cash flow problems and these adverse effects accumulated over the 10-year period. In Wagoner County, the 50 percent yield guarantee and low price elective options of all-risk crop insurance was the second best alternative. This result occurred partly because crop insurance is available for soybeans, however, soybeans are not covered under the deficiency and disaster payment programs. Among the FCI alternatives evaluated, the low yield guarantee and low price elective was once again the most favorable crop insurance option.

In Texas County, where both irrigated and dryland production are included, the results were quite similar to those for Wagoner County. Once again, no participation in government programs resulted in the the highest mean ending net worth and the lowest relative variability of ending net worth. Costs associated with setting aside acres and paying insurance premiums appeared to lower mean ending net worth and increase coefficients of variation relative to no government program participation. For example, participation in FCI lowered the mean ending net worth and increased the coefficient of variation relative to no government programs. Because of the set aside requirement, neither disaster nor deficiency payment programs had as high a mean ending net worth as did the no government program alternative.

Additional Analysis

All of the above analyses assumed FCI participation for all crops at the same level of Federal crop insurance coverage. Independent

analyses were conducted for wheat and cotton in Jackson County. These analyses revealed that the low price elective and low yield guarantee was the most favorable Federal crop insurance option for producers of these crops in Jackson County. This result differs somewhat from that found by Lemieux, Richardson and Nixon in evaluating cotton producers in Texas. Higher yield guarantee and price electives were found to be more favorable in the Texas analysis.

In a separate analysis, producers were permitted to provide proof of three or more consecutive years of yields higher than the FCIC established county averages. When these yield guarantees were increased with crop insurance premiums maintained at previous levels, all of the FCI options improved significantly. While these results were not surprising, they did add support to the notion that proving higher yields may be a favorable option for area producers.

Another portion of the analysis evaluated premium adjustments built in to the FCI program. If indemnities are less than premium payments, average FCI premiums are designed to decline. The premium adjustments in this analysis were made under the assumption that the producer being modeled operated independently of other producers in the county. In reality, premium adjustments would likely be made for all county producers and might be greater or less than those determined in this analysis. Nevertheless, under the assumptions utilized in the analysis, premium rates for wheat and cotton for Jackson County declined over the 10-year simulation analysis to about 75 percent of the 1982 levels. In Wagoner County, the premium for wheat fell only about 5 percent, grain sorghum premium declined about 15 percent and the soybean premium declined about 20-25 percent, based on 1982 premium levels. In Texas County, premiums for corn fell to 75-80 percent of the 1982 premium rate while the other crop premiums declined to about 70 percent of the the 1982 premium levels. While these adjustments may not be exactly correct for the reasons cited above, they do seem to indicate that FCI premiums may be too high to insure substantial participation by farmers in either of the three counties studied in Oklahoma.

Topics on the Crop Insurance Research Agenda

Rob King has pointed us in some productive research directions. Analyzing adjustments in crop yields and FCI premiums to fit individual farm situations appears to be a very large task. Based on the above Oklahoma analysis, a tremendous amount of detailed analysis would be needed to provide appropriate premiums for each crop in each county in Oklahoma, much less throughout the U.S. Nevertheless, it appears that additional work in this area is needed if FCI is to be widely adopted by farm operators. Perhaps a productive research direction would be to analyze crop insurance premium adjustments needed on U.S. Department of Agriculture benchmark farms in production regions throughout the country. These analyses might provide useful guidance for the FCIC in its attempt to establish appropriate premiums for all insurable crops throughout the country.

Income insurance currently being discussed by policy makers in Washington could well impact on the continued availability and

applicability of Federal all-risk crop insurance. Publication of a report on income insurance appears eminent. Developments in this area should be followed with interest by agricultural economists performing research on all-risk crop insurance.

Participation by farm operators in the Payment-In-Kind (PIK) program may have implications for participation in Federal crop insurance. Perhaps the PIK grain will generate an income cushion and give additional incentive to avoid all-risk crop insurance. Perhaps the withdrawal of marginal acres from production will increase per acre yields, reduce yield variability, and make crop insurance less important from a risk management standpoint. If the PIK program has income generating and risk reducing characteristics, will one result be reduced interest in risk management strategies, including crop insurance?

The relationships among the PIK program, Federal crop insurance and other production, marketing, and financial decisions deserve additional research attention. Despite the complexity of the interactions, our models must move forward in considering the interactions of these decisions over time. We have much to learn about farmer decisions in the face of risky conditions. Perhaps interviews with farm operators who have and have not participated in the all-risk crop insurance program would be revealing. Do those who participate do so because they are risk averse or because their financial condition dictates that course of action. Do the participants follow other risk managmement strategies in the production and marketing of their crops and livestock?

It seems that the more we know about risky decision making, the more we need to know. Despite the research recently completed on risk management strategies and cro insurance, much remains to be done. We appreciate the work done by Rob King in generating new ideas for future crop insurance research.

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