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Risk and Grain Marketing Behavior of Large-Scale Farmers*

by

Wesley N. Musser**

George F. Patrick

and

David T. Eckman

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** Wesley N. Musser is professor in the Department of Agricultural and Resource Economics, University of Maryland, College Park, Maryland and formerly professor of agricultural economics at Pennsylvania State University and visiting professor at Purdue University. George F. Patrick is professor and David T. Eckman is a former graduate research assistant in the Department of Agricultural Economics at Purdue University, West Lafayette, Indiana.

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EXECUTIVE SUMMARY

Pre-harvest marketing techniques to reduce price and income risk are receiving greater attention in response to greater globalization of agricultural markets and reductions in government stabilization programs. Past research has found farmers' uses of these techniques are much lower than optimal hedging strategies would recommend. This article examines the relationship between farm characteristics and the use of forward pricing techniques by large-scale Midwestern corn and soybean producers.

Data for the study were obtained from a survey of pre-harvest marketing behavior, farm characteristics, and risk attitudes of participants in the 1993 Top Farmer Crop Workshop at Purdue University. The maximum percentage that producers would consider marketing by August 1 was about 59 percent for both corn and soybeans. They reported that they had marketed about 23 and 37 percent of expected 1993 corn and soybean production, respectively, by July 15, 1993. Cash forward contracting was the primary forward pricing technique, followed in importance by hedging, options, and minimum price contracts. The percentages of producers using these marketing techniques were generally higher than found in previous studies of marketing behavior. The study also used Tobit regression techniques to determine the factors that affected farmers pre-harvest marketing behavior. The regression models were specified with variables to reflect the portfolio theory of optimal marketing and those used in previous marketing behavior research. Variables reflecting alternative forms of risk preferences were also included.

Results were mixed. Only dummy variables for the use of options or minimum price contracts and for the use of hedges had positive significant coefficients for all equations. Use of these techniques increases pre-harvest marketing. Yield variability, percent of income from

government payments, and a variable related to prospect theory were not significant in any of the equations.

Age, education, gross income, location and futures price expectations were significantly related to the percent corn marketed in 1993. The maximum percent corn marketed by August 1 was significantly related to percent of income from livestock and futures price expectations. Farm location significantly affected the percent soybeans marketed in 1993, while the maximum percent marketed was significantly related to the debt/asset ratio. A safety-first risk attitude toward losses variable significantly affected the maximum percent marketed of both commodities.

Results indicated differential impacts of risk attitudes, farm, and farmer characteristics between commodities and between short-run and long-run behavior. Thus, more research on these differences seems promising.

Risk and Grain Marketing Behavior of Large-Scale Farmers

Weather and output price variability were the most important sources of net income variability for both crop and livestock producers in a 12-state study (Patrick *et al.*). Among large-scale cornbelt cash grain farmers, crop prices and crop yields ranked first and second, scoring 4.31 and 4.21, respectively, on five-point Likert-type scales of the relative importance of sources of risk in farming (Ortmann *et al.*). With the North America Free Trade Agreement, a new framework for General Agreement on Tariffs and Trade, and decreased emphasis on price supports and disaster assistance in U.S. farm policy, producers are likely to face increased price and income variability. New forms of crop insurance can help mitigate production risk and a variety of marketing techniques, such as forward contracting, minimum price contracts, hedging, and options contracts, are available to manage price risk. The U.S. Department of Agriculture pilot program that uses options in lieu of deficiency payments was oversubscribed for the 1993-94 marketing year (Carlson), which indicates farmer interest in alternative marketing and risk management techniques.

Marketing research has emphasized the use of marketing techniques in a portfolio context of price or income risk reduction (e.g., Peck). Empirical applications of this approach "suggest that the optimal futures position is often a large percent--say 75 to 100--of the expected cash position." (Tomek, p. 7) Consistent with producers' concerns about yield variability, studies that have incorporated production risk find lower optimal hedging positions. For example, optimal hedging proportions have ranged from 20 to 60 percent for soybeans and from 60 to 70 percent for corn (Alexander, Musser, and Mason; Grant). Lapan and Moschini found optimal springtime hedge ratios for Iowa soybeans from 53 to 75 percent depending on risk aversion and harvest date.

Midwestern cash grain producers are giving increasing importance to forward contracting and hedging. For example, although not directly comparable, the importance ratings of forward

contracting and hedging as management responses to risk increased from 2.83 and 2.00, respectively, in 1983 (Patrick) to 3.86 and 3.21 in 1991 (Ortmann *et al.*).[1] The average importance to Iowa farmers of educational programs on use of futures for hedging increased from 2.67 on a five-point scale in 1988 to 2.84 in 1993, while programs about options for price insurance increased from 2.83 to 3.01 during the same period (Lasley and Sharp). However, only 26 and 24 percent of Iowa producers had ever used futures for hedging or commodity options, respectively, only a slight increase from 1988 to 1993 (Lasley and Sharp). A 1992 survey of Kansas farmers found that 42.8 and 10.4 percent used forward contract and futures hedges, respectively (Goodwin and Schroeder). Although producer interest in marketing before harvest appears to be increasing, the level of use is well below the proportions suggested in optimal hedging literature.

The purpose of this study is to determine the effects of risk and farm characteristics on the use of pre-harvest marketing techniques by a sample of large-scale Midwestern cash grain farmers. More specifically, the study examines the factors influencing the maximum percentages of expected corn and soybean production that farmers would be willing to market, or forward price, by August 1. The study also examines the factors influencing the percentage of expected 1993 corn and soybean production actually marketed by July 15, 1993. Data for this study were obtained with a survey of participants in the 1993 Top Farmer Crop Workshop at Purdue University. The sample is not a random sample of farmers and the number of observations is limited which restricts generalization of results. However, these large-scale farmers do not face some of the limits in the use of some forward pricing techniques, such as size of futures contracts, and presumably have higher than average managerial ability. Therefore, their marketing behavior may provide information about the potential of marketing technique use by commercial farmers.

Conceptual Background

The portfolio model of pricing has several dimensions that must be considered in an application to the choice of marketing techniques. The model involves a trade-off between mean and variance of price (or income). In marketing, these arguments in the portfolio objective function can be considered price enhancement and risk reduction, respectively. Distinguishing between these effects in behavioral models is not always straightforward. Furthermore, most marketing strategy studies have focused on a single forward pricing decision for one commodity at one point in time with one marketing technique. Fackler and McNew recently argued that most forward pricing applications involve multiple products and pricing opportunities. The traditional analysis of one pricing decision does not seem consistent with the overall portfolio framework that stresses choices from all relevant outcomes. The portfolio approach also suggests that combinations of marketing techniques at different points in time may be risk efficient. A third point concerns the time framework to be studied. The marketing strategy literature focuses on long-run decisions. However, each year presents specific anticipated supply and demand situations so that variations from the long run strategy may allow short-run price enhancement. Some proponents of forward pricing, (e.g., Purcell, Chap. 9) suggest this dynamic, short-run approach as an alternative to the longer run portfolio approach. Each of these issues must be accommodated in behavioral models of forward pricing.

The income risk reduction aspect of forward pricing also has several modeling complications. First, the effect of forward pricing on the risky choice set is ambiguous. The finding in the previously reviewed literature that optimal hedge ratios are less than one implies that forward pricing reduces income risk at low levels but increases income risk as the proportion forward priced increases. The prominence of sequential marketing as an income risk reducing strategy (Patrick, Whittaker, and Blake) and popularity of flexible marketing strategies

with producers (King and Lybecker) also supports the view that a combination of pre-harvest, harvest, and post-harvest pricing reduces income risk. Goodwin and Schroeder reported that adoption of forward pricing techniques is positively related to willingness to assume risk, which supports the view that forward marketing increases risk. Thus, the effect of the full range of forward pricing on risk reduction in the choice set is unclear.

Another dimension of the choice set for forward pricing is the contrast between forward contracting and hedging versus options and minimum price contracts. Options and minimum price contracts protect against downward price movements while providing the opportunity for upward price enhancement. Thus, these marketing instruments do not have the strict trade-off between income risk reduction and price enhancement of forward contracting and hedging. However, the net effects of price enhancement opportunities are reduced by the option premium and minimum price contract fee as compared to no forward pricing. Thus, a trade-off still exists but not to the extent with futures hedging and forward contracting.

Another conceptual point with respect to the choice set concerns economies of size in forward pricing. The literature reviewed above suggests that large-scale farmers are utilizing forward pricing methods more than the average of farmers in broader samples. The costs of learning about these strategies and implementing them each marketing year have significant lumpy components. Larger farms can spread these lumpy costs over more production, thus their use may be subject to significant economies of size. A smaller marketing cost per unit of production results in larger net price enhancement, so that farms with more output may be more likely to adopt forward pricing strategies and make greater use of them. However, this view abstracts from the more complex management requirements of large-scale farms. Production management requirements may limit management available for forward marketing and therefore limit its use. Goodwin and Schroeder found evidence of both size relationships: use of forward

marketing increased and then decreased as size of farm increased. In contrast, Shapiro and Brorsen found hedging positively related to size. Asplund, Forster, and Stout also found positive relationships for both cash forward contracting and hedging. Therefore, large-scale farmers in this study may either be in the range of increasing or decreasing returns to size in reference to use of marketing techniques.

Methods of measuring risk preferences also are an issue. Expected utility theory implies several methods of measuring risk preferences with certainty equivalents involved in most (Anderson, Dillon, and Hardaker). Safety-first formulations of avoiding losses (Pyle and Turnovsky) also have adherents, largely because of their intuitive appeal. Assuming safety-first preferences may modify the relationships between forward pricing and optimal portfolio positions discussed above. The process of forward pricing can directly contribute to loss avoidance and the features of safety-first preferences that take primacy over price enhancement. However, forward pricing may increase overall income risk while avoiding losses. Thus, the optimal forward pricing level may be higher than with a general expected utility framework. Another form of risk preferences is derived from prospect theory (Kahneman and Tversky) in which decision-makers are risk seekers with respect to losses and risk averse with respect to gains. Collins, Musser, and Mason recently demonstrated that a lower than expected income could generate risk seeking behavior in the next crop year.

If both expected general utility and safety-first formulations of preferences are present, a risk/return trade-off may be operational only after the loss-avoidance aspect of safety-first is accommodated. A higher loss avoidance goal would stimulate forward pricing. After this goal is met, a more risk averse producer would forward market less (more) than a less risk averse producer if further forward marketing increases (decreases) risk. If the producer also exhibits prospect theory behavior, less risk averse behavior would occur following a loss year. A

hypothesis of this study is that these alternative formulations of risk preferences all may influence risky choices and may be complementary rather than alternative themes.

Description of the Data

Data for this study are from participants in the 1993 Top Farmer Crop Workshop. The workshop is a three-day program that provides an update on crop economics and production technology and allows participants to analyze their own farm with a linear programming model. The workshop has been held annually at Purdue University since 1968. Shapiro and Brorsen used data from a previous session of this workshop. For this study, questionnaires were mailed about three weeks before the late-July workshop to registered participants who were asked to bring the completed questionnaire to the workshop.[2] With 74 questionnaires returned, the response rate was about 75 percent. After questionnaires were eliminated for multiple responses from farm operations, from a very small farm, from four respondents with inconsistent marketing information, and from two farms with livestock representing more than 67 percent of gross income, 58 were useable for this study.

Summary statistics for several characteristics of the farmers and farm operations are presented in Table 1. These characteristics are similar to those for the 1991 participants which are discussed in detail in Ortmann *et al.* The average workshop participant is younger and more highly educated than the average farmer in the 12-state North Central region.[3] The farm operations have about four times the acres operated by the average farm in the region, and less than 30 percent of the land operated is owned. Corn and soybeans together account for over 75 percent of gross farm sales. All farms had gross farm sales in 1992 of more than $100,000, with about 43 percent in the $250,000 to $499,999 category, and almost 39 percent over $500,000. Only one of the farms had no debt, and two had debt/asset ratios of greater than 50 percent. The majority of farm operations have debt/asset ratios of 20 to 39 percent.

Marketing Methods

Producers were asked, with no time period specified, if a number of forward pricing methods were used in their farm operations. Cash forward contracting was the most common forward pricing method and was used by 74.1 percent of producers. This level of use was higher than the 48 percent for a sample of over 1,000 large-scale Midwestern producers in 1993 (Akridge), the 47 percent of Ohio farmers in 1986 (Asplund, Forster, and Stout) or the 43 percent for Kansas crop producers in 1990-92 (Goodwin and Schroeder). Futures hedging was used by 53.4 percent of producers. This level of hedging is similar to the 63 percent found by Shaprio and Brorsen but higher than the 28 percent in Akridge, the 7 percent in Asplund, Forster, and Stout or the 10 percent in Goodwin and Schroeder. Options contracts were used by 34.5 percent of workshop participants and 20.7 percent used minimum price contracts. Use of options is higher than the 28 percent found by Akridge or the 14.9 percent of Kansas wheat producers (Goodwin and Schroeder).

Producers were asked to indicate their expected 1993 production of corn and soybeans and the quantities of these commodities that had been forward priced with different marketing techniques by July 15 of 1992 and 1993. It should be noted that, because of floods, 1993 provided distinctly different pricing opportunities from the 1990 to 1992 period with differences for corn and soybeans. As indicated in Figure 1, the weekly closing prices of December 1993 corn futures were sharply lower than the 1990-92 average of the December futures during April and May and were trending downward. In mid-June 1993, the corn futures price reached a low and began climbing. By early July, the futures price was near the 1990-92 average for the same period and did not move substantially higher until after the workshop in late July. In contrast, as can be seen in Figure 2, the 1993 November soybeans futures weekly closing prices were

near the 1990-92 average November futures prices during April and May. The 1993 November soybeans futures began a sharp raise in early June which continued through the workshop.

The percentage of producers using and the total quantities marketed with different methods in 1992 and 1993 are presented in Table 2. The total quantity of corn forward priced in 1993 was less than in 1992, while the situation was reversed for soybeans. Between 51.4 and 62.4 percent of the total quantities marketed by July 15 were cash forward contracted. Although the percentage of the producers forward contracting corn declined from 1992 to 1993, the percentage forward contracting soybeans increased. These differences were consistent with the price behavior in 1993 compared to previous years. The percentage of producers hedging corn and soybeans both increased from 1992 to 1993. However, changes in producers' use of other marketing techniques were not consistent across crops. The average percent marketed by July 15, 1993, was 24.4 percent for corn and 39.1 percent for soybeans.

Producers were also asked to indicate the maximum percentages of expected production that they would forward price by August 1. The maximum was used to encourage farmers to consider their potential future behavior rather than anchor on 1993 and the past. The mean of responses was 58.6 percent for corn and 59.2 percent for soybeans. The range of responses, 10 to 100 percent, was identical for both crops. Because years were not included in these questions, responses are interpreted as reflecting potential or long-run marketing strategies. As would be expected, mean responses on this question exceeded the mean percentages marketed in 1993.

Risk Attitudes

Producers were asked to indicate their agreement or disagreement on a five point Lickert-type scale with the statement, "I am more concerned about a large loss in my farm operation than missing a substantial gain." This question was designed to measure the safety-first

preferences of producers. Almost half, 48.3 percent agreed or agreed strongly (four or five on the five-point scale), 30.0 percent were neutral, and only 21.7 percent disagreed. Producers were also asked the percentage of their expected corn and soybean yields with current practices they would give up to have yields which did not vary from year to year. Responses are presented in Table 3 and indicate a wide range of yield risk premia. Eleven producers, about 19 percent, would accept no yield reduction to obtain stable yields, which implies risk neutral preferences. The majority of producers would accept a yield reduction of five percent or less. However, at the other extreme, nine corn producers and nine soybean producers were willing to give up 20 percent or more of their expected yields for year-to-year stability. Producers were also asked how their 1992 net farm income compared to the average of their previous five years. This question was designed to measure the importance of decreasing risk aversion associated with a loss position. About 25.8 percent had net farm incomes in 1992 that were about the same as the previous five years, while 45.2 percent had incomes which were higher and 11.3 percent had much higher incomes in 1992. Only 17.7 percent have lower or much lower incomes in 1992.

Empirical Model

Empirical models in this research reflect the conceptual issues discussed above. Both corn and soybean pricing decisions were evaluated. Unfortunately, it was beyond the scope of this research to directly consider joint decisions for the two crops. However, dependent variables included the use of all marketing instruments at multiple times for each crop, which is a broader definition than many previous simulation studies. Goodwin and Schroeder also aggregated all forward pricing for each crop. Each crop had two dependent variables. One was the maximum percent of expected production which would be priced by August 1. This variable was designed to reflect long run marketing strategies. The other variable was the percent of

expected 1993 production that was forward priced by July 15, 1993, the then current marketing year, to reflect short-run decisions. To compute this variable, the quantities marketed by the various techniques were summed for each producer and divided by the expected 1993 production.

Age and education were included in the equations to reflect human capital effects on adoption of forward pricing techniques found in previous studies. Age would be expected to be negatively related to use. Younger farmers have a longer planning horizon to recover the learning and adjustment costs associated with adoption of these marketing methods. Previous studies included experience rather than age, which supported this hypothesis (Goodwin and Schroeder; Shapiro and Brorsen) but Asplund, Forster, and Stout found age negatively related to forward contracting but not hedging. Education would be expected to have a positive effect on use: a higher level of human capital would facilitate successful use of these strategies. Goodwin and Schroeder supported this hypothesis, but Shapiro and Brorsen and Asplund, Forster, and Stout did not.

Some of the independent variables included in the models reflect the impact of forward pricing on the choice set. Gross income was included as a measure of farm scale. Previous studies have indicated this variable could have a positive or negative relationship with the dependent variables. A measure of yield variability for each crop, computed as the highest expected yield minus the lowest expected yield divided by the most likely yield, was included. Their expected signs are ambiguous. The optimal hedge literature suggests a negative sign. However, more production variability could also lead to greater use of marketing methods to compensate for the higher production risk. The percent of gross income from livestock was included in the corn equations to reflect a smaller proportion of production available for sale by livestock producers. This variable was expected to have a negative sign. A dummy variable,

equal to one if the farm was located west of the Mississippi River, was also included. This variable was intended to reflect the more variable weather in the western cornbelt, especially with 1993 floods, and was expected to be negative.

Dummy variables were also included to examine the portfolio effects of using various forward marketing techniques. One variable was equal to one if the farmer used options or minimum price contracts for the crop and zero otherwise. This variable was intended to reflect the more limited impact of options and minimum price contracts on the risk/return trade-off and was expected to have a positive sign. Similarly, a variable equal to one if the farmer hedged in the futures market and zero otherwise was expected to have a positive sign. A dummy for forward contracting was not included because some of the equations had all respondents using at least one of the three techniques.

Variables were also included to reflect the interaction of forward marketing with other characteristics that affect income risk. Percent of gross income from government payments measured government commodity program participation, and percent debt-to-asset ratio was included to measure financial leverage. These variables were expected to have negative and positive signs, respectively, as related to their effect on net income risk. Goodwin and Schroeder and Shapiro and Brorsen found some support for these hypotheses; however, Asplund, Forster, and Stout reported opposite signs on similar variables.

The December futures price for corn (November futures for soybeans) expected by the farmer at harvest was included to reflect potential short-run price enhancement effects of current price expectations. Their signs were expected to be negative. If the dependent variables were measured as interpreted, this variable should have more of an impact on the variables for the 1993 marketing equations. The variables were also included in the maximum equations to test this hypothesis.

Variables were included to measure potential effects of different forms of risk preferences on the forward pricing decision. Yield risk premium variables, attitude toward losses, and net income change in the previous year were measures of risk preferences consistent with general expected utility, safety-first, and prospect theory, respectively. Recall that a large yield risk premium variable implies greater risk aversion. If forward pricing reduces (increases) risk, the variable would have a positive (negative) sign. The attitude towards loss variable was coded so that the greatest concern about losses has the highest value. Thus, its sign should reflect the impact of forward pricing on avoiding losses. As discussed in the theory section, its sign may not be the same as the yield risk premium variable. The net income change was coded with the lowest value being for the largest loss in income. Under prospect theory, a loss should generate risk seeking behavior and a gain risk averse behavior. If forward pricing decreases (increases) risk, the variable will again have a positive (negative) sign. As prospect theory is concerned with loss/gain situations, it is more likely to influence the short-run percent marketed decisions while the other measures are more likely to influence the long-run maximum variables. These variables were included in all equations to test this perception.

Dependent variables in these models are censored with a minimum value of zero. Shapiro and Brorsen and Goodwin and Schroeder used Tobit procedures to estimate similar models because of this limited dependent variable characteristic. Goodwin and Schroeder also assumed that such dependent variables had maximums of 100 and were also censored on the upper end. However, this assumption implicitly assures that farmers only hedge and never take speculative forward positions. Limited research exists on speculative positions--Alexander, Musser, and Mason demonstrated that such positions can be consistent with risk aversion or risk neutrality. In the data for this study, the percent soybeans marketed had four observations greater than 100. All involved futures and/or options transactions so a speculative position is

plausible. In addition, this sample was forward marketing soybeans at a higher level than in the previous year. If this behavior was related to a perception of soybean prices declining from July highs as the production season unfolded, a speculative position in soybeans was plausible. The fact that similar positions were not also apparent in corn where forward pricing was less than in 1992 or in the maximum percent marketed, which are assumed to reflect long run behavior, further collaborates this interpretation. As a result, the model for percent soybeans marketed was estimated with only a lower censored value of 0. The other three were estimated with both lower and upper censored values of 0 and 100, respectively.

Regression Results

Maximum likelihood Tobit estimates of the four equations are presented in Table 4.[4] Missing observations on variables reduced the number of observations in the equations. With limited observations, the maximum correlation between independent variables fortunately was 0.38. All four equations had high overall significance as indicated in the high values of the log likelihood χ^2 statistics.

Age had the expected sign in all equations but was only significant in the percent corn marketed equation. Education had the expected sign in both the percent marketed in 1993 equations but was significant only in the corn equation. Most of the variables associated with the choice set were significant in at least one equation but yield variability is an exception. The optimal hedge literature suggests yield variability is related to forward pricing. Either farmers do not consider production variability in marketing decisions, or these variables are not measuring the correct theoretical variables.[5] Gross income was significant in the percent corn marketed in 1993 and the percent of income from livestock was significant in the maximum percent corn marketed.

The dummy variable for the western cornbelt was significant and had a negative sign in both 1993 marketing equations. These estimates probably reflect the adverse weather in this region in 1993. It is interesting that the variable was negative in the soybean equation even though the whole sample had an increased average quantity of soybeans marketed by July 15. The lack of pre-harvest marketing significant differences in long run behavior between regions reinforces the previously discussed lack of response to yield variability.

The dummy variables for options/minimum price contracts and for futures hedges were positive in all equations with six of the coefficients being significant. Several reasons for the overall increase in preharvest marketing with use of these techniques are plausible. Options and minimum price contracts provide protection from losses while allowing for price enhancement. These techniques and futures market transactions have more liquidity than cash forward contracts so farmers can adjust their marketing positions for changes in price or production expectations more readily. Finally, the techniques may have joint portfolio effects.

Variables reflecting other characteristics that affect income risk and farmers' price expectations had mixed effects. The government payments variable was not significant in any of the equations. The debt/asset ratio was significant only in the maximum soybean marketed equation. Its positive sign in this equation indicates that farmers perceive that reducing price risk for this commodity is important as financial leverage increases. However, behavior in the short-run may be modified if price enhancement opportunities exist. Lack of significance of the debt/asset ratio in the corn equations may be related to the market stabilization effect of the government commodity programs. The expected futures price variables had negative signs in all equations but were significant only in the corn equations. Presumably, expected futures prices at harvest should have affected only the percent marketed in 1993 variables. However, the maximum percent corn marketed was also significantly affected by this variable in this study.

Results with respect to the risk preference variables were mixed. The attitude toward loss variable had a positive sign in all equations and was significant in the maximum percent equations. Safety first behavior therefore seems to increase long-run forward pricing. The yield risk premium variables were all negative but significant only in the percent corn marketed in 1993. The results on yield risk premium variables therefore provide limited support for the hypothesis that forward marketing increases risk reported in Goodwin and Schroeder. Finally, the change of income variable associated with prospect theory was not significant in any of the equations. Both general expected utility and safety first theory were associated with farmer behavior--the former with short-run and the latter with long-run variables. These preferences also have different implications for the extent of forward pricing--safety-first preferences increased the percentage marketed, and expected utility decreased it. Inclusion of variables for alternative risk preferences therefore provided some intriguing results.

Conclusions and Implications

The large-scale farmers in this small and nonrandom sample did forward market a significant portion of their corn and soybean crops. Cash forward contracting was the most commonly used marketing method, and it was more widely used by these producers than by farmers in other studies. Hedging and options were used by 53 and 34 percent, respectively, of producers, levels somewhat higher than another sample of large-scale farmers (Akridge), and well above the levels found in broader studies of all farmers. About 24 and 39 percent of 1993 expected corn and soybean production, respectively, had been marketed by July 15, 1993. The level of actual forward pricing is lower than that suggested by many of the theoretical studies of optimal hedge ratios. However, average responses to maximum percent marketed by August 1 was 59 percent for both corn and soybeans, which is the range of these studies.

Factors affecting both the maximum percentage of corn and soybeans which would be marketed by August 1 and the percent of 1993 expected production marketed by July 15 were analyzed. Age and education of the operator affected the short-run, or 1993 marketing decisions, for corn, but did not influence the long-run maximum percentages marketed. Farm location also affected the 1993 marketing decisions only, probably reflecting the unusual weather events of 1993. Size of business had a significant negative impact for 1993 corn, which indicates decreasing returns to size in use of forward marketing for these large farmers. Variability of yields had no significant effect on either the short or long-run marketing decisions. The debt to asset ratio positively affected the maximum percent soybeans marketed while percent of gross income from government payments were not significant in any of the equations. Expectations of December corn futures prices at harvest negatively affected both corn variables, but expectations of November soybean futures prices did not have significant effect.

The risk preference variables had interesting results. The yield risk premium variable, that is associated with expected utility, was significant in the short-run 1993 corn marketing equation. The attitude toward losses, a safety-first related concept, was significant in the long-run decisions. The change in net income was not significant in any of the equations so no support for prospect theory was found. The differences in variables affecting short-run corn and long-run corn and soybean behavior should be emphasized. More importantly, the risk premium variable implied that 1993 corn marketing was negatively related to risk preferences while the loss avoidance variable was positively related to long-run marketing. Thus, the results suggest that these alternative theories of risk behavior are complementary, but that more research is necessary to determine how they interact.

The limited asymptotical significance of the variables in all the equations except percent corn in 1993 was somewhat disappointing. However, such an outcome is not unusual in cross-

sectional analyses of adoption behavior, especially with sample sizes of 43 to 54. Nevertheless, these results may suggest a large random component on forward pricing or some alternative non-economic explanation. One referee of this manuscript suggested that an alternative explanation is that "some farmers use forward pricing because it makes them feel good." Future research could test this hypothesis by including Likert-type scales on such non-economic motives in a survey.

Marketing techniques influence both price and risk. Marketing strategies that reduce price risk over a number of years may not be strategies which lead to price enhancement in a specific marketing year. As one reviewer suggested, directly asking farmers questions about the impact of these methods may provide more evidence than inferring it from analysis. Farmers who use options and/or minimum price contracts and future markets transactions forward marketed higher percentages of expected production. More research on the relationships among the different marketing methods is necessary to explain this interrelationship. Definitely, these results suggest that joint research on all techniques used throughout the marketing season are necessary to understand farmer behavior. Analysis of the relationships between marketing methods for all commodities, which was beyond the scope of the study, also would likely assist in understanding farmer behavior.

Footnotes

[1] A subsample of Midwestern grain producers from Patrick *et al.* gave an average rating of 2.55 on a five-point scale to the importance of 20 management responses to risk. Forward contracting ranked eighth and hedging was tied for fourteenth. In 1991, the mean rating of 18 similar management responses to risk was 3.33 (Ortmann *et al.*). Forward contracting ranked sixth and hedging ranked ninth of the 18 responses.

[2] A copy of the questionnaire is available from the authors.

[3] The states in the North Central region are Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota and North Dakota.

[4] The marginal effect of each variable on the percent corn marketed by July 15, 1993, evaluated at the data means, can be computed by multiplying the estimated coefficient by 0.695. The marginal effects, at the data means, for the other equations may be obtained by multiplying the estimated coefficients by 0.775, 0.989, and 0.975, respectively.

[5] An alternative model, using percent yield shortfall as a measure of variability, did not improve the statistical results.

References

Akridge, Jay T., Purdue University - Top Producer Survey, personal communication, 1994.

Alexander, Vickie J., Wesley N. Musser, and George Mason. "Futures Markets and Firm Decisions Under Price, Production, and Financial Uncertainty." *Southern Journal of Agricultural Economics* 18(1986):39-49.

Anderson, Jock R., John L. Dillon and Brian Hardaker. *Agricultural Decision Analysis*. Iowa State University Press, Ames, Iowa, 1977.

Asplund, Nathan M., D. Lynn Forster, and Thomas T. Stout. "Farmers' Use of Forward Contracting and Hedging." *Review of Futures Markets* 8(1989):24-37.

Carlson, Gordon S. "Agriculture Must Get Serious About Managing Production, Price Risk." *Feedstuffs*, February 7, 1994.

Collins, Alan, Wesley N. Musser and Robert Mason. "Prospect Theory and Risk Preferences of Oregon Seed Producers." *American Journal of Agricultural Economics* 73(1991): 429-35.

Fackler, Paul L. and Kevin P. McNew. "Multiproduct Hedging: Theory, Estimation, and an Application." *Review of Agricultural Economics* 15(1993)521-35.

Goodwin, Barry K. and Ted. C. Schroeder. "Human Capital, Producer Education Programs, and the Adoption Forward Pricing Methods." *American Journal of Agricultural Economics* 76(1994):936-947.

Grant, Dwight. "How Much Should Farmer Hedge at Planting Time?" *Options, Futures, and Agricultural Commodity Programs: Symposium Proceedings*. Bruce Wright (editor). Commodity Economics Division, ERS, USDA, 1988.

Kahneman, Daniel and Amos Tversky. "Prospect Theory: An Analysis of Decision Under Risk." *Econometrica* 49(1979):263-291.

King, Robert and Donald Lybecker. "Flexible, Risk-oriented Marketing Strategies for Pinto Bean Producers." *Western Journal of Agricultural Economics* 8(1983):124-133.

Lapan, Harvey and Giancarlo Moschini. "Futures Hedging Under Price, Basis, and Production Risk." *American Journal of Agricultural Economics* 76(1994):465-477.

Lasley, Paul, and Jeff Sharp. *Iowa Farm and Rural Life Poll - 1993 Summary Report*. Iowa State University, University Extension, PM-1540, August 1993.

Ortmann, Gerald F., George F. Patrick, Wesley N. Musser, and D. Howard Doster. *Information Sources, Computer Use, and Risk Management: Evidence from Leading Cornbelt Farmers.* Purdue University Agricultural Experiment Station Bulletin No. 638, June 1992.

Patrick, George F., S-180 survey special tabulation, personal communication, 1994.

Patrick, George F., Suzanne H. Whitaker, and Brian F. Blake. "Farmers' Goals and Risk Aversion: Some Preliminary Analyses." *Risk Analysis in Agriculture: Research and Educational Developments*. Department of Agricultural Economics, University of Illinois, AE-4492, June 1980.

Patrick, George F., Paul N. Wilson, Peter J. Barry, William G. Boggess, and Douglas L. Young. "Risk Perceptions and Management Responses: Producer-Generated Hypotheses for Risk Modeling." *Southern Journal of Agricultural Economics*, 17(1985):231-38.

Peck, Anne E. "Hedging and Income Stability: Concepts, Implications and an Example." *American Journal of Agricultural Economics*. 57(1975):410-419.

Purcell, Wayne D. *Agricultural Futures and Options: Principles and Strategies*, Macmillian Publishing Company, New York: 1991.

Pyle, D.H. and S.J. Turnovsky. "Safety-First and Expected Utility Maximization in Mean-Standard Deviation Portfolio Analysis." *Review of Economic Studies*. 52(1970):75-81.

Shaprio, B.I. and B. Wade Brorsen. "Factors Affecting Farmers' Hedging Decisions." *North Central Journal of Agricultural Economics* 10(1988):145-153.

Tomek, William G. "Effects of Futures and Options Trading on Farm Incomes." Cornell University Agricultural Economics Staff Paper No. 87-9, May 1987.

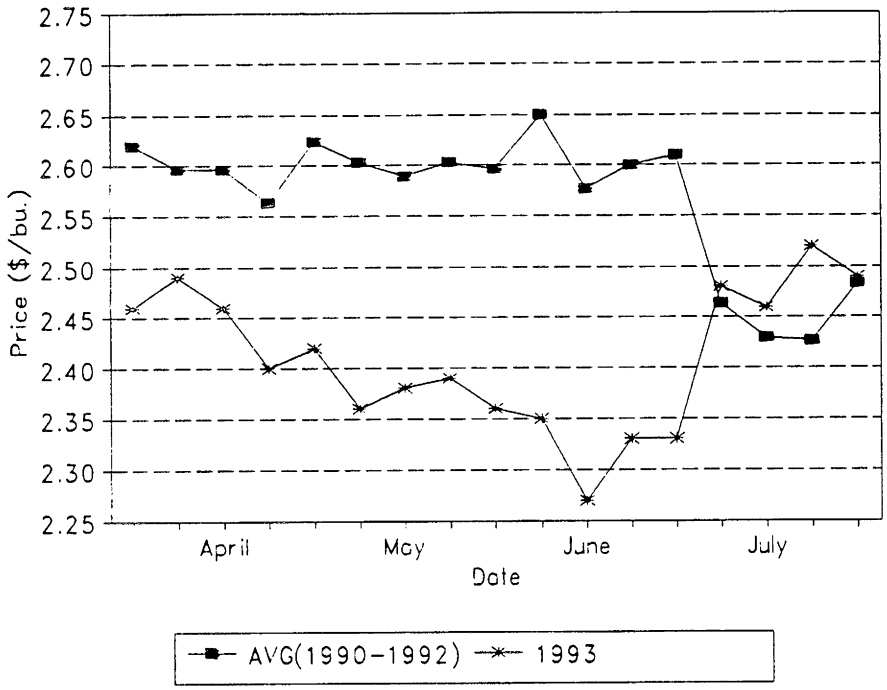

Figure 1. Weekly December Corn Futures Price Closes, Selected Periods.

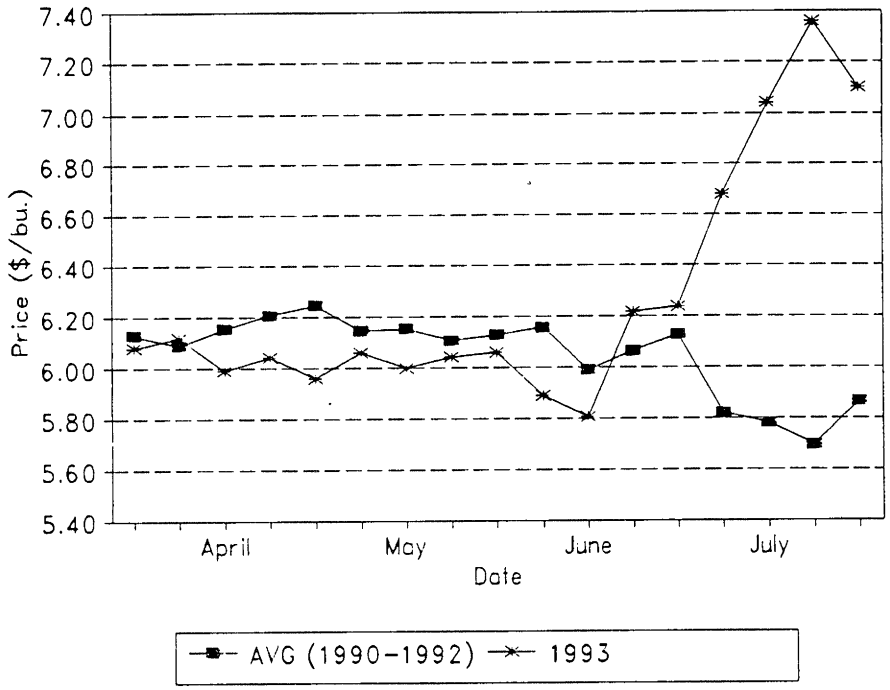

Figure 2. Weekly November Soybean Futures Price Closes, Selected Periods.

Table 1. Summary Statistics for Characteristics of Farmers and Farm Operations.

Variable	Mean	Minimum	Maximum	Number of Observations
Age	40.6	20	64	62
Education (years)	15.3	12	20	62
% of income from corn	42.7	3	65	60
% of income from soybeans	34.2	10	55	60
Total acres operated	1,834	595	3,956	62
Total acres owned	551	0	2,380	62

Table 2. Percentage[a] of Workshop Participants Using Selected Methods and Quantities Marketed as of July 15 for Corn and Soybeans.[b]

		Corn		Soybeans	
Marketing Method		1992	1993	1992	1993
Cash Forward	%	70.7	58.6	51.7	72.4
Contracts	1000 bu.	1047.5	960.0	294.8	317.6
Minimum Price	%	3.4	3.4	6.9	5.2
Contracts	1000 bu.	110.0	85.0	57.5	46.0
Hedging	%	19.0	25.9	13.8	22.4
	1000 bu.	480.0	348.0	109.0	192.0
Options Contracts	%	13.8	13.1	8.6	10.3
	100 bu.	150.0	145.0	50.0	61.5
Total	1000 bu.	1,787.5	1,538.0	511.3	617.1

[a] Percentages may sum to more than 100 because multiple marketing methods may be used.

[b] Number of observations is 58.

Table 3. Frequency Distribution of Producers' Yield Risk Premia[a] for Corn and Soybeans.

Risk Premium	Corn	Soybeans
	(% of survey respondents)	
0%	11	11
2% or less	6	10
5% or less	14	15
10% or less	17	15
20% or less	9	7
30% or less	0	2
Total Responses	57	60

[a] Largest percent of their expected yields with current practices one would be willing to give up to get the same yield every year.

Table 4. Maximum Likelihood Tobit Estimates of Models for Percent Marketed by July 15, 1993 and Maximum Percent Marketed of Corn and Soybeans.[a]

	Corn		Soybeans	
	Percent Marketed, 1993	Maximum Percent Marketed	Percent Marketed, 1993	Maximum Percent Marketed
Intercept	64.014 (60.962)	181.402*** (61.428)	32.023 (85.238)	41.188 (62.610)
Age	-1.138** (0.431)	-0.276 (0.395)	-0.261 (0.569)	-0.048 (0.409)
Education	5.202** (1.981)	-1.040 (1.824)	2.906 (2.735)	-0.118 (2.025)
Gross income	-1.900* (1.010)	0.804 (1.015)	-0.080 (1.309)	-0.966 (1.051)
Yield variability--corn	0.165 (0.134)	-0.074 (0.130)	----	----
Yield variability--soybeans	----	----	0.268 (0.206)	0.152 (0.151)
Livestock income (percent)	0.041 (0.187)	-0.387** (0.178)	----	----
Western cornbelt dummy	-43.572*** (13.820)	12.718 (10.976)	-43.267*** (15.682)	0.271 (11.778)
Options/min. price dummy--corn	28.896*** (8.771)	3.532 (9.479)	----	----
Options/min. price dummy--soybeans	----	----	50.066*** (11.762)	17.406* (10.003)
Futures hedge dummy-corn	17.220** (8.065)	16.958* (8.349)	----	----
Futures hedge dummy--soybeans	----	----	20.186 (13.896)	23.885** (10.032)
Government payments (percent)	0.592 (0.555)	-0.511 (0.597)	0.010 (0.766)	-0.462 (0.601)
Debt/asset ratio	-0.287 (0.185)	0.108 (0.182)	-0.288 (0.229)	0.319* (0.181)

Expected corn futures	-35.382* (17.433)	-48.821*** (18.515)	----	----
Expected soybean futures	----	----	-7.136 (8.320)	-4.893 (6.380)
Risk premium--corn	-1.229** (0.555)	-0.087 (0.486)	----	----
Risk premium--soybeans	----	----	-0.081 (0.643)	-0.356 (0.483)
Attitude toward loss	5.741 (3.600)	7.296** (3.367)	7.907 (4.986)	6.823* (3.667)
Change in income	-0.640 (3.957)	0.272 (3.921)	-4.697 (5.773)	5.720 (4.282)
Scale variable[b]	17.458*** (2.294)	20.124*** (2.168)	25.906*** (3.007)	22.885*** (2.435)
Log likelihood χ^2	80.589	88.967	68.872	69.896
Number of observations	43	53	45	54

[a] Asymptotical standard errors in parentheses. The *, **, and *** indicate coefficients asymptotically significant at ten, five and one percent levels, respectively.

[b] Estimate of standard deviation.

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