A STOCHASTIC DOMINANCE ANALYSIS OF ALTERNATIVE MARKETING STRATEGIES FOR MIXED CROP FARMS IN NORTH FLORIDA

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Abstract

Cumulative probability distributions of income for management scenarios involving four pre-harvest marketing strategies are subjected to stochastic dominance analysis to determine risk-efficient sets of strategies for different groups of farmers in North Florida. Results indicate that farmers should behave differently in their choice of marketing strategies according to their risk attitudes. Highly risk-averse farmers should prefer some forward contracting while low risk-averse and risk-loving farmers should prefer cash sales at harvest. Use of the futures markets leads to both higher income and greater risk than forward contracting but lower income and risk than cash sales.

Key words: marketing strategies, probability distributions, risk, stochastic dominance, uncertainty.

North Florida and adjacent areas in Alabama and Georgia are part of a "fringe" agricultural area between the major Corn Belt production to the north; wheat, cotton, and cattle operations to the west; and citrus and vegetable production to the south. The major crops produced include peanuts, corn, soybeans, and wheat. With the exception of peanuts, however, the region is not a major producer of any crop. The region's distance from and lack of ready access to the major crop and livestock markets introduces much price variability and increases income instability. Strategies for reducing income variability and raising average incomes of farmers need, therefore, to be investigated within the current economic environment to provide insight into the potential for farmers to strengthen their financial position.

The literature is replete with theoretical and empirical issues involved in the use of strategies to reduce income variability through minimizing production, price, and financial risks. Falatoonzadeh et al. recently demonstrated the use of five common management tools to reduce price and production risks. They concluded that the use of futures markets offers a viable tool to reduce price risk using hedging.

A key factor influencing beneficial usage of futures markets is the variation in the basis. The basis is the difference between the futures price and the local cash price at a give time. Garcia et al. analyzed basis fluctuations for selected livestock markets and determined that long-term price levels and unexpected changes in prices are important in explaining basis variation. Sophisticated marketing strategies involving stochastic simulation of daily cash and futures prices have been analyzed by Bailey et al.

Recent introduction of futures options at the Chicago Board of Trade has added a new marketing tool farmers may employ to reduce price risk. Nelson compared forward and futures contracts and showed evidence of imperfect substitutability of these two pre-harvest marketing tools. Such comparisons of marketing strategies have not involved the futures options strategy because of the newness of this strategy. In many cases, the different risk attitudes of farmers have also not been incorporated even though general treatment of risk is sometimes considered (Purcell and Riffe; Sullivan and Linton; Stokes et al.; Bobst et al.). Another important issue left untackled in the literature is the relationship between the use of marketing strategies as

complementary tools and the degree of risk aversion of the farmer.

This study contributes towards the goal of more precise evaluations of different marketing strategies by analyzing the associated probability distributions of income using risk efficiency analytic tools. Such evaluation is necessary to increase the information available to farmers on the economic viability of existing and potential marketing strategies. Comparison of marketing strategies with respect to expected income and risk is desired to establish optimal strategies based on the risk attitudes of farmers in a time when farmers are especially vulnerable to price uncertainty.

METHODOLOGY

Various marketing strategies are evaluated via an income simulation model of a typical middle-sized, mixed crop farm in Jackson County, North Florida. The typical farm produces four crops: corn, peanuts, soybeans, and winter wheat covering 55, 30, 100, and 50 acres, respectively, with a total size of 235 acres. Winter wheat is assumed to be double cropped with soybeans. The model farm can be modified with respect to the type of soil, amounts of irrigation water applied during the season, expected yields, and marketing techniques used for the crops.

Planting and harvesting dates of the four crops cover a period of 2 weeks reflecting the midpoint interval of the time periods provided by extension specialists and buying agencies.[1] The farmer is assumed to make certain marketing and planting decisions within the 2-week intervals.

The base income simulation model derives the income of the typical farm using 17 years of simulated yields of the four crops reflecting different weather years from 1955 to 1971 (Anaman). Output prices used in the model are historical prices from 1970 to 1984.[2]

Simulated yields of the four crops are based on several validated crop simulation models available in the Institute of Food and Agricultural Sciences, University of Florida. Yields for corn and peanuts are derived from the work of Duncan (1976 a and b). The soybean growth simulation model was developed by Wilkerson et al. The winter wheat simulation model was developed for this study.

In simulating the yields of the crops, all four crops are simulated over the same 17 years of weather data. Yields for a given year are jointly selected at random from the 17 observations. The choice of net output prices (output prices minus marketing transaction costs) is also done randomly. The model randomly selects the net output prices for all the crops jointly for the given year to account for any interdependence between the prices.

Correlation between the output prices and yields is assumed to be zero because the farm-firm is a price taker. Hence, the gross revenues of each management scenario are calculated as the product of the randomly selected yields and the randomly selected net output prices. All other prices and costs are based on a 1984 reference year. The total cost of production is then subtracted from the gross revenues resulting in the net revenues per acre of each of the crop enterprises. The total net income for each crop enterprise is derived as the net revenues per acre multiplied by the number of acres devoted to the crop in the model farm. The total net income for the farm is replicated 255 times in order to derive the cumulative probability distribution of income. This approach is followed because the underlying true parent distributions for the random variables are unknown.

Four alternative pre-harvest marketing strategies are evaluated: (1) cash sales at harvest, (2) forward contracting at planting; (3) hedging at planting; and (4) buying of

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[1]The planting and harvesting dates for the four crops are as follows:

Crop	Planting date	Harvesting date
Corn	March 8-22	August 1-15
Peanuts	April 15-29	September 1-15
Soybeans	May 22-June 5	November 1-15
Winter Wheat	November 15-30	May 16-31

[2]The crop simulation models use the 1955 to 1971 period as being representative of the weather patterns in the North Florida area. Assuming that yields and prices are independent at the farm level, it is not necessary to use the same period for both weather and prices data. The 1955 to 1971 period chosen for the weather data represents a very diverse set of weather years for which complete detailed weather records are available for the study area.

futures options at planting. The key assumption used in modeling the net price per unit of crop sold under the mentioned marketing strategies is that the farmer knows the planting time prices but does not know the actual harvest time prices. Many forces cause prices to fluctuate between the planting and harvest times in any given production year. These forces are linked to supply and demand interactions locally and to national and international markets. The change in price of a crop from planting to harvest time in any production year is regarded as a random event. The historical prices from 1970 to 1984 are used to derive this random variable.

Cash Sales of the Crops at Harvest

This marketing strategy is modeled using the actual average prices of the four crops at planting times. Changes in the prices of the four crops from planting to harvest times each year over the period 1970 to 1984 are considered possible sample values for the random variable. Expected harvest time prices of the crops for 1984 conditions (the reference year) are derived as follows:

$$(1) \quad ECP(L) = CPP(L) + CICP(NUM,L),$$

where ECP(L) is the expected harvest time price for crop L in 1984, where L = 1, 2, 3, 4, referring to the crops corn, peanuts, soybeans, and winter wheat, respectively; DPP(L) is the actual average planting time price for crop L in 1984, the reference year of the model; and CICP(NUM,L) is the randomly selected change in price between planting and harvest times.

For peanuts, the farmer is assumed to have an acreage allotment. The price used was the 1984 government guaranteed price.

Forward Contracting

This strategy is modeled for all four crops. Once again for peanuts, the forward contract price is equivalent to the government guaranteed price. The farm in the model is assumed to have an allotment of 30 acres.

Average contract prices at planting in 1984 paid to the farmers in Jackson County, North Florida are used in the modeling of the prices and, hence, the net income. It is also assumed that for all the management scenarios involving forward contracting, only 50 percent of the 17 years average yields are forward contracted. The remaining 50 percent is sold for cash at harvest.

Hedging

The hedging strategy is modeled only for corn and soybeans to approximate the behavior of the farmers in North Florida area since these are the two main crops hedged. Fifty percent of the 17 years average yields to the nearest thousand bushels of the two crops are assumed to be hedged. For all the management scenarios involving hedging, the remainder of the two crops (corn and soybeans) plus all the quantities of the other two crops produced (peanuts and winter wheat) are sold for cash at harvest.

The actual hedging net price of a crop (AHNP(L)) for 1984 conditions is calculated as follows:

$$(2) \quad AHNP(L) = FUPP(L) - BASIS(NUM,L) - COMM(L) - OCM(L),$$

where FUPP(L) is the average futures price at planting time in 1984 for the two crops, corn and soybeans; BASIS(NUM,L) is the randomly selected basis for the crop L in one of the 15 sample price years (1970-1984); COMM(L) is the commission and brokerage fees per unit of the crop in 1984; and OCM(L) is the opportunity cost of margin money using 14 percent as the opportunity cost of capital.

Options

Options were introduced in early November 1984 at the Chicago Board of Trade and are one of the newest marketing tools available to farmers to reduce price risk. Recent literature explains the working of the futures options scheme for farmers (Schmiesing; Catania et al.; Dalton and Bailey).

A simple case of the options marketing strategy is evaluated. The farmer at planting purchases put options for corn and soybeans. He chooses to exercise the options or not just about the time they are due to expire. The expiration date of the options is at the end of the first week of the month preceding the underlying futures contract month. Hence, the farmer makes the decision to exercise the options at the end of the first week in August for the September corn contracts and at the end of the first week in October for the November soybeans contracts. He is assumed to sell about 50 percent of the 17 years average yields of the corn and soybeans or to the nearest thousand bushels in the futures options market. The farmer decides on a strike price and pays the corresponding premium. Initially, the strike price is set at

the average planting time futures price for both crops and is later varied for sensitivity analysis. The strategy whereby the farmer writes or sells options is not considered in this analysis.

The risky nature of the futures put options decision rests on the fact that the farmer does not know what the futures price will be at expiration time. It is also partly due to the variability in the basis. These two factors determine the size of the actual net options price for the crops. If the futures price at expiration time is greater than the strike price, the farmer will not exercise the option and will let it expire worthless. He then gets the prevailing cash price less the premium and less the brokerage and commission fees. If the futures price at the expiration time is less than or equal to the strike price, the farmer exercises the option and the net price becomes the strike price less the premium, less the basis, and less the brokerage and commission fees.[3]

Stochastic Dominance Analysis

The cumulative probability distributions of income for the different marketing plans are subjected to stochastic dominance with respect to a function analysis to determine risk-efficient scenarios based on the risk attitudes of the different groups of farmers. Stochastic dominance with respect to a function is an efficiency criterion used to order or rank choices. It divides the decision alternatives or strategies into two mutually exclusive sets: an efficient set and an inefficient set. The efficient set contains the preferred choice of every decisionmaker whose preferences are consistent with the restrictions imposed by the criterion. Inefficient alternatives are not considered because no element in the inefficient set is preferred by any of the decisionmakers.

The stochastic dominance procedure therefore compares cumulative probability distributions of alternative plans for different groups of farmers who are classified by their risk attitudes defined by the lower and upper bounds of their absolute risk-aversion coefficient (Pratt). The absolute risk-aversion coefficient ($A(y)$) is defined by the expression:

$$(3)\quad A(y) = \frac{-u''(y)}{u'(y)},$$

where $u'(y)$ and $u''(y)$ are the first and second derivatives of a von Neumann-Morgenstern utility function. The lower and upper bounds of the absolute risk-aversion coefficient are designated $A_1(Y)$ and $A_2(Y)$, respectively.

First and second degree stochastic dominance rules are special cases of the more general procedure. First degree stochastic dominance requires that the decisionmaker has positive marginal utility of income; i.e., $A_1(y) = -\infty$ and $A_2(y) = \infty$. Second degree stochastic dominance requires that the marginal utility of income should be both positive and decreasing (risk aversion) implying that $A_1(y) = 0$ and $A_2(y) = \infty$. Meyer (1977) provides a more detailed description of the theory and limitations of the stochastic dominance methodology.

The key input needed to use stochastic dominance with respect to a function program is the absolute risk-aversion coefficient intervals of the target farmers, in this case North Florida mixed crop farmers. Since no empirical work has been done to estimate farmers' utility functions and the absolute risk-aversion coefficients in Florida, secondary work from other parts of the United States are used to establish a range of absolute risk-aversion coefficients intervals (Young et al.; Kramer and Pope; Wilson; Wilson and Eidman; King and Oamek; Rister et al.; Love and Robinson). The absolute risk-aversion coefficient intervals chosen are those that are common to all these studies. Table 1 lists

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[3]Hence, the actual option net price (AONP(L)) is determined as follows:
  (a) <u>DO NOT EXERCISE THE FUTURES OPTIONS</u> — if (FUPP(L) + CIFP(NUM,L)) > STRKP(L) then AONP(L) = CPP(L) + CICP(NUM,L) — PREM(L) — COMM(L) or
  (b) <u>EXERCISE THE FUTURES OPTIONS</u> — if (FUPP(L) + CIFP(NUM,L)) ≤ STRKP(L) then AONP(L) = STRKP(L) — PREM(L) — BASIS(NUM,L) — COMM(L),

where FUPP(L) is the futures price at planting time for the crop L; CIFP(NUM,L) is the randomly selected changes in the futures price from planting time to the expiration date of the options contract; STRKP(L) is the strike or the predetermined price chosen by the farmer at planting time for crop L; PREM(L) is the premium charged for the corresponding strike price for crop L, including the opportunity cost of capital assumed to be 14 percent in 1984; COMM(L) is the commission and the brokerage fees for crop L; and BASIS(NUM,L) is the randomly selected basis for crop L among the 15 possible values (1970 to 1984).

TABLE 1. DEFINITION OF GROUPS OF FARMERS ACCORDING TO THE LOWER AND UPPER BOUNDS OF THEIR ABSOLUTE RISK-AVERSION COEFFICIENTS

Types or groups of farmers	Absolute risk-aversion coefficient	
	Lower bound	Upper bound
Risk loving	−0.00050	0.00000
Very low risk averse	0.00000	0.00003
Low risk averse	0.00003	0.00010
Moderate risk averse	0.00010	0.00050
High risk averse	0.00050	0.00100

the various groups of farmers defined by lower and upper bounds of the absolute risk-aversion coefficient.

RESULTS

Table 2 reports the means and coefficients of variation of incomes for the various risk-management scenarios for production on sandy-loam soils.[4] Irrigation combined with marketing of the crops by cash sales at harvest (scenario 2) results in the highest mean income. Not surprisingly, scenario 2 dominates all other scenarios considered for groups of farmers classified as risk loving, very low risk averse, and low risk averse, Table 3.

However, for moderate risk-averse and high risk-averse farmers, these results no longer hold. For the high risk-averse farmers, scenario 6 involving a mix of cash sales and forward contracting dominates all other scenarios. Scenario 6 also has the lowest coefficient of variation of income, Table 2. Forward contracting reduces income variability and even though it results in lower incomes than cash sales at harvest, it is appealing to the high risk-averse farmers. Moderate risk-averse farmers are indifferent to the four marketing strategies evaluated since they are all in the risk-efficient set. Hence, there is a potential for use of all four marketing strategies as complementary tools rather than as substitutes to stabilize income for this particular group of farmers. These results suggest that farmers with different risk attitudes will behave differently in their choice of marketing strategies and they are consistent with recent farm risk survey results of North Florida farmers (Boggess et al.).

Table 3 reports the efficient set of the risk management scenarios according to the sample size or the number of replications used to generate the cumulative probability distributions of income. It can be observed that sample sizes of 50 or 100 rank the scenario similarly. However, when the sample size is increased to 125 and beyond, the risk-efficient set of scenarios changes for groups of farmers classified as moderate risk averse and high risk averse. Lower samples sizes (50 and 100), therefore, lead to both Type 1 errors (inaccurate rankings) and Type 2 errors (large

TABLE 2. MEANS AND COEFFICIENT OF VARIATION OF INCOME FOR VARIOUS RISK-MANAGEMENT SCENARIOS FOR THE TYPICAL NORTH FLORIDA FARM

Risk manage-ment scenario number	Description of risk-management scenario[a]	Means (1984 dollars)	Coefficient of variation
2	P-SLSI M-CS	31,931	0.37
4	P-SLSNI M-CS	17,956	0.73
6	P-SLSI M-CSFC	26,337	0.26
8	P-SLSNI M-CSFC	14,708	0.79
10	P-SLSI M-CSHE	27,396	0.29
12	P-SLSNI M-CSHE	16,023	0.76
14	P-SLSI M-CSPT	27,777	0.36
16	P-SLSNI M-CSPT	16,170	0.78

[a]The risk-management strategies are defined as: Production Conditions(P); SLSI-sandy-loam soils with irrigation and SLSNI-sandy-loam soils without irrigation and Marketing Strategies (M); CS-cash sales at harvest time only, CSFC-cash sales at harvest time plus forward contracting, CSHE-cash sales at harvest time and hedging and CSPT-cash sales at harvest time and futures options.

[4]Scenarios involving the production of crops on sand soils (1, 3, 5, 7, 9, 11, 13, and 15) generate much lower incomes and higher coefficients of variation than their corresponding scenarios involving sandy-loam soils (2, 4, 6, 8, 10, 12, 14, and 16). The obvious reason is that sandy-loam soils are more productive than sand soils due to their greater water holding capacity. With production risk reduced substantially by the use of sandy-loam soils and irrigation, interest shifts to evaluation of alternative marketing strategies to reduce price risk.

Utility groups (lower and upper bound of risk-aversion coefficient	Description of members of the group	Sample size or number of replications			
		50	100	125	255
		.... Efficient scenarios			
−0.00050 to 0.00000 ....Risk loving		2	2	2	2
0.00000 to 0.00003 ....Very low risk averse		2	2	2	2
0.00003 to 0.00010 ....Low risk averse		2	2	2	2
0.00010 to 0.00050 ....Moderate risk averse		2	2	2,6, 10,14	2,6, 10,14
0.00050 to 0.00100 ....High risk averse		2,6, 10,14,	2,6, 10,14	6	6

[a]The typical farm is a medium-sized farm growing corn, peanuts, soybeans, and winter wheat in Jackson County, Florida.

efficient set) as compared to larger sample sizes (125 or 255).[5]

These results support the findings of Pope and Ziemer. They concluded that the frequency of incorrect rankings decreases rapidly with larger sample sizes. However, the Pope and Ziemer study did not consider sample sizes larger than 100. The sample size of 100 leads to some incorrect rankings in this study. This observation appears more important considering the fact that testing the differences among the mean incomes of the scenarios according to the sample size reveals no significant differences. Therefore, a researcher basing the sample size on the significance of the differences among the mean incomes may end up choosing too small a sample size as a computer cost saving technique.

Scenario 2, the most profitable scenario involving cash sales at harvest only, dominated all other secenarios for all groups of farmers except the moderate and high risk-averse farmers at the 125 sample size or larger. Scenario 6 involving forward contracting dominated all scenarios for the high risk-averse farmers.

The risk-efficiency comparisons of these three other marketing strategies are presented in Table 4. The scenario involving forward contracting is dominated by both the hedging and options scenarios for risk lovers and very low risk-averse farmers. Moderate risk-averse farmers are indifferent to forward contracting and hedging; however, they prefer forward contracting to futures options in

such a pairwise comparison. Hedging is dominated by options for risk lovers. But low, moderate, and high risk-averse farmers prefer hedging to options. Very low risk-averse farmers are indifferent to the two futures marketing strategies. The results obtained from the comparisons of the marketing strategies can be explained by analyzing the basis and the changes in futures prices from planting time to the expiration date of the options (CIFP).

The average basis for corn was $0.11 with a negative value in 7 of 15 years and a coefficient of variation of 1.45. The average basis for soybeans was $0.37 with a coefficient of variation of 0.46. Thus, the basis was more unstable for corn than soybeans. One reason that may account for the relatively high variability in the corn basis is that corn is harvested in Florida in July and August rather than in October and November when the major production areas of the United States harvest. Thus, the Florida harvest time price is very sensitive to weather effects on markets in the major producing areas and to local supply and demand factors. Soybeans, on the other hand, are harvested primarily in October and November throughout the nation.

The key to a hedging marketing strategy is the reduction in price risk via a stable basis. The net output price of the crop under hedging is the futures price at planting time, less the basis, less the commission and brokerage fees, and less the opportunity cost of margin money. High variability in the basis makes achievement of stable output prices more

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[5]The risk-efficient set of management scenarios for the sample sizes of 125 and above are consistent with the actual use of marketing strategies obtained from a survey of farmers in the area in 1983 (Boggess et al.).

The null hypothesis is that the expected utilities of income of the two compared marketing strategies are equal. A Type 1 error results when the null hypothesis is rejected and such a rejection is not warranted. A Type 2 error arises when the null hypothesis is not rejected when actually it should be rejected. The results from Table 3 indicate that for sample sizes of 100 and 50, incorrect rankings or Type 1 errors occur for the moderate risk-averse farmers. However, large efficient sets or Type 2 errors occur for the high risk-averse farmers for the same sample sizes of 100 and 50.

TABLE 4. RISK-EFFICIENCY COMPARISONS[a] FOR VARIOUS DEGREES OF RISK AVERSION OF THREE MARKETING ALTERNATIVES AVAILABLE TO THE TYPICAL FARM IN NORTH FLORIDA, FORWARD CONTRACTING, HEDGING, AND FUTURES PUT OPTIONS

Utility groups of farmers (lower and upper bound of risk aversion coefficient)	Description of the members of the group	Forward contracting versus hedging (scenario 6 versus 10)	Forward contracting versus futures put option (scenario 6 versus 14)	Hedging versus futures put option (scenario 10 versus 14)
−0.00050 to 0.00000	Risk loving	−1	−1	−1
0.00000 to 0.00003	Very low risk averse	−1	−1	0
0.00003 to 0.00010	Low risk averse	−1	0	1
0.00010 to 0.00050	Moderate risk averse	0	1	1
0.00050 to 0.00100	High risk averse	1	1	1

[a]1 denotes that the first scenario dominates the second; 0 means that there is not domination between the two scenarios; and −1 indicates that the first scenario is dominated by the second.

difficult. Hence, the forward contract marketing strategy for which the final net output price of the crop is know at planting appears more appealing than hedging to farmers very much concerned about income instability, i.e., high risk-averse farmers.

With regard to the futures option marketing strategy, there are two sources of price risk which the farmer has to consider. The first is variation in the basis which has already been discussed. The second is change in the futures prices between planting time and the expiration date of the options (CIFP). The expiration date is generally 1 month before the delivery month of the underlying futures contract. In this simple case of options evaluated, the farmer makes the decision to exercise the option near the time it is due to expire.

The average CIFP is $0.11 for corn with a coefficient of variation of 5.15. For soybeans, the average CIFP is $0.27 with a coefficient of variation of 5.57. The coefficients of variation indicate the high variability in the futures prices. The signal from the high variability is that the farmer has a potential of using the options market to gain higher income. In the base model, the initial strike prices are set at $3.00 and $7.50 with the premiums being $0.09 and $0.75 for corn and soybeans, respectively. The CIFP exceeds the premium 7 of 15 times or a probability of 0.47 for corn and 3 of 15 times or a probability of 0.20 for soybeans. There is, therefore, some chance for the farmer to reap extra profits with the options strategy, particularly in the case of corn. However, there is also a significant chance that the premium paid for the options will exceed the CIFP and that the farmer will receive a lower net

price than if he had hedged. Hence, for risk lovers, the futures options marketing strategy seems more attractive than hedging and forward contracting. However, for moderate and high risk-aversion farmers, options lose their attraction first to forward contracting and then to hedging.

Sensitivity to Changes in the Option Premiums and Strike Prices

In the base model,[6] the strike price or the exercise price for which the farmer can sell his crop is set at the prevailing planting time futures price for the crop (1984) and the corresponding premium is calculated using the Agnet options program (Schmiesing). The premiums generated by the program are theoretical premiums. These premiums were validated by testing them with actual premiums obtained from various issues of *The Wall Street Journal* from November 1984 to February 1985. The correlation coefficient between the theoretical and actual premiums was 0.95. Personal communication with Dr. Schmiesing in January 1985 indicated that the options program has been working well, partly because many traders have also been using the program.

In this section, the analysis concentrates on varying the strike price 25 cents and 50 cents above and below the original strike price in the base model. The original strike price is roughly the planting time futures price of the crop. The corresponding premiums are calculated and used to derive the mean incomes, coefficients of variation of income, and the risk-efficiency comparisons.

From tables 5 and 6, it is apparent that the mean incomes and coefficient of variation of

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[6]In the base model, approximately 50 percent of the 17 years average yields of the corn and soybeans were traded through futures options. The remainder of the two crops and all other crops were sold for cash at harvest time. In a later analysis, about 90 percent of the 17 years average yields were traded through both futures options and hedging. The analysis indicated that there was no change in the risk-efficient set of the marketing strategies. However, the mean incomes of the scenarios declined by about 20 percent.

TABLE 5. MEAN INCOME AND THE COEFFICIENT OF VARIATION OF INCOME FOR THE VARIOUS RISK-MANAGEMENT SCENARIOS WITH CHANGES IN PREMIUM AND STRIKE PRICES FOR THE FUTURES OPTIONS FOR CORN UNDER 1984 CONDITIONS

Risk-management scenario[b]	Description of risk-management scenario	Strike price and premiums[a]				
		$2.60 (0.00)	2.75 (0.02)	3.00[c] (0.09)	3.25 (0.22)	$3.50 (0.42)
		.... 1984 dollars				
13	Production condition: sand soils with irrigation	23,007 (0.43)[d]	23,028 (0.43)	23,043 (0.42)	23,030 (0.41)	22,932 (0.40)
14	Production condition: sandy-loam soils with irrigation	27,742 (0.37)	27,762 (0.37)	27,777 (0.36)	27,774 (0.35)	27,665 (0.34)
15	Production condition: sand soils with no irrigation	1,300 (8.49)	1,317 (8.43)	1,322 (8.36)	1,321 (8.30)	1,285 (8.45)
16	Production condition: sandy-loam soils with no irrigation	16,519 (0.78)	16,166 (0.78)	16,170 (0.78)	16,669 (0.78)	16,134 (0.78)

[a]The premiums are in parentheses.
[b]Scenarios 13 to 16 are those involving the mix of cash sales and the futures put options marketing strategies.
[c]The strike price used in the base model.
[d]The figures in parentheses below those of the mean incomes are the coefficients of variation of income.

incomes are virtually identical across all strike prices and premiums. The differences in mean incomes for scenarios 13 to 16 are insignificant. The risk-efficient set of the management scenarios for the different groups of farmers remains the same across all strike prices and premiums considered.

Results from tables 5 and 6 clearly indicated that the futures options market is working well. The premium fee assigned to the specific strike price makes the prospective participant or farmer almost indifferent to the choice of strike prices. Whatever level of strike price chosen by the farmer, the premium charged makes the mean incomes and the coefficient of variation of income generated almost the same. The options market, at least at the time of the study, was working close to a competitive one. The net options prices (the strike price minus the premium) are almost identical across strike prices. Hence, a key factor affecting the farmer's decision to buy futures options may be to compare the income and income variability (risk) obtained from the futures options with that generated by other marketing strategies such as forward contracting, cash sales at harvest, and hedging.

CONCLUSIONS

The study shows that to achieve maximum benefit farmers should behave differently in their choice of marketing strategies according to their risk attitudes. Low risk-averse farmers should tend to choose the cash sales at harvest time strategy. However, high risk-averse farmers should combine the cash sales at harvest time with forward contracting. Moderate risk-averse farmers should combine the futures marketing strategies with both cash sales and forward contracting to stabilize their incomes. In other words, they should use the marketing strategies as complementary tools rather than as substitutes.

Use of the futures marketing strategies, hedging, and futures options lead to higher income and risk than forward contracting. However, they offer less income and risk to the farmer as compared to cash sales. Futures options offer the farmer more flexibility in participating in the futures market. However, the premium charged for purchasing options, the change in futures prices from planting time to the expiration date of the options, and the variability in the basis are key determinants of whether the farmer will choose either hedging or options if he participates in futures trading. Hedging appears to be best suited for soybeans because of the relatively stable basis. Purchase of futures options on the other hand may be profitable for corn because the change in futures prices exceeds the premium about 50 percent of the time. The implication of these findings

is that with increased access to education on the working of the futures market, farmers, especially the moderately risk-averse ones, may be able to use hedging and futures options as additional marketing tools to help reduce price risk.

TABLE 6. MEAN INCOME AND THE COEFFICIENT OF VARIATION OF INCOME FOR THE VARIOUS RISK-MANAGEMENT SCENARIOS WITH CHANGES IN PREMIUM AND STRIKE PRICES FOR THE FUTURES OPTIONS FOR SOYBEANS UNDER 1984 CONDITIONS

Risk-management scenario[b]	Description of risk-management scenario	Strike price and premiums[a]				
		$7.00 (0.49)	7.25 (0.62)	7.50[c] (0.75)	7.75 (0.91)	$8.00 (1.08)
		.... 1984 dollars				
13	Production condition: sand soils with irrigation	23,192 (0.43)[d]	23,129 90.43)	23,043 (0.42)	23,977 (0.41)	22,987 (0.41)
14	Production condition: sandy-loam soils with Irrigation	27,955 (0.37)	27,864 (0.36)	27,777 (0.36)	27,711 (0.35)	27,721 (0.35)
15	Production condition: sand soils with no irrigation	1,394 (7.97)	1,349 (8.16)	1,322 (8.36)	1,287 (8.50)	1,268 (8.38)
16	Production condition: sandy-loam soils with no irrigation	16,243 (0.78)	16,198 (0.78)	16,170 (0.78)	16,135 (0.78)	16,117 (0.78)

[a]The premiums are in parentheses.
[b]Scenarios 13 to 16 are those involving the mix of cash sales and the futures put options marketing strategies.
[c]The strike price used in the base model.
[d]The figures in parentheses below those of the mean incomes are the coefficients of variation of income.

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