SELECTION OF PRIMARY MARKETING STRATEGIES BY COTTON PRODUCERS

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Abstract

Few farmers use hedging to market their crops despite theoretical models that suggest high optimal hedge ratios and significant risk management education efforts. This study provides an analysis of factors that motivate cotton farmers to select hedging as their primary marketing strategy. The most important factors that explain the use of hedging by cotton producers were crop insurance, producer preferences, farm size and membership in marketing cooperatives. Income from government payments, off-farm income, and risk aversion also had an impact on the choice of the primary marketing strategy.

Problem and Objectives

U.S. farm commodity programs shifted course with the passage of the 1996 Federal Agriculture Improvement and Reform (FAIR) Act. In the new risk management environment prompted by changes in government programs, Congress recognized the need for educating producers about various risk management tools and opportunities. In 1998, Risk Management Agency (RMA) funded over $3 million in educational grants to help farmers and ranchers become active risk managers (Ag. Fact Book). However, there appears to be no complete understanding of the motivations to use some risk management tools, such as hedging.

While multiple price risk management tools are available to farmers today, few of them actually use these tools. Some recent surveys (Goodwin and Schroeder; Patrick, Musser, and Eckman) demonstrated that producers price only 20 to 50 percent of their crop using futures markets (Table 1). At the same time, theoretical studies (Peck; Barry and Willman; Berck; Lence and Hayes; Lapan and Moscini, McNew) suggest optimal hedge ratios in the range of 75 percent (Table 2). Furthermore, Asplund, Forster, and Stout and Goodwin and Schroeder demonstrated that less than 10 percent of producers use hedging to manage their price risk (Table 3), while most theoretical studies assume a 100 percent use. Thus, an obvious discrepancy exists between theoretical and empirical hedging levels. Therefore, the goal of this study was to assess hedging behavior of producers using cotton producers as an example. Specifically, the objective of this study was to examine the effects of the primary motivating factors identified by the previous studies on the choice of a primary marketing strategy by cotton producers.

This study utilizes the results of a price risk management survey, which was administered during the spring, and early summer of 2000 throughout the cotton growing states of the U.S. The survey revealed that about 22 percent of producers sold most of their crop in the cash market, about 62 percent used indirect hedging strategies and about 16 percent of cotton producers used futures and options markets to price most of their crop in 1999. The survey also demonstrated that about 65 percent of cotton producers market their cotton through a single marketing channel. The other 35 percent of producers that utilize some combination of several marketing strategies typically market the majority of their crop through one primary source. Therefore, it is important to examine what underlies a farmer's decision to select one of the available marketing strategies as their primary marketing tool.

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Model Development

Because the goal of this study was to examine the choice of a primary marketing strategy, the dependent variable reflected several marketing alternatives considered in this analysis. Selling crop in the cash market is probably the most traditional marketing tool available to farmers. This strategy is easy to use and it has significant liquidity benefits, because producer receives cash for his crop at the moment of sale. However, it is considered a risky alternative because the producer does not have any control of the market price for his crop at the moment of sale. Other marketing alternatives available for producers typically involve some form of forward pricing and are used to reduced producer's exposure to price risk. These alternatives include forward contracting, marketing through pools and hedging in the futures and options markets. Historically, these have been the most widely used strategies, therefore they should be representative of the marketing alternatives available to cotton producers.

In this study, the dependent variable took the value of 0 if the majority of the crop was sold in the cash market, the value of 1 if more than 50 percent of the crop was marketed through a pool or a forward contract, and the value of 2 if hedging in the futures and/or options markets was selected as a primary marketing strategy. Marketing through pools and forward contracting was combined in this analysis because these two strategies bear the features of indirect hedging. That is, when a producer sells his/her crop through pools or forward contracts, he/she does not directly take a position in the futures/options markets. Rather, the other party that entered into this contractual agreement with producer hedges this crop and the producer thereby receives the benefits of the hedge indirectly. According to pool regulations and many forward contracts, a producer under these arrangements is guaranteed a minimum price without forfeiting the opportunity to obtain a higher price, if it becomes available. Taking a position in the futures and/or options markets were also combined under a direct hedging option because these tools, although different, have a lot of similar characteristics. Another reason for combining several marketing strategies is the statistical qualities of a model to be estimated. Within a multinomial logit model, the number of parameters proliferates with the number of choices (Greene). Therefore, similar strategies were combined to conserve degrees of freedom.

A set of independent variables included in the model reflected three categories of factors hypothesized to have an impact on the choice of a primary marketing strategy: (1) characteristics of the farm operator and the farm: operator's human capital, farm size and financial condition; (2) operator use of alternative risk-reduction techniques: diversification of farm enterprises, participation in government commodity programs, and the use of crop insurance; and (3) non-economic factors.

Education and marketing-specific training were used in this study to measure the effects of human capital on forward pricing. Education and hours of marketing training are expected to have a positive effect on use of forward pricing strategies because the higher levels of human capital would facilitate successful use of these instruments. Level of producer education was introduced as a scale variable EDUC with 1= less than high school, 2= high school diploma or GED, 3= college, and 4= graduate school. Marketing-specific training was incorporated as HMKTRAIN, which describes number of hours of training on using alternative pricing mechanisms (such as forward contracting, futures, and options) to market agricultural commodities that a producer attended over the last three years.

Level of risk aversion was included to measure the potential effects of different forms of producer's risk preferences on the decision to use various

marketing strategies. The sign of this variable depends on the producer's perception about the role of forward pricing. If forward pricing reduces (increases) risk, this variable would have a positive (negative) sign. Producer's self-assessment of the willingness to take risks relative to other farmers on a scale from one to ten (with ten being the most risky) was used as a proxy for risk aversion (RISKAV).

The amount of acres devoted to the cotton production in the 1999 crop year (COT99) was included to measure the size of cotton operation. Previous literature discussed the economies of size associated with forward pricing (Goodwin and Schroeder; Asplund, Forster, and Stout). These studies suggest that the cost of learning about alternative marketing strategies and implementing them each marketing year have significant lumpy components. Because larger farms can spread these lumpy costs over more production and enjoy a potentially larger net price enhancement per unit of production, they are more likely to use these alternative marketing strategies. Thus, this variable is expected to have a positive effect on forward pricing use decisions, consistent with the economies of size.

Economies of size can also come from external sources. For example, membership in a marketing cooperative allows producers the opportunity to market in larger lots or lots of more consistent quality (which enables them to enjoy quantity and/or quality premiums) and to also economize on marketing costs by one marketing agent handling all marketing for a large group of producers. Membership in marketing cooperatives was included in this analysis as a 0-1 dummy variable, which is expected to have a positive impact indirect hedging (because producers who are members of cooperatives may opt for marketing through a pool to take advantage of these savings), and an inverse relationship with other marketing strategies.

Financial characteristics of the farm also play a role in the use of forward pricing techniques. One of the most important components of the financial characteristics of the farm is leverage (Shapiro and Brorsen; Turvey and Baker; Collins). Optimal hedge models suggest a positive impact of leverage on forward pricing because forward pricing may provide an additional source of liquidity. However, Asplund, Forster, and Stout suggest that leverage and forward pricing may be negatively correlated if a farm operator's use of debt and leverage indicates his lack of risk aversion, which would be consistent with lack of desire to reduce risk through forward pricing. This study utilizes a long term debt-to-asset ratio (LTD99), which reflects the percentage of the market value of the farm assets that was borrowed in 1999 crop year, as a proxy for farm's leverage. The long-term debt ratio is hypothesized to be a better measure of leverage than the total debt-to-asset ratio because it excludes the short-term component that varies from year to year depending on the capital needs for operating expenses. Thus, a long-term debt-to-asset ratio appears to be a more general measure of the leverage position of the farm.

Variables were also included to reflect the interaction of marketing methods with other factors that affect income risk. Using forward pricing tools is only one method for a farm operator to reduce risk. Alternative methods include obtaining income from off farm sources, participating in government commodity programs, and purchasing crop insurance. Income from off-farm sources and/or investments (POFFINC) was included to account for an alternative technique producers may use to lower his/her risk exposure. This income is measured relative to gross farm income (POFFINC= off-farm income/gross farm income). The sign of this variable is ambiguous. If off-farm income is used as a substitute for hedging, a negative sign is expected with respect to forward pricing decisions. However, as Asplund, Forster, and Stout pointed out off-farm work activities by farm family members may be a response to income/price variability. In this case, the use of forward pricing and off-farm income may be positively correlated because both are used as strategies to reduce risk.

Participation in government commodity programs may be another alternative way to reduce risk exposure. Percent gross farm income from government payments (INCGOV) including disaster payments, loan deficiency payments, producer option payments, and AMTA (transfer) payments, was included to measure participation in government programs. This variable was expected to have a negative impact on forward pricing because government programs, in essence, provide a free put option for a producer (Hanson, Myers, and Hilker).

Another alternative to minimize risk available to farmers is crop insurance. A 0-1 dummy variable (CRINS) reflecting a decision to purchase additional levels of crop insurance above the minimal catastrophic coverage required to remain eligible for government program benefits was included to reflect the use of crop insurance by cotton producers. The sign on this variable is ambiguous. Coble, Heifner and Zuniga observed that yield insurance products exhibit complementary relationship with hedging, while revenue insurance products act as substitutes to hedging.

Musser, Patrick and Eckman suggested that marketing behavior might be effected by some non-economic variables. A response to a Likert-scale question "I prefer to use other means of risk-management rather than hedging" (LS7) was included to account for the impacts of producers' personal preferences. This variable is expected to have a negative correlation with the use of hedging. Another Likert-scale question: "I believe that market timing strategies can increase revenues" (LS8) was included measure producer perceptions of market efficiency. If producers believe that markets are efficient, there should be no consistent premiums to market timing strategies. Otherwise, premiums would exist and act as additional motivators to using forward pricing. Responses to Likert-scale questions were coded such that the strongest agreement received a highest value and strongest disagreement received a lowest value.

Empirical Model

Contrary to previous studies, this analysis viewed hedging as one of the alternative marketing strategies available to farmers. Other marketing strategies considered in this study included cash sales, indirect hedging and direct hedging. Cash sales consisted of the transactions made in the cash market. Indirect hedging combined marketing through pools and forward contracting. And direct hedging included taking a position in the futures and/or options markets. These alternative marketing strategies were analyzed within a framework of a multinomial logit model in order to identify the factors that determine the choice of the primary marketing strategy.

The variables discussed above were included in the empirical model to be estimated. This model had a following general form:

$$\text{CHOICE} = f(\text{EDUC, HMKTRAIN, RISKAV, LTD99, COT99, INCGOV, POFFINC, COOP, CRINS, LS7, LS8})$$

Where independent variables were as described above, and CHOICE represented the probability of producer selecting one of the alternative marketing strategies as his/her primary marketing technique. The dependent variable included three categories with the following interpretation:

0=CASH99, selling in the cash market,
1=IDH99, marketing through a pool or forward contracting,
2=DH99, hedging directly in the futures and/or options markets.

Responses were classified in one of the above groups by the strategy used to market the majority of the crop. For example, a respondent is placed in the cash category if he sold more then 50 percent of his/her cotton crop in the cash market.

A multinomial logit model was applied to analyze factors related to producers' choice of the primary marketing strategy. The multinomial logit model is a general extension of binomial logit models as it allows estimation of qualitative choice models when more than two alternatives are involved. The model provides a set of probabilities for selecting a certain choice for a decision-maker based on his/her characteristics. The model is estimated using a maximum likelihood procedure, which yields consistent and efficient parameters that maximize the likelihood of observing the pattern of choice in the sample.

Estimation Results

The cross sectional data for 1999 crop year generated by the price risk management survey was used for the empirical analysis. The estimation procedure utilized 108 observations and 12 parameters for three choices, which resulted in 22 degrees of freedom. The model was highly significant in explaining producers' selection of preferred marketing strategies with a Chi-squared value of 71.57, which is statistically significant at the 0.01 level. Another measure of the goodness of fit is the model's likelihood ratio index, which was equal to 0.36. This measure is somewhat analogous to the R-squared in the conventional regression models (Greene).

Another indication of the goodness of fit is the model's predictive power. The predictive power of the model was examined by comparing the actual choices of the primary marketing strategies to the ones predicted by the model. The results of this analysis are presented in Table 4. As this table demonstrates, the model correctly predicted about 74 percent of marketing choices for the sample of producers used in this analysis. The model correctly predicted about 63 percent of the cash sales, 82 percent of indirect hedging, and about 59 percent of direct hedging observations as a primary marketing tool. Overall, the predictive power of the model appears satisfactory, which suggests that this model can be used for predicting cotton producers' marketing behavior.

The results of model estimation are presented in Table 5. The coefficients of this model are difficult to interpret; therefore the marginal effects evaluated at the means of the independent variables on the probabilities of choosing one of the marketing strategies as a primary marketing tool are used to demonstrate the results. Marginal effects in these models denote the effect of change in the independent variable on the dependent variable. The marginal effects demonstrate that risk aversion was significant only for the probability of choosing cash sales as a primary marketing strategy. The sign of this variable is consistent with expectations and suggests that more risk averse producers tend to not choose cash sales as their primary marketing method. The marginal effect of this variable suggests that a one unit change in the self-assessed measure of risk aversion would cause a 3 percent decrease in the probability of choosing cash sales as a primary marketing method. This result is consistent with Goodwin and Schroeder's findings, and implies that producers consider cash sales a relatively risky method of marketing. The fact that risk aversion is not significant in the indirect and direct hedging choices suggests that risk aversion simply leads producers to some form of forward pricing, but has no real effect on the choice of which forward pricing method used.

Cotton acreage, included as a measure of farm size, significantly increased the probability of choosing direct hedging as a primary marketing method. According to the marginal effects reported in Table 5, one additional acre in the size of a farm would cause a 0.9 percent increase in the probability of choosing direct hedging as a primary marketing tool. This evidence supports the hypothesis about the economies of size associated with hedging, which is consistent with previous studies (Goodwin and Schroeder; Asplund, Forster, and Stout; and Shapiro and Brorsen).

Income from government payments significantly increased the probability of choosing cash sales as a primary marketing tool. The marginal effects imply that a one percent change in the proportion of gross farm income from government payments would increase the probability of choosing cash sales as a primary marketing tool by 58 percent. This result confirms the risk-reducing properties of government payments, and suggests that because the income of these producers is protected in part by government payments, they are less inclined to use alternative marketing strategies and more likely to choose cash sales as their primary marketing tool.

Percent off-farm income significantly affected the choice of cash and indirect hedging as primary marketing tools. The signs of this variable indicate a direct relationship between off-farm income and the use of cash sales, and an inverse relationship between off-farm income and the use of indirect hedging. The marginal effects suggest that a one percent increase in the amount of off-farm income relative to gross farm income would result in a 32 percent increase in the probability of choosing cash sales and a 43 percent decrease in the probability of choosing indirect hedging as a primary marketing tool. This result supports the hypothesis that off-farm income may be used as an alternative method of risk management. An inverse relationship between off-farm income and indirect hedging suggests that off-farm income may be used as a substitute means of risk management. A direct relationship between off-farm income and cash sales may provide evidence of the risk-reducing characteristics of off-farm income. It appears that producers that have a large share of their total income coming from off-farm sources may be less inclined to use alternative marketing strategies and more likely to choose cash sales as their primary marketing tool. Significant off-farm income may also indicate that these producers may not have enough time (or its opportunity cost may be too high) to collect market information necessary to successfully use alternative marketing tools.

Cooperative membership was significant in the choice of all selected marketing strategies. The signs of this variable indicate an inverse relationship between membership in cooperatives and the use of cash sales and direct hedging, and a direct relationship between membership in cooperatives and the use of indirect hedging. The marginal effects suggest that cooperative membership decreases the probability of choosing cash sales by 19 percent, decreases the probability of choosing direct hedging by 10 percent and increases the probability of choosing indirect hedging as a primary marketing tool by 29 percent. This evidence demonstrates that the economies of size available to coop members make marketing through pools more attractive than alternative marketing strategies. Another advantage of marketing through cooperatives that could have contributed to these relationships are savings on transaction costs associated with crop marketing, including manager's time and money allocated on collecting market information, and additional liquidity available at harvest time when crop is relinquished to a cooperative.

Crop insurance was significant in the choice of direct hedging as a primary marketing tool. The results of the estimation demonstrate a direct relationship between crop insurance and the use of direct hedging. More specifically, for producers that purchased additional crop insurance above the minimal level required to remain eligible for government payments the probability of choosing direct hedging as a primary marketing tool was 12 percent higher. This finding indicates a complimentary relationship between crop insurance and the use of direct hedging. Coble, Heifner, and Zuniga suggested that complimentary relationships exist between forward pricing and yield insurance products. About 80 percent of the sample of producers used in this analysis purchased MPCI, which is a yield insurance product. Therefore, this finding appears consistent with Coble, Heifner , and Zuniga's conclusions. This result may also imply that producers that purchase crop insurance are generally more risk averse, therefore they are more likely to use forward pricing techniques such as hedging.

The response to LS7 ("I prefer to use other means of risk management rather than hedging") was significant in the choice of all selected marketing

strategies. This variable indicates the effect of producer preferences on his/her marketing decisions. This variable had a positive impact on indirect hedging and a negative impact on cash sales and direct hedging. The marginal effects of this variable indicate that a one unit increase in the level of agreement with LS7 would result in a 8 percent decrease in the probability of choosing cash sales, an 11 percent decrease in the probability of choosing direct hedging, and a 19 percent increase in the probability of choosing indirect hedging as a primary marketing tool. This evidence suggests that a preferred choice of producer marketing was indirect hedging.

Summary and Conclusions

Overall, the results of this analysis demonstrate that the proposed model was significant in explaining selection of the primary marketing tool from the strategies outlined in this study. The marginal effects of the estimated model suggested that the probability of choosing cash sales as a primary marketing tool was positively affected by income from government payments and off-farm income, and negatively affected by risk aversion, membership in cooperatives, and agreement with LS7 ("I prefer to use other means of risk management rather than hedging"). Choice of indirect hedging as a primary marketing tool was directly related to membership in cooperatives and agreement with LS7, and inversely related to off-farm income. Probability of choosing direct hedging as a primary marketing tool was positively affected by farm size and purchases of crop insurance, and negatively affected by membership in cooperatives and agreement with LS7. Overall, these findings confirmed expectations and were consistent with previous studies.

The results of this analysis consistently supported the dichotomy of producers' choice of pricing their crop in the cash market or forward pricing using alternative marketing techniques, such as direct and indirect hedging. The signs of the variables supporting cash pricing were typically opposite in the forward pricing decisions, with the exception of cooperative membership and agreement with LS7, which revealed producer preference of indirect hedging to other marketing strategies. The model demonstrated very good predictive power for the sample used in this analysis, which suggests that it may be used for predicting cotton producers' marketing behavior.

Overall, the results of this analysis suggest implications for educators and policy makers. This study clearly indicates that some producers would be more inclined to use forward pricing tools then others. Therefore, educators that provide marketing training for producers should tailor their training programs to the specific needs of the audiences they address. Another set of implications may be of interest to policy makers. This study revealed a negative impact of income from government programs on the use of forward pricing techniques. This finding suggests that as long as government payments remain in place, producer use of forward pricing is likely to remain low.

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Table 1. Empirical Hedge Ratios.

Authors	Location	Year	Commodity	% priced
Goodwin and Schroeder	Kansas	1992	Wheat	22.88
			Corn	33.84
			Sorghum	21.67
			Soybeans	28.65
Patrick, Musser, Eckman	Indiana	1995	Soybeans	54.4
			Corn	27.3

Table 2. Theoretical Hedge Ratios.

Authors	Location	Year	Commodity	% priced
Peck	USA	1975	Eggs	75-95
Barry and Willman	Texas	1976	Cotton, Sorghum	31-66
Berck	California	1981	Cotton	11-136
Lence and Hayes	Iowa	1994	Soybeans	40-80
Lapan and Moschini	Iowa	1994	Soybeans	53-75
McNew	Indiana	1996	Corn	55-90

Table 3. Empirical Futures Use.

Authors	Location	Year	Commodity	Fut. Use
Asplund, Forster and Stout	Ohio	1987	Crop	7
Goodwin and Schroeder	Kansas	1992	Wheat	5.91
			Corn	10.73
			Sorghum	1.84
			Soybeans	5.22
Patrick, Musser, Eckman	Indiana	1995	Soybeans	8.1
			Corn	16.2

Table 4. Comparison of Actual Choice of Marketing Strategies to a Choice Predicted by the Model.

	Predicted			
Actual	CASH99	IDH99	DH99	Total (Actual)
CASH99	15	8	1	24
IDH99	7	55	5	67
DH99	1	6	10	17
Total	23	69	16	108

Table 5. Marginal Effects of Market Strategy Choice Model Evaluated at the Means of Independent Variables.[a]

	CASH99	IDH99	DH99
Intercept	0.66947**	-0.77600**	0.10654
	(0.37207)	(0.43066)	(0.22310)
EDUC	-0.03666	0.02065	0.01600
	(0.05317)	(0.06437)	(0.03564)
HMKTRAIN	-0.00739	-0.00867	-0.12822
	(0.00858)	(0.00828)	(0.00207)
RISKAV	-0.02906*	0.01358	0.01548
	(0.02051)	(0.02441)	(0.01272)
LTD99	-0.00133	0.00042	0.00091
	(0.00203)	(0.00237)	(0.00127)
COT99	-0.00012	0.00003	0.00009**
	(0.00010)	(0.00011)	(0.00005)
INCGOV	0.58068**	-0.00442	-0.001383
	(0.00310)	(0.00372)	(0.002137)
POFFINC	0.32374***	-0.42695***	0.10321
	(0.17205)	(0.21724)	(0.09925)
COOP	-0.19321***	0.29054***	-0.09733**
	(0.09016)	(0.10610)	(0.05997)
CRINS	-0.10148	-0.02035	0.12183**
	(0.08528)	(0.10499)	(0.06702)
LS7	-0.08068*	0.19436***	-0.11368***
	(0.05150)	(0.06807)	(0.04489)
LS8	-0.04813	0.05933	-0.11111
	(0.05595)	(0.06770)	(0.03703)
P of choice at mean	0.151	0.778	0.071

[a]Numbers in parentheses are asymptotical standard errors. The *, **, and *** indicate coefficients asymptotically significant at 15, 10, and 5 percent levels, respectively.