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Abstract
A survey of cotton producers was conducted in Mississippi and Texas. The econometric model consists of a multinomial logit model of cotton producers' choice of marketing techniques. The results indicate that cotton acres positively influence pooling and negatively influence cash sales. Producers willing to incur higher transaction costs in market information systems and training tend to choose futures/options contracts and forward pricing. It was found that risk-averse producers tend not to choose pooling contracts. On the other hand, producers who seek abnormal gains through speculation tend to choose pooling contracts. Finally, producers who perceive markets as being price-efficient prefer cash sales.

1. Introduction

Agricultural economics researchers and marketing consultants have long attempted to understand the marketing behavior of crop producers. In particular, a significant body of literature has arisen which investigates producers' decisions regarding marketing strategies. This body of literature includes several analytical models, which attempt to predict optimal behavior under assumptions of risk aversion. For example, Lapan and Moschini (1994) reflect a strand of literature that investigates the use of futures and options instru-

ments for a representative producer. These studies tend to characterize the producers' risk environment and optimize the hedging or option level. Another branch of this literature, more directly related to our research, econometrically investigates observed producers' marketing behavior and attempts to identify the causal factors associated with particular forward pricing behavior.

In this study we evaluate producer choices for alternative methods of marketing cotton under risk and market perceptions. In particular we investigate economic factors that underlie those choices. According to the National Cotton Council of America (2001), the retail value of the U.S. cotton crop is approximately $120 billion per year, and it is expected to be more than $300 billion by 2009. Nevertheless, most studies of economic factors underlying crop marketing choices have focused on other crops. This investigation provides useful insights into the marketing strategy choice. In large part, this results from cotton producers being confronted with a unique set of alternatives, as compared with other major commodity producers in the United States. Cotton producers, as other major crop producers, have futures/options contracts, forward contracts, and cash sales at their disposal. They also have large marketing pools available, which are relatively unique to the cotton industry because of crop characteristics and marketing channels. A cotton pool is basically structured so that its marketing policies aim at obtaining an average price over the course of the marketing season by spreading sales across the season crop. In this study we particularly investigate the comparison between pooling strategies and the more standard alternatives cotton producers have at their disposal, under a producer risk and market perceptions framework.

2. Previous Research

According to Isengildina (2000), several empirical studies have related farm and nonfarm characteristics to the adoption of forward pricing techniques among grain producers. In a survey of corn and soybean producers in Indiana, Shapiro and Brorsen (1988) found that the use of forward pricing was related to education, experience, farm leverage, farm size, off-farm income, expected income change from hedging, and the belief that hedging could stabilize income.

In a survey of Ohio producers, Asplund, Forster, and Stout (1989) found that forward pricing was related to age, attendance at seminars, use of computerized information systems, farm size, farm leverage, diversification, and participation in government commodity programs. Among Kansas, Texas, and Iowa producers, Sartwelle, O'Brien, Tierney, and Eggers (2000) found that geographic location, farm size, grain enterprise specialization, farming experience, use of grain storage, and use of crop insurance had significant effects upon the respondent' choice of grain marketing practices. Patrick, Musser, and Eckman (1998), in a survey of Purdue University Top Producers, found that producers change their levels of forward pricing from year to year, suggesting there is a dynamic price relationship involved. McNew and Musser (2000) examined marketing behavior using data from a hedging game from Maryland marketing clubs during 1994–1998. They found that corn producers were not able to consistently profit from their forward pricing activity. A major constraint of most of these empirical studies is that they have typically used conference participants or other select groups such that they may not be representative of the general farm population.

With the exception of a study by Berck (1976), and Isengildina and Hudson (2001), little is known about marketing techniques for cotton. Berck applied portfolio theory to ex-

amine choices of crop diversification and futures contracts among cotton producers in California. Isengildina and Hudson (2001) developed a survey-based econometric analysis of the factors that affect cotton producer's marketing behavior. Nevertheless, their survey response rate of 7% is a source of concern. Furthermore, their econometric model lacks important variables such as price and yield variability. Price variability should be included since it is obviously one of the reasons why producers hedge. On the other hand, McKinnon (1967) showed that the minimum-variance hedge for a crop decreases as yield variability increases relative to price variability. Therefore, a measure of yield variability should be included in any model that seeks to explain producers' marketing choices.

Cotton is an obvious choice for further analysis because its futures and pool markets are well developed and active.[1] This leads to a unique decision by cotton producers. In a typical pooling arrangement, the output of many producers is sorted into large lots of uniform quality cotton. Because large quantities are offered at one time rather than small lots from each grower, premium prices may be obtained from buyers (Johnson, 1997). Pools also tend to sell cotton into the market throughout the marketing year. The participants then obtain an average price for the marketing year. Even if pooling has some initial transaction costs, such as handling costs, many pools are cooperatively owned and return earnings to producers. In that instance, pooling can be considered a relatively low-risk and low transactions cost marketing strategy.

In this study we examine which factors determine producer's choices for marketing techniques available in cotton and the economic factors underlying those choices, with emphasis on the importance of risk-related issues, market perceptions, and transaction costs for the decision-making process. The implications of this study are twofold. First, it contributes to a better understanding of producer's choices for cotton pooling strategies as compared with other common marketing techniques. Second, it contributes to identifying which factors motivate or discourage producers from hedging. Agribusinesses and marketing consultants can use these factors to assess the marketing needs of cotton producers.

3. Cotton Marketing Model

The optimization behavior of a producer considering a choice between primary marketing strategies is examined. Producers are assumed to maximize expected utility according to a Von Neumann and Morgenstern (1944) utility function defined over wealth and which is strictly increasing, concave, and twice continuously differentiable. Prices and the variable marketing costs associated with each cotton pricing strategy are expected to change. Obviously, an increase in marketing cost would reduce expected utility for that specific marketing strategy. The producers' best strategy would be to choose the marketing strategy that maximizes their expected utility. Also, since expected utility is assumed, the optimal strategy is also conditioned on the degree of risk aversion.

There is a significant body of literature that investigates producers' hedging decisions with respect to transaction costs. According to Lence (1995), producers' hedging behavior is closely related to transaction costs. Witt, Schroeder, and Hayenga (1987) developed a utility-maximizing hedge ratio model that included transaction costs. Blank (1990) used this model to test the significance of increased capital requirements in the hedging deci-

[1] Fluid milk is another commodity with a well-developed marketing pool. In a typical milk pooling arrangement, large quantities of milk are offered at one time, often at a premium based on volume.

sion. Results showed that risk-averse individuals are willing to incur transaction costs to achieve protection against risk. Nevertheless, Lence (1995) concluded that increased costs associated with hedging eventually would render the benefits of hedging negligible. Similar findings were reported by Coble, Heifner, and Zuniga (2000) with respect to the influence of transaction costs on optimal hedge and put ratios. They found that even small transaction costs were sufficient to offset the certainty equivalent gain for corn producers in Kansas. Producers choosing cash sales as their primary marketing technique have minimum transaction cost, even though they are fully exposed to price risk. Producers choosing pooling techniques delegate control of marketing decisions to the pool, but in exchange have risk protection from the pool. In both cases, marketing decisions are minimized and the producers have more time to spend on production activities.

Given these findings, we hypothesize that risk-averse producers will be strongly influenced by differences in risk reduction arising from a strategy or by the magnitude of transaction costs. Costs associated with the adoption of marketing techniques include information-gathering costs, commissions, and brokerage fees. Training received in marketing techniques is hypothesized as directly related to the costs and efficiency of adopting different marketing techniques. Therefore, the variable marketing costs associated with each cotton marketing strategy would vary inversely with a producers' accumulation of knowledge in relevant marketing techniques, plus investment in market information technology such as market news services. It is also likely that discounted expected return to education falls as the time horizon decreases, which implies that returns to education are likely to be smaller for older individuals, as it was showed by Goodwin and Schroeder (1994). Maximization of the expected utility function yields an expression relating a producer's *i* adoption of a marketing pricing technique Λ_i to a set of observable farm and operator characteristics X_i :

$$\Lambda_i = g(X_i \beta) + \varepsilon_i \tag{1}$$

where β is a parameter vector and ε_i represents residuals. The observable farm and operator characteristics X_i reflect the producers' production and marketing environment, factors related to the costs of adopting different marketing techniques, and producers' risk attitudes. Since Λ_i represent the discrete choice of adoption, its distribution is binary. Specifically, we define Λ_{i1}, Λ_{i2}, Λ_{i3}, and Λ_{i4} to be producer *i*'s expected utility when futures pricing marketing techniques, forward pricing marketing techniques, pool marketing techniques, and cash marketing techniques are adopted, respectively. For example, producer *i* would adopt a futures pricing marketing technique if $\Lambda_{i1} > \Lambda_i 2$, if $\Lambda_i 1 > \Lambda_i 3$, and if $\Lambda_i 1 > \Lambda_i 4$. A qualitative variable D_i indexes the marketing decision:

$D_i = 0$ if $\Lambda_{i1} > \Lambda_{i2}$, if $\Lambda_i 1 > \Lambda_{i3}$, and if $\Lambda_{i1} > \Lambda_{i4}$ when futures pricing is adopted,

otherwise

$D_i = 1$ if $\Lambda_{i2} > \Lambda_{i1}$, if $\Lambda_{i2} > \Lambda_{i3}$, and if $\Lambda_{i2} > \Lambda_{i4}$ when forward pricing is adopted,

otherwise

$D_i = 2$ if $\Lambda_{i3} > \Lambda_{i1}$, if $\Lambda_{i3} > \Lambda_{i2}$, and if $\Lambda_{i3} > \Lambda_{i4}$ when pooling pricing is adopted,

otherwise

$$D_i = 3 \text{ if } \Lambda_{i4} > \Lambda_{i1}, \text{ if } \Lambda_{i4} > \Lambda_{i2}, \text{ and if } \Lambda_{i4} > \Lambda_{i3} \text{ when pooling pricing is adopted.} \quad (2)$$

The probability that D_i is equal to zero, one, two, or three can be expressed as a function of a vector of operator and farm characteristics Z_i :

$$P_i = \text{Prob}(D_i = 1 \mid Z_i) = F(Z_i \beta). \quad (3)$$

An overall adoption of marketing pricing techniques is evaluated by considering whether, for any cotton producer, the adoption parameter Λ_i is greater than zero. The cumulative distribution function represented by F (.) in Equation (3) is assumed to be logistic. Maximum likelihood estimation of multinomial logit models is used to evaluate the discrete decisions of whether to adopt the marketing pricing techniques in question (see Greene, 2000).

4. Survey Procedure And Data

A survey conducted in the spring of 1999 elicited cotton producers' choices for different marketing techniques. The survey was conducted in four states: Mississippi, Texas, Indiana, and Nebraska. Each state's Agricultural Statistical Service was contracted to sample from their pool of commercial farms. After excluding small noncommercial farms generating less than $25,000 in gross income, the sample was stratified across four categories of gross farm income. A total of 6,810 surveys were mailed to producers prior to planting in the spring of 1999. A follow-up reminder card was sent 2 weeks following the first mailing, and a second mailing was sent to those who had not returned a survey 2 weeks after the postcard reminder. Overall, 1,812 useable questionnaires were returned, for a response rate of 27%.

This study utilizes 549 completed questionnaires returned by cotton producers in Texas and Mississippi.[2] Tables 1 and 2 provide a description and summary statistics, respectively, of the dependent and independent variables involved in this study. Producers were asked, "If you price any of your 1999 cotton production before harvest, which pricing technique is likely to be the primary technique you use?" Alternatives available were futures/options contracts, forward pricing, pool contracts, and cash sales. This question intentionally forces the producer to choose only one technique. Responses were then treated as the dependent variable of the multinomial logit model.

First, the dependent dummy variables are examined. Fourteen percent of the respondents indicated that they would use futures contracts as the primary marketing tool to market their cotton crop. Twenty-two percent of the respondents indicated that they would use forward contracts as the primary marketing tool to market their cotton crop. Forty- four percent of the respondents indicated that they would primarily use pooling techniques to market their cotton crop. Finally, 20% of the respondents fell into the cash sale category.

[2] Even though possible regional differences among cotton producers are possible as a reviewer noted, our analysis is based on pooled data from Mississippi and Texas since dummy variables used to account for regional differences were not statistically significant.

Table 1. Marketing Choices in Cotton—Description of Variables

Variables	Description
Dependent variable	
Primary marketing method used	Four levels: 0 (Futures/options contracts), 1 (forward pricing contracts), 2 (pools), and 3 (cash contracts).
Independent variables	
Cotton acres	Producer's total acres available for dry or irrigated cotton production.
Perceived yield variability	Dummy variable = 1 if producer strongly believes that crop yield variability has a high impact in terms of its potential effect in farm income.
Perceived price variability	Dummy variable = 1 if producer strongly believes that crop price variability has a high impact in terms of its potential effect in farm income.
Risk aversion	Dummy variable = 1 if producer strongly agrees with the following statement: "I am willing to accept a lower price to reduce price risk."
Producer's knowledge of	Dummy variable = 1 if producer is very knowledgeable forward contracts of forwarding contracts.
Producer's knowledge of futures	Dummy variable = 1 if producer is very knowledgeable and options of futures and options contracts.
Information systems	Dollar amount spent in purchasing market information services (DTN, ACRES) in the past year.
Perceived increased returns	Dummy variable = 1 if producer strongly believes that preharvest marketing strategies will, on average, result in a higher price than always selling at harvest.
Perceived market efficiency	Dummy variable = 1 if producer strongly believes that planting time futures market prices are an accurate predictor of the harvest time price.
Wealth	Total assets minus percentage of the dollar amount invested in the operation that is borrowed.
Age	Producers' age.
Education	Dummy variable = 1 if producer has at least some college education.
Crop insurance	Dummy variable = 1 producer has bought any type of crop insurance product.

The remaining variables in Table 1 are independent explanatory variables included in the analysis. The first variable, total cotton acres, is an indicator of specialization in cotton production. It is measured as the producer's total acres available for dry and/or irrigated cotton production. Previous literature associates economies of specialization with forward pricing practices (Asplund et al., 1989; Goodwin and Kastens, 1996). These studies conclude that the cost of learning and implementing different marketing strategies can be burdensome. Monoculture operations can cope better with the marketing costs by spreading them among more acres of production. On average, these producers allocated 1,002.74 acres to cotton production. This indicates that the farms included in this analysis are mostly large monoculture operations, specializing in cotton production.

Table 2. Marketing Choices in Cotton—Summary Statistics of Variables

Variable	*N*	Mean	Minimum	Maximum
Primary marketing method used	549	1.69	0	3
Cotton acres	549	1,002.74	3	10,000
Perceived yield variability	549	0.95	0	1
Perceived price variability	549	0.97	0	1
Risk aversion	549	0.192	0	1
Producer's knowledge of forward contracts	549	0.49	0	1
Producer's knowledge of futures and options	549	0.21	0	1
Information systems	549	1,051.05	0	40,000
Perceived increased returns	549	0.77	0	1
Perceived market efficiency	549	0.13	0	1
Wealth	549	576,402.03	0	6,500,000
Age	549	51	19	90
Education	549	0.74	0	1
Crop insurance	549	0.58	0	1

Note. In indicating their primary marketing method in cotton, 76 producers (13.9% of the sample) used futures/options contracts; 122 producers (22.2% of the sample) used forward pricing contracts; 244 producers (44.4% of the sample) used pooling contracts; 107 producers (19.5% of the sample) used cash contracts.

The perceived yield variability is elicited from the producers through a 5-point Likert (1932) scale ranging from 1 (low variability) to 5 (high variability). A dummy variable indicating whether producers perceive high yield variability was constructed by collapsing all responses with a rate of 4 or higher. On average, 95% of the producers in this sample indicated perceiving high yield variability. McKinnon (1967), and Lapan and Moschini (1994) showed that yield risk influences optimal forward pricing levels.

The perceived price variability is constructed similarly to the perceived yield variability. On average, 97% of the producers in this sample indicated perceiving high price variability.

Producer's risk aversion measures a producer's willingness to accept a lower return to reduce risk. They were asked to rate their agreement on a 5-point Likert scale for the following statement: "I am willing to accept a lower price to reduce price risk." This variable takes a value of one if the producer agrees (4) or strongly agrees (5) with the statement. It is expected that producers who agree will be inclined to choose either futures contracts, forward pricing, or pooling to reduce risk as compared to remaining in a cash marketing position. Approximately 39% of the producers indicated being in agreement with the statement.

Producer's knowledge of forward contracts measures how comfortable producers are with their knowledge on forward contracting tools. Producers were asked to rate their comfort level on a 5-point Likert scale. This variable takes a value of one if producers feel comfortable (4) or very comfortable (5) with their knowledge on the subject. Forty-nine percent of the producers indicated a comfortable knowledge on forward contracts. It is expected that increased knowledge of forward contracting will reduce the transaction costs associated with this marketing technique in cotton.

Producer's knowledge of futures contracts is constructed similarly to the producer's knowledge of forward contracts. Twenty-two percent of the producers indicated a com-

fortable knowledge on futures contracts. Again, it is expected that increased knowledge of futures contracting will reduce the transaction costs associated with this marketing technique in cotton.

Information services measures a producer's past expenses on computerized marketing information services, such as DTN® and ACRES®. It is expected that producers using market information services will choose marketing pricing techniques that require close monitoring of price movements, such as futures markets. Producers in this sample spent on average $1,051.05 purchasing some type of marketing information during the past year.

Producer's perceived increased returns measure a producer's belief that pre-harvest marketing strategies earn profits. The alternative marketing tools examined here do not offer equal opportunity to attempt speculation. Producers were asked to rank their agreement on a 5-point Likert scale for the following statement: "Pre-harvest marketing strategies will on average result in a higher price than always selling at harvest." This variable takes a value of one if the producer agrees (4) or strongly agrees (5) with the statement. Seventy-seven percent of the producers indicated being in agreement with the statement.

Producer's perceived market efficiency measures a producer's belief that planting time futures market prices are an accurate predictor of the harvest time price. Producers were asked to rank their agreement on a 5-point Likert scale for the following statement: "Planting time futures market prices are an accurate predictor of the harvest time price." This variable takes a value of one if the producer agrees (4) or strongly agrees (5) with the statement. Thirteen percent of the producers indicated being in agreement with the statement.

Producer's wealth was constructed by subtracting the dollar amount invested in the operation that is borrowed from the total gross farm assets. This variable is included since the producers' risk evaluation is conditional on wealth. On average, producers in this sample indicated having $576,402.03 of debt-free net worth.

Age measures producers' age on their last birthday. Assuming that experience is correlated with age, if producers evaluate the discounted value of their expected returns from different marketing techniques, then age would influence participation. Also, an individuals' efficiency may increase with experience. On average, producers in this sample are 51 years old.

Education indicates whether the producer has at least some college education or more. College-educated producers may be inclined to more complicated marketing strategies other than cash sales, because increased education increases producers' understanding of how the different cotton marketing techniques available work. Approximately 75% of the producers indicated having at least some college education or more.

The crop insurance variable takes a value of one if the producer intended to purchase crop yield insurance for the cotton crop. According to Coble et al. (2000), yield insurance exhibits a complementary relationship with hedging. It is expected that producers who protect themselves against yield variability by purchasing crop insurance can be more aggressive in the use of forward contracts. Slightly more than 58% of the producers indicated that they bought some form of crop insurance.

5. Results

In this section we report the multinomial logit model results predicting cotton producer choices for each of the alternative marketing techniques. The likelihood ratio chi-squared value of the model was 118.95, indicating strong significance at the 0.001 level. A

second measure of overall model performance is percentage concordance. It provides the percentage of observations where the predicted and observed responses agree. The model had 47% concordance. LIMDEP, the statistical package used to run the regression models, estimates the maximum likelihood coefficients on a multinomial logit as a vector $\boldsymbol{\beta}_j$ for each probability, except the first, which is left out as default (in this case, the futures/options equation in Table 3).

The marginal effects, calculated at the sample means of the data, are reported for each cotton marketing tool considered in the analysis (Table 3). The results indicate several significant economic factors influencing the producers' choice for a specific marketing technique.

Total cotton acreage was significantly related to pool contracts and cash contracts. The sign of this coefficient was positive for pool contracts, and negative for cash sales. An increase in cotton acreage tends to increase producers' participation in pool contracts and reduce participation in cash sales. This result may be related to the low transaction costs related to pooling. Also, this result is consistent with the low popularity of cash sales among cotton producers: 20% of the producers in the sample. Even if cash sales transaction costs are minimal, price risk may make risk averse producers consider other marketing strategies such as pooling.

Although the perceived yield and price variability are clearly theoretical explanatory factors for choice of marketing technique, little empirical significance is found in these variables. The perceived yield variability is never significant, and the perceived price variability is significant for futures/options contracts, forward contracts, and pool contracts. Producers who perceive a high variability in cotton prices are less likely to use futures/options contracts, less likely to use forward contracts, and more likely to use pool contracts as their preferred marketing technique.

The risk aversion variable was significant for pool contracts only. The negative coefficient implies that producers who are willing to accept lower prices to reduce price risk tend not to prefer pooling their cotton crop as their preferred marketing mechanism. This suggests that, all else equal, risk-averse producers view other marketing strategies as more favorable than pools.

Producers' knowledge of forward contracts was significantly related to forward pricing, pool contracts, and cash contracts. The positive sign of this coefficient implies that knowledge increases producers' choice for forward pricing techniques, as opposed to other marketing alternatives. Assuming that an individuals' efficiency in using forward pricing increases with additional knowledge, previous knowledge should be directly related to participation in forward contracts. The negative sign on this coefficient implies that producers with less knowledge on forward pricing tend to prefer pools and cash sales.

Producers' knowledge of futures/options contracts was significantly related to futures/options pricing and pool contracts. The positive sign of this coefficient implies that knowledge increases producers' choice for futures/options pricing techniques, as opposed to other marketing alternatives. The negative sign on this coefficient implies that producers with less knowledge on futures/options contracts tend to prefer pool contracts.

The market information systems variable was significant for futures/options contracts, forward contracts, and pool contracts. Producers who had previously purchased marketing information used more futures/options and forward pricing. Also, it is expected that as producers increase the usage of information systems to monitor market price movements and trends, they may be able to react faster to favorable price movements and

Table 3. Marketing Choices in Cotton—Multinomial Logit Model Results

Variable	Maximum likelihood coefficient	Marginal effects coefficient
Primary marketing method = Futures/options contracts		
Intercept		0.0441
		(0.136)
Cotton acres		0.000005
		(0.00001)
Perceived yield variability		0.030
		(0.083)
Perceived price variability		–0.124*
		(0.090)
Risk aversion		–0.004
		(0.032)
Producer's knowledge of forward contracts		0.017
		(0.036)
Producer's knowledge of futures and options	0.153***	
		(0.035)
Information systems		0.0002***
		(0.0001)
Perceived increased returns		0.028
		(0.040)
Perceived market efficiency		–0.025
		(0.050)
Wealth		–0.0000004**
		(0.0000002)
Age		–0.002***
		(0.001)
Education		–0.021
		(0.039)
Crop insurance		0.063***
		(0.034)
Primary marketing method = Forward contracts		
Intercept	–0.309	0.0017
	(1.321)	(0.176)
Cotton acres	0.00021	0.000006
	(0.0015)	(0.00002)
Perceived yield variability	–0.013	0.050
	(0.812)	(0.105)
Perceived price variability	0.0358	–0.212*
	(0.884)	(0.123)
Risk aversion	0.148	0.035
	(0.315)	(0.041)
Producer's knowledge of forward contracts	0.862***	0.244***
	(0.353)	(0.044)
Producer's knowledge of futures and options	–1.318***	–0.053
	(0.354)	(0.052)

(continued)

Table 3. Continued

Variable	Maximum likelihood coefficient	Marginal effects coefficient
Primary marketing method = Forward contracts (continued)		
Information systems	0.000099	0.00048**
	(0.00015)	(0.00024)
Perceived increased returns	–0.284	–0.020
	(0.389)	(0.050)
Perceived market efficiency	0.182	–0.0034
	(0.476)	(0.060)
Wealth	0.000002	–0.0000001
	(0.000002)	(0.0000002)
Age	0.0131	–0.0011
	(0.0137)	(0.0017)
Education	–0.0593	–0.053
	(0.375)	(0.048)
Crop insurance	0.0897	0.135***
	(0.335)	(0.043)
Primary marketing method = Pool contracts		
Intercept	–0.233	0.0346
	(1.219)	(0.195)
Cotton acres	0.00082	0.00036*
	(0.0014)	(0.00023)
Perceived yield variability	–0.373	–0.066
	(0.733)	(0.108)
Perceived price variability	1.4137*	0.218*
	(0.834)	(0.143)
Risk aversion	–0.175	–0.075*
	(0.293)	(0.046)
Producer's knowledge of forward contracts	–0.468*	–0.144***
	(0.318)	(0.050)
Producer's knowledge of futures and options	–1.414***	–0.131***
	(0.333)	(0.061)
Information systems	0.00036**	–0.00073**
	(0.00017)	(0.00036)
Perceived increased returns	0.0187	0.086*
	(0.361)	(0.054)
Perceived market efficiency	0.041	–0.060
	(0.446)	(0.066)
Wealth	0.000003*	0.0000001
	(0.000002)	(0.0000002)
Age	0.0223**	0.0019
	(0.0125)	(0.0018)
Education	0.3452	0.079*
	(0.349)	(0.053)
Crop insurance	–0.728***	–0.113***
	(0.307)	(0.047)

(continued)

Table 3. Continued

Variable	Maximum likelihood coefficient	Marginal effects coefficient
Primary marketing method = Cash contracts		
Intercept	–0.732	–0.0805
	(1.369)	(0.150)
Cotton acres	–0.00022	–0.00043**
	(0.0018)	(0.00022)
Perceived yield variability	–0.289	–0.014
	(0.808)	(0.082)
Perceived price variability	1.5058*	0.118
	(0.948)	(0.111)
Risk aversion	0.207	0.039
	(0.332)	(0.036)
Producer's knowledge of forward contracts	–0.728**	–0.117***
	(0.366)	(0.420)
Producer's knowledge of futures and options	–0.936***	0.031
	(0.391)	(0.048)
Information systems	–0.00019	–0.000016
	(0.0002)	(0.00028)
Perceived increased returns	–0.690**	–0.094***
	(0.391)	(0.414)
Perceived market efficiency	0.629	0.0861**
	(0.480)	(0.049)
Wealth	0.000005**	–0.0000004*
	(0.000002)	(0.0000018)
Age	0.0260**	0.0016
	(0.0139)	(0.0014)
Education	0.1289	–0.050
	(0.388)	(0.041)
Crop insurance	–0.895***	–0.085***
	(0.345)	(0.037)
χ^2 = 118.95		
Log likelihood = –647.14		
N = 549		

Note. Numbers in parentheses are standard errors.
*α = 0.10. **α = 0.05. ***α = 0.01.

therefore use more tradable futures/options and forward contracts. On the other hand, producers who do not invest in market information tend to prefer pool contracts. The negative relationship between usage of information systems and pool contracts implies that producers who undergo costs of obtaining market information expect higher returns than those available through a marketing pool.

The variable that measures a producer's belief that pre-harvest marketing strategies earn profits was significant for pool contracts and cash sales only. The positive sign on this coefficient implies that producers perceiving that it is possible to obtain abnormal gains through market speculation are more likely to participate in pools. On the other hand, producers who do not perceive the possibility of abnormal gains through specula-

tion tend to use more cash sales. Interestingly, this variable was not significant in the futures/options and forward contracting models. Rather, it appears that those approaching cotton marketing with confidence in speculative gains migrate to marketing pools instead. This is not surprising, given that cotton pools often claim to producers that they are efficient at capturing speculative gains.

The variable that measures a producer's belief that planting time futures market prices are an accurate predictor of the harvest time price was significant for cash sales only. The positive sign on this coefficient implies that producers perceiving that markets are efficient are more likely to sell their cotton crop in the cash market. It is also interesting to note that this variable was not significant in the futures/options and forward contracting models. Rather, it appears that producers who do not perceive that the opportunity exists to obtain abnormal gains through marketing schemes tend to sell in the cash market, and avoid the transaction costs of other marketing strategies.

The variable that measures producer's wealth was significant for futures/options contracts and cash sales only. The negative sign on this coefficient implies that wealthy producers tend not to prefer futures/options contracts or cash sales to market cotton. The positive sign on the coefficient indicates that wealthy producers tend to sell in the pool market. Nevertheless, the coefficient was not statistically significant.

Producers' age was significant for futures/options contracts only. The results show that older, more experienced producers are less likely to choose futures/options pricing mechanisms as their preferred marketing technique in cotton. We hypothesize the reason is the opportunity cost involved in the learning process, which is likely proportional with older age.

Education was significant for pool contracts only. The positive sign on the coefficient implies that educated producers are more likely to prefer pooling their cotton crop. Interestingly, years of schooling did increase the choice of pool contracts, but when producers supplemented their education with specific training in other marketing techniques, their choice for pooling decreased, as the negative signs on the coefficients for knowledge of futures/options, and forward contracts indicates.

Crop insurance was significantly related to all the marketing techniques in this study. The positive coefficient implies that futures/options and forward contracts increases with the purchase of crop insurance. The positive relationship between futures/options and forward contracts usage and crop insurance purchase indicates that producers do perceive the complimentary relationship suggested by Coble et al. (2000). The negative sign on the crop insurance coefficient implies that the use of pools and cash sales is reduced as producers purchase more crop insurance.

6. Conclusions

The results from the model indicate several significant relationships between economic variables and choices for cotton marketing techniques. While it is intuitive that the producers' market and risk perceptions guide the choice of the marketing technique for each individual operation, these results provide significant insights into the optimal choice. This study provides evidence that cotton producers balance risk-related issues with the transaction costs associated with each marketing strategy and choose rationally based on their risk perceptions and the potential of abnormal economic gains through speculation.

Total cotton acres positively influenced pooling and negatively influenced cash sales. Given the economies of specialization in cotton production this is not surprising. The results suggest that when cotton is the primary crop, producers are more likely to prefer pooling strategies that have been developed specifically to meet their needs.

Producers willing to incur higher transaction costs in market information systems and the opportunity cost of additional marketing training, show a significant choice for futures/options contracts and forward pricing. Market information systems' purchases and previous knowledge of futures/options and forward contracts are positively related to the adoption of these marketing tools by cotton producers. This is not surprising, given that the producers' expectation for higher returns increases with specialization.

Producers who are more risk-averse tend to choose less pool contracts. On the other hand, those who perceive that it is possible to obtain abnormal gains through market speculation are more likely to participate in pools. This behavior implies that producers may choose one type of marketing technique based on potential economic gains. Nevertheless, producers may not have a clear understanding on how this choice has affected their risk position. A logical follow-up of this study would include a measure of how much producers know about risk management tools to account for any educational deficiencies. This opens opportunities for extension educators' additional supply of risk management and marketing training to cotton producers.

This study provides insight into cotton producers' choices for marketing methods. It is unique in that producers from the predominant cotton-producing areas are included, and their trade-offs between risk and transaction costs has been incorporated into the decision model. This allows examination of the diversity of marketing choices that smaller studies have not allowed. It also reveals some of the economic forces underlying marketing choices. A natural extension of this work would investigate the role of speculative reasons in the choice process. Also, agribusinesses and marketing consultants may find useful our identification of which factors motivate or discourage producers from hedging, and adjust their services accordingly.

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