NCCC-134
APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

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Suggested citation format:

Pace, J. D. and J. R. C. Robinson. 2012. "Marketing Choices by Texas Cotton Growers." Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, MO. [http://www.farmdoc.illinois.edu/nccc134].

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Paper presented at the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management
St. Louis, Missouri, April 16-17, 2012

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Recent changes in farm programs, cotton supply and demand fundamentals, and cotton price patterns have likely shifted how producers market their cotton. This paper examines cash marketing choices by southwestern cotton producers in 2010. Hedging is included an explanatory variable, along with other independent variables studied in previous research. Producer marketing behavior was modeled in a multinomial logit framework as a discrete choice among forward contracting with a merchant, post-harvest cash contracting with a merchant, contracting with a merchant pool, or contracting with a cooperative pool. Data were collected from a mail survey of the population of cotton growers in Texas, Oklahoma and Kansas. The most important determinants of cotton cash marketing choices were 1) prior participation in cooperative pools, beliefs about the value of pre-harvest pricing, beliefs about the performance of merchant pools, willingness to accept lower prices to reduce risk, and several socio-economic variables.

Keywords: cotton, marketing, hedging, adoption

Introduction

The agricultural economics literature is replete with studies of marketing, insurance, and hedging. These include both theoretical work, e.g., optimal hedge ratios, as well as empirical studies of the levels and determinants of either hedging or insurance. These strands of literature have their parallels with research on technology adoption because of the influences of information, uncertainty, and socio-economic determinants. For example, Wozniak (1984) used a logit model to demonstrate that the probability of adoption of cattle feed additives increased as uncertainty decreased. Differences in uncertainty among producers faced with an adoption decision were attributed to differences in "human capital," such as age, experience and education. Producers with more information—which comes at a cost—about an innovation had a greater incentive to adopt. The probability of adoption also increases with economies of size.

Many applications of adoption studies of crop marketing and risk management have taken a similar approach. For example, Shapiro and Brorsen (1988) estimated a system that captured both the probability of the discrete choice of whether or not to hedge, and the continuous level of hedging if hedging is adopted by Indiana grain farmers. In addition to human capital and farm size, subjective risk assessment, producer self-characterization of management ability, leverage, income stability and perceptions of changes in income due to adoption were influential in these producers' decisions to hedge and level of hedging. The probability of adoption and level of hedging was directly related to leverage, possibly due to the idea that producers with higher financial risk may be required to hedge by their lenders. Interestingly, Shapiro and Brorsen found experience and formal education have an inverse relationship to the decision to hedge. Possible reasons for the counterintuitive result were sampling bias inherent in the survey respondents and the idea that education fosters the ability to use other tools to reduce risk.

Pennings and Leuthold (2000) elicited the probability of hedging by Dutch pork producers as influenced by attitude and perception variables. Their study was distinguished from much of the

adoption literature in that it disaggregated observations from the population of producers into segments according to operation size and geographic region. Pennings and Leuthold posited that unobservable latent variables can be accounted for in a model by pinning them to observable operator/operation characteristics trough confirmatory factor analysis. Their system simultaneously estimated links between latent variables and observations, and the relationships between the observable characteristics. Testing for heterogeneity among the population, the authors found that disaggregating into two segments based on market-outlet choice (either selling to a cooperative or selling to a merchant) was statistically significant. Among producers selling to cooperatives, risk attitude and risk perception were found to be the leading determinates of hedging behavior. Among producers selling to merchants, market orientation and the value of entrepreneurial freedom were found to be the driving factors of hedging behavior. On the other hand, cooperative producers were more apt to consider the financial structure of their farms and preserving their operation itself in deciding whether to hedge.

Although relatively understudied, cotton has seen some similar research of risk management choices. This includes analysis of optimal hedge ratios by Berk (1981) and Coble et al (2000). The two main empirical efforts date from the post-1996 farm bill era of price volatility. Isengildina and Hudson used logit analysis (2001a) and a systems approach (2001b) to analyze grower survey data measuring the primary choice of marketing outlet: (1) cash sales, (2) forward pricing (either through pools or merchants) and (3) direct hedging through the futures market. As with previous adoption and marketing studies, independent variables in the model were divided into operator and farm characteristics, use of other available risk management tools and non-economic variables. Operator and farm characteristics included farm size, education, market-specific training and age. Other risk management tools included crop insurance, government payments and off-farm income. Non-economic variables included attitude questions that captured producers' posture towards direct hedging, and evaluation of their own marketing performance versus that of pools.

Isengildina and Hudson showed that the probability of choosing forward pricing over cash sales increased with farm size and decreases with off-farm income and income from government payments. The attitude that pool usage can net producers a higher price than they could net marketing on their own was directly related to indirect hedging. Producers who purchased coverage levels above the government-mandated minimum were 11 percent more likely to choose cash sales as a marketing outlet. Predictably, risk aversion was found to be directly related with direct hedging, which confirmed the idea that growers view forward pricing as a risk-reduction tool. Financial leverage was not statistically significant in predicting choice of marketing outlet.

Vergara et al (2004) implemented a mail survey of Mississippi and Texas cotton growers to elicit data and test hypotheses similar to those of Isengildina and Hudson. Vergara et al classified "forward pricing" as either with a merchant or with a pool. Thus, marketing outlet choices included cash sales, merchant forward contracting, pool contracting and futures market contracting (i.e., direct hedging). In addition to typical instrumental variables (examples: insurance choices, formal education, farm size), producer perceptions of yield and price variability were included. They hypothesized that yield and price variability were important in eliciting producers' risk aversion because of these factors' influence on the optimal hedge ratio (as distinguished from the minimum-variance hedge ratio). Producer knowledge level of

marketing outlets and money spent on market advisory services was included. Other producer perceptions such as orientation to marketing strategies in terms of returns and perception of market efficiency were included. Interestingly, price and yield variability were not statistically significant in the model. Size of operation was directly related to pool pricing and inversely related to cash sales. Producers more willing to accept a lower price (less risk-averse for returns to marketing) were less likely to adopt pool pricing. Money spent on market advisory services was directly related to forward pricing, pool pricing and futures pricing. Age was inversely related to futures market usage because, according to the authors, the opportunity cost of education about the futures market increases with age. Crop insurance purchase was directly related to futures pricing and forward pricing, which confirmed prior theoretical predictions that forward pricing is complementary to crop insurance coverage (Coble et al).

Since these last empirical studies, the U.S. cotton market has experienced restructuring from globalization, the influence of ethanol and competing crops, and the alleged financialization of agricultural markets. Although this last influence is not supported by available research (Power and Robinson; Janzen et al), the last five years have seen several periods of historically high and volatile prices (Carter and Janzen). The anecdotal result of high cotton prices is grower shifting back and forth among traditional outlets like cooperative pools or merchant contracts. In addition, the last decade has seen cotton merchants begin organizing and managing their own marketing pools in competition with the large cooperatives.

The aforementioned changes in the cotton market suggest the need for an updated picture of cotton marketing decision making. This paper represents a preliminary econometric analysis of a recent survey effort of growers in the southwestern region, i.e., Kansas, Oklahoma, and (primarily) Texas.

Data Collection and Development

As with the previous empirical studies of cotton, this research involved a survey of cotton growers to obtain current information about cotton marketing outlet choices. Anecdotal evidence suggests that roughly half of Texas growers market their cotton through cooperative seasonal pools, with the balance sold through merchant contracts (both forward and spot) and merchant controlled pools. Another goal of the survey process was to obtain selling price performance data for the 2010 cotton crop, as well as respondent socio-economic and demographic information.

Survey Instrument Development. Elements of the survey instruments used by previous researchers (Isengildina and Hudson; Vergara et al) were adapted to the present task to include newer marketing outlets (i.e., merchant pools), current crop and revenue insurance products, and current issues. The survey solicited shares of 2010 cotton production that were allocated among forward contracts with merchants, post-harvest spot contracts with merchants, seasonal co-op pools, and merchant pools. Many of the same risk management attitude and belief questions used by previous research were applied in 5-point Likert scale format.

Survey Process. Following development and IRB approval of the survey instrument, the survey was implemented as a two round mailing with a postcard reminder. Surveys were mailed to the

current listing of the Cotton Board mailing list for Kansas, Oklahoma, and Texas. The Cotton Board is a quasi-government organization charged by USDA for "…the oversight and administrative arm of the Cotton Research & Promotion Program, representing U.S. Upland cotton… To fund the Program, the Cotton Board collects a per-bale assessment of all Upland cotton harvested and ginned in the U.S., as well as an importer assessment for all Upland cotton products imported into the U.S." (Cotton Board). In essence, this mailing list represented the whole population sample of those in Kansas, Oklahoma, and Texas who sold cotton in 2010-11[2].

6,627 questionnaires were mailed out on March 1, 2012, with a reminder postcard ten days later. The second mailing to non-respondents was April 15, 2012. Of the total mailings, 100 were returned to sender as undeliverable. A total of 314 surveys were returned, of which 51 had unusable/incomplete responses.

Data Development. The survey elicited shares of cotton sold through various marketing outlets in various time periods. Most of the responses reflected a primary outlet choice, so 0/1 variables were created indicating primary outlet choice. These were used in the subsequent logit analysis. Similarly, a 0/1 variable was created to indicate any instance of hedging in 2010 based on the reported shares of crop hedged with either futures or options. This involved excluding eight observations with an even allocation among marketing outlets, leaving 263 usable responses for the present analysis. Of these, twelve were from Oklahoma or Kansas, which matches the 97% Texas share of cotton production in the three state region. Shares of cotton marketed, by outlet, in the 2001-2006 and 2007-2009 time periods were developed into a 0/1 variable indicating a history of primarily cooperative participation in both periods.

Summary Statistics

Table 1 provides a listing of key variable names, descriptions, and summary statistics of key variables used in the subsequent regression analysis. Of the four primary market outlet choices in 2010, 64% of respondents primarily sold through seasonal cooperative pools, while 16%, 11%, and 7% primarily sold through merchant forward contracting, merchant spot contracts after harvest, or merchant pools, respectively. That such a large share of the crop was committed early in the 2010 growing season is not surprising given the relatively good price level during the first half of 2010. As it turned out, the 11% of growers who sold after harvest probably received the higher prices given the unexpected and unprecedented price rally in late 2010.

The mean of the CHIST variable indicates that 55% of the respondents had a history of selling through the cooperative seasonal pool. This fits anecdotal evidence of half of Texas growers marketing this way. It also conforms to the slightly above neutral rating of CPMTS, the statement that cooperative dividends and book credits are an incentive to pool participation. On average, the respondents were slightly more inclined to agree that pre-harvest pricing results in a higher price, and slightly less inclined to agree that merchant pools tend to give higher prices than cooperative pools. These results could reflect slightly more pool supporters/believers in the data set. However, there is the possibility of lingering negative bias on the part of 2010

[2] This includes all cotton farmers who sold upland cotton as well as landlords with share rent contracts. Share rent landlords vary in their marketing involvement, hence this likely contributed to non-response to the marketing survey questionnaire.

merchant pool participants. Similarly, the above neutral agreement with cooperative pools giving an average price could reflect a mixture of pool supporters (who accept getting an average price) and those who prefer alternatives to the cooperative pool.

Risk attitudes were slightly above neutral for the relevant variables WILLING (i.e., to accept lower prices for less risk) and RISKATT (self-assessment of willingness to accept risk relative to other growers). Price risk, PRRISK, was seen as fairly influential in overall net revenue risk with a mean of 4.338 on a 1 to 5 scale.

Only 5.7% of the respondents indicated any level of hedging with futures or options for the 2010 crop. The ASSETS and ACRES variables indicate perhaps more small to medium sized respondents in our sample. This low level of hedging conforms with prior research studies. Other demographic and socio-economic variables appear representative.

Multinomial Logit Regression Results

As with Isengildina and Hudson (2001b) and Vergara et al., the primary choice marketing outlet indicators were specified as a function of the remaining variables in Table 1 in a multinomial logit framework. Many of these explanatory variables were employed in the prior studies cited. The model was estimated with 265 observations, giving a pseudo R^2 value of .6119. Using seasonal cooperative pools as the base, the multinomial parameter estimates are shown in Table 2.

The strongest predictor of cooperative pool usage was historical usage. Producers whose primary choice from 2004-2009 was cooperative pools were highly unlikely to adopt forward contracting in 2010. Historical co-op usage was not significant in predicting cash market or merchant pool usage over co-op usage in 2010. This is not surprising given the similarities between seasonal co-op and merchant pools. Another interesting result was that producers' self-characterization of co-op dividend importance in their marketing decisions was not significant when historical co-op usage was included in the regression. This lines up with anecdotal evidence that dividends are less influential after the price spike of 2010-11. A handful of respondents wrote in the "comments" section of the survey that they perceived mismanagement of both co-op and merchant pools in 2010.

PHPBLF was directly related to choosing forward contracting over co-ops and significant at the alpha = .05 level. This is somewhat contrary to Isengildina and Hudson's result in which producers stated that a marketing pool could get them a higher price than they could get marketing on their own. The result is interesting because it demonstrates a possible change in attitude towards the co-ops ability to maximize welfare. Presumably, producers were more apt to market their own cotton after the price spike of 2010-11.

WILLING was a significant predictor of choosing merchant spot cash sales over co-op marketing. It was inversely related to marketing through co-op pools. Producers willing to accept a lower price to reduce price risk would be less likely to sell on the harvest-time cash market. Along the same lines, producers who consider themselves more willing to accept risk than their peers are significantly more likely to choose post-harvest cash sales over co-ops. Both of these results confirmed Isengildina and Hudson's findings. In their study, producers who

believed that pools netted them a higher price than marketing on their own were less likely to adopt cash sales as a marketing choice, and more likely to adopt cash sales if they were more willing to accept risk related to other producers. Interestingly, WILLING elicited a result contrary to the conclusion drawn by Vergara et al. Their study revealed that, at the time, less risk-averse producers were more likely to adopt co-op marketing. The change in relationship between risk aversion and preference for co-op marketing may be due to the change in expectations of co-op pool performance in light of the more recent high prices and high volatility. It might also be the case that, since this study was heavily focused on Texas, more risk-averse producers are less prone to adopting forward contracting with merchants because of higher yield variability when compared to other regions of the country such as the Southeast.

Yield variability was not a significant predictor of any specific marketing technique in the Vergara et al study. This paper includes the variable IRR in its analysis. A higher percentage of total acreage dedicated to irrigated production would lead to lower yield variability. The coefficient on IRR for choosing forward contracting over co-op marketing is negative and statistically significant at the alpha = .05 level. This is economically intuitive because a lower percentage of irrigated acreage would lead to greater production risk, which typically drives merchants away from contracting with producers. After the drought of 2011, merchants almost ceased to offer acreage contracts in Texas entirely, instead opting only to offer direct bale contracts that comprised no more than 75% of a producer's crop and with a specified basis (Bynum 2012). ACRES was a significant predictor of choosing merchant pool contracting over co-op contracting but was not significant for any other marketing choice.

Finally, producers who preferred forward contracting to co-op marketing believed that merchant pools give a higher price than co-ops (MPBLF). Why this variable was significant in choosing forward contracting and not in choosing merchant pools over co-op pools is unclear. One possible explanation lies in how respondents reported which merchant or merchant pool they contracted with. There are many merchants that offer both direct forward contracts and pooling. In some cases, respondents reported contracting with a specific merchant pool, but indicated their primary 2010 choice was direct forward contracting. This indicates there was likely some confusion as to how their general marketing choice and relationship with a specific merchant were reported. Another possible explanation involves the relatively small number of producers reporting merchant pools as their primary choice. In addition to MPBLF, EDUC and OFFINC were uniquely significant predictors of merchant pool contracting. This suggests that some coefficients on MPOOL could be biased. A possibly remedy would be to collapse MPOOL into either COOP (per the similarities between co-op pools and merchant pools) or MFORWD (per the fact that many merchants offer both forward contracting and pooling). Further research may be warranted to explore the possible complementary or substitutionary relationships between similar types of forward pricing.

In terms of the marginal probability of adoption (as derived from the log-likelihood coefficients), some interesting results are revealed. While the log-likelihood coefficient on CPMTS for MSPOT was not significant, producers believing that co-op dividends were not influential in their choice of marketing arrangement were 6.34% more likely to choose cash sales over co-op marketing. The marginal effect carried a z-score of -3.88. Confirming the log-likelihood coefficient for WILLING on MSPOT, producers were 5.27% less likely to choose cash selling over co-ops if they were willing to accept a lower price to reduce risk. Producers who viewed

price risk as a source of revenue risk were 6.69% less likely to adopt cash sales over co-op pooling. Producers who said they were more willing to accept risk than other farmers were 5.79% more likely to adopt cash sales over co-op pooling. Another economically intuitive result was that producers who believed pre-harvest pricing led to higher prices received relative to other methods (PHPBLF) were 6.3% more likely to adopt forward contracting over co-op pooling.

Additional Work

The multinomial logit framework allowed for comparison with prior studies. However, since our survey measured shares of production allocated to alternative marketing outlets, more information can be brought to bear. This suggests a demand system framework such as the seemingly unrelated regression approach by Isengildina and Hudson (2001b).

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Table 1. Summary Statistics of 2012 Survey of Southwestern Cotton Marketing Choices.

Variable	Description	Mean	STDDEV	Minimum	Maximum
CPOOL	0/1 indicator of primary co-op pool choice	0.639	0.481	0	1
MSFORWD	0/1 indicator of primary merchant forward contracting choice	0.156	0.363	0	1
MSPOT	0/1 indicator of primary merchant spot market choice	0.113	0.340	0	1
MPOOL	0/1 indicator of primary merchant pool choice	0.072	0.259	0	1
CHIST	0/1 indicator of historical marketing with co-op pool	0.55	0.498	0	1
CPMTS	5-pt scale of influence of co-op dividends and book credits (5=more influential)	3.247	1.147	1	5
HEDGED	0/1 indicator of 2010 hedging	0.057	0.232	0	1
MPCI	0/1 indicator of 2010 purchase of multi-peril crop insurance	0.414	0.494	0	1
REVI	0/1 indicator of 2010 purchase of revenue insurance	0.525	0.515	0	1
PHPBLF	5-pt scale belief about pre-harvest pricing and higher prices (5=strongly agree)	3.414	0.833	1	5
WILLING	5-pt scale of willingness to take a lower price to reduce price risk (5=more willing)	3.095	0.888	1	5
CPBLF	5-pt scale belief that co-op pool marketing gives average prices (5=strongly agree)	3.650	0.886	1	5
MPBLF	5-pt scale belief that merchant pools give higher price than co-op (5=strongly agree)	2.795	0.769	1	5
PRRISK	5-pt scale view of price risk as source of revenue risk (5=high potential effect)	4.338	0.707	2	5
RISKATT	5-pt scale comparison to other farmers' willingness to accept risk (5=much more willing)	3.243	0.857	1	5
GEOG	0/1 indicator of location in area with low co-op membership	0.015	0.123	0	1
OFFINC	Percent of household income from off-farm sources	16.0%	23.9%	0%	100%
ASSETS	Total market value of assets in farming operation (1=<$100K, 2=$100K--$499K, 3=$500K--$999K, 4=$1M--$1.99M, 5=$2M-$4.99M, 6=>$5M)	2.592	1.300	0	5
LEVRG	Percent of total dollars invested in operation that are borrowed	35.4%	32.6%	0%	100%
AGE	Respondent age in years	57.802	13.671	25	98
EDU	Respondent education level (0=<HS, 1=HS or GED, 2=some college, 3=4-yr degree, 4=grad school	2.430	0.993	0	4
ACRES	Size variable (2010 total cotton acres planted)	1,032	1,132	16	9,000
IRR	Total 2010 planted cotton acres that were irrigated	332.4	528.3	0	4,000

Table 2. Log-likelihood Estimates of the Probability of Adopting Forward Contracting, Cash Sales and Merchant Pooling Relative to Cooperative Pooling.

Variable	MFORWD	MSPOT	MPOOL
CONSTANT	-5.07	**11.918***	-7.239
	(-1.13)	(2.36)	(-1.23)
CHIST	**-6.386***	-22.007	-21.558
	(-4.92)	(-0.01)	(-0.01)
CPMTS	-.541	**-1.623***	-.868
	(-1.53)	(-3.64)	(-1.88)
HEDGED	-.474	**-2.814****	-21.179
	(-0.46)	(-1.76)	(0.00)
MPCI	-.265	1.134	-.719
	(-0.30)	(1.21)	(-0.65)
REVI	-.514	.797	-.578
	(-0.62)	(0.91)	(-0.58)
PHPBLF	**.925***	.141	.134
	(2.05)	(0.31)	(0.23)
WILLING	-.386	**-1.25***	-.425
	(-0.96)	(-2.55)	(-0.81)
CPBLF	-.818	-.532	-.467
	(-1.81)	(-1.11)	(-0.86)
MPBLF	**1.219***	.041	**1.54***
	(2.18)	(0.06)	(2.09)
PRRISK	.612	-.691	1.08
	(1.10)	(-1.14)	(1.50)
RISKATT	.465	**1.388***	.444
	(1.02)	(2.65)	(0.74)
GEOG	3.651	-23.237	5.12
	(0.62)	(0.00)	(0.87)
OFFINC	.023	-.024	**.043***
	(1.43)	(-1.24)	(2.03)
ASSETS	-.023	-.224	-.380
	(-0.08)	(-0.71)	(-0.99)
LEVRG	.009	-.012	.009
	(0.72)	(-0.80)	(0.54)
AGE	.021	-.015	.060
	(0.82)	(-0.49)	(1.65)
EDU	-.251	-.540	**-1.01***
	(-0.62)	(-1.16)	(-2.02)
ACRES	.0003	-.0005	**.0008***
	(1.20)	(-1.16)	(2.04)
IRR	**-.002***	-.0002	-.0001
	(-2.53)	(-0.15)	(-0.10)

*Denotes coefficient that is statistically significant at the alpha = .05 level , while ** implies significance at alpha = .10 level.