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by

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ANALYSIS OF PRODUCER PRICING METHODS

Ted C. Schroeder and Barry K. Goodwin[1]

Price risk is pervasive in agricultural markets because of inelastic demand and supply, production rigidities and lags, weather uncertainty, and the influence of macroeconomic policies and global demand on agricultural markets. Han, Jansen and Penson show that price risk in agricultural markets since the 1970s has been considerably higher than price risk in industrial markets.

Price variability is an important component of profit variability. For example, Schroeder et al. find that roughly 85% of the variability associated with feeding cattle over time is attributable to cattle and feed price variance. Patrick et al. report the results of a survey indicating that livestock producers ranked livestock price variance as their most important source of variability. Similarly, crop producers generally ranked price variability as either their first or second (behind weather) most important source of risk. In the survey reported here, 61% of Kansas producers indicated that they face more risk from price variability than yield risk. Price risk management is of considerable importance to agricultural producers. Results of a survey of lenders in Kansas revealed that they ranked commodity sale prices, yield variability, and commodity purchase prices as the three most important sources of producer cash flow variance (Mintert). In addition, agricultural lenders have indicated preferences for lending to producers who secure price protection (Harris and Baker).

Numerous forms of price risk management exist for agricultural producers. Futures hedges, forward contracts, option hedges, and output diversification are a few of the pricing strategies that producers may pursue. Several studies have established that the use of futures, forward contracts, and options markets can significantly reduce producer price risk relative to cash marketing (Berck; Curtis et al.; Davis and Franzmann; Elam and Vaught; Erickson; Holland et al.; Miller and Kahl; Spahr and Sawaya; Schroeder and Hayenga; and Zacharias et al.).

Despite extensive price risk, and a preponderance of research suggesting marketing techniques to manage price risk, few producers use hedging in pricing commodities. In surveys of Kansas grain producers, Hill found that in 1972 only 4% had ever hedged and 12% had ever forward contracted. In 1983 Tierney found that only 7% had ever hedged and 18% had forward contracted. Asplund et al., in a survey of 353 Ohio farms, found that 42% forward contracted and 7% hedged some of their crop in 1986. Obviously a lot of producers market their output in manners inconsistent with portfolio recommendations. Of course, most portfolio studies also ignore the fact that producers use other forms of responses to price risk than these pricing methods. Patrick et al. found that producers ranked use of market information and spreading sales out over time as more important responses to price risk than either hedging or forward contracting.

Concerns regarding the general lack of knowledge about the mix of marketing practices farmers use have recently been raised by USDA administration (Sumner). A particular concern is whether National Agricultural Statistics Service (NASS) price statistics, for commodities frequently marketed using forward contracts, are representative of prices at which commodities are actually transacted.

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Without more knowledge of the specific mixes of marketing methods used by producers, the representativeness of reported NASS cash prices is unknown. This research provides information regarding the actual usage of various pricing mechanisms for a large sample of representative farms. Results identify which commodities need additional consideration of forward contracting activity as public price data are collected and reported.

The objectives of this study are to which determine pricing methods are being used by Kansas producers and to estimate the determinants of the amount of forward pricing practiced by producers. In particular, we first examine the extent of farmers' use of cash, futures, forward contracts, options, and deferred pricing for each of six commodities (corn, wheat, soybeans, sorghum, hogs, and cattle). Second, we determine how farm operator and firm operation characteristics affect producers' uses of forward pricing alternatives (futures, options, and forward contracting) for these commodities.

Previous Research

Several studies have investigated factors affecting forward pricing activity by agricultural producers. Shapiro and Brorsen analyzed futures market use by 42 Indiana crop producers at a Top Farmer Crop Workshop. They found significant factors affecting hedging included managerial experience, education, self-assessed management rating, leverage, farm size, off farm income, expected percent change in income from hedging, and whether the producer believed hedging could stabilize income. Contrary to expectations, education was inversely related to amount of hedging. Experience was also inversely related to hedging and all other significant factors were positively related as expected. Given that their sample consisted of 42 innovative farmers, these results are not generalizable to a broad spectrum.

Asplund et al. evaluated factors affecting hedging and forward pricing of a sample of 353 crop farms in Ohio. They determined that forward contracting was significantly related to operator age, whether the producer had attended a general farm organization meeting, whether the producer used computers or consultants, gross farm receipts, and leverage. Operator age, and unexpectedly, leverage, negatively affected forward contracting and the remaining factors had positive effects. Hedging activity of the producers was affected only by whether the farm used computers or consultants and gross farm income. Asplund et al. considered only the binary decision of whether the producer had or had not used futures or forward contracting. They did not examine the percentage of crop sold using these markets.

Makus et al. analyzed hedging activity of a sample of 595 producers from a Futures and Options Marketing Pilot Program organized to educate producers regarding the use of futures and options markets across 22 states. They found that significant determinants of hedging activity included whether the producer had been a member of a marketing club, education, gross farm sales, and the region where the producer was located. Like Asplund et al., their study considered only whether the producer had or had not hedged and not the percentage of crop hedged.

This study contributes to earlier work in several ways. We examine the forward pricing of a sample of 539 Kansas crop and livestock producers. This large sample allows us the luxury to examine the mix of pricing strategies used and factors affecting forward pricing for each of six different commodities individually. This distinction is important since marketing strategies for different crops and livestock may differ significantly. These six commodities include corn, soybeans, wheat, sorghum, cattle, and hogs. None of the previous studies examined pricing mechanisms for different commodities individually. This study also estimates how different farm and farm operator characteristics affect the percentage of commodity marketed using forward pricing techniques.

Aside from Shapiro and Brorsen, who were limited by a relatively small unrepresentative data set, previous studies have used only dichotomous dependent variables representing whether the producer had or had not used forward pricing. This study also introduces several new variables not explicitly considered in past studies to explain forward pricing activity. Finally, actual financial and management records of the operations surveyed were used here to calculate specific independent variables whereas, previous studies have relied on survey respondent recall for this information likely increasing interpretation, recall, or other error.

Empirical Framework and Econometric Procedures

Producers choose among alternative marketing strategies to maximize the expected utility of profits. The central focus of this analysis is to evaluate factors affecting farmers' use of forward and futures pricing mechanisms. To this end, the proportions of each producers' crop marketed through forward pricing, futures hedging, and futures options were summed to obtain a measure of the total proportion of each crop sold through forward and futures markets.[2] Because marketing strategies and practices for different crops may vary, it is important to evaluate forward and futures marketing for individual crops.

The percentage of farmer i's output of commodity j marketed through forward and futures pricing methods is defined as Y_{ij}, where:

(1) $Y_{ij} = \Sigma_{k=1}^{3}$ Percent of Output Sold Through Forward/Futures Method k .

The percentage of output sold through forward and futures pricing methods can range between 0 and 100. Thus, Y_{ij} is doubly censored at 0 (if producer i does not forward or futures price any of commodity j) and 100 (if producer i markets all of crop j through forward and futures pricing). In this case, a two-limit Tobit model is appropriate.

An empirical representation of the model of forward and futures pricing, relating the proportion of commodity j sold through forward and futures pricing methods to observable explanatory variables, takes the form:

$$(2)\qquad \begin{aligned} Y_{ij} &= 0 && \text{if } 0 > X_{ij}\beta + e_{ij} \\ &= X_{ij}\beta + e_{ij} && \text{if } 0 < X_{ij}\beta + e_{ij} < 100 \\ &= 100 && \text{if } 100 < X_{ij}\beta + e_{ij} \ , \end{aligned}$$

where X_i is a vector of explanatory variables relevant to the use of forward and futures pricing alternatives by producer i, β is a vector of unknown parameters, and e_{ij} is a residual error which is assumed to be normally distributed with a zero mean and constant variance. Given the censored nature of the distribution of the dependent variable, maximum likelihood estimation of a two-limit Tobit (Tobin) model is appropriate.

Care must be exercised in interpreting parameter estimates from a censored regression model. Greene (pg. 737) shows that the expected value of all observations of the dependent variable where the distribution is censored from below at L and from above by U is given by:

$$(3)\quad E(Y) = L\Phi(z_L) + U(1-\Phi(z_U)) + \{X\beta + \sigma(\phi(z_L)-\phi(z_U))/(\Phi(z_U)-\Phi(z_L))\}(\Phi(z_U)-\Phi(z_L)) \ ,$$

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[2]Deferred pricing does not represent a forward or futures pricing strategy and thus was not included in the calculation of the forward and futures marketing variable.

where $z_L = (L - X\beta)$, $z_U = (U - X\beta)$, $\phi(\cdot)$ is the unit normal density, and $\Phi(\cdot)$ is the cumulative normal distribution function. Greene (pg. 738) shows that the effect of a change in the k^{th} variable of the expected value of y is given by:[3]

$$(4) \qquad \partial E(Y)/\partial X_k = (\Phi(z_U) - \Phi(z_L))\,\beta_k ,$$

where $\Phi(z_U) - \Phi(z_L)$ represents the probability of observing a noncensored observation. Equation (4) must be used to evaluate the marginal effects brought about by changes in the explanatory variables.

Discussion of Survey Data

The data utilized in this analysis were collected from two distinct sources. First, a survey was administered to 1,963 Kansas farms in September 1992. Producers were queried about their marketing practices for wheat, corn, sorghum, soybeans, cattle, and hogs. In particular, producers were asked to identify the percentages of each crop that were sold through cash marketing, forward contracts, futures hedges, futures options, and deferred pricing over the 1990 through 1992 crop years. These data were matched to a set of detailed farm management records in the Kansas Farm Management Association data bank. Of the 1,963 farms surveyed, 618 surveys were returned, corresponding to a 31.5% response rate. Of these, 79 surveys were dropped from the sample because of incomplete responses. This left a total of 539 observations for analysis.

Production and marketing characteristics of the farms in the sample are contained in table 1. Of the 539 farms evaluated, 84.8% produced (marketed) wheat, 32.7% produced corn, 60.3% produced sorghum, 46.4% produced soybeans, 52.6% produced cattle, and 16.7% produced hogs. For each commodity, a large majority (in excess of 90% for each commodity) of the producers used cash marketing to some extent to sell their crops.

Considerable use of forward contracting was revealed in the survey data. Overall, 40.4% of the producers forward contracted at least some of their crops during the preceding 3-year period. Over 32% of the wheat producers used forward contracting to market their wheat. Thirty-four percent of the corn producers used forward contracting. Over 31% of the soybean producers used forward contracting to sell their soybeans. Proportions of sorghum, cattle, and hog producers using forward marketing were considerably lower. Over 17% of the sorghum producers, 12% of the cattle producers, and only 1% of the hog producers used forward contracting to market their commodities.

Use of futures market hedging in the marketing activities of crop and livestock producers was considerably less frequent. Overall, 9.8% of the crop producers hedged at least some of their crop during the preceding 3-year period. Only 5.8% of the wheat producers used futures hedges, 10% of the corn producers and 8.5% of the cattle producers used futures hedges. For the other commodities, producers' use of futures hedges was very limited. Only 5% of soybean producers, 2% of sorghum producers, and 4.5% of the hog producers used futures hedges to market these commodities.

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[3]Note that, in an ordinary regression, the effect of a change in an independent variable X_k is simply equal to the regression coefficient β_k. However, in the Tobit model this effect is given by (4).

Table 1. Marketing Characteristics of Sample of 539 Kansas Farms

Characteristic	Percent of Sample
Sold Wheat	84.77
Sold Corn	32.71
Sold Sorghum	60.34
Sold Soybeans	46.43
Sold Cattle	52.63
Sold Hogs	16.73
Wheat Producers Using Cash Marketing	96.23
Corn Producers Using Cash Marketing	93.68
Sorghum Producers Using Cash Marketing	97.20
Soybean Producers Using Cash Marketing	97.57
Cattle Producers Using Cash Marketing	96.79
Hog Producers Using Cash Marketing	97.75
Wheat Producers Using Forward Contracts	32.15
Corn Producers Using Forward Contracts	34.48
Sorghum Producers Using Forward Contracts	17.45
Soybean Producers Using Forward Contracts	31.17
Cattle Producers Using Forward Contracts	12.14
Hog Producers Using Forward Contracts	1.12
Wheat Producers Using Futures Hedges	5.76
Corn Producers Using Futures Hedges	10.34
Sorghum Producers Using Futures Hedges	1.87
Soybean Producers Using Futures Hedges	5.26
Cattle Producers Using Futures Hedges	8.57
Hog Producers Using Futures Hedges	4.49
Wheat Producers Using Futures Options	14.86
Corn Producers Using Futures Options	9.77
Sorghum Producers Using Futures Options	2.80
Soybean Producers Using Futures Options	4.45
Cattle Producers Using Futures Options	10.36
Hog Producers Using Futures Options	3.37
Wheat Producers Using Deferred Pricing	4.89
Corn Producers Using Deferred Pricing	6.90
Sorghum Producers Using Deferred Pricing	4.98
Soybean Producers Using Deferred Pricing	6.48
Cattle Producers Using Deferred Pricing	0.36
Hog Producers Using Deferred Pricing	1.12

For most commodities, producers were more likely to use futures options than futures hedging techniques in their marketing activities. Nearly 15% of the wheat producers used futures options. Likewise, over 10% of the cattle producers and 9.8% of the corn producers used futures options. Only 4.4% of the soybean producers, 2.8% of the sorghum producers, and 3% of the hog producers used futures options in marketing their commodities.

Use of deferred pricing techniques was quite limited for all of the commodities. Only 4.9% of the wheat producers used deferred pricing. Nearly 7% of the corn producers, 5% of the sorghum producers, and 6.5% of the soybean producers used deferred pricing. Livestock producers use of deferred pricing was very limited. Only 0.36% of the cattle producers and 1.1% of the hog producers used deferred pricing.

Important information regarding futures and forward marketing practices can also be gleaned from an evaluation of the degree of use of the alternatives (*i.e.*, the proportion of crop sold under each alternative). Table 2 contains average proportions of each crop sold by the alternative methods for the subsamples of producers using each method. Of wheat producers using cash marketing, the average producer sold 85% of his or her crop in the cash market. Likewise, for the subsets of producers using cash marketing, 80.9% of corn, 92.3% of sorghum, 85.9% of soybeans, 91.2% of cattle, and 95.7% of hogs were sold on average in the cash market.

Of the producers using forward contracting, the average proportions of crops marketed through forward contracting were between 30% and 40%. The average proportions marketed through futures hedges were typically between 20% and 30%. The most intensive use of futures hedging occurred for corn, for which an average of 37% of the corn crop was marketed through futures hedging by those using hedges. For those producers using futures options, the proportion of the commodity marketed through options averaged between 30% and 45%. The cattle producers that used futures options marketed a large proportion (45% on average) of their cattle using options. Wheat producers using options also marketed a large proportion (33.7%) of their wheat in this manner. The average proportions of corn, sorghum, and soybeans sold using options were 29%, 37%, and 36.6%, respectively.

A small proportion of the producers used deferred pricing. However, for those producers that did defer the pricing of their commodity, the average proportions of their crops sold in this manner was quite high. For crops, the averages ranged from 29% to 44%. Only 2 of the cattle producers and 1 hog producer in the sample used deferred pricing.

A number of variables were hypothesized to be conceptually relevant to the use of alternative forward pricing methods. These variables are defined in table 3. Explanatory variables were selected based upon previous work and additional conceptualization. Operator age has been significant in previous research and was included to measure farm experience. Production efficiency was used to indicate whether the producer was low cost or high cost. We expected that lower cost producers would have less need for forward pricing and would thus use it less frequently. Net farm income was included to determine whether producers who forward priced had higher or lower incomes on average, no a priori sign was expected.

Table 2. Average Proportions of Crops Sold by Alternative Marketing Methods (for Sub-Samples of Producers Using Respective Methods)

Characteristic	Average Percent of Crop Sold By Method
Cash Marketing	
Wheat	85.41
Corn	80.86
Sorghum	92.38
Soybeans	85.93
Cattle	91.16
Hogs	95.74
Forward Contracting	
Wheat	30.09
Corn	37.13
Sorghum	35.41
Soybeans	33.27
Cattle	34.03
Hogs	20.00
Futures Hedge	
Wheat	22.24
Corn	34.06
Sorghum	21.67
Soybeans	28.65
Cattle	25.04
Hogs	10.00
Futures Option	
Wheat	33.65
Corn	29.26
Sorghum	37.00
Soybeans	36.59
Cattle	44.67
Hogs	15.67
Deferred Price	
Wheat	29.04
Corn	32.33
Sorghum	30.06
Soybeans	44.44
Cattle	25.00
Hogs	15.00

Table 3. Variable Definitions[a]

Variable	Definition
Age	Age (years) of producer
Efficiency	For crop producers, the ratio of gross crop receipts to total variable crop production costs. For beef producers, the ratio of gross livestock sales receipts to variable livestock production costs (purchased feed, veterinary services, drugs, breeding services, and marketing costs).
Income	Average of preceding three years' (1989-1991) net farm income
Seminar	1 if producer had attended a marketing or risk management seminar, 0 otherwise
Farm Size	Total farm size (acres)
Diversification	A Herfindahl index of diversification calculated using enterprise weights of total revenues
Livestock Sales	Proportion of total farm sales accounted for by livestock
Risk Preference	Producer's subjective risk preference rating on a scale of 1 to 10 (where 1 = Risk Hating and 10 = Risk Loving)
Leverage	Debt to assets ratio
CV Income	Coefficient of variation on net farm income for preceding ten years
Crop Acres	Proportion of total farm acres in crop production (not including set asides)
Education	Years of formal education
Off-Farm Income	Total non-farm income of farmer and spouse in 1991
CV Yield	Coefficient of variation for preceding ten years' yields for each respective crop
Mean Yield	Mean of preceding ten years' yields for each respective crop
Irrigation	Proportion of total crop acres that are irrigated

[a]Unless otherwise noted, all variables are for 1991.

Previous studies have found that producers who have attended a seminar on price risk management are more likely to use forward pricing methods. The hypothesis is that they are more informed about these market alternatives. Education was included for similar reasons. Off farm income was included to reflect whether this impacted forward pricing activity.

Farm size was included to test whether larger or smaller farms forward price more. Diversification and livestock sales were used to reflect output diversification of producers. Presumably, more diversified producers would forward price less if this is their form of price risk management. Risk preferences were included because previous research has suggested that the primary reason producers use forward pricing is to reduce risk. Thus, more risk averse producers would be expected to use more forward pricing. Leverage has a similar argument because more highly leveraged producers also are in higher risk positions. The coefficient of variation of income is also intended to measure the risk position of the operation.

Crop acres, yields, yield variation, and the proportion of crop acres irrigated are intended to measure size and yield concerns with respect to the willingness of producers to forward price crops. Patrick et al. found that weather is roughly as important a risk concern as price for crop producers. Thus, crops with higher yield risk are expected to be forward priced less often.

Summary statistics for each variable are presented in table 4. The average age of producers in the sample was 50.5 years. The average net farm income between 1988 and 1991 was $38,611. Nearly 70% of the producers had attended a marketing or risk management seminar. The average farm was 1,550 acres in size. The Herfindahl index of diversification had an average value of 0.57. On average, livestock sales represented 28% of total farm revenue. The average producer was slightly risk averse, as reflected in the average subjective risk preference rating value of 4.77.[4] The average debt to assets ratio was 0.40, reflecting a high degree of financial leverage. The average coefficient of variation on net farm income was 221.42%. This large value reflects the considerable volatility of farm incomes through the 1980s. The average producer had 14.2 years of formal education. However, there was sizeable variation in education, which is reflected in the standard deviation of 6.90. On average, producers and their spouses earned $13,533 from off-farm employment activities in 1991. Relative yield variation, as reflected in coefficients of variation for yields, was typically around 30% for each of the crops. Corn had the lowest yield coefficient of variation (29%) and soybeans had the highest yield coefficient of variation (40%).

Empirical Results

Parameter estimates and relevant statistics for the Tobit regression models of forward, futures, and option pricing are presented in table 5. Separate equations were estimated for the proportions of producers' output of wheat, corn, sorghum, soybeans, and cattle.[5] Operator age was significant and negatively related to forward pricing for wheat, sorghum, and cattle. For each additional year of age, the percentage of commodity forward priced declined 0.30% to 0.54%. This result is

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[4]Results for the variable representing subjective risk preferences must be carefully interpreted since the variable is an ordinal ranking. We implicitly assume the ranking to be quantitative in nature, such that a rating of 10 is twice as risky as one of 5 and so forth. Other categorical risk preference variables, including variables constructed according to the method of King and Robison, were also considered and found to give identical results.

[5]Use of futures and forward pricing by hog producers was not evaluated due to a relatively small number of observations (n=90).

Table 4. Summary Statistics for Variables Relevant to Usage of Forward and Futures Pricing

Variable	Mean	Standard Deviation
Age	50.5102	12.7199
Efficiency (Crops)	1.7331	1.5071
Efficiency (Livestock)	8.0655	51.2109
Income	38,611.67	44,028.47
Seminar	0.6920	0.4621
Farm	1,549.58	1,243.66
Diversification	0.5662	0.2025
Livestock Sales	0.2764	0.4477
Risk Preference	4.7668	1.9787
Leverage	0.4027	0.4027
CV Income	221.4171	1615.7500
Crop Acres	0.7193	0.2638
Education	14.1685	6.9022
Off-Farm	13,533.31	93,862.01
Irrigation	0.0597	0.1471
Mean Yield (Wheat)	33.9550	6.6592
CV Yield (Wheat)	34.0620	18.3650
Mean Yield (Corn)	112.4300	35.5490
CV Yield (Corn)	24.8860	18.2580
Mean Yield (Sorghum)	63.9598	29.5930
CV Yield (Sorghum)	34.7541	21.4420
Mean Yield (Soybeans)	29.6464	11.1170
CV Yield (Soybeans)	37.7427	22.0440

Table 5. Parameter Estimates and Summary Statistics for Tobit Models of Forward and Futures Pricing

Variable	Wheat		Corn		Sorghum		Soybeans		Cattle	
	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X
Intercept	-104.430 (34.020)**		-97.128 (59.010)*		-1.861 (57.310)		-106.510 (49.540)**		-65.582 (66.100)	
Age	-.617 (.306)**	-.301	.111 (.519)	.055	-1.468 (.657)**	-.630	.104 (.457)	.052	-1.170 (.609)*	-.539
Efficiency	-4.105 (2.406)*	-2.003	-17.844 (8.710)**	-8.762	-9.345 (7.383)	-4.009	-9.918 (5.388)*	-4.923	-4.789 (2.459)*	-2.206
Income	-.042 (.080)	-.021	.043 (.112)	.021	.290 (.231)	-.124	.038 (.099)	.019	.001 (.001)	.045
Seminar	25.016 (7.323)**	12.206	33.500 (13.880)**	16.449	12.810 (14.450)	5.496	19.848 (10.040)**	9.852	29.164 (14.080)**	13.433
Farm Size	.007 (.003)**	.003	.006 (.007)	.003	-.005 (.008)	-.002	.007 (.005)	.003	.003 (.005)	.001
Diversification	-10.500 (16.910)	-5.123	-40.733 (40.060)	-20.001	-4.990 (36.820)	-2.141	-83.540 (33.190)**	-41.467	-1.206 (36.000)	-.556
Livestock Sales	-3.755 (14.790)	-1.832	91.503 (33.640)**	44.929	75.721 (32.140)**	32.487	35.589 (19.43)*	17.666	-52.403 (30.470)*	-24.138
Risk Preference	7.598 (7.025)	3.707	-.963 (13.790)	-.473	20.837 (14.300)	8.940	-5.990 (9.690)	-2.973	34.999 (12.980)**	16.121
Leverage	22.472 (8.611)**	10.965	-21.590 (23.030)	-10.601	8.471 (16.140)	3.634	16.797 (12.560)	8.338	84.929 (22.430)**	39.119
CV Income	.003 (.002)	.001	.005 (.013)	.003	-.013 (.013)	-.006	-.006 (.010)	-.003	.007 (.003)**	.003

[a]Numbers in parentheses are standard errors. Single and double asterisks indicate statistical significance at the $\alpha = .1$ and .05 levels, respectively.

Table 5. (continued)

Variable	Wheat Estimate	Wheat ∂E(Y)/∂X	Corn Estimate	Corn ∂E(Y)/∂X	Sorghum Estimate	Sorghum ∂E(Y)/∂X	Soybeans Estimate	Soybeans ∂E(Y)/∂X	Cattle Estimate	Cattle ∂E(Y)/∂X
Crop Acres	79.827 (18.200)**	38.950	9.806 (42.260)	4.815	25.924 (38.180)	11.122	24.586 (26.010)	12.204	2.478 (29.790)	1.141
Education	-.005 (.429)	-.003	1.645 (2.942)	.808	-.872 (1.757)	-.374	5.227 (2.373)**	2.594	3.375 (3.154)	1.554
Off-Farm Income	-.001 (.001)	-.001	.001 (.001)	.001	-.001 (.001)	-.001	.001 (.001)	.001	-.001 (.000)**	-.000
CV Yield	.280 (.179)	.137	.545 (.324)*	.268	-.006 (.316)	-.003	-.271 (.231)	-.134		
Mean Yield	.966 (.532)*	.472	.067 (.259)	.033	-.058 (.251)	-.025	.317 (.478)	.157		
Irrigation	-8.302 (21.760)	-4.051	62.711 (32.830)*	30.792	5.918 (51.090)	2.539	-27.063 (35.650)	-13.433		
$\hat{\sigma}$	48.359 (3.313)**		46.947 (5.068)**		69.351 (8.369)**		44.254 (4.660)**		58.817 (6.473)**	
n	364		111		254		189		225	
Log Likelihood	-864.435		-320.355		-358.427		-374.913		-355.876	
McFadden's R^2	.226		.317		.257		.301		.242	
Chi-Square	506.138**		297.793**		247.627**		322.452**		227.422**	

[a]Numbers in parentheses are standard errors. Single and double asterisks indicate statistical significance at the α = .1 and .05 levels, respectively.

consistent with previous studies (Asplund et al. and Shapiro and Brorsen) and suggests that older, more experienced producers, do not use forward pricing as much as younger producers.

Production efficiency was significant in all of the models except sorghum. More efficient producers, measured by a higher ratio of gross receipts to total variable production costs, use forward markets less. This result is consistent with prior expectations that lower cost producers do not need the price risk protection available in forward markets. They manage risk by being low cost producers rather than by using price risk management.

Producers who had attended at least one marketing or risk management seminar used forward pricing more. Seminar attendance increased the percentage of forward pricing by 10% to 16%. This result is consistent with previous work by Makus et al. and Asplund et al. This contrasts with Shapiro and Brorsen who did not find a significant relation between attending a futures seminar and use of hedging. Given that their survey was a small sample of innovative producers at a Top Farmer conference it is not surprising that they did not find this factor significant (one would suspect that most of these producers understood futures market concepts and mechanics). The result here suggests that continued education and extension efforts targeted toward price risk management is warranted.

Farm size was significant only for wheat producers. The sign was positive as expected. Farm diversification was significant only for soybean producers. Apparently with the exception of soybean producers, the producers in the sample did not substitute between a large number of different enterprises and price risk management using forward markets. The proportion of total farm sales accounted for by livestock was associated with higher percentages of crops (except wheat) forward priced and lower percentage of cattle forward priced. The more livestock crop producers have, the more they tended to forward price their grain sales.

In general, risk preferences of the operator did not influence forward pricing except for cattle where producers having lower self-assessments of risk aversion forward priced more. This is counter to expectations if forward pricing reduces risk. However, producers with lower aversion to risk also tend to be more innovative and progressive and therefore may be more active in various pricing strategies. Leverage was positively associated with wheat and cattle forward pricing. This is consistent with expectations and previous work (Asplund et al. and Shapiro and Brorsen). Harris and Baker found that 70.6% of lenders responding to a survey indicated that hedging increased a farmer's loan limits. The coefficient of variation in income was significant for cattle only and had the expected positive sign.

Farm size, as measured by crop acres, was associated with higher percentages of forward pricing for wheat producers. Education had little impact in general on forward pricing, being positive and significant only for soybeans. This contrasts with Shapiro and Brorsen who found education was negatively related to hedging. Off farm income was significant only for cattle where increased off farm income reduced forward pricing activity. The coefficient of variation in crop yields was generally not significant, with the exception of corn, where the sign was unexpectedly positive. Mean yield was significant only in wheat with the expected positive sign. Corn producers who irrigated forward priced more of their production than those who did not irrigate. Irrigation was not significant for the other crops. This is consistent with expectations because irrigation is most critical for corn production.

Conclusions

This study examined current pricing methods being used by farmers for six different commodities and determined the factors affecting farmers' uses of forward pricing. A sample of 539 Kansas farmers indicated that cash marketing is the dominant method used for pricing. Forward contracting, futures, options, and to some extent deferred pricing are important pricing alternatives. Seventeen to 34% of the producers raising crops (depending upon the crop) forward contracted, 2% to 10% hedged, 2% to 15% used options, and 5% to 7% used deferred pricing on at least a portion of their production during the 1990-92 crop years. A larger percentage of wheat and corn producers used forward contracting and options and corn producers also tended to use the most hedging. Cattle producers were roughly equally split among percentage using forward contracts (12%), options (10%), and hedges (9%).

The average percentage of crops marketed using cash ranged from a low of 81% for corn to a high of 96% for hogs. Interestingly, of those producers who used forward pricing methods, on average they forward priced roughly 25% to 35% of their production using either forward contracting, futures, or options. Thus, fairly large percentages of sales are priced using the various forward pricing mechanisms if they are used at all.

Younger, less efficient producers, who had attended a seminar on price risk management, and had large livestock sales used forward pricing the most for crops. In addition, larger and higher leveraged producers of wheat tended to forward price their crop more. Corn producers who irrigated tended to market more of their crop using forward pricing. Younger, less efficient cattle producers, who were highly leveraged and had attended a price risk management seminar forward priced a larger percentage of their sales.

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