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The Effect of Personal and Farm Characteristics upon Grain Marketing Practices

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ABSTRACT

A survey of Kansas, Texas, and Iowa agricultural producers was taken to examine the factors affecting their grain marketing practices. Sales indices models and models of qualitative choice are used to determine whether marketers' choices of cash market, forward contract, or futures and options oriented marketing practices are significantly affected by their personal and farm business characteristics. Results indicate that geographic location, farm size, grain enterprise specialization, farming experience, use of grain storage, and use of crop insurance have significant effects upon the respondents' choice of grain marketing practices.

Key Words: *agricultural options, cash marketing, forward contracts, futures, grain marketing practices, multinomial logit, Tobit.*

Identification of the factors that affect farmers' selection of grain marketing practices has been the focus of continuing study by agricultural economists. While the timing and quantities of U.S. farmers' cash grain sales can be observed from U.S. government market reports, the personal and farm business factors that affect crop producers' decisions to use either cash sales, forward contracts, futures, options, and/or other marketing tools are not well understood. Previous studies have focused primarily on factors that affect farmers' preharvest forward pricing practices. This study takes a broader, whole-marketing-season approach by examining factors that affect crop marketers' total portfolio of preharvest and postharvest marketing practices. Musser, Patrick, and Eckman suggest such an approach, stating "joint research on all techniques used throughout the marketing season is necessary to understand farmer behavior" (p. 66), particularly in examining how marketing techniques influence both price and risk.

A better understanding of the personal and farm business factors that affect grain marketing practices will yield at least two benefits. First, university extension educators can design marketing education programs that are targeted to meet the specific needs of particular farm audiences. Second, applied researchers can use this information to provide comparative results and testable hypotheses in future marketing research efforts. Grain marketing decision makers will be the ultimate beneficiaries of these research and extension efforts.

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The purpose of this study is to determine how grain marketers' personal and farm business characteristics affect their choices of grain marketing practices. After a review of previous research, descriptions of the survey method and data collected are given. The econometric methods used are described and followed by the presentation and discussion of the results of the analysis. Finally, the findings of the study are summarized and conclusions are drawn about the relevance and applicability of the study findings.

Previous Research

Previous studies have focused on the factors that affect farmers' forward pricing decisions for grain rather than their combined preharvest and postharvest use of alternative marketing tools. Shapiro and Brorsen; Goodwin and Schroeder; and Musser, Patrick, and Eckman have performed research particularly relevant to this study. Shapiro and Brorsen surveyed participants of a university educational workshop for innovative farmers to examine the factors that determine whether or not a grain producer decides to use a preharvest grain futures hedge. A farmer's choice of whether or not to hedge was viewed as a technology adoption decision in their analysis. Goodwin and Schroeder surveyed Kansas farmers to determine the impact of a number of factors on adoption of forward pricing techniques. Their special focus was on the effect of human capital accumulation and educational program participation on farmers' grain forward pricing practices. Musser, Patrick and Eckman studied the effects of risk and farm characteristics on preharvest marketing techniques used by large-scale midwestern cash grain farmers. Their purpose was to determine whether factors such as age, gross income, geographic location, and risk-preference attitudes impacted farmers' preharvest forward pricing practices. Each study sought to identify factors that explained farmers' preharvest grain marketing behavior and each made use of two-limit Tobit econometric models in their analysis. Many of the specific findings of these earlier studies are incorporated into the discussion in later parts of this article.

Other relevant studies by Asplund, Forster, and Stout and Makus *et al.* have examined farmers' forward pricing practices using futures hedges and either forward contracts or options. Schroeder *et al.* surveyed agricultural producers to determine their perceptions about futures markets, price forecasting, market risk management and market timing signals.

Multinomial logit analysis has been used as an analysis tool in a number of studies relating to agricultural decision making. These include Schnitkey *et al.*; Skaggs, Kirksey, and Harper; Jensen and Saupe; and Bhattacharyya *et al.*

Survey Methods

A survey of Kansas, Iowa, and Texas marketing decision markers was conducted in 1998 to investigate the factors affecting their use of alternative marketing tools. The survey instrument was developed with the guidance of evaluation experts from Kansas State University (KSU), the University of Minnesota, and the University of Wisconsin. A pilot test of this survey with agricultural producers was carried out to establish its clarity and validity. All those surveyed were provided a postage-paid return envelope.

The survey audience was selected using a combination of a) geographic area-based random samples in Kansas and Iowa, and b) targeted extension information user groups in all three states. Random samples of agricultural producers and farmland owners were taken in 18 counties in northwest Kansas (350 surveys mailed out) and in eight counties in southwest Iowa (420 surveys mailed out). Approximately 75 agricultural producers attending extension grain market outlook meetings in northwest Kansas were also directly surveyed. Four hundred subscribers of *AgUpdate,* KSU's monthly marketing and farm management newsletter, were also surveyed. KSU *AgUpdate* recipients are primarily either agricultural producers or farmland owners, along with some agribusiness representatives and governmental-institutional employees. Two hundred fifty five agricultural producer grad-

uates of the Texas A&M University's (TAMU) Master Marketer program in 1997 and 1998 were asked to participate in the survey. Every survey respondent reported that they were involved in crop production and marketing as either a farmer or farmland owner. Some respondents also reported involvement in agribusiness and ag-related government services. After elimination of incomplete questionnaires, 351 usable surveys remained (218 from Kansas, 74 from Texas, and 59 from Iowa). Because the survey was not completely random and was limited in its geographic coverage, it is not strictly appropriate to generalize these results to represent all grain marketing decision makers in these states. However, to the degree that these survey respondents do represent grain marketers in these and other areas, the survey results may provide insight into how personal and farm business related factors affect an individual's grain marketing practices.

Survey Data

Information about respondents' grain marketing practices and their personal and farm business characteristics was collected in this survey. Regarding information on marketing practices, respondents identified the percentage of their annual grain marketings made throughout the preharvest, harvest and postharvest periods using alternative marketing tools. These tools included cash sales, forward contracts, basis contracts, hedge-to-arrive contracts, minimum price contracts, delayed price contracts, futures hedges, and agricultural options (puts and calls). Involvement in other types of specialized production-marketing contracts was also reported, such as for identity preserved grains.

Ninety-six percent of respondents reported that they used cash marketing transactions, while 70 percent used forward contracts and 52 percent used futures and/or options. The 70-percent use of forward contracts is similar to the 64-percent level reported by grain producers and land owners in a 1996 Kansas State University survey (Schroeder *et al.*) and the 74-percent level reported by Musser, Patrick, and Eckman in a 1993 study. The 52-percent use of futures and/or options is similar to the 1996 KSU survey (45 percent using futures hedges and 56 percent using options), and also comparable to the findings of Musser, Patrick and Eckman (53 percent using futures hedges and 35 percent using options). In addition, 14 percent of respondents reported the use of specialty production contracts for hybrid seed production, identity preserved grains, and other uses.

The average percentage of grain marketed through cash sales, forward and other types of marketing contracts, and futures and/or options marketings reported by respondents equals 64 percent, 26 percent, and 20 percent, respectively. The use of specialty production-marketing contracts for crops was included in forward contract percentage because of their common preharvest production commitments and forward pricing elements. The sum of total average cash, forward contract, futures and/or options is greater than 100 percent (i.e., 110 percent). This may reflect the selective use of futures and/or options by grain marketers for price protection purposes. Grain producers sometimes selectively place and then lift futures and/or options positions either before or after harvest in an effort to reduce price risk and/or enhance prices. Later in the marketing year they then may re-price those same bushels with either cash sales or forward contracts for future delivery, leading to a greater than 100 percent reported total marketings by respondents. Another reason for this greater than 100-percent total of marketings is that some survey respondents indicated a range of use of a particular marketing tool over a period of years rather than a point estimate. For example, in the case where a respondent indicated that grain was marketed via forward contract 25–50 percent of the time, the midpoint of the range was used (i.e., 37.5 percent) in the survey analysis.

From this marketing practice information, three alternative marketing indices as well as categorical designations of alternative types of marketing practices by grain marketers were developed. The first index (CASHIX) represents the proportion of strictly cash marketing

Table 1. Dependent Variables for Marketing Indices Models

Models and Dependent Variable Categorizations	Description of Categories	No. Obs.	Mean	Median	Std. Dev.	Min.	Max.
1. CASHIX: Cash Market Transaction percentage	Percent of Total Grain Marketings via Cash Practices	351	0.59	0.60	0.31	0.00	1.00
2. FCNTIX: Forward Contract Marketing percentage	Percent of Total Grain Marketings via Forward Contracts	351	0.25	0.20	0.24	0.00	1.00
3. FUTOPNIX: Futures Plus Options Marketing percentage	Percent of Total Grain Marketings via Futures Plus Options	351	0.16	0.04	0.21	0.00	1.00

transactions relative to the sum of reported percentages of cash, forward contract, futures and/or options marketings for each respondent (Table 1). In the overall survey sample, the average CASHIX value is 0.59 (i.e., 59 percent), while the median value is 0.60 (60 percent). Note that the average CASHIX value of 0.59 is less than the respondents' average reported value of 0.64 (64 percent) reported above. This difference exists because the proportion of cash sales is divided by the sum of the reported percentages for each type of marketing transaction, and on average that sum is greater than 100 percent (110 percent). Therefore, CASHIX represents the proportion of cash marketings relative to the total marketing percentages for all types of marketing transactions. Observations for CASHIX are distributed by quartile in the following manner: 19.9 percent in the 0–25 percent range, 23.4 percent in the 26–50 percent range, 29.6 percent in the 51–75 percent range, and 27.1 percent in the 76–100 percent range. Of these observations, 3.7 percent are at the lower limit of the range (0 percent) and 16.8 percent are at the upper limit (100 percent).

The second index (FCNTIX) represents the proportion of forward contract marketings relative to the sum total of marketing transaction percentages across all marketing tools (Table 1). Forward contracts are defined here to include all conventional forward contracts plus basis, hedge to arrive, minimum price, delayed price, specialty production and other types of contracts. The average FCNTIX value is 0.25 (25 percent), while the median value is 0.20 (20 percent). The distribution of FCNTIX index observations by quartiles is 58.4 percent in the 0–25 percent range, 29.6 percent in the 26–50 percent range, 10.0 percent in the 51–75 percent range, and 2.0 percent in the 76–100 percent range. Of these observations, 26.5 percent are at the lower limit of the range (0 percent) while 0.6 percent are at the upper limit (100 percent).

A third index (FUTOPNIX) represents the proportion of futures and options marketings relative to the sum total of marketing transaction percentages across all marketing tools (Table 1). Farm marketers' futures transactions typically include short (sell) positions for grain sellers and/or long (buy) positions for grain buyers. However, farmers' futures transactions may also include speculative long positions after grain is sold at harvest. Similarly, farm marketers' options transactions typically include buying puts to protect from futures price declines or buying calls to protect or benefit from futures price increases. The average FUTOPNIX value is 0.16 (16 percent), while the median value is 0.04 (four percent). The sizable difference between the average and median value of FUTOPNIX indicates that a few observations have high percentages of futures plus options marketings, while most others have a relatively low proportion of futures plus options marketings. The distribution of FUTOPNIX index observations by quartiles is as follows: 73.5 percent in the 0–25 percent range, 20.5 percent in the 26–50 percent range, 5.4 percent in the 51–75 percent range, and 0.6 percent in the 76–100 percent range.

Table 2. Dependent variables for the multinomial logit model of grain marketing practices

Models and Dependent Variable Categorizations	Description of Categories	No. Obs.
1. Cash Market Oriented Marketing Practices	≥90 percent Cash Practices, ≤10 percent Forward Contracts, ≤15 percent Futures/Options	95
2. Forward Contract Oriented Marketing Practices	10 percent–100 percent Forward Contracts Forward Contract percent Greater than Futures/Options percent	128
3. Futures/Options Oriented Marketing Practices	15 percent–100 percent Futures/Options Futures/Options percent Greater than Forward Contract percent	128
	Total Usable Survey Observations:	351

Of these observations, 47.3 percent are at the lower limit of the range (0 percent) while 0.3 percent are at the upper limit (100 percent).

The limited range of these three dependent variables and the concentration of observations at the upper and lower limits of their range make it appropriate to use a two-limit Tobit model to analyze the indices data. As shown above, the CASHIX index has a sizable proportion of observations at the upper end of its range (i.e., 100 percent), while the FCNTIX and FUTOPNIX indices have a sizable proportion of their observations at the lower end of their ranges (i.e., 0 percent). A more complete explanation of the two-limit Tobit model is given in the data analysis section below.

Although the CASHIX, FCNTIX and FUTOPNIX indices make use of the information directly provided by survey respondents, by design they do not allow for direct comparisons of how individual marketers' characteristics may affect their cash versus forward contract versus futures/options-oriented marketing practices. To provide a more extensive delineation of grain marketing tool use than that provided by the indices, the observations are divided into three categories or groupings of marketing practices (Table 2). The three categories are (1) cash market oriented marketing practices, (2) forward-contract-oriented marketing practices, and (3) futures/options-oriented marketing practices. Category #1 survey observations are those that are oriented primarily toward cash-market-oriented marketing transactions, with limited use of forward contracts, futures and options. Category #2 observations are those that regularly use alternative types of forward contracts in their marketing practices. These contracts include standard forward contracts plus basis, hedge-to-arrive, minimum price, delayed price, and other types of specialty production contracts. Farm marketers in this category may also use cash market and futures and options transactions, but the primary orientation of their marketing practices is toward forward contracts. Category #3 observations are those that make extensive use of futures and/or options in their grain marketing activities. This group may also use cash marketing transactions as well as forward and other types of marketing contracts, but to a lesser degree than futures and/or options.

In this analysis, 27.1 percent (95/351) of the observations are determined to be in Category #1, 36.5 percent (128/351) in Category #2, and 36.5 percent (128/351) in Category #3. A multinomial logit model is used to analyze how individual and farm business characteristics affect the probability that they will fall into one category of marketing tool usage as opposed to another. A more complete explanation of multinomial logit model analysis appears in the data analysis section.

The personal and farm business characteristics information collected in these surveys is defined and explained below. The IOWA and TEXAS variables indicate whether the surveys originated from either to these two states. A key issue regarding these geographic locations

is how differences in grain basis levels and variability may impact producers' use of alternative marketing practices. A number of studies have used similar geographic variables and found significant geographic differences in marketing practices (Goodwin and Schroeder; Makus *et al.*; and Musser, Patrick and Eckman).

The CROPAC variable indicates the size of the crop production enterprise for each survey respondent. Grain operations size categories are defined as follows: Category #1, less than 1,000 acres; Category #2, 1,000 to 1,999 acres; Category #3, 2,000 to 2,999 acres; Category #4, 3,000 to 3,999 acres; and Category #5, 4,000 or more acres. The average value for CROPAC is 2.14, with a standard deviation of 1.22. The SCALEOPN variable indicates respondents' opinions about whether their farming operations are small (Category #1), average (Category #2), or large (Category #3) in relation to other farms in their county or region. The average value in the survey for SCALEOPN is 2.02 with a standard deviation of 0.68. Increasing crop acreage or farm size is expected to have a positive impact on the use of grain forward pricing practices and in adopting more sophisticated marketing tools such as futures and options. Larger farms are expected to have lower per-unit costs or economies of size than smaller farms in terms of learning how to use these marketing tools and in collecting marketing information. However, Goodwin and Schroeder pointed out that management demand and complexity for some large farms may actually limit adoption of these tools. Results from previous studies have been mixed. Goodwin and Schroeder, Shapiro and Brorsen, and Makus *et al.* all found that hedging or forward pricing was positively related to farm acreage size. Musser, Patrick and Eckman used farm income as a proxy for farm size and found no significant effect on forward marketing practices.

The variable SPECIALIZED indicates whether or not respondents are specialized in grain production or diversified with both grain and livestock enterprises. Thirty-four percent of respondents indicate they have specialized grain production operations. Other studies have used alternative percentage measures of farm enterprise diversification or specialization, such as a Herfindahl index of diversification calculated using enterprise shares of total farm sales (Goodwin and Schroeder) or livestock sales as a percent of gross farm income (Musser, Patrick and Eckman). The former study showed no significant effect on forward pricing, while the latter showed that increasing livestock enterprise involvement had a significant negative effect on maximum percentage of crops that were forward priced. We would expect that specialized grain operations would be able to devote more resources toward marketing and make greater use of futures and options oriented marketing practices.

The variable for EXPERIENCE indicates the number of years of farming or agricultural experience of survey respondents. Years of experience in agriculture is categorized as follows: Category #1, fewer than 5 years; Category #2, 5 to 14 years; Category #3, 15 to 24 years; Category #4, 25 to 34 years; and Category #5, 35 years or more. The average value of EXPERIENCE is 3.59 with a standard deviation of 1.01 in this survey. The expectations of most previous studies have been that adoption of grain forward-pricing methods would decrease as the years of experience of agricultural producers increased. While some study findings reinforced this hypothesis (Goodwin and Schroeder; Shapiro and Brorsen; Musser, Patrick and Eckman), others resulted in no significant effect (Makus *et al.*), and others contradicted it (Asplund, Forster, and Stout). Years of farming experience may not be perfectly correlated with the age of a farmer. Some people may begin farming at a younger age or after having different periods of education or alternative employment than others. Therefore, it would not be completely accurate to assume that EXPERIENCE is a proxy for age.

The RISKATT variable represents how willing respondents are to accept price risk in their marketing practices. Respondents were asked the following question regarding their attitude toward managing price risk:

"In your pricing strategies and decisions,

would you characterize yourself as a person who (select one)

1. *Avoids price risk*—You STRICTLY AVOID the risk of lower prices if you are a seller, or the risk of higher prices if you are a buyer.
2. *Accepts some price risk*—You accept SOME, BUT NOT TOO MUCH price risk and uncertainty in exchange for the opportunity of receiving a better price later on.
3. *Accepts a large amount of price risk*—You are willing to accept a LARGER AMOUNT OF PRICE RISK THAN OTHER PEOPLE in exchange for the opportunity to buy or sell for very profitable prices."

The average value for RISKATT in this survey is 2.22 with a standard deviation of 0.51. While this study of preharvest and postharvest marketing practices focuses on price risk preferences, other studies focusing exclusively on preharvest marketing practices have measured income risk preferences. A five-point Lickert-type scale was used by Musser, Patrick and Eckman to obtain responses of agreement or disagreement to the following statement: "I am more concerned about a large loss in my farm operation than missing a substantial gain." Shapiro and Brorsen used a King-Robison type risk-interval questionnaire to elicit a Pratt-Arrow risk aversion measure. However, they also identified two alternative risk preference survey questions that were asked in the survey but not used in the final analysis. The first question was: "How do you feel about taking business risks (1 = dislike, 2 = indifferent, 3 = like)." The second question dealt with whether they like to gamble (1 = yes, 2 = no). Jensen and Saupe used a series of questions concerning the operator's perception of whether taking risks in farming is good or not, and how the operator perceived himself or herself relative to other farmers with respect to taking on risk. Responses were then used to construct indices of risk preferences related to farming. Musser, Patrick and Eckman discuss how other usable risk preference measures follow from either a) expected utility theory, using certainty equivalents, b) safety-first risk preference measures, or c) prospect theory. While various survey methods have been used to elicit an understanding of agricultural producers' attitudes toward price and income risk, most are similar in design to the question used in this survey.

Previous research results have been mixed regarding the impact of increased risk preferences (i.e., lower risk aversion) upon agricultural producers' marketing practices. Goodwin and Schroeder found that agents with a stated preference for risk are more likely to adopt forward pricing than risk averse producers, a finding counter to their pre-study expectations. Shapiro and Brorsen found that the use of forward pricing methods was not significantly related to risk attitudes. Musser, Patrick, and Eckman had mixed results regarding risk-preference variables, with attitude toward loss variables having a significant positive impact on maximum percent forward pricing by respondents. Their findings indicate that safety-first behavior seems to increase long-run forward-pricing activity. While the question asked in this research deals specifically with price risk rather than income risk, the results of these earlier studies which focused on the impact of varying income risk preferences are complementary.

The variables STORCM and STORFM indicate whether or not respondents regularly use commercial and/or on-farm grain storage, respectively, in their marketing practices. Sixty-four percent of respondents report that they use commercial grain storage, while 68 percent report that they use on-farm storage. Since most previous studies have focused on preharvest forward-pricing practices, the impact of using grain storage has not been thoroughly examined. Generally, the costs associated with commercial storage are higher than for on-farm storage.

Grain storage strategies by nature involve cash marketing practices as producers retain physical ownership of grain beyond harvest for the purpose of benefiting from potential postharvest price increases. Therefore, regular use of postharvest commercial or on-farm

grain storage leads to a decrease in the use of preharvest forward-pricing practices, such as forward contracts, futures and options, as well as harvest cash market sales. Farm marketers without on-farm storage availability are likely to be more aggressive preharvest marketers than those who have access to adequate on-farm storage. Because of the higher cost of commercial storage, they are likely to think that their opportunities to profitably store grain commercially are more limited than if they had access to lower cost storage on the farm. Because their postharvest pricing opportunities are more limited, these farm marketers have more incentive to take advantage of potentially profitable preharvest forward pricing opportunities.

To a lesser degree, storage strategies may involve forward contracting grain for postharvest delivery or the use of futures and options during the postharvest period for either price risk management or price enhancement purposes. We have observed that farmers' use of futures storage hedges is limited in the regions covered by this survey, although storage contracts, futures storage hedges, and options are all readily available to crop marketers during the postharvest period. If producers actually sell cash grain at harvest to avoid commercial storage costs and then use call options to benefit from postharvest futures price increases, their use of commercial grain storage would be limited and their use of call options would be greater. The same may be true for on-farm storage. However, lower on-farm storage cash expenses provide less financial incentive to sell at harvest and buy call options.

The variable DMNDCNTR indicates whether the respondent's crop production enterprises are geographically located close to major grain demand centers such as livestock feedlots, grain or feed processing facilities, unit train elevators, barge loading facilities, etc. No specific guidelines or criteria were provided to respondents regarding the definition of "close proximity" in answering this question. Instead, respondents were left to rely on their judgment as to what "close proximity to major grain demand centers" meant. It is assumed that respondents answered "yes" to this question if their grain production operations were located within a reasonable distance from such a grain transporting center or if they perceived that such a center was close enough to strongly influence local grain markets. In this survey, nearly equal proportions of Kansas (57 percent), Iowa (59 percent) and Texas (58 percent) respondents indicated that their grain production operations were located close to major grain demand centers. Other studies have indicated forward contracting may be more prevalent near demand centers, particularly with the presence of cattle feedyards in the high plains region of Kansas and Texas. The authors hypothesize that location near a grain demand center will increase the use of cash market and forward contract oriented marketing practices due to comparative strength of grain basis levels in these local grain markets.

The CROPINS variable indicates whether respondents regularly use either Multiple Peril Crop Insurance (MPCI) or Crop Revenue Coverage (CRC). Seventy-seven percent of survey respondents report that they use some form of crop and/or revenue insurance. Crop producers use MPCI to directly manage yield risk and to indirectly provide income risk protection. Alternatively, CRC insurance has a price-risk management component in addition to MPCI coverage that allows for more direct management of crop income risk. The use of these crop insurance tools is particularly relevant in managing yield and income risk related to preharvest grain pricing strategies. Goodwin and Schroeder found more evidence that crop insurance purchases have a positive impact on preharvest grain forward pricing practices than did Shapiro and Brorsen. The impact of crop insurance purchases on the use of cash, forward contract, futures and options has important implications for federal agricultural risk-management policy. Detractors of crop insurance and in particular crop revenue insurance, hold the view that crop insurance use leads to a decrease in the use of futures, options and forward contracts on the part of agricultural producers. Some university extension education programs such as the Coordinated Risk Management workshops of-

Table 3. Z-tests between means of selected survey variables by pairs of survey group[1,2]

Survey Group Comparisons	Selected Variables			
	RISKATT	EXPERIENCE	CROPAC	STORCM
KS Random vs. KS AgUpdate	−0.05	*−2.31	0.32	**−4.12
KS Random vs. KS Direct	0.47	−1.16	0.76	**−3.54
KS AgUpdate vs. KS Direct	0.43	−0.04	0.58	−0.50
KS Random vs. SW Iowa	0.18	*−2.39	**5.29	−0.04
KS Random vs. Texas	0.03	0.40	−0.69	0.35
KS AgUpdate vs. SW Iowa	0.14	−0.56	**5.84	**3.45
KS AgUpdate vs. Texas	0.39	**5.11	**−3.87	**9.49
KS Direct vs. SW Iowa	−0.30	−0.27	*2.54	**3.16
KS Direct vs. Texas	−0.17	**2.58	**−3.22	**7.63
SW Iowa vs. Texas	0.19	**4.65	**−8.19	**4.16

[1] RISKATT shows respondents' attitude toward risk (1. Avoids price risk, 2. Accepts some price risk, 3. Accepts a large amount of price risk). EXPERIENCE indicates years of experience in agriculture (1. <5 years, 2. 5–14 years, 3. 15–24 years, 4. 25–34 years, 5. 35 years or more.) CROPAC denotes the crop acreage size (1. < 1,000 acres, 2. 1,000–1,999 acres, 3. 2,000–2,999 acres, 4. 3,000–3,999 acres, 5. 4,000+ acres). STORCM shows the use of commercial grain storage.

[2] * and ** indicate statistical significance at 0.05 and 0.01 levels, respectively.

fered by Kansas State University have focused on the joint use of crop insurance and forward pricing tools (forward contracts, futures hedges, options, etc.) to manage grain enterprise income risk.

Large-sample hypothesis tests (Z tests) were performed on selected variables to determine whether statistically significant differences existed among them across the survey groups (Table 3). The selected survey variables are attitude toward grain price risk (RISKATT), years of farming experience (EXPERIENCE), crop acreage (CROPAC) and use of commercial grain storage (STORCM). The Z-test results indicate that producers' risk attitudes do not differ significantly across the survey sources, but that differences do exist in other variables. For instance, years of experience for respondents in the Kansas Direct and Texas groups are less than for the other survey sources. Average cropland acreage among the Texas producers is larger while the crop acreage of southwest Iowa producers is smaller than for other survey sources. Commercial grain storage use varied across the respondent groups. For example, commercial storage on the part of the Kansas Random group is less than for other Kansas survey groups. In addition, commercial storage use among Texas respondents is less than for all other groups except for the Kansas Random respondents, while commercial storage use among southwest Iowa respondents is less than for the Kansas *AgUpdate* and Kansas Direct groups, and more than for the Texas respondent group.

Bearing these similarities and differences in mind, these Kansas, Texas, and Iowa survey respondents are pooled for purpose of analysis. It is noted that among the three Kansas survey sources, no differences are found in regard to risk attitudes and cropland acreage size. However, differences do exist in regard to years of experience and commercial storage use. Because of the similarity in risk attitudes and farm size, no distinction is made in the following analysis among Kansas survey respondents. Therefore, surveys from the Kansas Random, Kansas *AgUpdate,* and Kansas Direct survey sources will all be viewed without distinction as coming from Kansas.

Analysis Methods

Censored regression or two-limit Tobit models are used to analyze the factors affecting the indices of cash (CASHIX), forward contract (FCNTIX) and futures plus options (FUTOPNIX) marketings. The use of two-limit Tobit models is appropriate because of the censored range of the dependent variables (from 0 to

100 percent) and because a sizable proportion of these censored observations exist at either the lower or upper endpoints of the ranges for these indices. The use of ordinary least squares in this case would lead to inconsistent and biased parameter estimates. The significance of the effect of independent variables upon the indices is determined using asymptotic t-ratios, in this case the ratio of the coefficient estimates to their asymptotic standard errors. Two-limit Tobit model estimation results will be reported in the form of maximum likelihood parameter estimates and also in the form of partial derivatives of the expected values with respect to the vector of characteristics as computed at the explanatory variable mean. Explanations of two-limit Tobit models and why they are appropriate to use when dependent variables have censored distributions are found in Greene and in Pindyck and Rubinfeld.

A qualitative choice analysis is also performed in addition to the censored regression analyses. As defined in Table 2, the marketing practices of respondents are categorized in the following manner: Category #1—cash market oriented marketing practices, Category #2—forward contract oriented marketing practices, and Category #3—futures/options oriented marketing practices. It is appropriate to use a multinomial logit model in this case because of its ability to analyze qualitative choice models with more than two discrete dependent variables. Multinomial logit model estimation results in Table 5 are reported in the form of maximum likelihood parameter estimates and of partial derivatives of the expected values with respect to the vector of characteristics as computed at the mean of the explanatory variables.

The multinomial logit analysis used reports the impact of a set of independent variables in each model upon the log-odds ratios of a particular discrete, categorical choice relative to a base categorical choice (i.e., Category 1). The following log-odds ratio models are calculated, with choice Category #1 (cash market oriented marketing practices) serving as the base category for normalization:

$$(1)\quad \ln(P_i/P_1) = B_{0i} + B_{1i}X_{1i} + B_{2i}X_{2i} + \ldots + B_{ki}X_{ki} + e_i + e_0,$$

where i = Categories 2 and 3; k = Explanatory variables 1, 2, . . . , 11.

This results in two log-odds equations being calculated for the three dependent variable categories. A third log-odds equation ($\ln(P_3/P_2)$) is derived from $\ln(P_2/P_1)$ and $\ln(P_3/P_1)$ based on the underlying assumptions of the logit model. The asymptotic variances and covariances from $\ln(P_2/P_1)$ and $\ln(P_3/P_1)$ are used to calculate standard errors and t-statistics for $\ln(P_3/P_2)$.

The multinomial logit model parameter estimates represent marginal log probabilities. For instance, in Table 5 a value of 0.203 for the CROPAC coefficient in the $\ln(P_2/P_1)$ multinomial logit model indicates that a small increase in crop acres results in a 0.203 increase in the log probability of the Category #2 (forward contract oriented marketing practices) relative to a Category #1 (cash market oriented marketing practices). In general, a positive model coefficient indicates that increases in the value of the explanatory variable (or a nonzero value of a 0/1 dummy variable) will increase the probability of the selection of the marketing practice category represented by the numerator relative to the category represented in the denominator. Conversely, a negative model coefficient indicates that increases in the value of the explanatory variable (or a nonzero value of a 0/1 dummy variable) will decrease the probability of the selection of the marketing practice category represented by the numerator relative to the category represented in the denominator. The asymptotic t-tests associated with each independent variable coefficient are used as indicators of the level of statistical significance. A description of multinomial logit analysis and its underlying theoretical and distributional assumptions is given in Maddala and in Pindyck and Rubinfeld.

A potential problem with multinomial logit analysis is the well-known "Independence of Irrelevant Alternatives" (or IIA) property. This problem exists because when three or more discrete, categorical choices are avail-

Table 4. Parameter estimates and summary statistics for two limit Tobit models of grain marketing practices[1]

	Marketing Indices Models					
	CASHIX		FCNTIX		FUTOPNIX	
Variables[2]	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X	Estimate	∂E(Y)/∂X
Constant	0.827	0.689	−0.089	−0.067	0.236	0.124
	*(0.133)	*(0.110)	(0.115)	(0.086)	*(0.133)	*(0.071)
IOWA	0.117	0.097	0.042	0.032	−0.382	−0.200
	*(0.055)	*(0.046)	(0.047)	(0.036)	*(0.069)	*(0.035)
TEXAS	−0.035	−0.030	0.019	0.014	−0.022	−0.011
	(0.057)	(0.048)	(0.049)	(0.037)	(0.056)	(0.029)
CROPAC	−0.050	−0.042	0.050	0.038	0.010	0.005
	*(0.020)	*(0.016)	*(0.017)	*(0.013)	(0.019)	(0.010)
SCALEOPN	−0.062	−0.051	0.032	0.024	0.051	0.027
	*(0.033)	*(0.027)	(0.028)	(0.021)	(0.033)	(0.017)
SPECIALIZED	−0.105	−0.087	0.147	0.111	−0.044	−0.023
	*(0.040)	*(0.034)	*(0.034)	*(0.026)	(0.041)	(0.021)
EXPERIENCE	0.029	0.024	−0.009	−0.007	−0.053	−0.028
	(0.019)	(0.016)	(0.017)	(0.013)	*(0.020)	*(0.010)
RISKATT	−0.004	−0.003	0.007	0.006	−0.021	−0.011
	(0.038)	(0.032)	(0.033)	(0.025)	(0.039)	(0.020)
STORCM	0.062	0.052	−0.009	−0.006	−0.095	−0.050
	(0.043)	(0.036)	(0.037)	(0.028)	*(0.044)	*(0.023)
STORFM	0.058	0.048	−0.008	−0.006	−0.068	−0.036
	(0.046)	(0.039)	(0.040)	(0.030)	(0.045)	(0.024)
DMNDCNTR	−0.047	−0.039	0.020	0.015	0.044	0.023
	(0.038)	(0.032)	(0.033)	(0.025)	(0.038)	(0.020)
CROPINS	−0.127	−0.106	0.094	0.071	0.077	0.041
	*(0.046)	*(0.038)	*(0.039)	*(0.030)	*(0.047)	*(0.025)
Sigma ($\hat{\sigma}$)	0.341		0.287		0.315	
	*(0.015)		*(0.013)		*(0.018)	
McFadden Pseudo R^2[3]	0.1666		0.1617		0.1940	
Log likelihood	−172.77		−129.99		−155.20	
Restricted Log likelihood	−207.31		−155.07		−192.56	
Model chi-square[4]	69.08		50.14		74.73	
Level of significance[5]	(0.0001)		(0.0001)		(0.0001)	

[1] Standard errors reported in parentheses. An asterisk indicates statistical significance of $\alpha = 0.10$ or smaller level.
[2] The IOWA and TEXAS variables indicate that surveys originate from those states. CROPAC denotes the crop acreage size (1. <1,000 acres, 2. 1,000–1,999 acres, 3. 2,000–2,999 acres, 4. 3,000–3,999 acres, 5. 4,000+ acres). SCALEOPN shows respondents' opinion of the size of their farming operation in relation to their county or region (1. Small, 2. Average, 3. Large). SPECIALIZED records involvement in either a diversified grain and livestock operation or a specialized grain producing operation. EXPERIENCE indicates years of experience in agriculture (1. <5 years, 2. 5–14 years, 3. 15–24 years, 4. 25–34 years, 5. 35 years or more.) RISKATT shows respondents' attitude toward risk (1. Avoids price risk, 2. Accepts some price risk, 3. Accepts a large amount of price risk). STORCM and STORFM show the use of commercial or on-farm grain storage. DMNDCNTR denotes whether grain production operations are located near a major grain demand center. CROPINS indicates whether MPCI or CRC crop insurance is used regularly or not.
[3] McFadden's Pseudo R^2 is given by one minus the ratio of the unrestricted to restricted log likelihood function values.
[4] The chi-square test evaluates the null hypothesis that $\beta_1 = \beta_2 = \ldots = \beta_\lambda = 0$.
[5] Numbers in parentheses are associated chi-square probabilities.

able, multinomial logit analysis assumes that the ratio of probabilities between any two choices is unaffected by the availability of a third choice. In other words, there may be a question as to whether the model's qualitative choices are truly independent. The odds of a particular choice or category selection are not affected by the presence of additional alternatives if they are truly independent and not just substitutes. A chi-square test proposed by Hausman and McFadden is used to determine the validity of the IIA property in this application. The IIA test statistic is:

$$(2) \quad \chi^2 = (\beta_s - \beta_f)'[V_s - V_f]^{-1}(\beta_s - \beta_f),$$

where s indicates model coefficients estimated with a subset of choices, f indicates model coefficients estimated with the full set of choices, β_s and β_f are the estimated model coefficients for the limited and full choice models, respectively, and V_s and V_f are estimates of the asymptotic covariance matrices. The degrees of freedom for the χ^2 test statistic is equal to the rank of the covariance matrix, $V_s - V_f$.

Empirical Results

The results of the two-limit Tobit model for the cash marketings (CASHIX), forward contract marketing (FCNTIX) and futures plus options marketing (FUTOPNIX) indices models are reported in Table 4. Parameter estimates and marginal effects are both reported. The CASHIX, FCNTIX and FUTOPNIX models have chi-square test statistics of 69.08, 50.14 and 74.73, respectively, and are all statistically significant at the 1-percent level. The McFadden Pseudo R^2 values of 0.167, 0.162 and 0.194 for the three models compare favorably with those for the two-limit Tobit models used in Goodwin and Schroeder.[1] Results for the multinomial logit model are presented in Table 5, with both parameter estimates and marginal effects being reported. The multinomial logit (MNL) model has a chi-square test statistic of 80.64, and is significant at the 1-percent level. The McFadden Pseudo R^2 measure of 0.11 is quite acceptable in comparison to other published multinomial logit studies (Schnitkey *et al.*) and according to standard texts (Maddala, Pindyck and Rubinfeld). Hausman and McFadden tests fail to reject the independence of irrelevant alternatives (IIA) null hypothesis for the MNL model at the 1-percent significance level for the alternative restricted subsets of categories. This result implies that marketing strategy Categories #1, #2 and #3 are not close substitutes and thus validates the use of multinomial logit analysis in this application. A comparison of predicted versus survey outcomes for the MNL model is presented in Table 6. The multinomial logit model accurately predicts the actual categorization 55 percent of the time, a percentage that is lower than for other published studies. The model has a tendency to under-predict observations in Categories #1 and #2, and to over-predict observations in Category #3. The following discussion of results will focus on the signs of statistically significant findings for each explanatory variable, including both the two-limit Tobit and MNL models.

Findings for IOWA indicate that Iowa respondents are more likely to use cash market and forward contract marketings, and less likely to use futures and options than those from Kansas. Evidence of this is found in the significant positive effect of the IOWA variable on the Tobit index model of cash marketings (CASHIX) and the significant negative effect on the futures and options marketing index (FUTOPNIX). The MNL model results also show that Iowa respondents have a sig-

[1] Limitations of various traditional goodness-of-fit measures under Tobit limited dependent variable estimation are illustrated by Veall and Zimmerman. The authors found McFadden Pseudo-R^2 values from Tobit analysis on censored data were "substantially lower" than R^2 values from OLS estimations on the corresponding uncensored data set (p. 485). Comparing alternative measures of goodness-of-fit, the authors found R^2 measures that more closely agreed between Tobit and OLS estimations than did the McFadden R^2. However, as alternate model specifications in this study each analyze censored data, the McFadden R^2 remains a useful tool for comparison of goodness-of-fit across models.

Table 5. Multinomial logit model analysis results for grain marketing practices[1]

	Multinomial Logit Model					
	Parameter Estimates			Marginal Effects: $\partial E(Y_j)/\partial X$		
Variables[2]	$Ln(P_2/P_1)$	$Ln(P_3/P_1)$	$Ln(P_3/P_2)$	J = 1	J = 2	J = 3
Constant	−2.974	−0.974	2.000	0.410	−0.590	0.180
	*(1.024)	(1.020)	*(0.957)	*(0.184)	*(0.239)	(0.188)
IOWA	0.225	−2.717	−2.942	0.211	0.413	−0.624
	(0.375)	*(0.778)	*(1.155)	*(0.081)	*(0.106)	*(0.241)
TEXAS	0.564	0.051	−0.513	−0.066	0.130	−0.063
	(0.495)	(0.470)	(1.038)	(0.088)	(0.093)	(0.077)
CROPAC	0.203	0.192	−0.011	−0.039	0.024	0.015
	(0.165)	(0.165)	(0.880)	(0.031)	(0.030)	(0.027)
SCALEOPN	0.467	0.537	0.070	−0.098	0.042	0.056
	*(0.255)	*(0.264)	(0.971)	*(0.049)	(0.051)	(0.049)
SPECIALIZED	1.160	0.584	−0.612	−0.175	0.208	−0.033
	*(0.335)	(0.346)	(1.008)	*(0.070)	*(0.069)	(0.057)
EXPERIENCE	−0.073	−0.354	−0.282	0.039	0.029	−0.067
	(0.147)	*(0.154)	(0.866)	(0.027)	(0.030)	*(0.031)
RISKATT	0.247	0.212	−0.035	−0.045	0.032	0.014
	(0.286)	(0.305)	(0.994)	(0.052)	(0.057)	(0.055)
STORCM	0.493	0.075	−0.419	0.061	0.109	−0.049
	(0.336)	(0.344)	(1.018)	(0.060)	(0.069)	(0.063)
STORFM	0.378	−0.380	−0.758	−0.009	0.141	−0.133
	(0.385)	(0.362)	(1.024)	(0.066)	*(0.078)	*(0.066)
DMNDCNTR	0.015	0.448	0.433	−0.040	−0.056	0.096
	(0.292)	(0.302)	(0.994)	(0.052)	(0.059)	*(0.057)
CROPINS	0.778	0.883	0.104	−0.162	0.072	0.090
	*(0.337)	*(0.347)	(1.027)	*(0.065)	(0.072)	(0.069)
n	351					
McFadden Pseudo R^2[3]	0.108					
Log likelihood	−331.94					
Restricted Log likelihood	−372.26					
Model chi-square[4]	80.64					
Level of significance[5]	(0.0001)					

[1] Standard errors reported in parentheses. An asterisk indicates statistical significance of $\alpha = 0.10$ or smaller level. Subscripts in these models represent the following marketing practice categories as defined in table 2: #1 = cash marketings; #2 = forward contract marketings; and #3 = futures/options plus forward contract marketings.

[2] See footnote #2 in Table 4 for definitions of explanatory variables.

[3] McFadden's Pseudo R^2 is given by one minus the ratio of the unrestricted to restricted log likelihood function values.

[4] The chi-square test evaluates the null hypothesis that $\beta_1 = \beta_2 \ldots = \beta_k = 0$.

[5] Numbers in parentheses are associated chi-square probabilities.

nificantly lower probability of using futures/options (Category #3) than either cash marketing (Category #1) or forward contract (Category #2) oriented marketing practices. The marginal effect results of the MNL model indicate that IOWA respondents make greater use of cash market (Category #1) and forward contract (Category #2) oriented marketing practices and less use of future/options (Category #3) than those from Kansas. The lack of significance of the TEXAS variable shows that Texas survey respondents do not differ significantly from Kansas respondents in terms of marketing practices.

As crop enterprise acreage (CROPAC) increases, the percent of cash marketings decline

Table 6. Predicted vs. survey outcomes for the multinomial logit model

Categories	Predicted Outcomes from Model Results (percent) (A)	Actual Outcomes from Survey Results (percent) (B)	Difference (percent) (A − B)
#1. Cash Market Oriented Marketing Practices	21.1 percent	27.1 percent	−6.0 percent
#2. Forward Contract Oriented Marketing Practices	31.9 percent	36.5 percent	−4.6 percent
#3. Futures/Options Oriented Marketing Practices	47.0 percent	36.5 percent	10.5 percent
Totals	100 percent	100 percent	

while the percent of forward contract marketings increases as indicated by the Tobit CASHIX and FCNTIX indices model results. The Tobit CASHIX model also shows that as the size of respondents' farming operations becomes larger relative to others in their county or region (SCALEOPN), there is a decline in their proportion of cash market transactions. These Tobit model results are consistent with the MNL model results for SCALEOPN. As the relative scale of a respondent's farming operation within a locale increases, the MNL model shows that there is an increase in the probability of his or her using both forward contract (Category #2) and futures/options (Category #3) as opposed to cash market oriented marketing practices (Category #1). The marginal effect results of the MNL model also show that cash market oriented practices (Category #1) decrease as the relative size of a respondent's farming operation increases. These findings imply that as farm size increases in both absolute and relative terms, the use of cash market oriented marketing practices tends to decrease in comparison to forward contract and futures and options oriented marketing practices. These results are consistent with the authors' pre-survey hypothesis and the results of previous studies regarding the existence of economies of size in futures and options use for larger farms.

Specialization in grain production (SPECIALIZED) has the effect of decreasing the proportion of cash market transactions and of increasing the proportion of forward contract marketings as reported in the Tobit CASHIX and FCNTIX models, respectively. These findings are consistent with those from the MNL model which show that specialization in grain production leads to an increase in the probability of using forward contract (Category #2) as opposed to cash market (Category #1) oriented marketing practices. The marginal effect results of the MNL model indicate that specialized grain producers make significantly greater use of forward contract (Category #2) and less use of cash market (Category #1) oriented marketing practices than diversified grain and livestock producers. By implication, these results also show that diversified grain and livestock operations in this survey tend to make greater use of cash market transactions. These findings are consistent with the authors' pre-study hypotheses and are not inconsistent with previous studies oriented toward forward pricing practices, which found that increased livestock enterprise activity tended to decrease the amount of grain that was forward priced by either forward contracts or hedging.

As years of farming experience (EXPERIENCE) increase, respondents make less use of futures and options marketings as indicated by the Tobit FUTOPNIX index model results. In addition, the MNL model results show that as years of farming experience increase, respondents have a lower probability of using fu-

tures/options (Category #3) as opposed to cash market (Category #1) oriented marketing practices. The marginal effect results of the MNL model indicate that more experienced grain producers make less use of futures/options (Category #3) oriented marketing practices. These results are consistent with those from earlier forward pricing oriented studies and are in agreement with the authors' pre-study expectations.

The willingness of respondents to accept more risk in their marketing practices (RISKATT) leads to no significant effects upon their use of cash market, forward contract, or futures and options marketings as indicated by the results of both the Tobit and MNL models. Other studies (i.e., Goodwin and Schroeder) have found that respondents with a stated preference for risk make greater use of forward contract oriented marketing practices. It is notable that as respondents' willingness to accept price risk increases, there are no indications that they are more or less willing to use futures and options marketing practices. This lack of significant findings regarding the effect of risk attitude on futures and options for preharvest and postharvest marketing is consistent with the generally mixed results of other studies regarding the effect of income risk preferences on preharvest marketing practices.

The use of commercial grain storage (STORCM) has the effect of decreasing the percentage of futures and options marketings as shown by the Tobit FUTOPNIX model results. The MNL model analysis shows that the use of commercial grain storage has no significant effect on grain marketing practices. The use of on-farm grain storage (STORFM) leads to increased use of forward contract (Category #2) and decreased use of futures/options (Category #3) oriented marketing practices according to the marginal effect findings of the MNL model. These findings provide some support for the hypothesis that extensive use of commercial and on-farm storage will lead to decreased use of futures and options marketing tools. However, the result that forward contracting is increased by on-farm storage use is counter-intuitive. In addition, these results do not explicitly contradict the hypothesis that some marketers may avoid paying commercial storage charges by selling at harvest and buying call options.

Location near a major grain demand center (DMNDCNTR) leads to an increase in the use of futures and options (Category #3) oriented marketing strategies as shown by the marginal effects of the MNL model. These results provide no support for the hypothesis that location near a major grain demand center will lead to increased use of cash and forward contract oriented marketing practices.

Use of either multi-peril crop insurance and/or crop revenue coverage (CROPINS) has the effect of decreasing the amount of cash market transactions, and of increasing the amount of forward contract and futures and options marketings as indicated by the Tobit CASHIX, FCNTIX and FUTOPNIX models. The MNL model results show that utilization of crop insurance increases the probability that respondents use both forward contract (Category #2) and futures/options (Category #3) relative to cash market (Category #1) oriented marketing practices. The marginal effect results of the MNL model also indicate crop insurance users make less use of cash marketing practices (Category #1). These results directly contradict the idea that crop insurance use leads to diminished use of forward contracts, futures and options marketing tools. Rather, they indicate that respondents who purchase crop insurance make greater use of these marketing tools than those who do not purchase crop insurance.

Summary and Conclusions

This analysis of a survey of Kansas, Iowa and Texas grain marketers finds that their grain marketing practices are affected by their personal and farm business-related characteristics. The focus of this study is to determine how individuals' characteristics impact their use of alternative cash, forward and other types of contracts, and futures and options oriented grain marketing tools through the preharvest, harvest and postharvest periods. Both two-limit Tobit and multinomial logit econometric models are used in the analysis. The

study results indicate some personal and business characteristics have significant impacts upon individuals' grain marketing practices. Significant factors include geographic location, both the absolute and relative size of crop acreage, grain enterprise specialization, years of farming experience, the use of commercial and on-farm grain storage, proximity to major grain demand centers, and the use of crop insurance.

The use of cash market oriented marketing practices is positively affected by geographic location (i.e., in southwest Iowa as opposed to Kansas or Texas) and years of farming experience (relative to futures and options use). Conversely, cash market oriented marketing practices are negatively affected by specialization in grain enterprises, use of crop insurance, average farm size and farm size relative to other farms in a local area. Use of conventional forward contracts and other types of grain marketing contracts are positively affected by geographic location (i.e., in southwest Iowa), average crop acreage, specialization in grain enterprises and use of on-farm storage. The use of futures and options is positively affected by crop insurance use, proximity to grain demand centers, and relative farm size (in comparison to cash marketings). Futures and options use is negatively affected by geographic location, years of farming experience, and use of on-farm grain storage.

Among the most noteworthy results is the lack of impact of grain marketers' attitudes toward managing price risk upon their marketing practices. Increased willingness to accept price risk has no effect upon farmers' use of alternative types of marketing practices in this analysis. Other factors not identified in this study may influence this result, such as a farm marketer's working familiarity with futures and options, the necessity of dealing directly with commodity brokers and managing margin accounts, and the increased investment in time and resources to monitor futures and options market activity. It may be beneficial for future studies to focus on how the characteristics of the marketing alternatives themselves as well as personal and farm business characteristics affect decision makers' choices of marketing practices. Another important finding regards crop insurance and its positive relationship with the use of forward contracts and futures and options use. This finding has implications in the public policy debate about how crop insurance use affects farmers' management and marketing practices. The finding that the use of commercial and on-farm storage leads to a decrease in futures and options oriented marketing practices is a unique contribution of this study.

The findings of this study are of practical importance to farmers and agribusiness, as well as to applied researchers and extension educators. Agricultural producers may be able to make more objective and profitable grain marketing decisions as a result of an improved understanding of their grain marketing practices and tendencies. These results may be useful as a guide to future studies as well as to the development of more effective extension grain marketing educational programs.

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