Explaining Differences in Prices Received by Farmers: Testing Theory Based on Actual Farmer Transactions

Lewis T. Cunningham III, B. Wade Brorsen, and Kim B. Anderson

Lewis Cunningham is Graduate Student (cunninl@okstate.edu), Wade Brorsen is a regents professor and Jean & Patsy Neustadt chair (brorsen@okstate.edu), Kim Anderson is a professor and extension economist (anderso@okstate.edu), Department of Agricultural Economics at Oklahoma State University.

Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Denver, Colorado, July 1-4, 2004

The efficient market theorem states that market prices reflect all available information (Fama). Therefore, in the absence of transaction costs expected returns will be the same no matter when grain is priced. The only theoretical way that farmers can out perform the market is to get information first or to have superior analytical ability. More than likely, farmers will not have either. If the theory does not hold then large producers would be justified in purchasing private information to receive a higher price.

Producers have a number of choices of what to do when it comes to marketing their wheat. Producers can either sell before harvest, at harvest, or after harvest. There is little known on how producers make their decisions, because few studies have examined actual producer data (McNew and Musser; and Slusher). Brorsen and Irwin call for researchers to start making use of actual data to understand what producers are doing. Only through the use of actual data can researchers measure the effectiveness of past research and discover new areas of economics that need to be explored.

Behavioral finance is a fairly recent concept in finance literature. Behavioral finance is the study of actual human actions and how humans behave in the market place. It focuses on how people make decisions based on factors that are not directly market related or for other personal reasons that make people believe that these factors do determine the future or current price. Barber and Odean (2000; 2001) found that overconfidence leads to bad marketing decisions and typically men carry this trait. Odean found irrational behavior with stock portfolios, Wang found it in the futures market, it has been found in wheat markets (Brorsen; Brorsen and Anderson), and corn and soybean markets (Irwin, Martines-Filho, and Good). Shiller explains these different behaviors through classifying certain types of behavior in to certain categories. Harwood et al. claim people act differently based on how they view risk. People have biases and certain biases lead them to making decisions that sometimes results in outcomes that are not what they expected (Kahneman). Zulauf and Irwin have come up with the most complete categorization of marketing strategies. He categorizes them under routine, systematic, strategies based on individual-generated forecasts, and strategies based on market-generated forecasts. Behavioral finance may appear to disprove the efficient markets hypothesis, but as people make their mistakes they will change them and use mechanical marketing strategies instead of psychological (Brorsen). These behavioral decisions can lead to certain marketing strategies that farmers will follow. Producers can change these behavioral fallacies through research that determines what causes differences in net price per bushel between producers. At this time it is not important to understand why producers make these decisions, but to recognize what decisions are causing the differences in net price realized by producers. This article does not focus on categorizing the people themselves, but on what factors explain the differences in net price received by producers.

Through examining the actual farmer data, certain details that differentiate producers can be investigated. These differences in marketing decisions could be related to gender, volume a producer markets, or other cash marketing characteristics. Through studying producer marketing decisions certain mistakes farmers make can be identified. For example, a mistake a farmer could be making is that they could be holding their wheat so long that storage costs consume all their profits. The behavioral finance literature would describe farmers as exhibiting myopic loss aversion when they store past the economically optimal point in order to postpone selling at a loss.

Recent studies with gender have shown that there are differences in how men and women approach economic decisions. Barber and Odean (2001) found that men often trade stocks more than women and thus men receive lower returns than women. It was also found that men exhibited overconfidence in believing that they could out perform others through their own decisions. This study was performed on common stocks and perhaps a similar scenario could be true for marketing cash grain.

This article first determines if differences in net price per bushel received by wheat producers on the cash market can be explained by (a) total annual volume sold by the producer, (b) frequency of weekly sales, (c) average week of sales after harvest, and (d) gender. Then the article measures differences in marketing styles by gender for average week of sales after harvest and frequency of sales.

Data

Data are from three grain elevators located in the north, south, and center of western Oklahoma. The data are from the harvest of 1992 through the spring of 2001 (nine crop years). The data contain all individual transactions of wheat sales at each elevator. Each transaction has the seller, number of bushels, price per bushel, and date. However, each seller's name was not always spelled correctly and some sellers operated under a variety of names. To remedy this problem, elevator managers were asked to identify the primary marketing decision maker and their gender for each sale. This was done by giving the elevator managers a spreadsheet containing the seller names, and then they identified the primary decision maker for each seller. In table 2, the descriptive statistics by gender and elevator are given.

Table 1. Descriptive Statistics for Each Elevator

Descriptive Statistics	South	Central	North
Average price	3.41	3.32	3.39
Average net price	3.35	3.12	3.17
Harvest price	3.47	3.20	3.39
Number of observations	14434	7089	6389
Percent harvest sales	58 %	19 %	14 %
Average week	5	16	18

Table 2. Gender Descriptive Statistics by Elevator

	Gender	# Producers	Mean Week Wheat Sold after Harvest	Mean Number of Weekly Transactions	Mean Number of Bushels Sold	Total Number of Bushels Sold
South	Male	154	8.66	2.05	7.64	61.90
	Female	12	8.43	1.58	3.53	28.07
Central	Male	214	14.47	2.46	4.87	37.86
	Female	70	16.97	1.51	2.17	16.62
North	Male	129	16.87	3.47	9.90	67.23
	Female	8	16.14	2.73	4.88	36.76

A number of other data errors were also corrected, and some transactions were deleted from the data set. First, the northern elevator is missing transactions from 5/1/98 to 6/1/99. Second, if the price per bushel was less than $1.50, it was deleted. The reason for deletion was that the transaction was probably for wheat cleanings or a data entry error. If the price per bushel was greater than $10.05, it was deleted. The reason for deletion was that the transaction was probably a data entry error. The $10.05 amount is the high cut off, because it was the lowest extremity on the high side of price. The other prices that were high were similar or near other prices around the same date. Another deletion within the data set included, transactions that had negative bushels. These transactions were deleted because they identify purchases rather than sales. If an elevator manager suggested the transaction be deleted, then it was deleted as well as transactions with missing data (such as a missing name, bushels, or price). Data are still included when the elevator manager could not easily determine a decision maker for that seller name. It is assumed that the same seller was the decision maker all 8 years for transactions where a name was included but decision maker could not be determined.

Many of the transactions for decision makers happen on the same day or on days close to each other. Since the number of transactions is a variable being examined, the transactions have been lumped into weeks. Thus, if there were 24 transactions within a specified seven-day period[1], they would count as one transaction. Therefore if a seller has X transactions, this means the seller traded in X different weeks.

Local harvest dates differ. The southern elevator's harvest is assumed to be May 25 thru June 21, the central elevator's harvest is assumed to be June 1 thru June 27, and the northern elevator's harvest is assumed to be June 12 thru July 7. Storage costs and interest costs used are determined the same way for all elevators. The storage cost, set by the elevators, averages $.00085/day, which is $.0255/month. The interest cost is calculated at the prime rate for that year plus 2%. The prime rate is the prime rate charged by banks in June for that year, quoted from the Kansas City Federal Reserve Bank. Multiplying the interest rate by June wheat price and then dividing the product by 365 days gives interest cost per day. The June wheat price is the June price quote for wheat in Oklahoma for that year from the National Ag Statistics Service. The cost of

[1] There are weekend sales during harvest.

carry is then figured per day. Table 3 shows the interest, storage, and combined carrying costs per day.

Table 3. Interest, Storage, and Carrying Costs

Year	Interest Rate	Wheat Price $/bu	Interest Cost/day cents/day	Storage/day cents/day	Cost of Carry/day cents/day
92	8.50%	$3.27	.075	.085	.160
93	8.00%	$2.54	.070	.085	.155
94	9.25%	$3.07	.081	.085	.166
95	11.00%	$3.88	.096	.085	.181
96	10.25%	$5.48	.090	.085	.175
97	10.25%	$3.28	.090	.085	.175
98	9.75%	$2.62	.085	.085	.170
99	11.50%	$2.31	.101	.085	.186
00	9.00%	$2.50	.079	.085	.164

The selling prices net of interest and storage costs are

$$netprice_{itd} = P_d - d\left(\frac{P_0(z_t + .02)}{365} + S_d\right) \quad (1)$$

where i is the producer, t is the year, d is the number of days after harvest, $netprice_{itd}$ is the net price, P_d is the price received on day d, P_0 is the harvest price for that year, z_t is the prime interest rate for that year, and S_d is the storage cost/day.

Procedures

The procedures include first a linear regression to determine if differences in net price per bushel received by western Oklahoma wheat producers on the cash market can be explained by (a) total annual volume sold by the producer, (b) frequency of weekly sales, (c) average week of sales after harvest, and (d) gender, and second regressions to determine if gender differences exist for each of these independent variables.

Regression Model

The following regression is estimated using maximum likelihood:

$$(2) \qquad lprice_{it} = \beta_0 + \sum_{j=1}^{8} \beta_{1j} year_{jt} + \beta_2 tvol_{it} + \beta_3 awk_{it} + \beta_4 frequency_{it} + \beta_5 gender_i + \varepsilon_{it}$$

where i is the producer, t is the year, $lprice_{it}$ is the log of $aprice_{it}$ the bushel-weighted net price for producer i in year t, $year_t$ is a dummy variable for each year, $tvol_{it}$ is the total volume producer i sells in year t, awk_{it} is the yearly bushel-weighted mean weeks after harvest when wheat was sold by producer i, $frequency_{it}$ is the number of different weeks producer i sold wheat in year t, $gender_i$ is a dummy variable that accounts for producer i being male or female, and ε_{it} is the error term.[2] The plots of error terms versus awk_{it} for the OLS model with $aprice_{it}$ as function of $year_t$, $tvol_{it}$, awk_{it}, $frequency_{it}$, and $gender_i$ exhibited heteroskedasticity with variance increasing for either high or low values of awk_{it}. The plots are shown in Figures 1. The plots exhibited the need for a quadratic adjustment to the model. ε_{it} is defined as

$$(3) \qquad \varepsilon_{it} \sim N(0, \sigma_i^2)$$

and the variance of ε_{it} (σ_i^2) is defined as

$$(4) \qquad \sigma_i^2 = \exp[\mathbf{Z_i \alpha}]$$

$$(5) \qquad \mathbf{Z}_i = [1 \quad awk_{it} \quad awk_{it}^2 \quad tvol_{it} \quad frequency_{it} \quad gender_i]$$

to adjust for heteroskedasticity.

Two other misspecification tests, tests for random effects and nonlinearity, will be used to examine the model. Random effects need to be tested because the regression uses

---

[2] Number of transactions, $trans_{it}$, and transaction standard deviation, $transsd_t$, were also considered but were not significant and were dropped from the model since theory to support their inclusion was weak.

panel data and there is a possibility that some omitted variables may be constant over time, but differ between producers. To measure this, random effects are tested using a maximum likelihood test. Tests for nonlinearity will also be done as another misspecification test. Two nonlinearity tests were done. The first test was done by adding the log term of the $tvol_{it}$ variable and squared term of the awk_{it} variable and testing the new variables significance. However, no significant results were found. The second test is a reset test done by adding the predicted value of the dependent variable into the regression. This test showed more conclusive evidence. The null hypothesis is H_o: $\gamma = 0$ and the alternative is not H_0. If H_o is rejected then there is nonlinearity.

The awk_{it} is calculated as follows

$$awk_{it} = \sum_{w=1}^{48} (tvol_{itw} wk_{itw}) / tvol_{it} \tag{6}$$

where w is the week[3], $tvol_{itw}$ is the bushels sold by producer i in year t and week w, wk_{itw} is the weeks after harvest that the transaction occurred, and $tvol_{it}$ is total bushels sold by producer i in year t.

The dependent variable in (2) is the log of annual bushel weighted price by producer, $lprice_{it}$. The annual bushel-weighted mean price is

$$lprice_{it} = \log(\sum_{d=1}^{d=365} (bu_{itd} netprice_{itd}) / tvol_{it}) \tag{7}$$

where i is the producer, t is the year, d is the day, bu_{itd} is the bushels sold that day by a producer, and $tvol_{it}$ is yearly total volume of bushels sold per producer.

[3] Based on four-week harvest, so 48 weeks in a marketing year.

Gender Regression Models

For this procedure two regression models will be run to measure differences between genders. The first regression has $frequency_{it}$ as a function of $gender_i$ and $tvol_{it}$, and the second has awk_{it} as a function of $gender_i$ and $tvol_{it}$. These regressions will help to determine if women and men differ in their marketing styles of choosing when and how often to sell. The first regression is

(8) $$frequency_{it} = \beta_0 + \sum_{j=1}^{8} \beta_{1j} year_{jt} + \beta_2 gend_i + \beta_3 tvol_{it} + \varepsilon_{it}$$

and the second regression is

(9) $$awk_{it} = \beta_0 + \sum_{j=1}^{8} \beta_{1j} year_{jt} + \beta_2 gend_i + \beta_3 tvol_{it} + \varepsilon_{it}.$$

Depending on the sign and the significance of the $gender_i$ variable, will determine if men or women differ in their marketing styles with respect to time and frequency.

Results

Regression Model

The null model likelihood test revealed that the model adjusted for heteroskedasticity gave a more significant estimate of the dependent variable. The adjustment for heteroskedasticity was accomplished through shifting the variance. The variance is defined through equations (3), (4), and (5). The null hypothesis was tested using the χ^2-distribution where H_0: $\alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$, and reject H_0 if Likelihood Ratio Statistic (LR) > χ^2. Table 4 shows the LR statistics and the α's for equation (4). For each region H_0 is rejected at the 99% level, thus showing the model adjusted for heteroskedasticity is a suitable model.

Table 4. Estimates of the Multiplicative Variance Equation by Elevator

Alphas	Explanatory Variable	Southern	Central	Northern
Intercept		.0585	.0160	.0194
Average Week Sold	awk_{it}	-.0338	-.1283	-.1656
Average Week Sold Squared	awk_{it}^2	-.0010	.0035	.0039
Total Volume	$tvol_{it}$	-.0111	-.0118	.0001
Number of Transactions	$frequency_{it}$	-.0978	-.1042	-.0821
Gender	$gender_i$	-.1342	-.0092	-.0715
LR Statistic[a]	χ^2	80.82	344.32	210.35

[a] The null hypothesis

The null hypothesis for the test of nonlinearity is H_o: $\gamma = 0$ and the alternative is not H_0. The independent variable that is tested is predicted y^2. The p-value results for the test for nonlinearity for the southern, central, and northern elevators are .6323, .4612, and .4583 respectively. When the predicted y^2 term is added to the equation, it is not found to be significant. Thus fail to reject the null hypothesis.

The model was also estimated using random effects for each producer. The test illustrated no random effects and therefore provides evidence that by including or excluding a producer will not affect the outcome of the regression.

Estimations of the regression in equation (2) that is defined by (3), (4), and (5), are shown in tables 5, 6, and 7. The tables show that each elevator has considerably different results for the regression. The $tvol_{it}$ estimate is only significant at the southern elevator and is negative. This most likely is purely coincidental because the other elevators did not exhibit this same occurrence. The only estimate that is significant at all the elevators is that which is related to time and storage, awk_{it}. This estimate is negative;

thus illustrating that the longer a producer stores, the lower the expected price received. This theory of negative returns to storage in areas close to the gulf holds consistent with past literature. Benirschka and Binkley claimed that areas close to the gulf should expect low returns to storage because of transportation costs increase as distance from ports increase. As a result storage costs, or opportunity costs, decline with distance. Number of sales, $frequency_{it}$, is not significant at any of the elevators. The signs for this estimate also differ between the elevators. It can be deduced that having a large are low number of sales per year does not have an effect on the expected price received. The final estimate is for gender, $gender_i$. The estimate does not suggest there to be any variation of expected price between women and men.

Table 5. South Regression Model with $lprice_{it}$ as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	1.1864	39.86	<. 0001
1992	.0536	2.23	.0256
1993	.0278	1.15	.2519
1994	.0288	1.18	.2400
1995	-.0136	-.57	.5677
1996	-.0700	-2.96	.0031
1997	.0247	1.05	.2956
1998	.0373	1.53	.1271
1999	.0383	1.46	.1454
2000	0		
TVol	-.0008	-6.02	<. 0001
Awk	-.0059	-11.43	<. 0001
Frequency	.0042	1.83	.0668
Male[4]	-.0210	-.85	.3930

[4] Male represents the gender dummy variable for a producer to be male.

Table 6. Central Regression Model with *$lprice_{it}$* as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	.9261	134.53	<. 0001
1992	.2029	27.16	<. 0001
1993	.1486	20.93	<. 0001
1994	.2753	37.42	<. 0001
1995	.5901	84.44	<. 0001
1996	.5159	69.30	<. 0001
1997	.1984	27.04	<. 0001
1998	-.0259	-3.62	.0003
1999	-.1890	-24.20	<. 0001
2000	0		
TVol	-.0001	-.57	.5657
Awk	-.0017	-9.51	<. 0001
Frequency	-.0000	-.04	.9693
Male	-.0019	-.46	.6427

Table 7. North Regression Model with *$lprice_{it}$* as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	.9566	83.67	<. 0001
1992	.1700	18.68	<. 0001
1993	.1625	19.90	<. 0001
1994	.2777	34.56	<. 0001
1995	.6078	80.49	<. 0001
1996	.4667	63.53	<. 0001
1997	.1765	24.37	<. 0001
1998	0		NA
1999	-.2166	-28.69	<. 0001
2000	0		
TVol	.0002	1.52	.1300
Awk	-.0014	-5.67	<. 0001
Frequency	-.0001	-1.29	.1974
Male	.0004	.04	.9661

Past literature in behavioral finance found that women and men tend to react differently in financial markets. If they are behaving differently in cash wheat markets, there does not appear to be any financial benefit related to net price. This supports the theory of efficient markets, because both genders showed receive an average price over time. Neither gender outperforms the other; consequently no gains are found from fighting the markets, with respect to enhancing net price. The gender regression models are examined in the next section to see if gender differences exist with regard to number of sales, $frequency_{it}$, and timing of sales, awk_{it}.

Gender Regression Models

The descriptive statistics in table 2 show the disbursement of gender between elevators and their means with respect to time of sales, frequency, and bushels sold. There are less than 10% of producers that are women at the southern and northern elevators. However there are 25% of the producers at the central elevator. Because there is a higher population of women at the central elevator there should be more emphasis given to this elevator when looking at gender differences.

The regression results for the regression with $frequency_{it}$ as the dependent variable and volume and gender as the independent variables are given in tables 8, 9, and 10. The total volume sold each year by producer, $tvol_{it}$, is significant at all the elevators and positive. Essentially this means that the more a producer has to sell the more often they will sell. The gender variable is not consistent between the elevators. However, it is positive at all elevators and significant at two. At the central elevator, where there are more women producers, women have fewer sales. The reason women sell less times in a year can be revealed in table 2, where the table for the central elevator shows that men have a higher volume of bushels sold.

Table 8. South Model with *frequency*$_{it}$ as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	1.1131	5.06	<. 0001
1992	.5733	2.82	.0049
1993	.0891	.43	.6640
1994	.1862	.93	.3538
1995	.7480	3.77	.0002
1996	.3239	1.62	.1064
1997	1.0012	4.99	<. 0001
1998	.1668	.82	.4141
1999	.0578	.27	.7836
2000	0		
Male	.4441	2.52	.0120
TVol	.0271	10.95	<. 0001

Table 9. Central Model with *frequency*$_{it}$ as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	.6502	4.13	<. 0001
1992	.6248	3.25	.0012
1993	.5535	2.98	.0029
1994	.6202	3.31	.0009
1995	1.4830	8.11	<. 0001
1996	.6320	3.41	.0007
1997	.6980	3.79	.0002
1998	.3583	1.96	.0499
1999	.0728	.38	.7023
2000	0		
Male	.6233	6.19	<. 0001
TVol	.1425	22.04	<. 0001

Table 10. North Model with *$frequency_{it}$* as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	2.0180	4.91	<. 0001
1992	-.3139	-.79	.4291
1993	-.0820	-.22	.8221
1994	.0656	.18	.8545
1995	.6993	2.10	.0360
1996	.6846	2.04	.0416
1997	-.0726	-.22	.8262
1998	0		NA
1999	-.3576	-1.06	.2915
2000	0		
Male	.0147	.04	.9662
TVol	.1138	27.25	<. 0001

The regression with average week of sale after harvest, awk_{it}, as the dependent variable and gender and volume as the independent variables is shown in tables 11, 12, and 13. The volume variable is again significant and positive at all the elevators. This can be interpreted as the higher the volume a producer sells, the later the average week they market their wheat will be. This is similar to the frequency variable. The more wheat a producer markets during a marketing year, the more transactions they will have and the later the bushel weighted average week they sell in will be. The gender variable is not as simple to interpret. At the northern and southern elevators it is positive and insignificant, yet the central elevator is negative and significant. Because there are a higher percentage of women marketing wheat at the central elevator, it will be used. The negative coefficient is interpreted as men are selling earlier than women. Which means women are storing longer. However, this contradicts the volume theory where a producer will store longer if they have a larger volume of wheat for that marketing year, because women at this elevator have a smaller average volume of wheat and sell wheat in fewer weeks.

Table 11. South Model with awk_{it} as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	7.9047	4.78	<. 0001
1992	-.5951	-.39	.6977
1993	-2.3726	-1.54	.1243
1994	.4539	.30	.7638
1995	-.9891	-.66	.5080
1996	-.7059	-.47	.6396
1997	-.3229	-.21	.8305
1998	2.6718	1.74	.0821
1999	4.9011	3.10	.0020
2000	0		
Male	1.2403	.93	.3505
TVol	-.0832	-4.47	<. 0001

Table 12. Central Model with awk_{it} as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	13.8132	13.40	<. 0001
1992	2.4918	1.98	.0476
1993	2.0762	1.71	.0874
1994	2.8654	2.34	.0195
1995	1.4657	1.23	.2206
1996	4.2054	3.47	.0005
1997	2.4342	2.02	.0436
1998	3.4424	2.88	.0040
1999	6.6174	5.31	<. 0001
2000	0		
Male	-2.6374	-4.00	<. 0001
TVol	.0980	2.32	.0206

Table 13. North Model with awk_{it} as the Dependent Variable

Parameter	Estimate	t-value	Pr > |t|
Intercept	14.3574	7.94	<. 0001
1992	2.3391	1.34	.1807
1993	1.7098	1.07	.2866
1994	2.0110	1.28	.2014
1995	-.3151	-.22	.8289
1996	2.6199	1.78	.0762
1997	-2.6386	-1.81	.0700
1998	0		NA
1999	6.2177	4.17	<. 0001
2000	0		
Male	.6387	.42	.6765
TVol	.0703	3.25	.0012

Conclusion

There were two objectives to this article. First, to determine the extent to which time, gender, frequency of sales, and volume had on differences in net price received. Second to measure differences in market decisions with regards to time and frequency of sales between women and men. The obvious finding in this article from the regression relates to storage. From every regression, time appears to have a negative effect on price. This may only be true for Oklahoma wheat farmers because of their early harvest and their close proximity to the gulf. This is in agreement with Benirschka and Binkley because areas closer to the gulf should have negative returns to storage. However, it does appear to maintain that markets are efficient. It is imperative to realize that this anomaly could be a direct result of the cost of carry, or opportunity costs, which are used in this article.

Volume and frequency of sales were not significant in the regression, leading to the conclusion that they did not explain the differences in prices between producers. This means that a large farmer and small farmer should get the same price at the elevator and that spreading out sales should not increase or decrease the net price a producer will receive. It is interesting that there appears to be some gender differences, but it is hard to determine to what extent it is and how widespread. It also can be assumed from the gender regressions that the larger a producer is the later they will sell and the higher the number of weekly transactions, however this was not one of the focuses of the article.

Barber and Odean found that men trade more than women in financial markets. This article found it also to be true for wheat cash markets to a certain extent; however, this could be related to the volume the producer market for that year. It would be interesting to know if this might also be a factor in the stock market. They also found men to be more overconfident, choosing to follow their own marketing styles trying to beat the market. However, much of the literature suggests for Oklahoma wheat producers to market their wheat at harvest, and at the central elevator it appears that men are selling earlier.

In conclusion, the article agrees with past literature that wheat marketed closer to harvest should receive a higher net price. But, this may not be true for other years or other carrying costs. There does not appear to be any other factors explored in this article that would explain the differences in prices received by producers. There are some differences between men and women on how they market their wheat, but it does not seem to account for price differences between producers. Neither gender outperforms the other with respect to net price. This model represents historical data at three elevators and should only be used as an aid in assisting the decision-making process. It is not meant to predict future prices, but used as a historical measure of past influences in net price

References

Barber, B.M., and T. Odean. "Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment." *The Quarterly Journal of Economics* 116(February 2001): 261-292.

Barber, B.M., and T. Odean. "Trading Is Hazardous to Your Wealth: The Common Stock Performance of Individual Investors." *The Journal of Finance* 55(April 2000): 773-806.

Benirschka, M. and J.K. Binkley. "Optimal Storage and Marketing Over Space and Time." *American Journal of Agricultural Economics* 77(August 1995): 512-524.

Brorsen, B.W. "Economically Rational Marketing Strategies." *Visions* 73(2000): 9-12.

Brorsen, B.W., and K. Anderson. "Actual Farmer Market Timing." Paper presented at the NCR-134 Conference, St. Louis, MO, 22-23 April 2002.

Brorsen, B.W., and S.H. Irwin. "Improving the Relevance of Research on Price Forecasting and Marketing Strategies." *Agricultural and Resource Economics Review* 25(April 1996): 68-75.

Fama, E.F. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance* 25(1970): 383-417.

Harwood, J., R. Heifner, K. Coble, J. Perry, and A. Somwaru. "Managing Risk in Farming: Concepts, Research, and Analysis." Washington DC: U.S. Department of Agriculture, Agricultural Economics Report No. 774, March 1999.

Irwin, S.H., J. Martines-Filho, and D.L. Good. "The Performance of Agricultural Market Advisory Services in Corn and Soybeans." Paper prepared for presentation at the 2003 Annual AAEA Meeting, Montreal, Canada, July 2003.

Kahneman, D., and M.W. Riepe. "Aspects of Investor Psychology." *The Journal of Portfolio Management* 24(Summer 1998): 52-65.

Kansas City Federal Reserve "Bank Prime Loan." Available at http://www.federalreserve.gov/releases/h15/data/m/prime.txt. Accessed on April 15, 2004.

McNew, K., and W. Musser. "Evidence of Farmer Forward Pricing Behavior." Working paper, Department of Agricultural and Resource Economics, University of Maryland, College Park, February 2000.

National Agricultural Statistics Service. "Agricultural Prices Monthly: Oklahoma Winter Wheat Prices 1995-2000." Available at http://usda.mannlib.cornell.edu/reports/nassr/price/pap-bb. Accessed on January 15, 2004.

National Agricultural Statistics Service. "Agricultural Statistics Data Base." http://www.nass.usda.gov:81/ipedb/. Accessed on January 15, 2004

Odean, T. "Are Investors Reluctant to Realize Their Losses?" *The Journal of Finance* 53(October 1998): 1775-1798.

Shiller, R.J. "Human Behavior and the Efficiency of the Financial System." *Handbook of Macroeconomics* 1(1999): 1305-1340.

Slusher, D.W. "The Relationship of Soybean Price Received to Marketing Alternative Selection and Farmer Characteristic for Northwest Indiana Farmers." MS Thesis, Purdue University, August 1987.

Wang, C. "The Behavior and Performance of Major Types of Futures Traders." *The Journal of Futures Markets* 23(2003): 1-31.

Zulauf, C.R., and S.H. Irwin. "Market Efficiency and Marketing to Enhance Income of Crop Producers." *Review of Agricultural Economics* 20(1998): 308-331.