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**Will Mandatory Price Reporting Improve Pricing and Production Efficiency
in an Experimental Market for Fed Cattle?**

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Abstract

Mandatory price reporting legislation will make available to the public on a weekly basis information on terms of trade for forward contracts. The new information will provide marketing intentions details that were previously unavailable to agents in the fed cattle market. An experiment was designed to assess the potential impacts of this new information on price discovery and production efficiency. Results suggest that the proposed new information will reduce price level, reduce price dispersion, and improve production efficiency. Prices may be reduced as information risks are reduced for both buyers and sellers in the fed cattle market. This result may not be popular among sellers in the market

Introduction

The evolution from centralized auction trading to private negotiations has been a source of interest and concern regarding price discovery in cattle markets (Koontz and Purcell). Change has resulted in less information available to market agents because terms of trade can be private. Moreover, information from centralized trading may not reflect market conditions if the volume of transactions is reduced. The USDA estimates that under the current market news reporting program 35 to 40 percent of cattle transactions are not reported (USDA AMS).

An amendment proposed to the Agricultural Marketing Act of 1946 in September of 1999, commonly referred to as “Mandatory Price Reporting,” has been passed in response to these issues (USDA AMS). Information on forward contract terms of trade for fed cattle transactions will now be provided to the public on a weekly basis. The impacts of this new information on price discovery and efficiency in fed cattle markets are not known. Research regarding the impacts of mandatory price reporting can potentially improve policy prescription and implementation so that public resources are allocated efficiently, as well as help market participants better adjust to this legislation.

The objectives of mandatory price reporting are to be achieved through the reporting of the information from federally inspected cattle processing facilities that slaughtered an average of at least 125,000 head annually for the years 1994-1998. Weekly reporting shall include the following information applicable to the prior slaughter week, and is required to be given on the first reporting day of each week: “The quantity of cattle purchased through forward contract that were slaughtered... The quantity, basis level [and price series to be used], and delivery month for all cattle purchased through forward contracts that were agreed to by the parties...”(U.S. Senate).

The weekly forward contract information provides marketing intentions knowledge previously unavailable to actors in the fed cattle market. Fed cattle marketings by feedlots should respond to this type of information. Volume of cattle sold on the cash market, timing of marketings, and weights of cattle marketed could all be impacted by this information. The objective of this research is to determine the impact this new information will have on price level, price variability, and production efficiency in the fed cattle sector.

The level of concern regarding price discovery in cattle markets and the costs associated with implementation of this policy warrant ex-ante evaluation of this legislation. Policy makers as well as cattle feeders and meat packers want to know how mandatory price reporting will affect the fed cattle market environment. Will this new information affect competition in the market? Will it change the bargaining power of buyers or sellers, thereby affecting price discovery? Will the potential change in marketings affect price variability, cattle weights, or price levels? This knowledge could help policy makers and the USDA AMS adjust implementation of the legislation. Market participants could develop marketing strategies to better deal with the changes brought about by this information from mandatory price reporting.

Traditional methods using secondary data require a policy to be in place for a significant length of time before impacts can be estimated. A laboratory market, which provides incentives for participants to exhibit behavior consistent with real world phenomena, allows different parameters to be controlled, observed, and analyzed. For these reasons, the Fed Cattle Market Simulator (FCMS) used by Anderson et al. and developed at Oklahoma State University provides a means to test our hypotheses. This research is an extension of Anderson et al. work which examined the effects of reducing public information in fed cattle markets. Transactions data from experiments incorporating forward contract information to be provided under mandatory price reporting will be analyzed using econometric models. These models evaluate transaction prices, price variability, and the optimal timing of marketings as indicated by cattle weights under the different experimental treatments.

Review of Studies Evaluating the Impact of Market Information

The efficiency of a market in discovering price is largely affected by the information available to market actors. Grossman and Stiglitz indicate that an increase in the quality of information will increase the information content of prices. Stigler indicates that price dispersion can be a result of ignorance on the part of market actors.

Research in agricultural markets suggests that information can affect price discovery and price variability. Colling and Irwin found that live hog futures prices adjusted to unanticipated information in the USDA *Hogs and Pigs* reports. Colling, Irwin and Zulauf indicated that nearby pork belly and live hog futures prices were significantly affected by the release of the USDA *Cold Storage* report. Grunewald, McNulty and Beire reported that live cattle futures prices responded to unexpected information in USDA *Cattle on Feed* reports. All three of the above

mentioned studies used analyses aimed at testing the efficiency of the futures market in incorporating information in government reports. Given that prices were impacted by unanticipated information, the authors conclude the reports do in fact contain important information, and they indicate these reports fulfill their public policy mission.

Research in financial markets suggests that the transparency of the market (i.e., public disclosure of trade and quote information) is important in market efficiency and price discovery. Bloomfield and O'Hara tested the effects of trade and quote disclosure on market efficiency using experimental laboratory currency markets. They conclude that trade disclosure increases informational efficiency of transaction prices. Flood et al. examined the effects of price disclosure in a continuous experimental multiple-dealer market. Public price queues were compared with bilateral quoting. Flood et al. conclude that higher search costs reduced trade volume and induced aggressive pricing strategies that increased the speed of price discovery in markets with bilateral quotes. Pagano and Röell investigated differing levels of transparency in several market types. They conclude that greater transparency generated, the lower trading costs for uninformed traders. Overall, the above research indicates that increased information reduces risk or costs for market actors as they form price expectations and discover prices.

The above studies focus primarily on the efficiency of futures or stock prices when incorporating information rather than examining price impacts in cash markets associated with new information. Anderson et al. examined specifically how a reduction in public cash market information affected fed cattle markets. They concluded that reducing public information increased price variance and decreased production efficiency for fed cattle. While the research by Anderson et al. provides an experimental and econometric framework with which to achieve

our research objective, they do not specifically address the impact of marketing intentions data on fed cattle prices.

Theoretical Model of Bilateral Negotiation

An adaptation of the model reported by Menkhaus et al. using Robison and Barry's expected value-variance (EV) provides a theoretical baseline for understanding the research problem. Fed cattle markets are typified by bilateral negotiation between an agent for the packer and an agent for the feedlot. This can be modeled in a private negotiation framework where price becomes a function of q , given there is one buyer and one seller for each transaction. As such the expected price for the seller is $E(p(q) + \omega + \varepsilon) = p(q)$, where ω and ε are random variables with expected values of zero and variances of σ_ω^2 and σ_ε^2 . The distributions of ω and ε are assumed to be such that price cannot be negative. The random variable ω represents the risk the seller faces associated with sunk costs incurred due to advanced production of the commodity, i.e., the seller risks losing all production costs if the commodity is not sold. The random variable ε represents the risk associated with reduced information, i.e., no forward contract information.

Under this price scenario, the expected profit for the seller is $E(\pi) = p(q)q - C(q)$ with variance $q^2\sigma_{\omega+\varepsilon}^2 = q^2\sigma_\omega^2 + q^2\sigma_\varepsilon^2 + 2q^2\rho\sigma_\omega\sigma_\varepsilon$, where ρ is the correlation between ω and ε . The certainty equivalent of profit for the seller is

$$(1) \quad \pi_{ce} = p(q)q - C(q) - (\lambda_s/2)(q^2\sigma_\omega^2 + q^2\sigma_\varepsilon^2 + 2q^2\rho\sigma_\omega\sigma_\varepsilon),$$

where λ_s is the Pratt-Arrow measure of risk attitude for the seller. The first-order conditions for the seller requires

$$(2) \quad MR_s = p'(q)q + p(q) = C'(q) + \lambda_s (q^2\sigma_\omega^2 + q^2\sigma_\varepsilon^2 + 2q^2\rho\sigma_\omega\sigma_\varepsilon) = MC_s$$

Expected profit for the buyer is $E(\pi) = R(q) - p(q)q$ with variance $q^2\sigma_\varepsilon^2$. The certainty equivalent

of the buyer's profit function is

$$(3) \quad \pi_{ce} = R(q) - p(q)q - (\lambda_B/2)(q^2\sigma_\varepsilon^2).$$

The first order condition for the processor/buyer requires

$$(4) \quad MR_B = R'(q) = p'(q)q + p(q) + \lambda_B (q\sigma_\varepsilon^2) = MC_B.$$

Both buyers and sellers incur risk due to the added cost associated with reduced information. The seller also has the additional cost of price risk resulting from production before the sale. The quantity traded in this scenario is expected to decline, and total surplus, and thus market efficiency, will be reduced relative to the purely competitive case with full information. The potential impact of increased information is uncertain from the model. The negotiated price will depend on the relative risk preferences of the buyer and seller and also on differences in the variances of price risk attributable to production before sale for the seller and price information risk for both the seller and buyer.

The theoretical model and intuition suggest that bargaining power plays a role in determining the level of price in this setting of private negotiation with less than full information. It can be argued that the buyer is in a stronger bargaining position than the seller as buyers must understand that sellers have the risk of losing the cost of production if produced cattle are not sold (Menkhaus et al.). This puts sellers at a disadvantage relative to buyers even in the case of full information. However, the reduced risk associated with more information may in fact improve the bargaining position of the seller, assuming that buyers may have more knowledge of forward contracts than sellers without mandatory price reporting. Due to the indeterminacy of impacts regarding the value of increased information from mandatory price reporting for forward contracted cattle, empirical analysis is required to address our proposed hypotheses.

Hypotheses

Lack of information is clearly a source of risk when market actors discover price. Mandatory price reporting seeks to reduce this risk in livestock markets by increasing the public information set. Specifically, the publicly reported information on terms of trade and intended delivery dates for forward contracted cattle could affect the timing of marketings, volume of cattle sold in the cash market, and cattle weights at the time of delivery. Several hypotheses are to be investigated in this study. The null hypotheses to be tested are:

- (1) H_0 : Increased information will not affect price level.
- (2) H_0 : Increased information will not decrease price uncertainty in fed cattle markets.
- (3) H_0 : Increased information will not affect productive efficiency in cattle feeding.

Experimental Design and Procedure

Participants in the forward contract information sessions of the study were recruited from the agricultural commodity marketing class at Colorado State University during Fall 2000 semester. The participants were paid based on profitability of their team.¹ This was done to insure the conditions of monotonicity, salience and dominance, which induced agent incentives consistent with economic theory are met (Friedman and Sunder). Two daylong experiment sessions were conducted which allowed participants to make transactions over a simulated period of 40 weeks where for 32 weeks forward contract information was provided. The first eight weeks were dropped from the analysis to allow for learning. The baseline information observations came from previously conducted trading sessions. The baseline information was

¹ Students were paid \$40 per person to participate and \$0.25 per \$1 of profit on a pen of cattle bought or sold. Likewise, students were penalized \$0.25 per \$1 of losses on a pen of cattle bought or sold.

from a two-day session conducted with personnel from Excel Corporation in Wichita, Kansas during the fall of 1999.

The key elements of the experimental design include practices and features of the market simulator, market information provided to the participants for the baseline portion of the study and market information provided to participants reflecting forward contracts. A brief description of FCMS is provided to better understand the experimental market environment experienced by participants. A more complete description of the FCMS can be found in Anderson et al.

Participants in the FCMS are divided into eight feedlot teams and four meatpacking teams. Each team consisted of two-to-four persons. These teams bought and sold simulated pens of fed cattle during each trading week.

Each trading week consisted of a 15-minute cycle. During the first ten minutes, feeders and packers negotiated and finalized transactions. Trades were conducted in face-to-face bilateral negotiations. Each feedlot had a number of paper pens of cattle with each pen containing 100 animals on a show-list. Prices were negotiated and sales occurred for show-list cattle. Cattle weights ranged from 1,100 to 1,200 pounds in 25-pound increments. Transactions were recorded on sheets, which were scanned into a computer. Prior to the actual experiment the rules and practices of the simulator were explained and several practice sessions were held to familiarize participants with procedures.

The five minute period following the trading period allowed teams to process market information, update show lists, calculate breakeven prices and develop strategies for the next trading period. An income statement for each team documenting transactions was provided after each trading period.

Each FCMS transaction represented a data point involving the sale and purchase of one pen of 100 animals between a feedlot and a packer. For each of these transactions the following data were recorded: week traded, packer purchasing cattle, feedlot selling cattle, weight of cattle, transaction price, and type of transaction (cash or forward contract). Other weekly recorded data included: breakeven price for 1,150 pound animals, boxed beef price at which meat was sold, closing nearby futures price for cattle, total marketings, and number of pens of cattle on the show-list at the beginning of each trading week.

The key feature of this experiment was the market information provided during each trading period. The baseline scenario (i.e., the Excel sessions) for the experiment was based on the market information currently available to agents in the fed cattle market (i.e., no contract information). Two digital displays provided the following information throughout the trading period. One display showed continuously updated cash market information that included trading volume and high-low price ranges, which is analogous to current USDA Agricultural Marketing Service information. The second display disclosed continuously updated trading volume and current prices for three futures market contracts which is analogous to the information available from the Chicago Mercantile Exchange. This information was available to participants throughout all experiment sessions.

During the experiment sessions forward contract information was provided to market participants in addition to the baseline information described. The forward market information included the volume of cattle purchased through forward contract by intended delivery week and the negotiated price range by delivery week. (However, the AMS 3-60 rule was not followed. This rule was unknown at the time the experiment was conducted. The computer reports all spot

market transactions after scanning each transaction card which enforces mandatory price reporting.) During this information treatment, the forward contract information summarized from the trading period was provided during the five-minute period interval between trading periods. This was designed to be analogous to the weekly forward contract information proposed under mandatory price reporting.

Econometric Models

The econometric models used to evaluate the impact of forward contract information on price level, price variability, and production efficiency are similar to those developed in Anderson et al. The transaction data from the experiments was used to estimate the models. Anderson et al. developed models for the FCMS based on previous research of fed cattle prices by Jones et al., Schroeder et al., and Ward 1981, 1982, and 1992.

The price-level model was specified as per Anderson et al. except indicator variables regarding forward contract information and type of sale (cash or forward) were added. The model is specified as follows:

$$(5) \quad \text{PRICE}_{it} = \beta_0 + \beta_1 \text{BBP}_{t-1} + \beta_2 \text{FMP}_{t-1} + \beta_3 \text{TSL}_{t-1} + \beta_4 \text{TLST}_{t-1} + \beta_5 \text{PPL}_t \\ + \sum_{j=1}^8 \beta_{6j} \text{FDLT}_{ijt} + \sum_{j=1}^4 \beta_{7j} \text{PACKER}_{ijt} + \beta_8 \text{FWD} + \beta_9 \text{INFO}_t + \beta_{10} \text{INFO} \times \text{FWD}_t + v_{it}$$

where PRICE is the transaction price for one pen of fed cattle, BBP is the boxed beef price, FMP is the fed cattle futures market price, TSL is the total pens of fed cattle slaughtered, TLST is the total number of pens on the show list, PPL is the potential profit or loss available to the industry, FDLT denotes binary variables identifying the feedlot involved in the transaction (base = Feedlot 1), PACKER denotes binary variables identifying the packer involved in the transaction (base = Packer 1), FWD denotes the binary variable identifying type of sale (0 – cash; 1 – forward),

INFO denotes the binary variable identifying the provision of forward contract information through mandatory price reporting (0 – no information; 1 – information), INFO×FWD is an interaction variable between INFO and FWD.

The price variance model is specified with the same independent variables, but the dependent variable is $\ln(v_{it}^2)$, the residual from the price-level model. The price variance model is specified as follows

$$(6) \quad \ln(v_{it}^2) = \beta_0 + \beta_1 \text{BBP}_{t-1} + \beta_2 \text{FMP}_{t-1} + \beta_3 \text{TSL}_{t-1} + \beta_4 \text{TLST}_{t-1} + \beta_5 \text{PPL}_t \\ + \sum_{j=1}^8 \beta_{6j} \text{FDLT}_{ijt} + \sum_{j=1}^4 \beta_{7j} \text{PACKER}_{ijt} + \beta_8 \text{FWD} + \beta_9 \text{INFO}_t + \beta_{10} \text{INFO} \times \text{FWD}_t + \varepsilon_{it}$$

where variables are as defined before.

The price level and price variance models were estimated as weighted random effects models (WREM) given observations in the data set include numerous transactions each week for which some variables have the same values for every transaction within each week. Ward et al. use the same procedure for estimating econometric models using data from the FCMS. These models correct for two forms of heteroscedasticity in the error term. One type of heteroscedasticity is associated with random effects as there are periods in the simulation where bargaining power varies between feedlots and packers across trading weeks (Ward et al.). The second source of heteroscedasticity comes from market agents having common information each week of trading while negotiating prices. For example, all market actors receive the same previous week's boxed beef price quote for a week of trading. Thus, errors associated with the transaction prices for a given week are not independent (Ward et al.). The price variance model then uses the residuals from the WREM price level model for the dependent variable ($\ln v_{it}^2$). The price variance model is then estimated as a random effects model for unbalanced panel data.

Production efficiency is measured by weight deviations from the optimal market weight for fed cattle of 1,150 pounds. An ordered logit model with absolute weight deviations from 1,150 pounds as the dependent variable was used to determine the effect of forward market information on participants' production efficiency. The dependent variable is a categorical variable with a value of 0, 1, or 2 representing the 0, 25, and 50 pound weight deviations from the optimum weight of 1,150 pounds. These are the only weight deviations allowed as cattle not sold gain 25 pounds each week until they reach a maximum weight of 1,225 pounds in the FCMS.² The weight deviation model is specified as follows

$$(7) \quad WTV_{it} = \beta_0 + \beta_1 BBP_{t-1} + \beta_2 FMP_{t-1} + \beta_3 TSL_{t-1} + \beta_4 TLST_{t-1} + \beta_5 PPL_t \\ + \sum_{j=1}^8 \beta_{6j} FDLT_{ijt} + \sum_{j=1}^4 \beta_{7j} PACKER_{ijt} + \beta_8 FWD + \beta_9 INFO_t + \beta_{10} INFO \times FWD_t + \mu_{it}$$

where WTV_{it} is the categorical weight-deviation variable.

Results

Descriptive statistics for selected variables across and for the two information treatments are reported in Table 1. Results for the price-level, price-variance, and weight-deviations models are presented in Table 2. The price-level model has results consistent with a priori expectations. The lagged boxed beef price is positive and significant in explaining price level. The same also is true for the lagged futures market price. The total show-list and slaughter variables lagged have negative and significant relationships with transaction price. The potential profit variable has a positive sign, but it is not significant. As we might suspect from our theoretical model individual market participants have significant effects on transaction price. This result is

² There were almost no cattle marketed at 1,225 pounds during the two sessions. Thus, there was no need for a 75 pound weight deviation category.

expected given the bilateral nature of the price discovery process in this simulation.

All or some combination of the FWD and INFO variables are significant in all three of the models. The price impacts, elasticities associated with the price impacts, and marginal effects from the ordered logit model are reported in Table 3. The reference point for measuring the impacts is a spot market transaction without the information provided by mandatory price reporting.

The forward contract transactions are lower priced than spot market transactions without information on forward contracts provided through mandatory price reporting. Transaction prices are \$0.266/cwt. or 0.34% lower than spot prices without the information. This may be related to a discount associated with the risk of future delivery. These results are consistent with Menkhaus et al. findings regarding forward versus spot market transactions in experimental markets.

Perhaps most interesting is the negative impact the new information has on spot transaction prices. With mandatory price reporting, spot prices are \$1.058/cwt. (or 1.37%) lower and forward contract transactions are \$0.40/cwt. (or 0.52%) lower than spot transaction without the new information. This suggests the increased information reduces marginal costs associated with information risk thereby reducing the spot price in the bilateral negotiation. Since the forward price and quantity information is known the risk for both the buyer and seller is reduced lowering information risk costs in the bilateral model. This in turn lowers the price the seller is willing to accept when setting marginal revenue equal to marginal cost as they negotiate. This fact coupled with the seller's risk of loss from production gives the buyer a bargaining advantage, and the price negotiated between the two parties is lowered. This conclusion is supported by the

fact that, while forward contract transactions with the new information are lower than spot transactions without the information, the forward contract transactions are higher priced than spot transactions under the new information regime. Forward contract transactions are \$0.658/cwt. higher. Price appears to be discovered in the forward market and the spot market has become the residual market. In this case, the seller's risk of loss from production costs is reduced relative to the spot market negotiation. Thus, the relative bargaining position of the seller is improved compared to spot market transactions. This translates into slightly higher forward prices in the information scenario relative to the no information scenario.

With the new information from mandatory price reporting, it is expected that price dispersion will decrease. The results from the price-variance model provide some evidence supporting this hypothesis. The information variable is not significant, but it does have the expected negative sign. The interaction between information and forward is significant and indicates a negative relationship to price. This suggests price variance at least for forward prices is reduced with this information. The results also suggest that forward contract transaction have higher dispersion than sport transactions. But, the difference is not significant. However, we do see that increased information reduces price dispersion and has the greatest impact on forward contract transactions. The percent reduction reported in Table 3 is close to 100% but is based on all the estimated coefficients. If we just use the significant coefficient then dispersion of forward contract transactions is reduced 85.1%

The weight deviations model indicates that the futures price has a significant and negative relationship with the dependent variable. This indicates the potential temporal allocation effect associated with futures prices in the FCMS. The variable on potential profit has a significant and

negative relationship suggesting that as potential profit decreases, the probability of selling at a non-optimal weight increases. This likely indicates that market agents bargain more aggressively as the total profits in the system decrease. This bargaining behavior creates greater inefficiencies that will further reduce potential profits. Likewise, as the total show-list increases in size their are increased probability that marketings will occur at non-optimal weights. The forward contract variable is significant and negative. Information has the expected sign and is close to significant at the ten percent level (i.e., $p\text{-value} = 0.109$). There is also a significant interaction.

The marginal effects reported in Table 3 indicate that forward contract transactions are more likely to be marketed at optimal weights than spot market transactions without the new information provided under mandatory price reporting. Forward contracts are 9% less likely to be traded at 50 pounds away from the optimal weight and 9% more likely to be traded at the optimal weight. With mandatory price reporting we see that spot market transactions are more likely to be marketed at optimal weights (+3.6%). However, the increased information makes strategic behavior present in the contract market. Forward contracts are only 2.6% more likely to be marketed at optimal weights, instead of 9% without the information.

A hypothesized result is that production efficiency should be improved by the forward contract information. It is expected that the timing of sales will be adjusted so that the number of cattle sold above the optimum weight will be reduced. These results suggest that will happen. But only if the volume of spot market transactions remains greater than the number of contracts. The increased information creates strategic behavior and non-optimal marketings in the contract market. Overall, these results point toward a potential improvement in production efficiency with the new information.

Summary and Conclusions

Forward contract information is to be provided to the public on a weekly basis under mandatory price reporting. This forward contract information will provide marketing intentions information that is previously unavailable to agents in the fed cattle market. An experiment using the FCMS was designed to assess the potential impacts of this new information on price discovery and production efficiency for fed cattle.

Results from the econometric models suggest that proposed forward contract information may reduce price level, reduce price dispersion, and improve production efficiency. Prices may be reduced as information risks are reduced for both buyers and sellers in the fed cattle market. This result may not be popular among sellers in the market place, but it suggests market agents may have to become more efficient as they adjust to this information. While the results are somewhat mixed, they suggest that production efficiency associated with selling more cattle at optimal weights may be improved with this information. The results suggest that price variance in forward contracted sales could be reduced.

Overall, these results suggest that mandatory price reporting may have a significant impact on the fed cattle sector. The results do suggest that efficiency may be improved by this information. However, if price level is in fact reduced, as these results suggest could occur, some producer groups may be disappointed with the outcome of mandatory price reporting.

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Table 1. Descriptive Statistics for Model Variables.

Variables	Full Sample		No Information		Information	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
BBP	121.87	6.85	122.94	7.77	120.39	4.95
FMP	77.25	4.80	77.72	4.64	76.58	4.94
TSL	38.27	6.29	37.97	6.90	38.69	5.30
TLST	126.31	19.32	125.47	18.98	127.47	19.75
PPL	1.54	4.67	2.17	4.96	0.66	4.08
PRICE	77.16	4.97	77.44	4.95	76.77	4.97
WEIGHT	1156.51	16.94	1156.12	16.72	1157.05	17.22

Table 2. Estimated Coefficients for Price-Level, Price Variance, and Weight Deviation Models.

Variables	Price-Level		Price Variance		Weight Deviation	
	Coeff	t-Stat	Coeff	t-Stat	Coeff	t-Stat
BBP _{t-1}	0.250**	(4.152)	-0.031	(-0.553)	0.004	(0.929)
FMP _{t-1}	0.327**	(3.791)	0.078	(0.966)	-0.021**	(-2.436)
TSL _{t-1}	-0.103**	(-3.536)	0.011	(0.401)	-0.007	(-1.113)
TLST _{t-1}	-0.876**	(-4.676)	0.016	(0.940)	0.008**	(3.637)
PPL _t	0.098	(1.259)	0.024	(0.740)	-0.053**	(-4.738)
FDLT ₂	0.268**	(4.128)	-0.454**	(-3.425)	0.041	(0.262)
FDLT ₃	0.374**	(5.350)	-0.076	(-0.558)	-0.087	(-0.547)
FDLT ₄	0.213**	(3.009)	0.117	(0.853)	0.069	(0.435)
FDLT ₅	0.362**	(5.614)	-0.467**	(-3.477)	-0.168	(-1.053)
FDLT ₆	0.196**	(2.949)	-0.306**	(-2.269)	-0.098	(-0.613)
FDLT ₇	0.095	(1.393)	-0.339**	(-2.511)	0.115	(0.731)
FDLT ₈	0.597**	(8.530)	0.003	(0.002)	-0.318**	(1.965)
PACKER ₂	-0.074	(-1.480)	-0.128	(-1.233)	0.131	(1.071)
PACKER ₃	-0.087*	(1.845)	-0.161	(1.640)	-0.030	(-0.257)
PACKER ₄	0.159**	(3.435)	-0.041	(-0.427)	-0.016	(-0.141)
FWD	-0.266**	(-3.792)	0.166	(1.426)	-0.381**	(-2.790)
INFO	-1.058**	(-3.037)	-0.314	(-0.964)	-0.146*	(-1.603)
INFO×FWD	0.924**	(9.701)	-0.851**	(-4.274)	0.634**	(2.835)
Constant	36.314**	(3.986)	-4.455	(-0.525)	2.518**	(28.614)
N=2721	R ² = 88.7		R ² = 3.9		χ^2 = 50.59	
Model Signif	0.0001		0.0001		0.0003	

Note: ** denotes significant at the 0.05 level and * denotes significant at the 0.10 level.

Table 3. Price Impacts, Elasticities, and Marginal Effects from the Price-Level, Price-Variance, and Weight Deviation Models.

	Price- Level	Price- Variance	Weight (optimal)	Weight (+25 lbs.)	Weight (+50 lbs.)
Spot w/o Info	Base	Base	Base	Base	Base
Forward w/o Info	-0.2660 (-0.0034)	(0.1660)	0.0903	0.0044	-0.0947
Spot w/ Info	-1.0580 (-0.0137)	(-0.3140)	0.0355	0.0011	-0.3650
Forward w/ Info	-0.4000 (-0.0052)	(-0.9990)	-0.0264	-0.0001	0.0265

Note: Figures in parentheses are elasticities.