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Abstract

Federal budgetary pressures raise questions regarding the importance of public market information. This study assesses the impact on price discovery and marketing efficiency from reductions in the availability of public information. The amount and type of information provided to Fed Cattle Market Simulator participants was varied according to a predetermined experimental design. Reduced information decreased the quality of price discovery decisions and led to increased price variance. Marketing efficiency was decreased also. With reduced information, more cattle were delivered at weights deviating from 1150 pounds -- the least-cost marketing weight in the simulator.

Key words: efficiency, experimental economics, fed cattle, price discovery, public information

Public Information Impacts on Price Discovery and Marketing Efficiency in the Fed Cattle Market

Information, through its impact on the expectations of market participants, plays a critical role in price discovery. In agricultural markets, much of the information available to decision-makers is collected and disseminated by government agencies. Reductions in the amount of government-provided information have occurred throughout the 1980s and 1990s and continue to be considered as government agencies look for ways to cut their budgets in the ongoing effort to reduce federal spending. If public resources are to be efficiently allocated, it is vital to know the potential impact of such reductions on the affected markets.

The fed cattle market -- like most agricultural markets -- receives considerable information through government reporting.[1] Furthermore, this market has undergone tremendous structural change in the last fifteen years. The market share of the four largest meatpacking firms increased significantly over this time period. In 1980, the four largest meatpackers accounted for 35.7 percent of the total steer and heifer slaughter. By 1994, their share had risen to 80.9 percent (Grain Inspection, Packers and Stockyards Administration). In addition, cattle are increasingly traded on a forward contract basis. Forward contracts and marketing agreements were virtually nonexistent in 1980, but in 1994, 17 percent of the cattle slaughtered by the four largest firms were traded using these instruments (Grain Inspection, Packers and Stockyards Administration). These structural and behavioral changes may have affected the role of information in this market. Information asymmetries may exist due to the fact that larger firms have more resources to use in obtaining private information. Larger firms may also have more information simply due to the greater volume of their own transactions. Furthermore, as forward contracting increases, less information is revealed through cash market transactions.

In light of these facts and the limited funding for government collection and reporting of information, a determination of the importance of public information to the efficient functioning of this market is warranted. The debate over mandatory versus continued voluntary price reporting provides additional incentive to investigate the role of information in the fed cattle market. The unwillingness of some firms to report prices has led to concerns that price reports are not representative of the market (Schroeder et al. 1997). Understanding the effect insufficient public information has on price discovery and marketing efficiency in the fed cattle market is necessary if policy decisions related to government price reporting are to be made judiciously. Policy-makers need to know the potential impacts of policy changes if their decisions are to result in the efficient allocation of both public and private resources.

Policy-makers are not the only ones interested in knowing the impacts of policy changes. In the fed cattle market, cattle feeders and meat packers would certainly like to know how price reporting changes may affect the market in which they operate. For example, will a reduction in the availability of public information result in a bargaining advantage for either packers or feeders? Will it lead to greater risk in the market due to increased price variability? Knowing the answers to such questions could help market participants develop strategies for dealing with any possible public information reductions.

The objective of this research is to improve policy decisions regarding public price reporting in the fed cattle market. To accomplish this goal, two questions must be answered:

1) What is the effect on the level and variability of prices from reducing public information in the fed cattle market?

2) What effect does reducing public information have on marketing efficiency in the fed cattle market, where marketing efficiency is closely linked to the weights of cattle

being traded?

Background and Theory

Pricing efficiency can be defined as the ability of a marketing system to efficiently allocate resources and coordinate the food production and marketing process in accordance with consumer directives (Kohls and Uhl). The ability of any market to function efficiently with respect to pricing depends in large part on the information available to market participants. This fact is underscored by Hayek's reference to the price system as a "mechanism for communicating information."

Grossman and Stiglitz note that prices cannot perfectly reflect all available information since information is costly. The fact that prices imperfectly reflect information represents the necessary compensation to economic agents who use resources to obtain it. Consequently, an increase in the quality of information or a decrease in its cost will increase the informational content of prices.

Other authors note the link between information and pricing efficiency. For example, Stigler equates price dispersion with ignorance in the market. He relates the level of price dispersion to search costs, i.e., the cost to sellers of determining the bid prices of competitors and, more importantly, to buyers of surveying the offer prices of sellers. Conklin expresses this point more succinctly, stating that "the efficiency of a market in price discovery depends on its ability to transform information into price."

Tomek attempts to quantify the relationship between information and price variability, defining information as the reciprocal of variance. He suggests that poor information results in larger errors in price formation. Devine and Marion characterize such price dispersion as an imperfection in a market for a homogeneous product. In their study of comparative price information on retail food prices, they found that the dissemination of accurate market information reduced price dispersion as well as the average price level in the market.

In agricultural markets, government reports have traditionally been the primary source of information concerning both prices and production. Though market alternatives to government reporting may exist, these alternatives may not have the same informational content as government reports (Carter and Galopin). The prevalence of private sources of information may complicate the job of the decision maker. Irwin and Thraen point out that under heterogeneous information, decision makers must develop strategies for finding out about the private information of other decision makers in the market.

More recently, Irwin examined the value of public situation and outlook programs. He found that in the framework of a rational expectations model incorporating learning behavior and costly information, public situation and outlook information leads to increased social welfare by increasing the speed of convergence to equilibrium. Such public information increases the speed of convergence, he argues, by educating producers about the underlying economic model and economic conditions and by collecting information less expensively than private firms. Moreover, Irwin hypothesizes a competitive impact of public information. In markets characterized by imperfect information and asymmetric information, public information may force informed market participants to reveal more of their information through prices. This effect of public information may be of particular importance in the imperfectly competitive fed cattle market.

While Irwin examines situation and outlook reports, many other authors have evaluated the informational content of government production and inventory reports. Colling, Irwin, and

Zulauf found that nearby pork belly and live hog futures prices did respond significantly to the *Cold Storage Report* (*CSR*) release. They cite this as evidence that the *CSR* is providing useful information and, therefore, performing one of its public policy goals. Carter and Galopin found that a trader with advance knowledge of the *Hogs and Pigs Report* (*HPR*) could not trade profitably. Colling and Irwin note that unanticipated information in the *HPR* does affect the live hog futures market but not enough to permit profitable trading based on that unanticipated information. In a similar study of the live cattle futures market, Grunewald, McNulty, and Biere found that that market also responds to unanticipated information in the *Cattle on Feed Report* (*COF*).

Additional studies have attempted to assess the informational content of government reports by observing the price impacts of report releases. Sumner and Mueller concluded that USDA harvest forecast announcements had a significant impact in corn and soybean futures markets. Milanos had previously obtained similar results looking at crop report impacts on corn, wheat, soybean oil, and soybean meal cash prices. Conversely, Patterson and Brorsen found little evidence that the *U.S. Export Sales Report* provided any new information to the market.

All of these studies focused on production or inventory reports rather than price reports. In addition, with the exception of Milanos, they have examined futures market rather than cash market responses to public information. This study is unique in that it investigates how a cash market (the fed cattle market) responds to public price information.

Fed Cattle Market Simulator (FCMS) Description, Experimental Design and Data Collection

The FCMS allows experimental simulation of the fed cattle market, integrating the static structure-conduct-performance approach with the dynamics of price behavior (Ward et al.; Koontz et al.). It provides a market framework and institutional structure within which individual and firm decisions are made that directly influence the subsequent behavior and performance of other firms and the market. The FCMS was developed to closely model the real-world fed cattle market. This simulated market environment allows participants to experience market dynamics through numerous repetitions of market trading periods. Market participants must make a series of interrelated marketing decisions and then react to the interdependent firm and market consequences of those decisions.

FCMS participants act as feedlot marketing managers and meatpacking procurement managers. Eight feedlot and four meatpacking teams, consisting of from two to four persons, interact to generate fed cattle transactions. The number of feedlot and meatpacking teams reflects the fact the FCMS was not intended to represent a perfectly competitive market. Rather, it reflects the market which has evolved for fed cattle, i.e., fewer larger cattle feeding firms and even fewer larger meatpacking firms.

Participants experience increasing degrees of market complexity, beginning with cash trading only and progressing through the addition of forward contracting and a live cattle futures market. Forward contracts are defined as transactions which occur this week for delivery two or more trading periods in the future. Market price reports do not include these contract prices. Futures market contracts expire at eight trading-period intervals, consistent with the two-month intervals for live cattle contracts on the Chicago Mercantile Exchange (CME). Three contracts -- a nearby and two distant -- are open at all times. Because the futures contract is specifically designed for this simulated market, the basis is zero.

One week in the FCMS consists of an eight to twelve minute cycle. During the first five-to-seven minutes of the cycle, feeders and packers negotiate prices and finalize trades. Transactions are conducted face-to-face, and decisions of participants largely determine the direction of market prices and the profitability of each feedlot and meatpacking team. Generally, about 40 trades occur each week. Each feedlot has a visible array of paper pens of cattle, each sheet of paper representing 100 steers on a show list. Prices are negotiated and sales occur for the range of available weights of show-list cattle, from 1100 to 1200 pounds in 25 pound increments. Completed transaction sheets are scanned into a computer for record keeping and analysis.

Throughout the trading period, market information is provided on two digital display bars. One display bar scrolls cash market information (trading volume and high-low prices) which is analogous to current market information available to fed cattle buyers and sellers from the Agricultural Marketing Service, U.S. Department of Agriculture (AMS-USDA). The other display bar scrolls futures market information (trading volume and current prices for three futures market contracts) which is analogous to information available from the Chicago Mercantile Exchange (CME).

The three-to-five minute period following trading is an information-processing period or "weekend" during which each team updates its show list, calculates break-even prices, and formulates marketing strategy. Each period, the FCMS software provides an individual income statement for each team as well as summary market information for the preceding period. This summary information also resembles that available from AMS-USDA in the real-world fed cattle market.

The data to be used in this research were collected from the FCMS during an agricultural economics course which met weekly in 90 minute sessions during the spring 1996 semester at Oklahoma State University. FCMS-generated data has previously been used in research relating to price discovery in the fed cattle market by Ward et al. and by Dowty. The data for this experiment were collected in a manner similar to the method of those studies.

Trading in the FCMS course began in week 21. This is a common start-up period. Feeder cattle weighing 700 pounds are placed on feed in Week 1, gain 25 pounds per week, reach the show list in Week 17, and weigh 1150 pounds in Week 19. By Week 21, there are two weeks of historical market information generated from a predetermined base of trading activity to begin the market simulation.

Teams were rotated twice during a preliminary learning phase, during which no data were collected for analysis. By week 33, final teams had been established. Data collection was begun at week 37 and continued through week 96 -- a simulation period of 60 weeks or approximately one year and two months. Teams were rotated a final time after week 72, and trading ended after week 97.

Each FCMS transaction represents a data point. Each transaction involves the sale/purchase of one pen of 100 steers between one feedlot and one packer. During the 60 weeks of the experiment, 2197 transactions occurred. For each of these, the following data were recorded: week traded, packer purchasing cattle, feedlot selling cattle, weight of cattle, transaction price, and type of transaction (cash or contract). In addition to this transaction data, weekly data were also recorded. These data include the break-even price for 1150 pound steers, boxed beef price at which meat would be sold that week, closing nearby futures price for the preceding week, previous week's fed cattle marketings, and number of pens of cattle on the show list at the beginning of each trading week.

In this experiment, the amount and type of cash market information available to FCMS participants was changed at predetermined intervals.[2] Three limited information alternatives were specified in addition to complete (or full) information. Thus, trading in the FCMS occurred under the following four information sets:

A) Complete (full) information:

This set consisted of current information displayed on a light-bar at the front of the room as well as end-of-week summary information posted on the blackboard at the end of each trading session. "Current information" consisted of cash and contract trading volume and high-low cash price. "Summary information" consisted of weekly average cash prices by weight groups, weekly average boxed beef price, weekly average feeder cattle price, cost of gain, and total volume of cattle traded the preceding week.

B) Incomplete information:

"Current information" was removed.

C) Incomplete information:

"Summary information" was removed.

D) No cash-market information:

Current and summary cash-market information were both removed.

One final note concerning the design of the experiment is in order. In accordance with experimental economics methodology, participants were paid based on the profitability of their team (Friedman and Sunder). Performance was not continuously evaluated for payment purposes.

Rather, participant performance was evaluated over randomly selected 4 to 8 week intervals. Participants were notified of the beginning of these payment periods but not the duration. These periods were selected so as not to coincide exactly with an information alternative period. Figure 1 gives a complete description of the experimental design.

The FCMS transactions data were used to determine what effects a reduction in public price information might have on the pricing and productive efficiency of the cash fed cattle market. Based on pricing efficiency theory, it was hypothesized that reducing the amount of information available to market participants would increase the price variance due to less efficient price discovery. It was further hypothesized that the less informative prices would lead to less efficient production. In the FCMS, the least cost of production or optimal marketing weight for fed cattle is 1150 pounds. Here, optimal is in a comparative static sense. That is, deviations from the optimal weight result in less efficient use of resources and reduced revenue for the industry compared to what would have been realized by marketing 1150 pound cattle. Weight deviations from 1150 pounds can therefore be used as a measure of the productive efficiency lost as a result of reduced information.

Finally, we hypothesized that reducing information would lead to lower fed cattle prices. This price level change would favor packers. This hypothesis is based on the fact that the demand for fed cattle is derived from the retail demand for beef. Packers, by virtue of their position in the market, are in a better position than feeders to assess this retail demand. In the absence of objective market reporting, this fact could give packers an information advantage over feeders.

Model Development

The transaction data from the FCMS are used to estimate three basic models. Two of these, a transactions price model and a price variability model are based on other models employing FCMS data (Ward et al.; Dowty). A third model is developed to give further insight into any loss of productive efficiency resulting from incomplete information. In the FCMS, the least-cost or optimal weight for marketing fed cattle is 1150 pounds. This fact quickly becomes obvious to feedlot and packer teams, as deviations from this optimal weight can have a significant impact on their revenues. An ordered logit model with absolute weight deviations from 1150 pounds as the dependent variable is estimated to determine the effect of limited information on participants' ability to efficiently market fed cattle.

The selection of variables for inclusion in the two price related models is based on previous research into fed cattle transaction prices (Jones et al.; Schroeder et al. 1993; Ward 1981, 1982, 1992). Variables chosen from previous research to explain transactions prices for fed cattle included boxed beef prices, futures market prices, total show list, total weekly slaughter, potential profit/loss in the market, and individual buyers (packers) and sellers (feedlots). This previous research draws on the pricing process followed by packers in determining bid prices for fed cattle. Discussion here will focus on the variables specifically arising from this experiment, i.e., information level variables. Specifications of the three models are presented below. Variable definitions and expected signs are given in table 1.

Price Level Model:

(1)
$$PRC_{it}=\beta_0+\beta_1 BBP_{t-1}+\beta_2 FMP_{t-1}+\beta_3 TSL_{t-1}+\beta_4 TLST_{t-1}+\beta_5 PPL_t+ \\ \Sigma_{j=1}^{8}\beta_{6j}DFD_{ijt}+\Sigma_{j=1}^{4}\beta_{7j}DKP_{ijt}+\Sigma_{j=1}^{n}\beta_{8j}DINFO_{ijt}+\beta_9 DPAY_t+v_{it}$$

where PRC = transactions price for one pen of fed cattle,
BBP = lagged boxed beef price,
FMP = lagged futures market price,
TSL = total slaughter,
TLST = total show list,
PPL = potential profit or loss,
DFD = binary variable identifying feedlot involved in the transaction,
DPK = binary variable identifying packer involved in the transaction,
DINFO = binary variable identifying information available at time of transaction, and
DPAY = binary variable identifying payment/nonpayment periods.

Price Variance Model:

(2) $$VPRC_{it}=\alpha_0+\alpha_1 BBP_{t-1}+\alpha_2 FMP_{t-1}+\alpha_3 TSL_{t-1}+\alpha_4 TLST_{t-1}+\alpha_5 PPL_t+ \Sigma_{j=1}^{8}\alpha_{6j}DFD_{ijt}+\Sigma_{j=1}^{4}\alpha_{7j}DPK_{ijt}+\Sigma_{j=1}^{n}\alpha_{8j}DINFO_{ijt}+\alpha_9 DPAY_t+v_{it}$$

where VPRC is the natural log of the price variance estimate calculated from the price level model, and other variables were defined previously.

Weight Deviation Model:

(3) $$WTV_{it}=\gamma_0+\gamma_1 BBP_{t-1}+\gamma_2 TSL_{t-1}+\gamma_3 TLST_{t-1}+\gamma_4 PPL_t+ \Sigma_{j=1}^{8}\gamma_{5j}DFD_{ijt}+\Sigma_{j=1}^{4}\gamma_{6j}DPK_{ijt}+\Sigma_{j=1}^{n}\gamma_{7j}DINFO_{ijt}+\gamma_8 DPAY_t+v_{it}$$

where WTV is a multinomial variable indication absolute weight deviation from 1150 pounds, and other variables were defined previously.

In the above models, t denotes the simulation week (t = 36, 37, ..., 96) and i denotes observations within a week (i = 1, 2, ..., n_t). In order to estimate the models, base feedlot and packer binary variables must be excluded from the estimation to avoid perfect collinearity. Binary variables corresponding to feedlot 1 and packer 1 are used as bases.

The subscripts in the above equations indicate that these are hierarchical models. This refers to the fact that the individual transactions which comprise the data are arranged in groups.

In this experiment, numerous transactions occur each week. Goldstein points out that if modeling does not take into account the hierarchical nature of data, coefficient estimates may be inefficient; and standard errors, confidence intervals, and significance tests may be incorrect. In order to avoid the problems discussed by Goldstein, both price level and variance models are specified as weighted random effects models (WREM) for unbalanced panel data. The random effects model assumes two components for the error term. Thus the error term in the previous equations (v_{it}) can be represented as the sum of its components:

(4) $$v_{it} = e_{it} + u_t$$

The component e_{it} is the random variation in prices within each week while the second component, u_t, is the random disturbance which is common to prices in each trading week.

Heteroskedasticity will be a problem with this data due to the nature of this experiment. Therefore, the natural log of the squared error terms from the basic random effects model is used as the dependent variable in an artificial regression against the independent variables. Predicted values from this regression are then used to generate weights which are applied to the models, resulting in weighted random effects models. The weights are computed as

(5) $$wt_{it} = 1/\exp(\hat{e}_{it}^2)$$

where $\hat{e}_{it}$ is the prediction obtained from the artificial regression. All models are estimated using the LIMDEP 6.0 econometric program (Greene).

Two versions of each of the three models are specified using different definitions for the information period dummy variables. The most basic models represent all limited information periods with a single dummy variable. The comparison is thus between full and limited information with no distinction made between the type of information withheld. The second specifications use two information dummy variables: one to represent the withholding of current "light bar" information and another to represent the withholding of end-of-week "blackboard" information. The interaction of these two dummy variables represents periods when all information is withheld. Thus, under this definition of information periods, the following interaction term (*DINFO1x2*) is included in each of the three model specifications:

$$DINFO1x2 = (DINFO_{i1t} \bullet DINFO_{i2t}) \quad (6)$$

where $DINFO_{ijt}$ is as defined after equation (1).

Results and Discussion

Results from price level, price variance, and weight deviation models for the single information period specification are given in table 2. Table 3 shows results from the models using separate dummy varialbes for current and summary information.

Price Discovery Variables

It is instructive to compare the price level model from this study to previous studies using FCMS data in order to gain insight into the effect of limiting information on the price discovery process. The results of the basic single-information period price model differ somewhat from previous studies using FCMS data. The effect on price of several of the covariates seems to have been altered by the withholding of information. Boxed-beef price has previously been found to have a strong relationship with fed cattle transaction prices (Ward, et al.; Dowty). In this model, however, the coefficient on lagged boxed-beef price, while still significant at the 0.01 level, is much smaller than in previous studies. The elasticity of fed cattle price with respect to boxed beef price at the means is 0.371. This compares to elasticities of 0.792 and 0.520 calculated using data from Ward et al. and Dowty.

Boxed-beef price was one element of the end-of-week summary information. When this information was withheld, boxed-beef price information was not available at all to feedlots. Packers could determine this price from their profit and loss statements, i.e. from sales data; however, it was not publicly available to them either. This reduced availability of boxed-beef price may have weakened the relationship between boxed-beef price and fed cattle transaction price.

On the other hand, the relationship between futures market price and transaction price is much stronger in this model than in previous studies. This relationship is stronger than that between boxed-beef price and transaction price. This is not consistent with previous FCMS studies; however, given the design of the experiment, it may not be surprising. Futures market prices were never withheld from participants in this study. They may have therefore come to rely more heavily upon these prices than boxed-beef prices in their decision making. The elasticity of fed cattle price with respect to futures price is 0.441. In Ward et al. and Dowty, this elasticity was 0.040 and 0.265, respectively.

The coefficient describing the relationship between lagged total show list and transaction price is negative and significant. This is consistent with the findings of Ward et al. Not consistent with Ward et al. and Dowty is the positive and significant coefficient on lagged total slaughter. It should be pointed out that the estimate of this coefficient is not particularly robust. In the price level model with two information period dummy variables, the coefficient on lagged total slaughter is not significant at the 10 percent level.

The variation in transaction prices among feedlots is greater in this study than in others using similar data. The maximum price difference between feedlots in this study is $0.96/cwt. This compares with maximum differences of $0.34/cwt. and $0.49/cwt. for Ward et al. and Dowty, respectively. Apparently some feeders found more successful strategies than others for dealing with the lack of information. The maximum price difference between packers in this study is $0.40/cwt. This is consistent with Ward et al. and Dowty, who found differences among packers of $0.38/cwt. and $0.48/cwt., respectively. Packers evidently were better able to adjust to changes in the amount and type of information available than were feeders. One final comparison between this study and Dowty is in order. In both the price level and variance models estimated in this study, significant differences exist between payment and nonpayment periods. Price is significantly higher and variance significantly lower in payment periods. Dowty found no significant price level differences between payment and nonpayment periods; however, he did find that variance was significantly higher in payment periods.

Results of Price Level Models

The impact of limited information on prices is revealed by the coefficient on the limited information dummy variable. In the basic price model, that coefficient is not significantly different from zero. The effect of limited information on price therefore cannot be determined when all limited information periods are aggregated. In the second specification of the price model in which three information dummy variables are used (current information, summary information, and interaction of the two), removal of the current trading information results in a $2.37/cwt. decline in fed cattle prices while removal of both current and summary information results in a $2.52/cwt. increase in fed cattle prices. Removal of summary information alone has no significant impact on prices.

Results of the price level models are difficult to interpret. Aggregating the limited information periods suggests that limiting public information does not affect the price level; however, a model specification using more narrowly defined information variables suggests that the price effects of limited information are important and that the effects are different for different types of information. Removal of current information reduced prices (favoring packers) whereas withholding all information increased prices (favoring feeders). It could be argued that limiting current information gives packers an advantage since they are in a better position to assess the remaining summary information -- particularly boxed beef price and total slaughter figures. With the removal of all information, however, neither packers nor feeders have an advantage. The increase in price simply reflects higher transaction costs which result from reduced information (Stigler). Clearly, these hypotheses are *ad hoc* and are only offered as a possible explanation for the results obtained here. More research is needed to clearly define any price level effects that may result from limiting information.

Results of Price Variance Models

The results of the price variance model are more conclusive than those of the price level model when aggregated information periods are considered. The coefficient on the information dummy variable is positive and highly significant, indicating an increase in price variance due to limited information. This is consistent with hypothesized results.

Results again become more ambiguous as efforts are made to determine effects of different types of information. In the second specification of the variance model, variance is increased by removal of current information and by removal of all information. Removal of summary information, however, decreases the variance of prices.

The price variance model provides stronger evidence of the importance of public information to the efficient functioning of the fed cattle market than does the price level model. The aggregate information period model shows conclusively that limiting information increases price variance. Evidence further indicates that limiting current information definitely increases price variance; however, in the second model limiting summary information decreases price variance. It is possible, perhaps even likely, that limiting summary information would lead to greater reliance on current price information. The resulting inertia could perhaps reduce price variability. This does not mean that limiting summary information would result in a more efficient market. On the contrary, if prices fail to quickly register changes occurring in underlying supply/demand conditions, the market would be much less efficient from a resource allocation standpoint in spite of the increased price stability.

Results of Pricing Efficiency Models

The effect of limiting information on the efficiency of the market is further examined using an ordered logit model with absolute weight deviations from the optimal 1150 pound weight as the dependent variable. Specification of a logit model is possible due to the fact that cattle weight in the FCMS is a discrete variable. Cattle enter the show list at 1100 pounds. Cattle not sold gain 25 pounds each week until they reach a maximum weight of 1225 pounds.[3] Thus, absolute weight deviations from 1150 pounds will always be 0, 25, 50, or 75 pounds. These values are represented by a multinomial dummy variable with values of 0, 1, 2, and 3 representing 0, 25, 50, and 75 pound deviations respectively. As with the price level and variance models, the logit model is run with two different configurations of information period dummy variables.

Results of the single period model clearly indicate that limiting information results in marketing fed cattle at higher deviations from the least cost weight. The second specification of the model indicates that these higher deviations are due to the removal of summary information.

Direct observation of FCMS transaction data from the experiment clearly show that weight deviations were toward heavier and less cost-efficient weights. Just over half of all fed cattle were marketed at 1175 pounds. Only 6 percent were marketed at the least cost, 1150 pound weight. This is not at all consistent with results of previous use of the FCMS. Figure 2 compares the marketing weights obtained under this experiment to those obtained from the FCMS when no experiment was being conducted.

These results suggest that removing summary information results in lost efficiency regardless of the price variance effects of removing information. Moreover, these results point to an advantage to packers resulting from limited information. When cattle are marketed at heavier than optimal weights in the FCMS, packers have a large bargaining advantage over feeders. This stems from the fact that feeding costs rise rapidly as cattle reach higher weights and that price discounts become significant as cattle approach 1200 pounds. Thus, results of the logit model indicate that packers receive an advantage from the removal of information in general and of summary information in particular. This result was hypothesized from the fact that packers are closer to final demand and should thus be better able to compensate for the missing summary information including boxed-beef price and total marketings of fed cattle.

The most significant result of the logit model is not that packers gain a bargaining advantage over feeders when summary market information is limited. What is critical to note is that the productive efficiency of the industry is compromised. Rausser, Perloff, and Zusman define productive efficiency as requiring that each firm produces in a manner which places the economy on its production possibilities frontier. That is not the case when cattle are fed to heavier-than-optimal weights. Resources must be expended in cattle feeding which would be better utilized elsewhere. This represents a loss to society, not just to cattle feeders.

Summary and Conclusions

Data from the FCMS were used to assess the impact of limiting information on the efficiency of the fed cattle market. Results of the econometric models developed here indicate unequivocally that the quality of decision-making declined in the absence of current market information. This was evidenced by increased transaction price variance and by the increased marketing of fed cattle at less industry-efficient weights as a consequence of the removal of information from the market.

The results of this experimental simulation also provide evidence that traditional, predictable economic relationships may be altered in the absence of public market information, thereby contributing to pricing inefficiencies. Differences in econometric results for this study compared with two previous studies suggest that removing and restoring different types and amounts of information into the FCMS altered the normal economic relationships between transaction prices and traditional variables, particularly boxed beef prices but also futures market prices and fed cattle marketings to a lesser extent.

Looking only at price level impacts, it is impossible to determine which sector of the industry stands to lose most from reduced market information. Price impacts were sometimes in the feeders' favor and sometimes in the packers'. Considering the marketing of cattle at less efficient weights, on the other hand, shows a clear advantage to packers from the loss of information.

Rather than focusing on who stands to gain or lose from a reduction in public information, the price variance model indicates how the price risk faced by all market participants is affected. The results of this model indicate that reducing market information definitely increases price variance and, consequently, price risk. This result may have important implications for both feeders and packers.

Ginn and Purcell have discussed the impact of price risk on the competitiveness of the beef industry as a whole. They contend that price risk, which increases costs throughout the industry, is in some measure responsible for beef's loss of market share to poultry and pork in the 1980's. While their hypothesis is only one of many possible explanations for beef's loss of market share, it does correctly emphasize that risk represents a cost of doing business. If reducing public information increases this cost -- as this research suggests it will -- then feeders and packers may need to consider how any public policy change regarding public market information could affect the competitiveness of the entire beef industry rather than focusing on which side may gain a short-term advantage over the other.

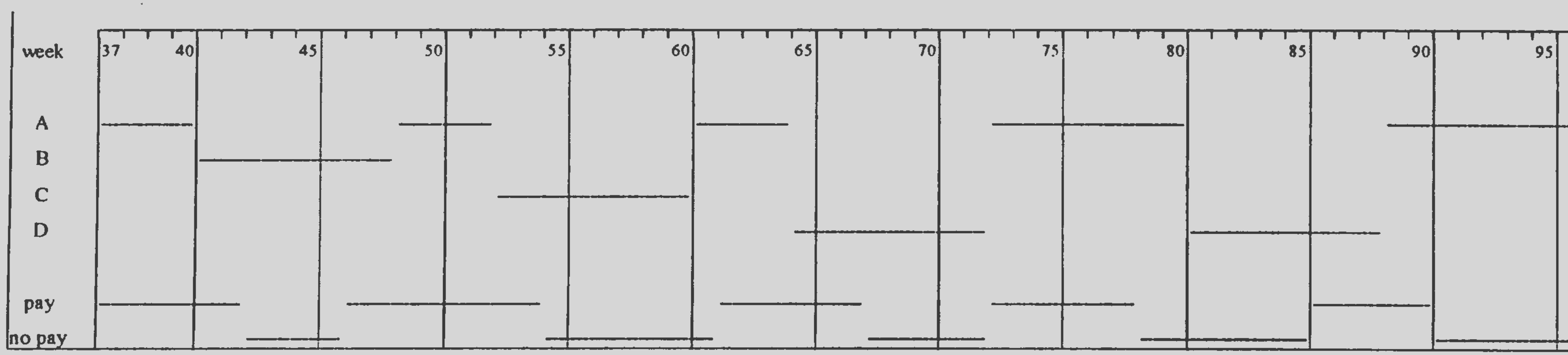
Endnotes

1. The term government reporting as used here encompasses the collection and compilation of data as well as its dissemination in government reports.

2. It is critical to note the disticntion being made here between cash and futures market information. This experiment involved varying levels of cash market information. Futures market information was available to participants at all times. This is appropriate given the objective of this experiment, i.e., to assess the market impacts of *public* information such as that provided by AMS-USDA. Futures market information would more appropriately be considered private information since public funds are not used in its collection/dissemination.

3. Feedlots can sell cattle weighing 1200 pounds. Cattle unsold at the end of the trading week in which they weigh 1200 pounds are automatically sold to an anonymous packer for a large discount in price, beginning at $5/cwt. below the average price that week. All cattle sold to the anonymous packer weigh 1225 pounds.

Figure 1. **Experimental Design for Estimating Public Information Impacts on the FCMS**



A: full information
B: removal of within-week current information
C: removal of end-of-week summary information
D: removal of both current and summary information
Note: Teams were rotated at the end of week 72.

Table 1. **Variable Names and Definitions for Price Level, Price Variance, and Weight Deviations Model**

Variable Abbreviation	Variable Definition	Expected Sign
Dependent Variables		
PRC_{it}	i^{th} transaction price for one pen of fed cattle ($/cwt) in week t	N/A
$VPRC_{it}$	Log_e of the i^{th} transaction price variance estimate ($/cwt) calculated from price level model in week t	N/A
WTV_{it}	Multinomial variable indicating absolute value of weight deviation from 1150# of pen traded in i^{th} transaction in week t	N/A
Independent Variables		
BBP_{t-1}	Boxed beef price ($/cwt.) for Choice Yield Grades 1-3 550-700 lb. carcasses, lagged one week	+
FMP_{t-1}[a]	Closing live cattle futures price ($/cwt.) for nearby contract, lagged one week	+
TSL_{t-1}	Total pens slaughtered (100hd./pen), lagged one week	-
$TLST_{t-1}$	Total pens on market-ready show list, lagged one week	-
PPL_t	Potential profit or loss in week t. Equal to largest packer's break-even price ($/cwt.) for 1150 lb. cattle less the mean feedlot break-even price ($/cwt.) for 1150 lb. cattle	-
DFD_{ijt}	Binary variables identifying individual feed-lots. j=1-8; 1=feeder 1 (base), 2=feeder 2, 3=feeder 3, etc.	+/-
DPK_{ijt}	Binary variables identifying individual packers. j=1-4; 1=packer 1(base), 2=packer 2, 3=packer 3, 4=packer 4	+/-
$DPAY_t$	Binary variable identifying week t as payment or nonpayment period	+/-
$DINFO_{ijt}$	Binary variables identifying available information. In specification A, j=1; 1=all periods of limited info. In B, j=1-2; 1=no current info,2=no summary info.	+/- price level model + variance model + weight deviation model

[a] not used in weight deviation model

Table 2. **Models Using Single Information Period Dummy Variable**

Variables	Price Model	Price Variance Model	Weight Deviation Model
BBP_{t-1}	0.235**	-0.133**	-0.005
	(4.291)	(-6.779)	(-1.731)
FMP_{t-1}	0.436**	0.010	N/A
	(5.863)	(0.384)	
TSL_{t-1}	0.082*	-0.101**	-0.050**
	(2.165)	(-7.406)	(-8.541)
$TLST_{t-1}$	0.070**	0.011**	0.039**
	(-6.786)	(3.488)	(17.644)
PPL	-0.068	0.048**	-0.059**
	(-1.377)	(2.712)	(-5.057)
DFD2	0.572**	-0.803**	0.446*
	(15.888)	(-4.324)	(2.500)
DFD3	0.375**	-0.111	0.963**
	(9.914)	(-0.565)	(5.198)
DFD4	0.960**	-0.657**	1.243**
	(25.529)	(-3.355)	(6.353)
DFD5	0.678**	-0.165	1.946**
	(16.047)	(-0.852)	(9.852)
DFD6	0.481**	-0.107	0.770**
	(11.948)	(-0.529)	(3.812)
DFD7	0.813**	-0.026	1.150**
	(17.831)	(-0.138)	(6.132)
DFD8	0.459**	0.452*	1.841**
	(9.879)	(2.317)	(9.656)
DPK2	0.152**	-0.034	-0.916**
	(4.144)	(-0.213)	(-6.241)
DPK3	0.123**	-0.340*	-0.029
	(3.755)	(-2.429)	(-0.242)
DPK4	0.404**	-0.929**	-0.937**
	(13.073)	(-6.711)	(-7.749)
DINFO	0.149	0.790**	0.420**
	(0.433)	(7.051)	(4.162)
DPAY	1.193**	-0.259*	0.058
	(3.468)	(-2.363)	(0.590)
Constant	19.576*	17.521**	N/A
	(2.170)	(5.953)	

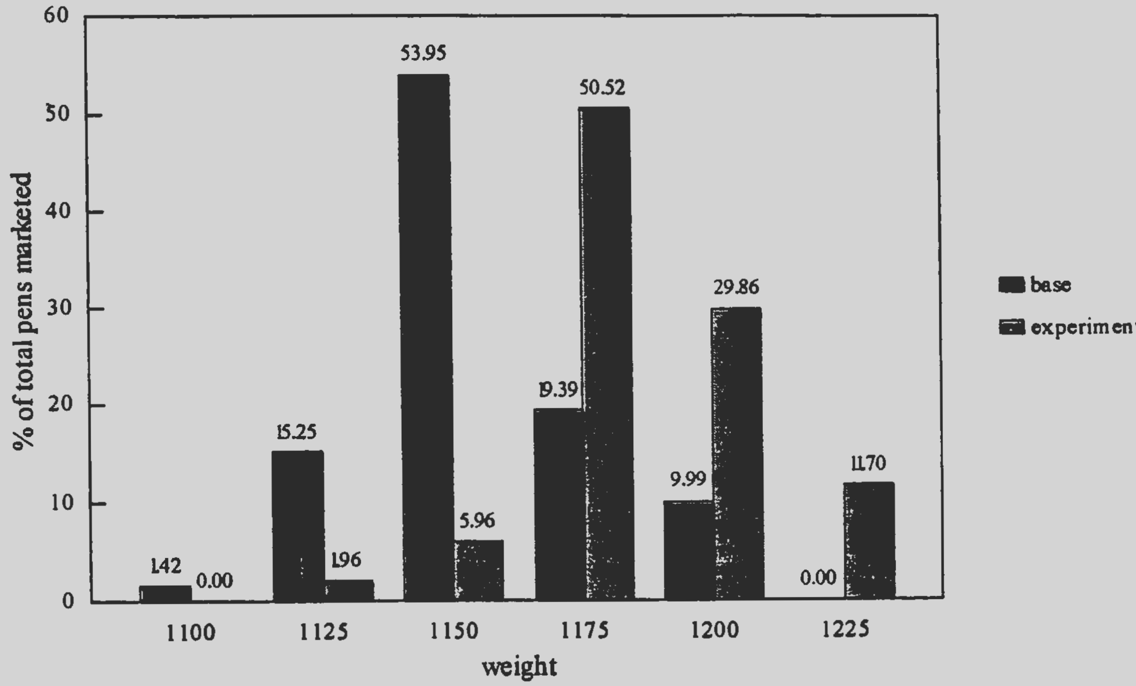
* significant at 0.05 level
**significant at 0.01 level
t-statistics in parentheses

Table 3. **Models Using Information Type Variable With Interaction Term**

Variables	Price Model	Price Variance Model	Weight Deviation Model
BBP_{t-1}	0.118*	-0.076**	-0.007
	(2.085)	(-3.680)	(-1.639)
FMP_{t-1}	0.327**	0.096**	N/A
	(4.141)	(3.611)	
TSL_{t-1}	0.038	-0.047**	-0.046**
	(1.031)	(-3.515)	(-7.664)
$TLST_{t-1}$	-0.063**	0.026**	0.039**
	(-4.491)	(5.849)	(10.610)
PPL	-0.091*	0.048**	-0.054**
	(-2.005)	(2.971)	(-4.261)
DFD2	0.500**	-0.459**	0.449*
	(9.410)	(-2.751)	(2.440)
DFD3	0.334**	-0.080	1.007**
	(5.595)	(-0.457)	(5.349)
DFD4	0.765**	-0.367*	1.266**
	(14.119)	(-2.085)	(6.360)
DFD5	0.406**	0.190	2.012**
	(6.602)	(1.094)	(9.889)
DFD6	0.463**	-0.040	0.758**
	(7.642)	(-0.220)	(3.680)
DFD7	0.649**	0.428*	1.114**
	(9.545)	(2.499)	(5.731)
DFD8	0.383**	0.071	1.858**
	(5.938)	(0.405)	(9.614)
DPK2	0.119*	-0.155	-0.857**
	(2.192)	(-1.083)	(-5.829)
DPK3	0.112*	-0.626**	-0.012
	(2.463)	(-4.984)	(-0.098)
DPK4	0.399**	-0.597**	-0.891**
	(8.851)	(-4.795)	(-7.265)
DINFO1	-2.370**	0.899**	0.026
	(-3.579)	(4.236)	(0.128)
DINFO2	0.723	-0.557**	1.108**
	(1.135)	(-2.652)	(6.393)
1 x 2	2.521*	0.808*	-0.763*
	(2.280)	(2.214)	(-2.101)
DPAY	1.033**	-0.485**	0.196
	(3.300)	(-4.743)	(1.884)
Constant	43.726**	-0.222	N/A
	(3.953)	(-0.061)	

* Significant at 0.05 level
**Significant at 0.01 level
t-statistics in parentheses

Figure 2. **Comparison of FCMS Fed Cattle Marketings by Weight Group: Experimental vs. Base Data**



Note: Experimental data consists of 2197 observatons collected from simulator weeks 37 to 96. Base data consists of 2682 observations collected from simulator weeks 30 to 101.

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