Impacts of "Right of First Refusal" on Competitiveness of Fed Cattle Markets:

Results from an Economic Experiment

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Introduction

Market power potentially exercised in agricultural markets is a well-research topic. What to do about it, when it is found, is much less discussed. The purpose of this paper is to examine an institutional practice that has the potential to increase – or decrease – competitiveness in fed cattle markets and determine the impact in an experimental marketplace.

It is not a premise of this paper that all the market power research that is needed has been conducted. Market power research remains innovative and progressive. It continues to expand what we know about the organization and performance of agricultural markets. Further, given that industry structure and conduct continue to change, and the political sensitivity of the topic, then measures of market power need to be updated and replicated. However, there is somewhat of a separation between the advance of academic research and change in agricultural markets. Specifically, it is difficult to identify lines of research and agricultural markets or industries that have been changed based on that research.

There are three paths for challenging the organization within a market – or for addressing the level is industry concentration. Two of these are public anti-trust actions and private law suites. Recently, the Department of Justice challenged the acquisition of National Beef Packing – the fourth largest beef packer – by JBS – one of the three largest beef packers. This is an example of a public anti-trust action but similar such actions are infrequent. The original formation of Cargill's beef packing business, Excel Corporation, was challenged through a private law suite that sought to block the merger of MBPXL and Spencer Beef. This suite was brought by the large cattle feeder and beef packer Monfort of Colorado, took years, and after winning the trial and all appeals but the last before the U.S. Supreme Court then Monfort accepted a bid to be purchased by ConAgra. Costs of these public actions and private suites are not small, raise many difficult to answer questions, and ultimately must be viewed in the context of political realities.

The third approach is vaguer and involves thinking about and changing market institutions. For example, there was a fruitful line of research on electronic markets in the 1970s and early 1980s (see Koontz and Ward). Use of electronic markets improved competitiveness is a ubiquitous finding along with the high cost of the infrastructure needed. It is interesting to think what agricultural markets might look like had this research not stopped before the commercialization of the internet. Other examples of market institutions include things like livestock mandatory price reporting and bidding behavior research on the Winner's Curse. Institutions can have substantial impacts on price discovery within a market and on the competitiveness of observed prices (Tomek and Robinson).

The institution examined in this paper is the "Right of First Refusal". It has a history of use in fed cattle markets and of being challenged by the USDA's Packers and Stockyards Administration.

What is the "Right of First Refusal"?

Right of first refusal gives the meatpacker with the right the ability to purchase fed cattle upon which a second packer has bid. For example, suppose a cattle feeder in Kansas gives the right of first refusal to the local Kansas packer with which they typically do business. This cattle feeder is visited regularly by buyers from other meatpackers. If the high-bid on a pen of fed cattle is by a firm other that the local packer – suppose a meatpacker in Nebraska – then the feedlot will check with the local packer to see if they want the cattle at the negotiated price. Tradition in fed cattle markets is that the local packer would need to advance the bid to secure the cattle and advance the bid by a minimum amount.

The right of first refusal could be competition enhancing. The idea is that packers without the right will give better bids if they know the packer with the right has the option to take the cattle. A similar argument can be made for the reverse. Meatpackers may not bid on animals at feeding businesses that use the right of first refusal if they view the exercise as a waste of time and this may result in decreased competition. This negative contention is of course what happened in Kansas with feedyards belonging to the Beef Marketing Group (BMG). The BMG had a marketing arrangement with IBP, the largest beef packer at that time, which included the right of first refusal. The Packers and Stockyards Administration, reacting to a complaint, filed a P&S action against the BMG. The USDA Administrative

Law Judge (ALJ) initially ruled that the marketing agreement with the right of first refusal did not harm competition and did not violate the P&S Act. On appeal, the USDA Judicial Officer overruled the ALJ, stated the right of first refusal did lessen competition and violated the P&S Act. A cease and desist order was issued to IBP and the BMG.

The arguments within the writings of the USDA administrative law proceedings are interesting and devoid of empirical evidence. The arguments are at their base an empirical question. The work presented in this paper seeks in part to address these missing facts. Does the right of first refusal positively or negatively impact market competitiveness? Further, this work seeks to expand the question. We do not focus on the impacts on a regional market but rather what would be the price impacts if the right of first refusal was adopted through the cattle industry? It is not possible to answer this broader question with public data. And it is this type of institutional change that can have far-reaching impacts.

There are further interesting arguments associated the right of first refusal. The right of first refusal is assignable based on actions by businesses. The meatpacker does not have to agree – the feeding business can unilaterally act using the right. Further, this right is a market institution. If it is competition enhancing, it can be adopted, and does not require the normal changes in industry structure – such as anti-trust actions or private law suites and divestiture or blocking of acquisitions – to improve competition. Thus, right of first refusal would be an easy method for improving competition.

Experimental Design and Procedure

The objective of this research is to test whether or not the right of first refusal is competition enhancing in an economic experiment. The Fed Cattle Market Simulator (FCMS), developed at Oklahoma State University, was used to develop data to test the hypothesis. Three replications of an experiment where conducted with the right of first refusal instituted. Prices, volumes, trading patterns, and other measures in the market were compared to six other replications where right of first refusal was not used.

Participants in the experiments were recruited from a senior-level agricultural commodity marketing class at Colorado State University during 2000 through 2011. The participants were paid based on profitability of their team. This induces agent incentives consistent with economic theory (Friedman and Sunder. Two day experiment sessions were conducted each semester in which participants were to make transactions over a simulated period of approximately 50 weeks.

Key elements of the experimental design include practices and features of the market simulator, market information provided to the participants, and market institutions. A brief description of the FCMS follows and are provided to understand the simulated market environment experienced by participants. Other descriptions of the FCMS can be found in Anderson et al. and Ward et al. (1996 and 1999).

Participants in the FCMS comprised eight feedlot teams and four meatpacking teams. Each team consisted of three-to-five persons. These teams bought and sold simulated pens of fed cattle during each trading week. Each trading week consisted of a ten-minute cycle. Feeders and packers negotiate transactions. Trades were conducted in face-to-face. Each feedlot has a number of op-scan paper pens of cattle representing the market-ready inventory – or showlist – with each pen containing 100 animals. Weights of animals on the showlist range from 1,100 to 1,200 pounds in five 25-pound increments. Cattle enter the showlist at 1,100 pounds and, if are not sold during the current trading week, gain 25 pounds and are available for sale the following week. Cattle reach a maximum weight of 1,200 pounds in the FCMS. Transactions were recorded on the sheets which were scanned into a computer. Prior to the experiment, the rules and practices of the simulator were explained and several practice sessions were held to familiarize participants with procedures.

Following each ten-minute trading period, a five-minute decision period allowed teams to process market information, update show lists, calculate breakeven prices and develop strategies for subsequent trading periods. An income statement for each team documenting transactions of the previous trading period was provided during each decision period.

During the right of first refusal replications the two feedlots closest to each packer were linked to that packer through the institution. Other packers would approach each feedlot and bid/ask would proceed on showlist cattle. After a price was agreed to the feedlot would then ask if the right of first refusal packer wanted the cattle at that price.

For each transaction 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 recorded data included: breakeven prices, boxed beef price at which meat was sold, closing nearby futures price for cattle, total marketings, and number of pens of cattle on the industry show-list at the beginning of each trading week.

The FCMS software controls a number of aspects of the experiment based on researched economic relationships. The FCMS sells meat from cattle purchased last trading period into the boxed beef market this trading period and accounts for plant operation costs. Boxed beef prices are determined by a weekly boxed beef demand function. Plant costs are determined by a U-shaped average total cost curve. Both are based on real-world parameters. The FCMS also purchases feeder cattle, keeps track of feedlot costs and feedlot cattle inventories. All are simplifications but are based on real-world economic and animal physiology relationships.

A feature of the market similar is the market information provided. Two digital displays provided the following information throughout the trading period. One display showed continuously updated cash transactions that included trading volume and high-low price ranges, which is analogous to USDA Agricultural Marketing Service cash market information. The second display provided continuously updated trading volume and current prices for three live cattle futures market contracts which is analogous to the information available from the Chicago Mercantile Exchange. Weekly summaries were also provided during the decision period – similar to USDA AMS summaries for boxed beef, fed cattle and feeder cattle prices, feed costs, and volumes. There is also information provided to the participants on forward contracts. 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. The forward contract information summarized from the trading period was provided during the five-minute decision period. This information was available to participants throughout all sessions and is consistent with the system of livestock mandatory price reporting.

The market simulator is structured similar to the real-world fed cattle market but because the simulator controls all but the negotiation and the specific dynamics resulting from participant actions in the current trading week (the models that determine the dynamics are controlled) then there is a level of abstraction needed for experimental economics (Kagel and Roth, Davis and Holt). While the market simulator has a specific commodity context similar to field experiments (Harrison and List) the participants were actually trading slips of paper.

It is also worth mentioning the events that not incorporated into the exercise. There are no unknown changes to demand, there is a strong seasonal pattern in animal availability but there are no changes due to the cattle cycle, there are no trade flow disruptions, there are no changes to the number of firms or changes in the underlying technology of cattle feeding or beef packing. These are all events which would need to be modeled and held constant in an econometric exercise with real-world data.

Econometric Models and Data

The econometric models used to evaluate the impact of right of first refusal on transaction price levels, price variability and production. The transaction data from the replications were used to estimate the following three models.

The price-level model is specified as follows:

$$PRICE_{it} = \beta_0 + \beta_1 \, BBP_{t-1} + \beta_2 \, FMP_{t-1} + \beta_3 \, TVOL_{t-1} + \beta_4 \, TINV_{t-1} + \beta_5 \, PPL_t$$

$$+ \beta_6 \, FDSZ_{it} + \beta_7 \, PKSZ_{it} + \beta_8 \, FWD_{it} + \beta_9 \, RFR_{it} + \beta_{10} \, RFR_{it} \times FWD_{it} + e_{it}$$

where t is the trading week and i denotes the transaction within the week. The number of trading weeks was variable depending on the length of play during each replication. The target was number of weeks 40-50. The number of transactions per week (i) depends on the participants and is variable. There are a few replications with small numbers of transactions and there are weeks with 60 pens traded, but the typical volume is 40 pens.

PRICE is the transaction price for each pen of fed cattle ($/cwt.), BBP is the boxed beef price ($/cwt.), FMP is the fed cattle futures market price ($/cwt.), TVOL is the total pens of fed cattle slaughtered, TINV is the total number of pens of market-ready cattle, PPL is the potential profit or loss available to the industry, FDSZ is the size of the feedlot involved in the transaction relative to the smallest of the eight feedlots, PKSZ is the size of the packer involved in the transaction relative to the smallest of the four packers, FWD denotes the binary variable identifying type of sale (cash = 0; forward = 1), RFR denotes the binary variable identifying the right of first refusal institution (no right of first refusal = 0; right of first refusal = 1) and RFR×FWD is an interaction variable.

The price-level model is a standard model where transaction price is a function of market aggregate boxed beef price, cattle futures price, slaughter volume, and market-ready cattle inventories. The model is a reduced-form derived demand model which has been used by Anderson et al., Ward et al. (1996 and 1999) and Ward (2005) with data from the FCMS and follows Ward (1992), Schroeder et al., Ward et al. (1998), and Muth et al. which use real world cattle market data. Variables are lagged if they are simultaneously determined with the transaction price and are contemporaneous if they are predetermined the week of the transactions.

The potential profit variable is the dollars per cwt difference between the meatpacker breakeven and the feedlot breakeven price. This variable is included to measure if transaction price levels are different when the available profit is high or low. The feedlot/packer size variables measure if larger feedlots/packers paid higher or lower prices relative the smallest operations in the industry. Or, is there a firm size impact on transaction price levels? The forward contracting dummy variable measures if forward contract prices are higher or lower than cash transaction prices. Likewise, the information variable measures if the information on forward contracting impacts transaction prices.

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

$$\ln(e_{it}^2) = \alpha_0 + \alpha_1\,BBP_{t-1} + \alpha_2\,FMP_{t-1} + \alpha_3\,TVOL_{t-1} + \alpha_4\,TINV_{t-1} + \alpha_5\,PPL_t$$
$$+\ \alpha_6\,FDSZ_{it} + \alpha_7\,PKSZ_{it} + \alpha_8\,FWD_{it} + \alpha_9\,RFR_{it} + \alpha_{10}\,RFR_{it}{\times}FWD_{it} + u_{it}$$

where variables are defined above. Independent variables in this model measure if variation in these variables explain the unexplained variation in transaction prices. This price-variance model essentially measures price risk or price dispersion at the transaction level. It identifies the variables that explain the difference between transaction prices and price implied by underlying supply and demand variables in the derived demand price-level model. It will also identify if, for example, prices discovered in the institution treatments have more or less unexplained variation.

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. These models correct for two related forms of dependence in the error term. The first source of dependence comes from market agents having common information each week of trading while negotiating prices. For example, all market participants receive the same previous week's boxed beef price quote before a week of trading. Thus, errors associated with the transaction prices for a given week are not independent. The second source is there are periods in the simulation where bargaining power varies systematically between feedlots and packers across trading weeks (Ward et al., 1999). For example, if a specific transaction price for a given week is high – relative to all the explanatory variables – then all transaction prices will likely be high for that week. This is due to inertia in market dynamics that is readily observable. Hausman tests support the random effects specification over fixed effects.

The price-variance model uses the residuals from the WREM price-level model for the dependent variable. The price-variance model is estimated with the random effects described above. Predicted values of the price-variance model are used to further correct heteroskedasticity in the price-level model. Last, the price-level model and the price-variance model were iteratively re-estimated until convergence – residuals from the price-level model are used to construct the dependent variable in the WREM of the price-variance model and predicted values from the price-variance model are used as weights in the WREM of price levels.

Production efficiency is measured by weight deviations from the optimal market weight for fed cattle of 1,150 pounds. This is the third model. Fixed production technology is used to simulate cattle growth and 1,150 pounds represents the low-cost weight in the FCMS. An ordered-logit model with the absolute value of deviations from 1,150 pounds as the dependent variable is the model of 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. The weight deviation model is specified as

$$WTD_{it} = \gamma_0 + \gamma_1 \, BBP_{t-1} + \gamma_2 \, FMP_{t-1} + \gamma_3 \, TVOL_{t-1} + \gamma_4 \, TINV_{t-1} + \gamma_5 \, PPL_t$$

$$+ \gamma_6 \, FDSZ_{it} + \gamma_7 \, PKSZ_{it} + \gamma_8 \, FWD_{it} + \gamma_9 \, RFR_{it} + \gamma_{10} \, RFR_{it}{\times}FWD_{it} + v_{it}$$

where WTDit is the categorical weight-deviation variable. As with the prior two models, we are interested in the supply and demand variables that explain deviations from optimal marketing. The variables of specific interest are the forward contracting and institution dummy variables – and the interaction term. The model will determine if the institution impacts production efficiency.

Results

Descriptive statistics for selected variables across and for the two institution treatments are reported in Table 1. Boxed beef, futures and fed cattle prices are all higher in the right of first refusal treatment. The transaction prices are significantly higher. Transaction weights between the treatments are slightly different with fewer heavy-weight transactions in the right of first refusal treatment. Differences and tendencies are analyzed in more detail through the econometric models. The estimated model results and associated impacts are reported in Tables 2 through 4.

The results are presented in the following sequence. The economic variables within the models that are used in other FCMS research and research using real-world data are discussed first. The results of these economic variables provide context and support for the price-level, price-variance, and weight-deviation models. We argue that if the results from these supply and demand variables are reasonable then the treatment variables should be isolating the impacts of the institutional change.

Price-Level Models

The price-level model results in Table 2 are consistent with a priori expectations. The lagged boxed beef price and futures market price coefficients are positive and significant in explaining transaction price level. The total slaughter and total market-ready inventory variables lagged show negative and significant relationships with transaction price. Fed cattle prices are in part derived from the demand for boxed beef and are impacted by fed cattle prices discovered in the forward-looking futures market. Transaction prices are also influenced by slaughter volume and the volume of market-ready inventories holding constant boxed beef and futures price levels. The potential profit coefficient is negative – the greater the profit potential the less of that profit that is captured by the feedlots – but it is significantly different from zero at the 7% level.

The model R-Squared is 78.78%. The random effects result in larger standard errors on model coefficients – mainly for those variables that are the same for each transaction within each trading week. These variables are the boxed beef price, futures price, market-ready inventory, and marketings volume.

Larger packers paid higher prices. And larger feedlots received higher prices but this result is only significant at the 17% level. Within the FCMS and similar to the real world, larger packers have lower costs than smaller packers and pass some of that advantage to feedlots in discovered transaction prices to secure the larger volumes needed. Larger feedlots have more cattle available for sale in a given trading week and appear to be able to capture a portion of the saved transactions costs – or in other words there may be volume premiums.

The overall results within the price-level models are consistent with past uses of the FCMS (see Anderson et al., Ward et al. (1996 and 1999), and Ward (2005)) and are consistent with similar models using real-world transaction data (see Schroeder et al., Ward et al. (1998) and Muth et al.).

Price-Variance Model

A priori expectations for the price-variance model are less clear. Results for the economic variables in the price-variance model indicate higher fed cattle futures prices are consistent with more unexplained variation in transaction prices (Table 2). This suggests that when the market outlook is for higher prices that there is more uncertainty in the transaction price. Higher futures prices create a more unstable negotiation environment. There are no other variables, not related to forward contracting and the institution experiment, that are significant.

The model R-Squared is 9.6% but the model summary statistic is highly significant. And as with the price-level model, the random effect reduces significance of many variables.

There is an interesting lack of results in the price-variance model. Larger packers – and to a lesser degree larger feedlots – pay and receive higher prices and there is modest evidence of less risk between these larger players. There are also no clear price risk incentives to use forward contracting. However, as will be discussed later, the right of first refusal has a strong impact on price dispersion.

Weight-Deviations Model

Results for the economic variables from the weight deviation model suggest that many market variables impact optimal marketing. The model coefficients, p-values, and marginal effects elasticities for the continuous independent variables are presented in Table 3. Higher futures prices, larger slaughter volumes, and greater potential industry profits are all consistent with more cattle being marketed at optimal weights. Higher boxed beef prices and larger market-ready inventories are consistent with increased sub-optimal marketings.

All of these results – with the exception of higher boxed beef prices – suggest market agents bargain more aggressively when the market conditions have deteriorated and when total profits in the system are lower. Lower futures prices, increased market-ready inventories, smaller volumes marketed, and lower potential profits are all indicative of difficult market conditions. The potential aggressive behavior or perceptions of fairness during these periods creates failed trades and inefficiencies.

Both larger packers and feedlots are more likely to transact cattle at optimal weights. This result is interesting. Optimal marketing appears to be a strategy followed by larger feedlots. Further, packers actually make higher profits from sub-optimal weight cattle, holding transaction price constant, because there are more pounds of meat to sell. The results suggest larger packers are not able to secure pens of larger animals. Sub-optimal marketings appear to be most persistent with smaller feedlots and smaller packers. These firms are also receiving and paying lower prices. Thus, there is clearly different behavior between large and small firms.

Right of First Refusal Impacts

In this section, we report the results associated with the RFR and FWD variables in all of the models. All or some combination of the coefficients are significantly different from zero in all three of the models.

The price impacts, elasticities associated with the price impacts, elasticities associated with price dispersion, and marginal effects from the ordered logit model are all reported in Table 4. The reference point for measuring the impacts is a cash market transaction price without the right of first refusal. The FWD, RFR, and interaction dummy variables allow examination of prices relative to cash market prices without the right of first refusal.

Forward contract transactions are significantly higher than cash market transactions when no first of first refusal is present. Forward contract transaction prices are $0.8083/cwt or 1.04% higher than cash prices. Perhaps most interesting is the positive impact the institution has on cash transaction prices and forward contract transactions prices. With the right the first refusal, cash prices are $1.2348/cwt (or 1.59%) higher than cash transaction prices without the institution and forward contract transactions are $0.9569/cwt (or 1.23%) higher than forward contract transaction prices without the institution.

The impact on cash prices when moving from a market without right of first refusal to a market with right of first refusal are measured by the coefficient for the RFR dummy variable (i.e., +$1.2348/cwt). The impact on forward contract prices when moving from no-right of first refusal to a market with the institution is that forward contract prices are $0.1486/cwt (or 0.19%) higher. This result is not significant. Marketing fed cattle through a forward contract instead of the cash market will result in $0.2780/cwt (or 0.36%) lower prices with the institution. This result is also not significant.

The results clearly support that the right of first refusal as a competition enhancing institution. The limitation is that the institution must be pervasive throughout the industry. The institution has the strongest impact on the cash market. The threat to the packer of losing the cattle associated with a trade after negotiating the trade results in packers offering stronger bids. Further, the strength in the cash market leads to improved forward contracted prices. The right of first refusal is not used with contracted cattle but only in cash market negotiations. The stronger forward contract prices are a spillover.

With the right of first refusal, it is reasonable that price dispersion – or unexplained variation in transaction prices – will decrease. There are less opportunistic trades on the part of the packing industry. The price-variance model results show this. In Table 4, elasticities are calculated using methods of

Halvorsen and Palmquist (1980) and significance is examined with Wald tests. Forward contract prices are 8.8% less disperse than cash market transactions without the right of first refusal and this result is not significant. Cash price dispersion shrinks 64.13% with the right of first refusal. With the right of first refusal, forward contract prices are 11.15% less disperse than without the right of first refusal and this result is also not significant. Thus, again it is clear that the right of first refusal has a strong positive impact on the cash market – prices are higher and less disperse – with spillovers to the forward contracting market being much less significant.

The weight deviations model indicates that the forward contract variable coefficient is statistically significant. The institution variable is statistically significant at the 10% level. There is also a significant interaction between RFR and FWD. The marginal effects reported in Table 4 indicate that forward contract transactions are more likely to be marketed at optimal weights than cash market transactions without the institution. Forward contracts are 32.67% more likely to be traded at the optimal weight and 49.05% less likely to be traded at 50 pounds away from the optimal weight. With the right of first refusal we see that cash market transactions are more likely to be marketed at optimal weights (+8.08%). This impact is significant. The institution has almost no impact on the efficiency of market forward contracts. This is reasonable in that the institution impacts how business is conducted in the cash market. The improved competitiveness of the cash market results in improved production efficiency but has little impact on contracting.

Summary and Conclusions

The work presents evidence of an institutional change that can improve the competitiveness of fed cattle markets. That institution is the right of first refusal. This right is given to a third party allows them to secure property transacted by two other parties. It changes how cattle feeders and beef packers interact in the cash market. The threat of a third party taking ownership causes the packer in that negation to offer better terms of trade. It institution has been challenged by the USDA Packers and Stockyards Administration as violating the Packers and Stockyards Act. The argument was that right of first refusal limited bidding. This work presents evidence to the contrary. An experiment using the FCMS was designed to assess the impacts of use of the right of first refusal on price discovery and production efficiency for fed cattle. We find the institution as competition enhancing if adopted across the industry.

The institution has a definitive impact on the cash market. It is price improving from the standpoint of the cattle feeder and appears to counteract some of the market power exercised by packers due to their limited numbers – relative to cattle feeders – and different production and marketing risks. Further, there are also spillovers to the forward contract market. Prices are improved in forward markets as well. There are very limited spillovers impacting production efficiency as measured by least cost production of fed cattle – packing plant production efficiency is not examined.

This work offers an example of what to do regarding market power and concentration in fed cattle markets. An institutional change – or a business practice change – can potentially counteract market power. It is a practice which could be adopted by the cattle feeding industry with low-cost relative to other avenues of action. Other institutions maybe worth research as well.

Table 1. Descriptive Statistics for Model Variables.

	Full Sample		Right of First Refusal		No Right of First Refusal	
Variables	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Boxed Beef Price ($/cwt.)	123.4310	7.6291	123.5929	7.7232	123.4067	7.6147
Cattle Futures Market Price ($/cwt.)	78.8853	4.2031	79.2791	4.0608	78.8262	8.4314
Slaughter Volume (# pens)	37.7696	6.4783	37.5073	6.0261	37.8090	6.5427
Market-Ready Cattle Inventory (# pens)	124.2586	21.4355	122.9815	19.5762	124.4503	21.6946
Industry Potential Profit or Loss ($/cwt.)	1.5234	4.9390	1.4839	4.7540	1.5294	4.9663
Feedlot Size (% of smallest)	1.1552	0.0921	1.1548	0.0923	1.1553	0.0921
Packer Size (% of smallest)	1.2817	0.1959	1.2854	0.1939	1.2812	0.1962
Forward Contract Dummy	0.2807	0.4494	0.3078	0.4616	0.2767	0.4474
Right of First Refusal Dummy	0.3040	0.4600	1.0	0.0	0.0	0.0
Transaction Cattle Price ($/cwt.)	77.8481	5.4876	78.0648	4.6490	77.8156	5.6020
Transaction Cattle Weight (Pounds)	1156.4521	17.0813	1156.3412	15.6747	1156.4687	17.2828
Number of Transactions	13,305		4,045		9,260	

Table 2. Estimated Coefficients for the Price-Level and Price Variance Models.

	Price-Level		Price-Variance	
Variables	Coeff.	P-Value	Coeff.	P-Value
Boxed Beef Price (BBP_{t-1})	0.3595	0.0001	-0.0007	0.9654
Futures Market Price (FMP_{t-1})	0.3741	0.0001	0.0595	0.0127
Slaughter Volume ($TVOL_{t-1}$)	-0.0844	0.0001	0.0101	0.3022
Market-Ready Cattle Inventory ($TINV_{t-1}$)	-0.0475	0.0001	0.0037	0.3978
Potential Profit or Loss (PPL_t)	-0.0608	0.0603	0.0119	0.6085
Feedlot Size ($FDSZ_{it}$)	0.0998	0.1650	-0.1720	0.1188
Packer Size ($PKSZ_{it}$)	0.2516	0.0001	-0.0752	0.1433
Forward Contract Dummy (FWD_{it})	0.8083	0.0001	-0.0921	0.3557
Right of First Refusal Dummy (RFR_{it})	1.2348	0.0007	-1.0252	0.0001
$RFR_{it} \times FWD_{it}$	-1.0862	0.0001	0.8948	0.0001
Constant	8.0766	0.0001	-4.9707	0.0001
R-Squared	0.7878		0.0960	
Model Significance	0.0001		0.0001	

Table 3. Estimated Coefficients and Selected Marginal Effects Elasticities for the Weight Deviation Model.

	Model		Marginal Effects Elasticities		
Variables	Coeff.	P-Value	Optimal	25	50
Boxed Beef Price (BBP_{t-1})	0.0304	0.0073	-0.7494	0.6028	0.1466
Futures Market Price (FMP_{t-1})	-0.0399	0.0299	0.6284	-0.5055	-0.1229
Slaughter Volume ($TVOL_{t-1}$)	-0.0320	0.0001	0.2420	-0.1947	-0.0473
Market-Ready Inventory ($TINV_{t-1}$)	0.0242	0.0001	-0.5957	0.4792	0.1165
Potential Profit or Loss (PPL_t)	-0.0892	0.0001	0.0232	-0.0187	-0.0045
Feedlot Size ($FDSZ_{it}$)	-1.5227	0.0001	0.3516	-0.2828	-0.0688
Packer Size ($PKSZ_{it}$)	-0.8417	0.0001	0.2152	-0.1731	-0.0421
Forward Contract Dummy (FWD_{it})	-2.3540	0.0001			
Right of First Refusal Dummy (RFR_{it})	-0.4238	0.0941			
$RFR_{it} \times FWD_{it}$	0.5543	0.0001			
Mu	2.2726	0.0001			
Log Likelihood Ratio Test	575.62	0.0001			

Table 4. Price Impacts, Elasticities, and Marginal Effects from the Price-Level, Price-Variance, and Weight Deviation Models Explaining the Impact of the Right of First Refusal Institution.

	Price-Level Model Impact ($/cwt)	Price-Level Model Elasticity (%)	Price-Variance Model Elasticity (%)	Weight (optimal) (%)	Weight (±25 lbs.) (%)	Weight (±50 lbs.) (%)
Cash Transactions w/o RFR	Base	Base	Base	Base	Base	Base
Forward Transactions w/o RFR (E.g., β_8)	0.8083 (0.0001)	0.0104	-0.0880 (0.3557)	0.3267	0.1637	-0.4905
Cash Transactions w/ RFR (E.g., β_9)	1.2348 (0.0007)	0.0159	-0.6413 (0.0001)	0.0808	0.0243	-0.1051
Forward Transactions w/ RFR (E.g., $\beta_8 + \beta_9 + \beta_{10}$)	0.9569 (0.0204)	0.0123	-0.1995 (0.0561)	0.3339	0.1503	-0.4843
Cash Transactions from w/o to w/ RFR (E.g., β_9)	1.2348 (0.0007)	0.0159	-0.6413 (0.0001)	0.0808	0.0243	-0.1051
Forward Transactions from w/o to w/ RFR (E.g., $\beta_8 + \beta_{10}$)	0.1486 (0.8875)	0.0019	-0.1115 (0.8454)	0.0072	-0.0134	0.0062
Cash to Forward Transactions w/ RFR (E.g., $\beta_9 + \beta_{10}$)	-0.2780 (0.6137)	-0.0036	0.4417 (0.3347)	0.0772	0.0641	-0.1413

Note: Weight column percentages denote the probability of observing the weight category (optimal, ±25 lbs, or ±50 lbs) under the different regimes and the sum of the row is to zero. P-Values are reported in parentheses.

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