FEEDLOT AND PACKER PRICING BEHAVIOR: IMPLICATIONS FOR COMPETITION RESEARCH

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Abstract
Seldom are observed losing bids available in industry data. A special workshop of the Fed Cattle Market Simulator was designed to capture bids for each pen of cattle traded. Data enabled identifying buyer and seller behavior in the price discovery process, both before and after imposed mergers of the two largest and two smallest packer teams. Highest losing bids also were estimated with packer bid functions and compared with observed highest losing bids. An estimated price discovery model indicated market structure as measured by number of buyers was more important than simply the number of bids or size of transactions.

Keywords
Buyer behavior, Competition, Fed cattle, Marketing, Pricing, Seller behavior

Introduction

Crespi and Sexton's (2004, 2005) award-wining research on bid shading in the procurement market for fed cattle cited two key weaknesses in the data. One was not having unsuccessful bids; and the other was not knowing how many bids were received for each lot of cattle. Data limitations led to implicit assumptions of the fed cattle market studied. For example, one implicit assumption was that feedlots seek bids from all buyers for each pen of cattle traded, thus leading to a distribution of losing bids which can be compared with winning bids (i.e., sale prices). Hunnicutt, Bailey, and Crook (2004), using the same data as Crespi and Sexton, found that a majority of feedlots (57%) preferred trading with a single packer. This finding raises a question regarding another implicit assumption by Crespi and Sexton, that sellers do or always would sell cattle to the highest bidder. In fact, given their preferences for a single packer and the importance of preserving a long-standing buyer-seller relationship, they conceivably might reject occasional higher bids rather than jeopardize their trading relationship with a preferred buyer.

Until recently, data were not available to confirm or refute assumptions such as some in Crespi and Sexton's research (2004, 2005). The *Fed Cattle Market Simulator (FCMS)* provides unique data with which to better understand buyer-seller behavior; though the author (and one of the *FCMS* developers) clearly recognizes that data from the market simulator are *not* data from the "real-world" fed cattle market. Results presented here with market simulator data have implications for future research related to what Crespi and Sexton (2004) describe as a key issue in the beef industry, i.e., buyer competition for fed cattle. Data from the market simulator challenge some conventional assumptions and provide insight into buyer-seller relationships and behavior. One frequently made assumption is that buyers control the competitive environment regarding price discovery; when in fact, price discovery by one long-used definition involves both buyers and sellers (Thomsen and Foote 1952). Thus, seller behavior is important also, as are the relationships between buyers and sellers as found by Hunnicutt, Bailey, and Crook (2004).

The overall objective of this research is to determine the strategic behavior of buyers *and* sellers in competing for and marketing fed cattle in an experimental market representative of the real-world fed cattle market. This paper reports on bids (offers) and purchases (sales) by buyer-seller pairs, trades involving multiple pens of cattle, trades where bids exceed sale prices, highest losing bids and estimated highest losing bids relative to successful bids, and market consolidation effects on each of the above components of buyer-seller behavior.

Procedure and Data

A specially-designed workshop conducted with the *FCMS* generated bid data not generally available from the experimental market (Tostao 2006). Winning and losing bids resulted from first-price auctions just as were successful bids available to Crespi and Sexton

(2004, 2005) and Hunnicutt, Bailey, and Crook (2004). A graduate student was assigned to each *FCMS* feedlot team to monitor and record bidding activity for each pen of cattle sold during each trading period. Thus actual bids were captured along with the usual data from the market simulator (Ward 2005). Experimental market data were available for 14 weeks, 8 in a pre-merger period and 6 in a post-merger period. Mergers between the two largest and two smallest packers were imposed on the market to determine the effects on buyers, sellers, buyer-seller relationships, resulting bidding behavior, competition, and prices. Available data consisted of the winning live cattle price, losing bids, boxed beef price, show list, winning buyer, losing rivals, feedlot, cattle weight, cattle genetic type, and trading week.

Bid and sale/purchase information was summarized in a variety of ways to identify similarities and differences in buyer and seller behavior. Examples include: developing the distribution of purchases (sales) from feedlots by packers (by feedlots to packers), distribution of purchases (sales) by number of bids made (received), mean prices and variation by buyer and seller as well as by number of bids made, distribution of purchases (sales) in multiple pens of cattle at the same price, purchases (sales) at prices less than highest bids, and the relationship between losing bids (when observed) with winning bids. Regression models similar to those estimated previously with experimental market data (Ward 2005) were estimated to explain the variation in winning prices, especially from the extent of bidding and buyer competition before and after the imposed packer mergers.

Summary statistics of the data are shown for the pre-merger and post-merger periods in Table 1. In each time period, one packer bid on significantly more pens of cattle than other packers, but bids per pen averaged less than two. As the HHI (Hirschman-Herfindahl Index)

indicates, the imposed mergers greatly increased the degree of market concentration during the post-merger period.

Buyer-Seller Relationships and Bidding Characteristics

Several tables detail various aspects of trading between buyers and sellers during the experimental simulation. However, for space considerations, only a few are included in this paper. Anyone wanting further information can contact the author. Instead of including some tables, brief comments on the nature of trading are discussed to highlight differences in buyer-seller relationships.

Purchases, marketings by firm – Purchases from feedlots by packers varied. For example, packer 2 purchased more than a third of its cattle in the pre-merger period (35.9%) from feedlot 5 and none from feedlot 7 (0%). Packers 1 and 3 purchased some cattle from every feedlot with less concentrated purchases from any single feedlot (packer 1, 1.5-20.0%; packer 3, 4.3-23.4%).

Viewed from the feedlot perspective, some feedlots preferred certain packers more than others. For example, feedlot 3 sold more than half of its cattle to packer 3 (57.9%) but sold some to each packer. Feedlot 5 sold nearly half (48.9%) to packer 2, but none (0%) to packer 4. Feedlot preference for a specific packer tended to increase dramatically in the more concentrated post-merger environment. Two feedlots sold either exclusively (feedlot 4, 100%) or almost exclusively (feedlot 5, 97.4) to a single packer.

In summary, this initial look at trading relationships seems consistent with findings by Hunnicutt, Bailey, and Crook (2004), that buyer-seller relationships matter in price discovery and to market competition.

Bids made, received by firm – Few feeders sold cattle with bids from all four packers; or stated conversely, few packers purchased cattle with all four packers having bid on them. For example,

no pens of cattle purchased by packer 4 had four bids on them; and at the other extreme, 4.3% of cattle purchased by packer 3 had 4 bids on them in the pre-merger period. For all four packers, most cattle were purchased with two bids (75.0-78.7%). After the imposed mergers, a higher percentage of pens had bids from all available packers but that meant a maximum of two bids.

From the feedlot view, 5 feedlots never sold cattle with four bids for them. Feedlot 5 sold 80.8% of its cattle with a single bid. Feedlot 2 seemed most adept at securing bids, marketing the lowest percentage of its cattle with one bid (13.2%) and nearly the most with four bids (7.9%). For all feeders, the post-merger period saw more cattle sold with a single bid though three feedlots were able to sell more than half their cattle (from 52.6 to 59.0%) with bids from both merged packers.

Average prices paid (received) varied by number of bids. However, viewing the mean and standard variation by packer, by feedlot, and by period shows little evidence number of bids was important in the price discovery outcome. While there were mean and standard deviation difference, there was no consistent pattern according to number of bids. As such, this result tends to refute research conducted in the 1980s and 1990s which often showed that prices increased as number of bids or buyers increased (see review of several studies by Ward 2002). Other market conditions such as availability of information, the spatial dimension of the market, and degree of consolidation may affect the bid-price relationship.

In summary, feeders apparently did not seek bids from all buyers and/or all buyers did not attempt to bid on all pens of cattle. This is contrary to the implicit assumption in the Crespi and Sexton (2004, 2005) study. However, had more bids been made on cattle sold, there was no clear evidence higher prices would have resulted.

Multiple pen purchases, marketings by firm – In early work on price discovery for fed cattle, data were collected on pens of cattle sold and nearly every pen represented a separate transaction (for example, Ward 1981). In the 1990s, likely a product of packer consolidation, packers more frequently bid on multiple pens of cattle, including entire show lists at a single price. Thus, bids were not received on each pen individually. This led to two results; quantity of cattle purchased (and marketed) per transaction increased and transaction costs declined for packers and feeders. Evidence from the *FCMS* shows the same behavior of buyers and sellers in the experimental market as in the real-world market.

From the distribution of purchases (marketings) by number of pens bundled in a single transaction, variation was observed across buyers and sellers. For example, packer 4 purchased more than half of its cattle in multiple pens of 4 or 5 (54.4%). Packer 2 purchased 10.9% in groups of 6 pens or more. At the other extreme, packer 2 purchased nearly a third of its cattle in single-pen purchases (32.8%), more than any other packer. Multiple-pen purchases clearly increased with the increase in packer consolidation. Packer 1-2, the smaller of the two packers in the post-merger period, bought over two-thirds of its cattle (68.3%) in groups of 5 or more pens.

Feeders, too, appeared to package cattle in groups of multiple pens. Only feedlot 3 sold as much as a third of its cattle in single-pen transactions (34.2%). Three feedlots (2, 5, and 6) sold a quarter or more of their cattle in groups of 5 or more pens (26.3%, 27.7%, and 25.0%, respectively). Note for feedlots placing about 3-6 pens of cattle weekly in the experimental market, many were marketing entire weight groups of cattle as a single transaction.

The market structure change again significantly affected feeders' apparent willingness to market cattle in larger groups. Seven of 8 feedlots sold a smaller percentage of cattle in single-

pen transactions and all 8 sold a higher percentage in groups of 5 pens or more in the post-merger period.

In summary, experimental market data clearly show that packers do not bid on each pen of cattle, instead purchasing multiple pens in a single transaction. Feeders, too, apparently preferred marketing multiple pens in a single lot rather than attempting to market single-pen sale lots.

Purchases, sales and highest losing bid(s) – Thus far, data from the experimental market confirm that packers do not bid on each pen of cattle and feeders do not seek bids from each packer for each pen. As a result of many pens of cattle being traded after only a single bid and multiple pens of cattle traded in a single transaction, the observance or availability of a highest losing bid does not exist as frequently as Crespi and Sexton (2004, 2005) implicitly assumed.

Table 2 summarizes transactions for which a highest losing bid was observed and transactions for which no losing bid was observed. A highest losing bid was observed for 51.8% of pens traded in the pre-merger period. However, with a more concentrated buying structure, the percentage of observed losing bids dropped to 34.6% in the post-merger period. More differences were noted among feeders in the number of pens marketed for which a losing bid existed than among packers. As implied from the earlier discussion, some feeders apparently were more successful or had a stronger preference for receiving more than a single bid on pens of cattle sold.

Also computed were the number of pens of cattle purchased (sold) for which the highest bid exceeded the sale price. Perhaps the most common example of how this happens is when a feedlot passes on (i.e., rejects) a bid for their cattle (expecting a higher bid later), but cannot get another packer to bid the same or a higher price and is forced to accept a lower price later than

the earlier bid. The frequency of the winning packer paying a price below another packer's bid or of a feedlot having to accept a lower price than was bid by another packer was not large, 6.3% of all pre-merger transactions and 5.5% of post-merger transactions. While not large, it is important to note the phenomena occurred.

Lastly, Table 2 reports the average difference between the winning bid and highest losing bid (when observed) for purchases (sales). Average bid-vs.-sale price differences ranged from \$0.25-0.50/cwt. for packers and \$0.22-0.76/cwt. for feeders during the pre-merger period. Differences narrowed for some firms and widened for others during the post-merger period. These differences for both periods provide evidence of the *a priori* expectation some feedlot and packer teams would be better negotiators than others.

In summary, highest losing bids were not observed for over half of all transactions in the two periods combined. Also, there was evidence that in a small percentage of cases, feeders failed to accept the highest bid from packers. Differences between the winning bid and highest losing bid (when observed) varied among packers and feedlots and appeared to be influenced by market consolidation but not in a consistent manner.

Winning Bids versus Actual and Estimated Losing Bids

Crespi and Sexton (2004, 2005), faced with not having losing bids to determine the extent packers bid lower than their valuation of the fed cattle being purchased, estimated losing bids. They derived and estimated four, plant-specific bid functions for the three largest packing firms competing in the Texas panhandle over the data period.

Similar packer bid functions were estimated with the available experimental market data. The model estimated for each packer was

$$(1) \qquad \Pr ice_i = \alpha + B_1 BoxedBeef_{t-1} + B_2 ShowList_t + \sum_{j=1}^{3} B_{3j} LiveWt_j + \sum_{j=1}^{3} B_{4j} Genetics_j$$

where BoxedBeef is the wholesale price of beef sold by packers, ShowList is the available cattle packers can purchase each week, LiveWt is the live weight of cattle (1125, 1150, 1175 lbs.), and Genetics is the known set of carcass components for each pen of cattle (low quality-high yielding cattle, medium quality-medium yielding cattle, high quality-low yielding cattle). Several variables in the Crespi-Sexton models were not applicable or held constant in the experimental market data; e.g., yield grade and quality grade were incorporated in Genetics, sale lot size is fixed at 100 head, distance to the plant is not applicable in a market without a spatial dimension, and day of the week was not relevant in a trading week unit. Crespi and Sexton estimated their bid functions with dummy variables for each week. Here, the ShowList variable and BoxedBeef combine to proxy the overall market price level for each week.

The above procedure generated highest losing bids for all transactions in the experimental market data set in a manner similar to that followed by Crespi and Sexton (2004, 2005). Table 3 shows a comparison of actual highest losing bids (when observed) for each packer and estimated highest losing bids for the same transactions in both the pre-merger and post-merger periods. Packer bid functions yielded estimated highest losing bids which were significantly above actual highest losing bids and slightly above winning bids on average. Therefore, packer bid functions overestimated highest losing bids compared with actual, observed highest losing bids. Accuracy of the estimated highest losing bids procedure was lower in the more concentrated market following mergers of the two smallest and two largest packers.

Readers should be cautioned that one cannot directly compare results of efforts here to estimate highest losing bids with those of Crespi and Sexton (2004, 2005). However, their estimated highest losing bids were above observed highest winning bids by a greater amount than was the case in the experimental market. Similarly, one cannot determine the accuracy of

their procedure since highest losing bids were not observed in the data they had available. However, it is clear that the accuracy of the estimation procedure is critically important to any further analysis on potential bid shading and conclusions from simulations which use estimated losing bids in lieu of actual losing bids. *If* – and a critical *if* – the Crespi-Sexton procedure overestimated highest losing bids, as is implied by estimated highest losing bids with experimental data, the overestimation led to an overstatement of bid shading by packers in their study by some unknown amount.

Competition Impacts – Number of Bids versus Number of Buyers

Two components of competition in price discovery are number of bids and number of bidders or buyers. While the two may seem inextricably linked, they are not identical, especially as market consolidation increases. Number of bids is affected by the preference and propensity of sellers to seek bids from available buyers as well as the preference and propensity of buyers to bid on all available fed cattle. As shown above, some sellers are more adept at seeking bids than others and some buyers have a higher propensity to bid on cattle from many feedlots than others. Number of bidders or buyers is related primarily to the market structure in which price discovery occurs. Number of buyers occurs independently of sellers' preferences and behavior in a static sense. In this research, pre-merger and post-merger periods directly determined the number of buyers.

A price discovery model was estimated similar to one reported in Ward (2005) to determine the effect number of bids, multiple-pen sales, and number of buyers had on prices paid and received. The model estimated was

$$\begin{aligned}\Pr ice_i = {} & \alpha + B_1 BoxedBeef_{t-1} + B_2 ShowList_t + \sum_{j=1}^{3} B_{3j} LiveWt_j \\ & + \sum_{k=1}^{3} B_{4j} Genetics_j + \sum_{j=1}^{8} B5_{6j} Feedlot_j + \sum_{j=1}^{4} B6_{7j} Packer_j \\ & + \sum_{j=1}^{2} B_{8j} NmbrBids + \sum_{j=1}^{2} B_{9j} NmbrPens + \sum_{j=1}^{2} B_{10j} MktStruc\end{aligned} \tag{2}$$

where Feedlot is the seller (1-8), Packer is the buyer (1-4), NmbrBids is a dummy variable (1=1 is bid, 2=>1 bid), NmbrPens is a dummy variable (1=1 pen, 2=>1 pen), and BoxedBeef, ShowList, LiveWt, and Genetics were defined above. MktStruc was included in two ways. One was a dummy variable (1=pre-merger period, 2=post-merger period) in one version of the model and the weekly computed HHI was used in the second.

The model was estimated by feasible generalized least squares (FGLS) to account for heteroskedasticity present in the experimental market data. Regression results are presented in Table 4. Both models explained a high percentage of the variation in transaction prices for the experimental simulation period (adj R^2=0.936-0.942). Note the two models differed only by the two versions of the MktStruc variable.

Signs and significance for most variables were expected and/or were reasonable given previous experience with *FCMS* data (e.g., BoxedBeef, Showlist, LiveWt, Genetics, Feedlot, and Packer). Number of bids was not significant in either version of the model, nor was number of pens purchased in a singe transaction. However both versions of the MktStruc variable were negative and significant. Prices in the post-merger period, when market consolidation was much higher, were $2.31/cwt. (3.0%) lower than in the pre-merger period with twice the number of buyers (packers). For the model where the HHI was substituted for the merger dummy variable, a one-unit increase in the HHI after the imposed mergers (where HHI was expressed in decimal, i.e., 0.5118) was associated with a price decline of $9.39/cwt. for fed cattle traded.

In this case, number of bids and number of pens traded per transaction was less important than the market structure in which price discovery occurred. The imposed mergers, halving the number of buyers from 4 to 2 and nearly doubling the mean HHI from 2640 to 5118, had a significant negative effect on prices paid and received.

Implications and Conclusions

Oftentimes, economists focus on buyer behavior at the exclusion of seller behavior in the price discovery process. Seller behavior is likely of lesser importance but should not be ignored. Buyer-seller preferences, strategies, relationships, and practices combine to influence the competitive process and resulting discovered prices.

This research, with an experimental market designed to mimic the real fed cattle market among buyers and among sellers, demonstrated differences exist regarding trading relationships, bids made (received), and multiple-pen purchases (marketings). A special workshop with the *Fed Cattle Market Simulator* was designed specifically to capture losing bids. Thus, perhaps for the first time, actual losing bids were observed along with winning bids in a first price auction. Far fewer losing bids were observed than were assumed in prior research with industry data. Evidence supports the contention that buyers at times pass (reject) bids which, in hindsight, were higher than later bids received for the same cattle. It was found here that observed highest losing bids were not as high as estimated by individual packer bid functions. Given the differences between actual and estimated losing bids, care must be exercised when interpreting and using estimated losing bids in lieu of actual losing bids.

Number of available buyers was much more important than number of bids received or the number of pens bundled into a single transaction. Thus, economists are correct to be

concerned about market structure, defined here by number of competing firms, moreso than some buyer-seller practices such as number of bids make (received) per transaction.

Lastly, I want to make clear any apparent criticism of the Crespi-Sexton research (2004, 2005) *is not intended* to denigrate their innovative work. As a reviewer of both published articles, I supported publication because of the contribution each made to an important issue. The intent of this paper is to highlight the importance and care all researchers must place on understanding the nature of the market being studied. Such understanding is critical to the relevancy of research findings. Researchers should strive to make the best assumptions possible for any given research study; and those of us with many years in the profession certainly have made necessary – and likely questionable – assumptions over time. It is equally imperative that we recognize how alternative assumptions might alter our findings and that the best available methodology may not adequately replace complete, detailed data. Unfortunately, we can only use data which are available and oftentimes data have serious limitations for our intended research.

References

Crespi, John M. and Richard J. Sexton. "Bidding for Cattle in the Texas Panhandle." *American Journal of Agricultural Economics*. 86,3(2004):660-74.

Crespi, John M. and Richard J. Sexton. "A Multinominal Logit Framework to Estimate Bid Shading in Procurement Auctions: Application to Cattle Sales in the Texas Panhandle." *Review of Industrial Organization*. 27(November 2005):253-78.

Hunnicutt, Lynn, DeeVon.Bailey, and Michelle Crook. "Rigidity in Packer-Feeder Relationships." *Journal of Agricultural and Applied Economics*. 36,3(2004):627-38.

Thomsen, Frederick L. and Richard J. Foote. *Agricultural Prices*, 2nd ed. New York: McGraw-Hill, 1952.

Tostao, Emilio. "Consolidation and Market Power in the U.S. Beef Processing Industry." Unpublished Ph.D. dissertation, Oklahoma State University, July 2006.

Ward, Clement E. “Short-Period Pricing Models for Fed Cattle and Impacts of Wholesale Carcass Beef and Live Cattle Futures Market Prices.” *Southern Journal of Agricultural Economics.* 13(1981):125-132.

Ward, Clement E. “A Review of Causes for and Consequences of Economic Concentration in the U.S. Meatpacking Industry.” *Current Agriculture, Food, & Resource Issues* 3(2002):1-28. www.CAFRI.org

Ward, Clement E. “Price Discovery and Pricing Choice Under Divergent Supply Scenarios in an Experimental Market for Fed Cattle.” *Journal of Agricultural and Resource Economics* 30,3(2005):580-96.

Table 1. Summary statistics for pre-merger and post-merger periods

Pre-Merger Period Variable	Observations	Mean	Standard deviation
Packer 1 bids ($/cwt)	125	78.76	0.87
Packer 2 bids ($/cwt)	121	78.68	2.73
Packer 3 bids ($/cwt)	126	79.34	0.77
Packer 4 bids ($/cwt)	163	78.80	0.95
Bids per transaction	302	1.77	0.85
Live weight price ($/cwt)	302	79.22	0.80
Boxed beef price (t-1) ($/cwt)	302	125.31	2.49
Show list pens	302	113.36	4.21
HHI	302	2640.82	91.82

Post-Merger Period Variable	Observations	Mean	Standard deviation
Packer 1-2 bids ($/cwt)	179	74.31	1.51
Packer 3-4 bids ($/cwt)	210	74.70	1.62
Bids per transaction	289	1.36	0.48
Live weight price ($/cwt)	289	74.74	1.53
Boxed beef price (t-1) ($/cwt)	289	121.71	2.84
Show list pens	289	131.18	8.82
HHI	289	5118.32	106.40

Table 2. Sale price versus highest losing bid for purchases (marketings) by packer (feedlot), pre-merger and post-merger periods

Pre-merger period	Winning Packer			
	1	2	3	4
Number of pens with a highest losing bid	31	38	48	40
Number of pens without a highest losing bid	35	26	46	39
Mean sale price less highest losing bid ($/cwt.)	0.49	0.50	0.25	0.47

Post-merger period	Winning Packer	
	1-2	3-4
Number of pens with a highest losing bid	47	53
Number of pens without a highest losing bid	79	53
Mean sale price less highest losing bid ($/cwt.)	0.32	1.01

Pre-merger period	Feedlot							
	1	2	3	4	5	6	7	8
Number of pens with a highest losing bid	24	33	23	15	9	24	9	20
Number of pens without a highest losing bid	13	5	15	26	38	16	19	13
Mean sale price less highest losing bid ($/cwt.)	0.22	0.26	0.76	0.29	0.63	0.35	0.32	0.60

Post-merger period	Feedlot							
	1	2	3	4	5	6	7	8
Number of pens with a highest losing bid	23	20	20	9	3	12	5	8
Number of pens without a highest losing bid	16	18	15	26	36	23	27	28
Mean sale price less highest losing bid ($/cwt.)	0.07	1.01	0.56	-0.17	1.63	1.23	0.86	1.63

Table 3. Mean actual and estimated highest losing bids for purchases by packer, pre-merger and post-merger periods

Pre-merger period

	Winning packer			
	1	2	3	4
	(Mean price and Standard deviation)[a] ($/cwt.)			
Actual HLB	0.49	0.50	0.25	0.47
	(0.610)	0.755	0.531	0.776
Est. HLB	-0.03	-0.10	-0.02	0.15
	0.536	0.633	0.610	0.589
Difference	0.52	0.60	0.26	0.31
	0.780	0.908	0.707	0.998

Post-merger period

	Winning packer	
	1-2	3-4
	(Mean price and Standard Deviation)[a] ($/cwt.)	
Actual HLB	0.32	1.01
	1.053	1.281
Est. HLB	-0.15	-0.17
	0.869	0.831
Difference	0.47	1.77
	1.064	0.328

[a] Standard deviation is in parentheses.

Table 4. FGLS regression results for bid and merger effects on price discovery

Dependent variable
Transaction price ($/cwt.)

Independent variable	Coefficient[a]	
	Model 1	Model 2
Intercept	81.075***	78.763***
	(53.40)	(48.16)
Boxed beef $_{t-1}$	0.086***	0.084***
	(8.27)	(7.59)
Showlist$_t$	-0.092***	-0.091***
	(19.85)	(17.98)
Wt-1125	0.075	0.122
	(1.00)	(1.53)
Wt-1150	Base	Base
Wt-1175	-0.968***	-0.908***
	(4.51)	(4.05)
Genetic-Lo	-0.281***	-0.279***
	(3.89)	(3.63)
Genetic-Med	Base	Base
Genetic-Hi	0.0.045	0.044
	(0.81)	(0.74)
Feedlot 1	-0.427***	-0.498***
	(3.32)	(3.63)
Feedlot 2	-0.248*	-0.316**
	(1.94)	(2.34)
Feedlot 3	0.06	0.044
	(0.53)	(0.37)
Feedlot 4	-0.630***	-0.648***
	(5.23)	(5.05)
Feedlot 5	0.447***	0.447***
	(3.70)	(3.47)
Feedlot 6	0.045	0.004
	(0.34)	(0.03)
Feedlot 7	-0.318**	-0.340***
	(2.72)	(2.71)
Feedlot 8	Base	Base
Packer 1	Base	Base
Packer 2	0.541***	0.544***
	(8.45)	(8.01)
Packer 3	0.945***	0.968***
	(12.97)	(12.53)

Table 4. FGLS regression results for bid and merger effects on price discovery

Dependent variable
Transaction price ($/cwt.)

Independent variable	Coefficient[a]	
	Model 1	Model 2
Packer 4	0.576***	0.605***
		(5.44)
Bid=1	Base	Base
Bid>1	-0.079	0.058
	(1.33)	(0.92)
Pens=1	Base	Base
Pens>1	-0.057	-0.042
	(0.69)	(0.48)
Pre-merger period	NA	Base
Post-merger period	NA	-2.310
		(19.34)
HHI	-9.394	NA
	(21.41)	
Adj R^2	0.942	0.936
n	591	591

[a] Numbers in parentheses are absolute values of calculated t statistics; *=0.10, **=0.05, and ***=0.01 significance level.