Competition and Price Relationships For An Electronic Market

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ABSTRACT

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A typical structural characterization of producer-first handler commodity markets is competitive sellers facing oligopsonistic buyers. New evidence is presented which suggests that each additional bidder in an electronic market results in nearly 3 percent added to price, net of the effects of quality and location variables. This evidence reinforces the importance of buyer competition to producers.

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Introduction

Electronic markets have been a major development in agricultural marketing for the last several years (Henderson and Holder). Although most of those markets were only experimental, some were in operation for several years and still are (Bell). These electronic markets were developed to minimize problems that exist in conventional commodity cash markets (Henderson, et al).

Electronic markets are designed to bring many buyers and sellers together in a trading environment to make transactions without physically being in one location (Sporleder). Obvious potential advantages of reduced costs compared to private negotiation and competitive price discovery provide the economic justification for such markets. In addition, electronic markets allow instantaneous dissemination of market news which theoretically assists in a competitive price discovery process (Perloff and Rausser).

Electronic markets, and the computers typically associated with them, record events that occur in those markets that cannot be readily and accurately observed in private treaty cash markets. For example, with CATTLEX, an electronic market for feeder cattle operated in Texas during the early 1980's, a detailed record of each bid submitted over the system was automatic (Sporleder and Davis). With such detailed records, it is possible to empirically test certain hypotheses difficult to test in conventional markets. Specifically, the linkage between price and number of buyers can be empirically tested. Industrial organ-

ization theory suggests that increased buyer competition results in a higher price, all else equal (Scherer).

This research is designed to measure the impact of competition, as proxied by the number of bidders in an electronic market, on price after adjustment for the "main quality variables" (e.g. weight, sex, grade). A related variable, bids per bidder, is examined to determine if an increase in the average number of bids per bidder has a separate impact from number of bidders on price.

Previous Research

There have been few empirical studies of markets in which price, or some other similar dependant variable is a function of the number of buyers in a market. Love and Shuffet found that prices at a terminal market for hogs in Louisville, Kentucky declined substantially compared to prices at other markets after two of its major buyers left the market. They concluded that market structure can have a significant effect on price.

Ward (1982) found that an increase in the number of buyers led to higher prices for wholesale beef carcasses. However, that study was not intended to specifically test for the effects of the number of buyers and the regression coefficient was not reported. Ward (1984) did a second study which was designed specifically to test the effects of the number of bidders on price for slaughter lambs in an experimental teleauction. He found that an additional bidder on the auction added $1.11 per cwt to the selling price of a lot of lambs. This translates into a 1.7 to 1.8 percent increase in the selling price for each additional

bidder.

William Tomek found that "the relationship of prices of choice steers on the Denver terminal market to comparable prices on the Omaha market apparently were influenced by a sharp decline in saleable receipts in Denver" when trading became very light in 1967 and 1968, the last two years of the Denver market. While volume on the Denver market had been declining for several years prior to 1967, he found that it was not until that year that characteristics of a "thin market" could be found and that relatively low volumes could produce fairly accurate prices. However, the study suggests prices in that time period were generally less volatile than in the seventies and that it might be difficult to draw the same conclusion today.

Methodology

While CATTLEX was in operation, data collected for each bid included lot number, time and date, no-sale-price of the lot, buyer identification number, terminal from which the bid was submitted (location of the buyer), location and quality of the cattle tendered, and each bid price. Cattle were offered for sale daily using a regular English auction as the price discovery process. From these data, and from documents that described the characteristics of the cattle in each lot and detailed terms of sale, a new data set was created which includes a complete description of each lot offered for sale over the computerized trading system.

Regression Model of CATTLEX

Ordinary least squares regression was used to estimate parameters of the CATTLEX system where the high-bid price is a function of various quality and market structure parameters (number of bidders and bids per bidder). The model is:

$$(1)\quad P_i = f\,(GS_i,\ W_i,\ D_i,\ T,\ S_i,\ LT_i\ NB_i,\ BB_i,\ IGSW_i,\ ILTS_i)$$

P_i = high bid price for lot i ($/cwt)[1]

GS_i = discrete variable for feeder cattle grade and sex for lot i,

W_i = average weight per head of lot i,

D_i = distance from Amarillo (miles) for lot i,

T = discrete variable for week of the auction (time trend variable),

LT_i = discrete variable for lot type (ranch or delivered) for lot i,

S_i = size of lot i (number of head),

NB_i = number of bidders for lot i,

BB_i = bids per bidder for lot i,

$IGSW_i$ = interaction variable for grade-sex and weight (GS and W), and

$ILTS_i$ = interaction variable for type of lot and size of lot (LT and S),

The variables NB_i and BB_i, bidders and bids per bidder respectively, allow the influence of structure to be estimated net of the effects of grade, quality and location variables. A priori signs on both variables were expected to be positive.

[1] The dependent variable is high bid price rather than sale price so that all lots offered could be included in the analysis, not just lots actually sold over the electronic market.

Results

Quality Characteristics-Location and Price

A linear regression model of high-bid price for CATTLEX was statistically significant, Table 1, explaining about 85 percent of the variability in high bid price. All parameter estimates had the correct a priori hypothesized sign.

Five USDA grades of cattle were traded over CATTLEX while it was in operation. These were medium-1 heifers, medium-1 steers, medium-2 steers, large-1 heifers and large-1 steers. Medium-1 heifers were dropped from the analysis. An F-test of this variable indicated significance (F-value of 11.450). Parameter estimates for medium-1 steers and large-1 steers indicate medium-1 steers sold at a premium of $8.87/cwt and large-1 steers at $9.52/cwt over medium-1 heifers. The parameter estimates for medium-2 steers and large-1 heifers cannot be interpreted alone since interaction terms of medium-2 steers by weight and large-1 heifers by weight were significant in the model.[1]

The parameter estimate for medium-1 steers must be interpreted with the estimates for the interaction term for grade-sex by weight. Similarly, the parameter estimate for large-1 heifers must be interpreted with the interaction term. The interaction term for medium-2 steers by weight indicates price drops of $4.40/cwt for each hundredweight increase while the estimate for weight indicates another $2.00/cwt drop per hundredweight increase. The estimate for large-1 heifers indicates

[1] Parameter estimates for interaction terms between weight and M-1 steers and between weight and L-1 steers were not significantly different from zero. Thus, these two interaction terms were excluded and the model was re-estimated.

Table 1. Parameter Estimates for Price Dependent Regression in An Electronic Market for Cattle.

Notation	Independent Variable	Parameter Estimate	Absolute Value of t-Statistic[a]
a_0	Intercept	71.362	18.58***
GS_{1i}	Medium-1 Steers	8.875	b
GS_{2i}	Medium-2 Steers	23.356	b
GS_{3i}	Large-1 Steers	9.517	b
GS_{4i}	Large-1 Heifers	-16.806	b
W_i	Weight	-0.020	4.22***
D_i	Miles from Amarillo	-0.009	2.82***
T	Week of Auction	-0.141	5.49***
S_i	Number of Head	0.007	2.66**
LT_i	Lot Type	6.131	2.80***
NB_i	Number of Bidders	1.763	2.88***
BB_i	Bids per Bidder	0.390	1.20
$IGSW_{1i}$	M-2 Steers by Weight	-0.044	5.09***
$IGSW_{2i}$	L-1 Heifers by Weight	0.031	1.71*
$ILTS_i$	Type of Lot by No. of Head	-0.120	4.04***

Number of Observations: 65
F-Value: 20.404 (Significant at >0.0001)
R-Square: 0.851
Dependent Mean: 60.32
Durbin-Watson D: 1.988

[a] Significance values are: *** = 0.01, ** = 0.05, * = 0.1

[b] An F-test was used to test the significance of the dummy variables for grades. The F-value was 11.450 and was significant at >0.0001

a $16.81/cwt discount to medium-1 heifers. The interaction terms for large-1 heifers by weight indicates that price increased by $3.10/cwt while the parameter for weight (in cwts) indicates a price decrease of $2.00/cwt, for a net gain of $1.10/cwt over medium-1 heifers.

The parameter estimate for weight is significant and indicates price drops $2.00/cwt for each additional hundredweight. However, as with the grade-sex parameter estimate, this estimate cannot be interpreted alone for medium-2 steers and large-1 heifers.

The parameter estimate for number of miles from Amarillo also was significant and suggests a discount of $0.90/cwt/mile for transportation to Amarillo. This reflects transportation costs, shrink and death loss associated with shipping cattle to the Panhandle feeding region. The estimate is roughly comparable with previous estimates on transportation costs by Clary, Dietrich, and Farris.

The parameter estimate for the week of the auction (time trend variable) indicates an average weekly price drop of $0.14/cwt during the data period. This is consistent with general price trends of feeder cattle during that time period (Mahoney).

There were two different types of lots offered over CATTLEX while it was in operation. These were ranch lots and delivered lots. Ranch lots were a truckload or more and were graded and offered for sale while on pasture. Delivery was made FOB seller's choice after the sale. Delivered lots were less than truckload, described and offered for sale at an assembly point (usually an auction market). Therefore, type and size of lot were highly correlated. Because of this, three variables capture these effects on price. A discrete variable for type of lot

(with ranch lots dropped), a variable for number of head in the lot and an interaction term were used to capture the effect of size and type of lot.

Parameter estimates for these variables were significant. The parameter estimate for the number of head indicates that an additional head increases high-bid price by $0.70/cwt while the interaction term indicates a $0.12/cwt discount for each additional head.

Competition and Price

Number of bidders and average number of bids per bidder are of greatest interest. These variables were used to proxy the impact of competition on high bid price. The parameter estimate for the number of bidders was significant and indicates that an additional bidder added an average of $1.76/cwt to the high-bid price. The mean high-bid price was $60.32/cwt, meaning that each additional bidder raised the price by 2.92 percent. This is somewhat larger than the increase that Ward (1984) estimated for each additional bidder in a teleauction for slaughter lambs. He estimated a $1.11 increase, or about 1.78 percent for each additional bidder.

The parameter estimate for bids per bidder is not significantly differnt from zero. If the NB_i variable is dropped, BB_i becomes significant. This simply indicates that BB_i and NB_i are proxies for one another and tend to capture the same competitive effects.

Conclusions and Implications

The regression model of the CATTLEX data suggests competition on the buyers side of a commodity market has a significant impact on price. An additional bidder for a lot of cattle offered over the system raised the high-bid price by $1.76 per cwt. That translates into an increase of 2.92 percent for each additional bidder. At an average weight of 600-700 pounds for cattle, this represents an additional $10.50 - $12.30 per head resulting from one additional bidder.

No separate effect of the number of bids per bidder was observed from the number of bidders. This seems reasonable since number of bids per bidder and number of bidders logically serve as proxies for one another.

The analysis provides additional empirical support for the conventional wisdom among economists that buyer competition is an important structural aspect of agricultural commodity markets. The literature suggests that, especially in the case of direct buying of livestock, spatial oligopsony is common. The empirical evidence presented here implies that one additional order buyer bidding on a direct sale of livestock could raise producer prices somewhere around 3 percent, all else equal.

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