Relationship Between Fed Cattle Market Shares and Prices Paid by Beefpackers in Localized Markets

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Industrial organization theory hypothesizes that larger beefpackers can depress prices paid for cattle. Prices paid between at least two beefpackers in some localized markets studied were found to be significantly different for the one-month study period. However, larger beefpackers in each market paid neither lower or higher prices than the smallest buyer, with just one exception. No significant relationship was found between market shares of buyers and average prices paid for cattle. Thus, the hypothesis that larger beefpackers pay significantly lower prices was rejected.

There is a clear lack of concensus among agricultural economists regarding whether or not the beefpacking industry is competitive [Ahmaddaud, et al.; Connor; Hall, et al.; Multop and Helmuth; Schnittker Associates; Ward 1980; and Williams]. Implicit or explicit conclusions range from one extreme — that beefpacking is the last remnant of perfect competition; to the polar opposite conclusion — that there are serious anticompetitive practices by beefpackers stemming from increasing concentration. Previous studies can be challenged, but the purpose here is not to critically review previous work.

Purpose of this paper is to report empirical evidence on prices paid for fed cattle among beefpackers and on the relationship between market share and prices paid in relatively localized markets. Previous studies implicitly or explicitly suggest that data from localized markets are appropriate in examining the relationship between market structure and performance [Ahmaddaud, et al.; Multop and Helmuth; Packers and Stockyards Program; Ward 1980; and Williams]. This study was based on primary data (individual transactions) from cattle feedlots, enabling a different methodology than previous studies.

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Conceptual Framework

Bain hypothesized a causal relationship emanating from market structure, through market conduct, to market performance. Both before and after he formalized the industrial organization model, economists have attempted to identify desirable performance norms and determine appropriate performance measures. Jesse summarized several such attempts at identifying performance criteria, but defining quantifyable measures is difficult.

The most commonly used industrial organization norm is the perfectly competitive model. Demsetz, however, questions its appropriateness as a norm, given that it is more of an ideal rather than a practical alternative. Greig suggests there are social costs resulting from market power of firms in an imperfectly competitive market structure, but that there are also social costs resulting from an atomistic market structure, which approaches the theoretically perfect market model. Bressler and Sosnick, too, have questioned the appro-

priateness of the perfectly competitive model as a performance norm. Thus, there seems to be no acceptable norm for measuring market performance which meets both theoretical and practical criteria. However, performance measures can be compared over time and conclusions drawn about directional change in selected performance criteria.

Structure of the beefpacking industry is imperfectly competitive, and categorizing the structure depends on the relevant market size assumed. The four-firm concentration ratio for steer and heifer slaughter in the U.S. increased from 29.5 in 1969 to 31.7 in 1978 [Packers and Stockyards Program].[1] [2] National four-firm concentration ratios are inappropriate for studying performance in cattle procurement. Most cattle are purchased within 100 miles of a plant, though some cattle are regularly purchased 300 miles or more from the plant [Packers and Stockyards Program; Ward 1979].

Studies confirm that buyer concentration is higher in smaller market areas. Sales from feedlots in 403 counties in 6 major feeding states were studied in 1975 [Packers and Stockyards Program]. In 33.8 percent of the counties, the four largest buyers in each respective county bought 65 percent or more of all cattle sold in that county.[3] Interviews with meatpacker-buyers indicated that they purchased between 15 and 75 percent of fed cattle sold in their defined area (ranging from one-half to four counties) and as much as 90-95 percent of the cattle from a given community or near their slaughter facility [Ward 1979].

Market structure data alone provide no conclusive information about economic performance. Theoretically, structure suggests something about potential market pricing behavior, and ultimately about potential market performance. Industrial organization theory hypothesizes that larger firms in imperfectly competitive procurement markets can depress input prices relative to those expected in a perfectly competitive market [Bain, Scherer]. Packers and Stockyards Program cites studies supporting this relationship in the livestock and poultry industries, but empirical evidence is limited.[4]

It is hypothesized here that in relatively small geographic markets, larger beefpackers pay significantly lower prices for fed cattle than their smaller competitors. Thus, an inverse relationship is expected between market share and average prices paid.

Model Specification

Two models were specified and estimated to determine whether there was a significant difference between prices paid by beefpackers. Both models are specified by

$$(1)\quad TPFC = f(DB_i, TRND, PCHG, PYG3, P6/7, DRPR, LVWT)$$

where

TPFC = Transaction price for each sale lot of cattle on a liveweight basis ($/cwt.)

DB_i = Zero-one dummy variable for the ith buyer

TRND = Trend variable

PCHG = Percentage of cattle in each lot estimated to be quality grade choice or above

[1] It can be argued whether or not steer and heifer slaughter comprise the relevant product market. Steer and heifer data were assumed relevant since this study was concerned with pricing of and competition for fed cattle from feedlots.

[2] Data used by the Packers and Stockyards Program is not without criticism but is cited here because it is believed to be acceptably accurate for the purpose of discussing the general structural characteristics of the beefpacking industry.

[3] The four largest buyers in one county were not necessarily the same as the four largest buyers in any other county.

[4] Concentration is only one element of market structure, but is the primary element of concern in this study.

PYG3 = Percentage of cattle in each lot estimated to be yield grade 3 or above

P6/7 = Percentage of cattle in each lot estimated to yield 600-700 pound carcasses

DRPR = Estimated average dressing percentage of the lot

LVWT = Estimated average live weight of the lot.

Sale price (TPFC) was hypothesized to differ among beefpackers (DB_i) after accounting for variation due to cattle quality differences and time of purchase. A trend variable (TRND) was included because there was a downward movement in carcass and live cattle prices during the study period. Thus, cattle purchased later in the period cost less than comparable quality cattle purchased earlier in the period. Several variables were included to remove price variation associated with cattle quality differences, i.e. differences in carcass weight (P6/7), live weight (LVWT), quality grade (PCHG), yield grade (PYG3), and dressing percentage (DRPR).

The two models estimated differed in terms of the omitted dummy variable. In the first model, the omitted dummy variable was the buyer with the smallest market share of the cattle purchased from feedlots in a given market during the study period. Thus, the model estimated price differences among the smallest and larger buyers, after accounting for price differences associated with cattle quality and time of purchase. The omitted dummy variable in the second model was the buyer paying the lowest average price in a given market. Thus, the second model indicated whether there was a significant price difference among the lowest paying and higher paying buyers, irrespective of size, after accounting for cattle quality differences and time of purchase.

Data and Procedure

Paul suggests the level of aggregation in many industrial organization studies causes problems in interpreting the often-found correlation between concentration and price levels. The procedure in this study was to take a cross-section of microeconomic data and to analyze prices paid in relatively narrowly defined geographic and product markets.

Data were collected from 26 commercial feedlots sampled in Texas, Oklahoma, and Kansas, and from 3 marketing agents representing cattle feeders in three multicounty areas of Nebraska and Iowa. Data were collected on 344 pens of cattle (transactions) or 51,586 head sold during July 1979. The relatively short data collection period was chosen because of the respondent burden to record requested data.

Feedlot operators and marketing agents were asked to record data on each pen of cattle offered for sale. Data were requested: (1) before buyers bid on cattle (e.g. cattle sex, estimated proportion of choice grade or above, estimated proportion of yield grade 3 or above, estimated proportion of carcasses weighing 600-700 pounds, and estimated average live weight and dressing percentage); (2) during the pricing process (e.g. seller's asking price, and first and highest bid for each bidder); and (3) after cattle were sold (e.g. sale price, beefpacker-buyer, and terms of delivery).

Data were divided by geographic area and sex (i.e. steers and heifers). Areas and their approximate size were: Texas South Plains, 23 counties; Texas North Plains, 15 counties; Oklahoma Panhandle, 3 counties; Southwest Kansas, 23 counties; Eastern Nebraska and Northwest Iowa, 4 counties each; and Central Iowa, 6 counties. Two areas were combined for the analysis (Eastern Nebraska and Northwest Iowa) due to a limited number of observations of either steers or heifers in the two areas.

Twelve area-sex equations were estimated by OLS regression for each model to determine whether or not beefpackers paid significantly different prices for cattle purchased. A second test of the market share — price level relationship was made by computing Spearman's coefficient of rank correlation and test-

ing for significance [Snedecor and Cochran].[5] Buyers in each area-sex market were ranked in terms of their market share and average price paid after accounting for cattle quality and time of purchase. Largest buyers and those paying the highest average price in each area-sex market were given the rank of 1. Data were then pooled across area-sex markets to compute Spearman's rank correlation coefficient.

Empirical Results

Six beefpackers were found to be the largest buyer in at least one of 12 area-sex markets, and one buver was the largest in 4 markets. Table 1 shows share of purchases for the largest and four largest buyers in each market. For all 12 markets combined, 15 firms were among the four largest buyers at least once, and one beefpacker was among the four largest buyers in 8 markets.

Models estimated indicated there were statistically significant price differences among beefpackers in one-half of the twelve area-sex markets, after accounting for cattle quality differences and time of purchase.[6] A significant difference was found between prices paid by the smallest buyer and one larger buyer in one market (Table 2). The sixth largest of 8 heifer buyers in the Texas North Plains paid significantly higher prices ($3.45/cwt.) than the smallest buyer during the study period.

Thus, larger buyers generally did not pay either lower or higher prices than the smallest buyer in the relatively localized markets studied. Results were contrary to the inverse relationship hypothesized between market share and average price paid (that large buyers use market power to depress input prices in localized markets), based on industrial organization theory.

[5]Spearman's rank correlation coefficient is

$$r_s = 1 - \frac{6\,\Sigma d^2}{n(n^2-1)}$$

where $1 > r_s > -1$, d is the difference in rank of X_1 (market share) and X_2 (average price paid), and n is the number of observations. The appropriate significance test is based on Student's t distribution with n − 2 degrees of freedom.

[6]Time of purchase (TRND) was not significant in one equation. Cattle quality grade (PCHG) was significant in one-half the equations, but other cattle characteristics hypothesized to account for cattle quality differences were inconsistently significant. Neither yield grade (PYG3), carcass weight (P6/7), live weight (LVWT), or dressing percentage (DRPR) were significant in more than one equation so were dropped from results reported here. Lack of significance may be due to relatively little variation in data for these variables.

TABLE 1. Market Shares for the Largest and Four Largest Buyers, by Area and Sex.[a]

Area	Steers		Heifers	
	Largest Buyer	Four Largest Buyers	Largest Buyer	Four Largest Buyers
	percent			
Texas South Plains	40.3	98.7	36.5	87.4
Texas North Plains	45.3	98.6	33.4	85.2
Oklahoma Panhandle	34.2	88.1	39.4	92.3
Southwest Kansas	39.2	96.1	46.5	90.6
Eastern Nebraska and Northwest Iowa	27.2	75.1	25.0	69.6
Central Iowa	48.9	100.	42.4	94.5

[a]Market shares reported are the proportion of total number of cattle purchased in each area-sex market.

TABLE 2. Regression Estimation Results Comparing Prices Paid Between Smallest and Larger Beefpackers, by Area and Sex.[a]

Independent variable	Area and Sex											
	Texas South Plains		Texas North Plains		Oklahoma Panhandle		Southwest Kansas		Eastern Nebraska and Northwest Iowa		Central Iowa	
	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers
Intercept	66.28[b] (42.68)***	64.81 (21.54)***	68.75 (31.11)***	63.87 (31.80)***	64.54 (52.71)***	64.58 (28.51)***	68.42 (20.56)***	69.75 (48.06)***	66.24 (15.14)***	68.28 (11.15)***	69.44 (13.22)***	50.49 (8.76)***
TRND	−.17 (5.25)***	−.30 (3.81)***	−.10 (3.47)***	−.26 (4.22)***	−.35 (4.53)***	−.28 (3.14)**	−.32 (8.41)***	.02 (.78)	−.50 (5.01)***	−.44 (3.36)**	−.34 (4.65)***	−.32 (7.24)***
PCHG	.04 (2.65)**	.04 (.34)	.04 (2.02)**	.08 (3.30)**	.08 (4.10)***	.06 (2.27)*	.03 (.86)	−.02 (1.40)	.07 (1.32)	.00 (.94)	.02 (.24)	.21 (2.95)**
DB 1	--[c]	--	--	--	--	--	--	−.30 (.83)	--	--	--	--
DB 2	--	--	--	†	--	--	--	--	--	--	--	--
DB 3	.17 (.14)	−.17 (.07)	--	--	--	--	--	−.90 (1.71)	−.55 (.20)	2.06 (.71)	−.00 (.00)	1.64 (1.44)
DB 4	--	--	--	--	--	--	--	--	--	1.56 (.53)	--	†
DB 5	--	--	--	1.88 (1.29)	--	--	--	--	--	--	--	--
DB 6	--	--	--	--	--	--	--	--	.40 (.20)	2.60 (.92)	--	--
DB 7	--	--	--	--	†	.43 (.23)	--	--	--	--	--	--
DB 8	--	--	--	3.45 (1.89)*	--	--	--	--	--	--	--	--
DB 9	--	--	†	--	--	--	--	--	--	--	--	--
DB 10	--	--	--	--	--	--	--	--	.42 (.22)	1.62 (.62)	--	--
DB 11	--	--	--	--	--	--	.66 (.61)	--	--	--	--	--
DB 12	--	−.62 (.24)	--	--	--	--	--	--	--	--	--	--
DB 13	†[d]	2.66 (1.01)	--	--	--	--	--	--	--	--	--	--
DB 14	.77 (.67)	--	−1.37 (1.45)	.15 (.12)	1.35 (1.23)	†	−.48 (.46)	†	.46 (.21)	--	−.16 (.21)	.43 (.51)
DB 15	.59 (.52)	.13 (.06)	−.31 (.30)	--	.12 (.10)	−.75 (.34)	†	−.36 (.78)	--	--	--	--
DB 16	--	−.69 (.27)	--	−.99 (.79)	--	−1.82 (.93)	--	--	--	.78 (.31)	--	−.38 (.51)

TABLE 2. (Continued)

Independent variable	Area and Sex											
	Texas South Plains		Texas North Plains		Oklahoma Panhandle		Southwest Kansas		Eastern Nebraska and Northwest Iowa		Central Iowa	
	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers
DB 17	--	--	−.81 (.72)	--	.38 (.31)	1.78 (.93)	.43 (.41)	.44 (1.28)	--	--	--	--
DB 18	--	†	--	--	--	--	--	--	--	--	--	--
DB 19	--	--	--	--	--	--	--	--	†	1.53 (.44)	--	--
DB 20	--	--	--	−1.85 (1.35)	--	--	--	--	--	--	--	--
DB 21	--	--	--	--	--	--	--	--	−1.92 (.80)	.56 (.22)	--	--
DB 22	--	--	--	--	--	--	--	--	--	†	--	--
DB 23	1.55 (1.34)	.85 (.43)	−.93 (.99)	1.34 (1.15)	1.06 (.93)	.75 (.42)	.65 (.66)	--	--	--	--	--
DB 24	--	--	--	--	--	--	--	--	.34 (.19)	2.04 (.77)	†	.57 (.72)
DB 25	--	--	--	−.94 (.59)	--	--	--	--	--	--	--	--
n	51	17	53	17	25	15	40	14	17	17	15	11
R^2	.503	.798	.311	.895	.688	.860	.744	.609	.871	.789	.766	.964

[a]Smallest beefpackers were those with the smallest market share for each area-sex market during the study period.

[b]Numbers in parentheses are absolute values of t-statistics; and *** = .01 significance level, ** = .05 significance level, and * = .10 significance level.

[c]Beefpacker did not purchase cattle in this market.

[d]† = zero-one dummy variable omitted.

The largest buyer did pay lowest prices in two markets (Texas South Plains — heifers and Central Iowa — steers), but not significantly different from other prices paid. The corollary situation, but still consistent with that hypothesized, was found in two markets (Texas North Plains — steers and Central Iowa — steers). There, the smallest buyer paid highest prices, though not significantly higher than other buyers.

Another extreme was observed, and was inconsistent with the hypothesized relationship. The smallest buyer paid lowest prices in three markets (Texas North Plains — steers, Oklahoma Panhandle — steers, and Easter Nebraska — Northwest Iowa — heifers), but in no case were prices significantly different than other buyers.

Spearman's rank correlation coefficient was also computed to determine whether larger buyers paid a lower price than smaller ones. The rank correlation coefficient was positive ($r_s = .096$), but was not statistically significant different from zero at the .01 level. Thus, the hypothesis that larger beefpackers exhibit market power by depressing input prices for cattle purchased in relatively localized markets is rejected in this study.

Implications and Conclusions

Competition research lacks a definitive norm for comparing what is vs. what ought to be. Thus, research such as this can best be considered a benchmark for future empirical studies and an aid in suggesting hypotheses to be tested, as well as aiding identification of areas needing theoretical attention.

Market shares of the largest buyer in area-sex markets in this study ranged from 25.0 to 48.9 percent for the study period, and market shares for the four largest buyers in each market ranged from 69.6 to 100 percent. Based on standards identified by Bain and Scherer, these market shares are relatively high, if it is appropriate to consider localized markets as the relevant market.

An underlying assumption in this study is that studies of market structure and price levels in larger markets may mask price differences in local markets. However, research reported here found that price differences among smallest and larger buyers occurred once (between two beefpackers) in the twelve relatively localized markets studied. Thus, this study rejects the argument that larger beefpackers pay lower prices.

Additional research is needed to study the hypothesized relationship between market structure and performance. Results here suggest that price differences among beefpackers may occur but are dependent on variables other than market share, such as access to and ability to use information on demand and supply, plant location and transportation costs, and slaughtering and processing costs. Further research could support or refute results presented here by expanding the feeding areas from which data were collected, the sample size, or time period analyzed.

Further research is also needed on market behavior of beefpackers. As *Journal* reviewers noted, this study did not address whether or not large beefpackers acted as price leaders in markets studied or otherwise influenced prices paid by competing firms.

Finally, a most difficult research area is determining performance norms which are realistic yet theoretically sound. Imperfections in commodity markets suggest markets such as cattle procurement and beef marketing are imperfectly competitive. However, exact location of a market on the continuum between perfect competition and monopoly and whether or not it is acceptably competitive are difficult to determine.

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