Competition, Bargaining Power, and the Cattle Cycle[*]

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Abstract: Cattle production follows a dynamic cycle that has often been analyzed, and cattle markets receive much scrutiny because of the potential for buyer market power. The relationship between the two has been little studied, however. This paper provides a simple conceptual framework to study how the cattle cycle and market concentration jointly affect the bargaining power of producers and packers yielding the following main results. Not surprisingly, a larger cattle stock reduces producers' bargaining position, which results in a lower fed cattle price. More importantly, however, the cattle stock's negative effect on price is magnified by the market concentration in beef packing. Thus, the cycle itself is very importantly related to a posited cycle of bargaining power between cattle producers and beef packers. Secondly, the model also shows how beef packers may use the special feature of cattle as both consumption and capital goods to lower the cattle price by influencing cattle inventories.

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Introduction.

While it is well known that cattle production follows a dynamic cycle, indeed, one that has often

been analyzed and, while cattle markets have received much attention because of the potential

for buyer market power, any relationship between the two has been little studied. The purpose of

this paper is to measure the cattle industry's market power during the ebbs and flows of the

cycle. How the oft-analyzed cattle cycle interacts with packer concentration, affecting the

bargaining power of cattle producers and beef packers is an important unanswered question.

Enhancing the profession's understanding on this issue is very important because the interaction

of the cattle cycle and packer concentration have significant welfare and policy implications for

cattle producers, beef processors and marketers, consumers, and policymakers. Further, although

cattle markets have garnered a good deal of attention in economic studies and policy debates, the

effects of the cattle cycle and its interaction with market concentration have been left mostly

unexamined.

Background.

Historically, profitability factors have resulted in cyclical increases or decreases in U.S. cattle

numbers. Other factors such as weather (long term droughts that impair forage supplies, for

example) and herd health issues such as BSE events (both in the U.S. and globally) can enhance

or magnify the supply and demand factors that "drive" the cattle inventory cycle. The interested

reader is referred to Rosen, Murphy, and Scheinkman (1994) for more details on the cycle itself.

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We posit that this cattle cycle likely affects the bargaining position between producers and packers yet, so, too, does the industry's market structure. Beef packing has become increasingly concentrated in the United States (Ward, 2002). From 1976 to 1999, the four-firm concentration ratio of U.S. steer and heifer slaughter increased from 25% to 82% (USDA, Grain Inspection, Packers and Stockyards Administration, 2002; Ward, 2002). Cattle producers and policy makers are concerned about the possible weakening bargaining power of cattle producers (McEowen, Carstensen and Harl, 2002; Rogers, 2002). Recently, producers and others urged the U.S. Department of Justice to reject Smithfield Beef's acquisition of National Beef (*High Plains Journal*, April 7, 2007). Surveys by Azzam and Anderson (1996) and Ward (2002) summarize much of the economic analysis of the price effect of beef packers' exercise of market power and the competitive implications of various forms of vertical coordination. However, no published research has established the link between the cattle cycle and the bargaining power between producers and packers in this concentrated market.

The effect of supply changes on market power have been put forward on occasion. Sexton and Zhang (1996) examined the effect of supply movements on market power in perishable commodity markets, specifically iceberg lettuce. The only paper that explicitly takes supply variance into account in an examination of market power in cattle markets is by Stiegert, Azzam and Brorsen (1993), but that paper models the effect on market power from *anticipated* supply shocks where packers employ some average pricing cost and *unanticipated* supply shocks. They found that when supplies were unexpectedly low, packers competed for cattle very aggressively. By comparison, our paper is concerned with the effect on market power from the ebbs and flows of the cycle itself – ebbs and flows that can be altered through optimizing decisions by the participants themselves– as opposed to shocks.

This paper provides a conceptual framework to study how the cattle cycle and market concentration jointly affect the bargaining position of producers and packers. Further, it provides the technique to conduct an empirical estimation of these effects in U.S. cattle markets.

In the conceptual model, the market contains several packers and a large number of cattle producers. Producers allocate their young adult female cattle stocks between either feeding, which ultimately results in selling to packers, or breeding. This decision is made based on current cattle prices, expected cattle prices in future periods, feeding costs, fertility and weaning rates, and the natural death rate of cattle. Each packer considers not only the effect of its current purchase decision on the profit in the current period, but also the effect on the profit in the subsequent periods, through the effect of its current purchase decision on future cattle stocks. We examine the joint effects of adult cattle stocks and market concentration on the cattle price and compare the market equilibria for the case when cattle are both consumption and capital goods and the hypothetical case when cattle are only consumption goods.

The hypothesized relationships that arise are important in part because of the conflicting results in research studies where measured buyer market power in cattle has been found to be either small (e.g. Azzam, 1997; Morrison Paul, 2001) or quite pronounced (Crespi and Sexton, 2004, 2005). See Table 1. The theoretical model lends insight into the plausible supposition that the time period of the cattle cycle where the measurements are taken can importantly affect the results. Figure 1, with an example from two recent studies, is insightful.

Table 1. Literature on Market Power in Cattle Procurement.

Study	Conclusion on Procurement Market Power?	Time Period in Study
Schroeter (1988)	−	1951-1983
Azzam (1992)	+	1988-1991
Schroeter & Azzam (1990)	+	1976-1986
Azzam & Park (1993)	−	1955-1977
Azzam & Park (1993)	+	1982-1987
Koontz et al. (1993)	+	1980-1982
Koontz et al. (1993)	+, but lower than in 80-82	1984-1986
Stiegert et al. (1993)	+	1972-1986
Morrison Paul (2001)	−	1992-1993
Crespi & Sexton (2005)	+	1995-1996

Notes: "−" means little to no evidence of market power in the purchasing of cattle; "+" means evidence of market power.
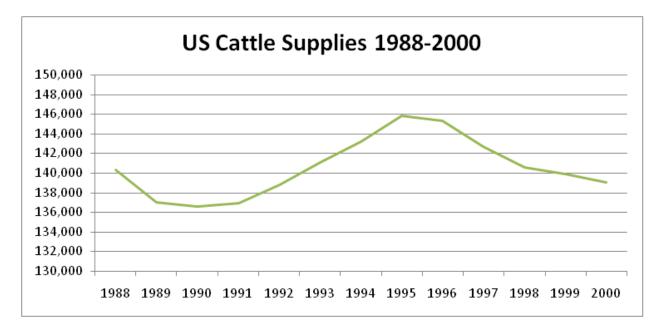

Figure 1. US Cattle Supplies 1988-2000.

Figure 1 above shows U.S. inventories from 1988 to 2000 showing a low and a high in the cattle cycle. Morrison Paul (2001) examined market power in the packing industry using firm-level, transaction-specific data from 1992-93. As shown, cattle supplies were low during this period. Crespi and Sexton (2005) used very similar firm-level, transaction-specific data covering 1995-96; a period in which the cattle cycle was at a peak. Both data sets were obtained as the result of regulatory oversight

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from the Grain Inspection Packers and Stockyards Administration (GIPSA) and both papers were developed for the specific purpose of measuring market power in beef processing. Aside from the time difference, the only difference in the data gathered were that Morrison Paul had a national data set whereas Crespi and Sexton had a regional data set from the Texas Panhandle.

What is intriguing is that both papers came to quite different conclusions concerning market power. Morrison Paul concluded that there was little to no buyer market power as measured by an estimate of non-competitive markdown of the price packers paid for fed cattle. Crespi and Sexton, however, found markdowns from 5-10%, among the highest markdowns estimated in the literature cited in Table 1. The difference in results could be due to geographical differences or due to technique (Morrison Paul used a traditional cost equation model whereas Crespi and Sexton used a probability-based bidding model), but the figure suggests another possibility. Clearly Morrison Paul was looking for market power during a seller's market, whereas Crespi and Sexton were looking for market power during a buyer's market. We are aware of no discussion in the cited literature suggesting that the differences in market power may be attributable to the swings of the cycle. The conceptual model that follows provides more insight.

Conceptual Model

We begin construction of the theoretical model by considering the objective function of cattle producers. To simplify the analysis, we integrate the cow-calf, ranching, and feedlot operations into a single sector called "cattle production." This simplification is used merely to cut down on unnecessary parameterization as we could add an additional stage (for example, separating out feedlot operations) if necessary, but doing so will not add importantly to the results from this simpler formulation. Further, while packing operations are highly concentrated, feedlot and ranching operations as noted by many researchers are numerous (e.g. the summaries of previous work in Azzam and Anderson). Therefore, on the reasonable justification that the initial

upstream production operations are competitive and atomistic, there is no real benefit in separating out these stages since marketing costs from stage to stage would be taken as exogenous. Since our main interest is in keeping with the spirit of earlier studies (e.g. Azzam and Anderson, Morrison Paul, Crespi and Sexton) that specifically looked at packer buyer power over upstream operations, usually feedlots, the simplifying integration of upstream producers is in keeping with the theme of these earlier studies.

A large number of cattle producers choose between slaughtering young adult female cattle and breeding them. The adult stock of cattle at time t is S_t and, as argued, each cattle producer is a presumed a price taker. A representative cattle producer will choose to slaughter and sell Q_t cattle to beef packers at a price of P_t per unit and keep $S_t - Q_t$ female cattle for breeding. S_t and Q_t are measured in generic units in this model, but the choice of units (heads, pounds, cwt) is innocuous as we presume a constant yield per animal for simplicity so that quantities can be translated between units with an appropriate choice of the transformation parameter resulting in the yield. The total cost for slaughtering and selling Q_t cattle is $C_{1,t} = (1/2) c_1 Q_t^2$, thus the cattle producer's profit from slaughtering and selling Q_t cattle is $P_t Q_t - (1/2) c_1 Q_t^2$.

The natural death rate for cattle during the production stage is $\delta \in (0, 1)$. After one year, $1 - \delta$ of the $S_t - Q_t$ cattle reserved for breeding would survive and, assuming no use value for an animal dying of natural causes, each surviving animal would have an expected value at time t of $E_t (P_{t+1})$. The annual cost of feeding the $(1-\delta)(S_t - Q_t)$ cattle is $C_{2,t} = (1/2) c_2 \left[(1-\delta)(S_t - Q_t) \right]^2$.

After one year, each cow reserved for breeding will give birth to and wean λ calves; as not every cow will successfully wean a calf, the weaned calf expectation is $\lambda < 1$. After another two years, the λ calves-per-cow will become adult cattle and would be valued at $E_t(P_{t+3})$ per unit of cattle, where $E_t(P_{t+3})$ is the producer's expectation at time t for the cattle price in time period $t+3$. The cost of feeding $\lambda(S_t - Q_t)$ calves for two years is $C_{3,t} = (1/2)c_3\left[\lambda(S_t - Q_t)\right]^2$.

This is all that is needed to discern the profit function for a representative producer. The expected profit of keeping $S_t - Q_t$ female cattle for breeding stock

is: $E_t(P_{t+1})(1-d)(S_t - Q_t) - (1/2)c_2\left[(1-d)(S_t - Q_t)\right]^2 + E_t(P_{t+3})1(S_t - Q_t) - (1/2)c_3\left[1(S_t - Q_t)\right]^2$,

hence the total profit (π) of the representative producer is given in equation (1):

(1)
$$\pi = P_t Q_t - (1/2)c_1 Q_t^2 + E_t(P_{t+1})(1-\delta)(S_t - Q_t) - (1/2)c_2\left[(1-\delta)(S_t - Q_t)\right]^2$$
$$+ E_t(P_{t+3})\lambda(S_t - Q_t) - (1/2)c_3\left[\lambda(S_t - Q_t)\right]^2.$$

To maximize this profit, a producer chooses the optimal Q_t. Solving the first-order condition yields the direct (equation (2)) and indirect (equation (3)) supply functions for cattle slaughtering:

(2)
$$Q_t = P_t/A' + (A/A')S_t - \left[(1-\delta)E(P_{t+1}) + \lambda E(P_{t+3})\right]/A', \text{ and}$$

(3)
$$P_t = A'Q_t - AS_t + (1-\delta)E(P_{t+1}) + \lambda E(P_{t+3}),$$

where $A = (1-\delta)^2 c_2 + \lambda^2 c_3$ and $A' = c_1 + (1-\delta)^2 c_2 + \lambda^2 c_3$.

Next we consider the beef packers' decisions. N>1 beef packing firms purchase and process cattle from producers and sell packaged beef at a price V_t in a competitive beef market. While it is true that concentration is high among packers in the United States, selling markets are

national and international in scope while purchasing markets are regional. Hence the assumption that there is potential market power in the purchasing of cattle, but little in the selling of boxed beef is not only reasonable, it conforms to previous research (e.g. Morrisson Paul). Assuming constant unit variable processing and selling cost c_4, the per-unit gross profit of beef processing is $R_t = V_t - c_4$.

Because we are interested in whether beef packers can manipulate cattle markets through their inventory decisions, the strategic choice variable is quantities rather than prices in this model. Thus, each packing firm chooses its optimal quantity $q_{i,t}$, where i = 1, 2, …, N, and

$\sum_{i=1}^{N} q_{i,t} = Q_t$, to maximize its profit not only in time period t, but also its profit in future time periods $t+1$ and $t+3$. The reason is that a packer knows that its quantity choice q_{it} at time period t will affect the breeding stock $S_t - Q_t$, which then affects future cattle stocks at time periods $t+1$ and $t+3$. Obviously, in turn, the packer's profits in time periods $t+1$ and $t+3$ are also implicated. Packer i's objective function comprises its total profit from periods t, $t+1$, and $t+3$ as given in equation (4):

(4)
$$\max_{q_{i,t}} \Pi_i = \left[R_t - P_t(Q_t) \right] q_{i,t} + \left\{ E_t(R_{t+1}) - P_{t+1} \left[E_t(S_{t+1}) \right] \right\} E_t(q_{i,t+1})$$
$$+ \left\{ E_t(R_{t+3}) - P_{t+3} \left[E_t(S_{t+3}) \right] \right\} E_t(q_{i,t+3}),$$

where $E_t(S_{t+1}) = (1-\delta)(S_t - Q_t) + \lambda(S_{t-2} - Q_{t-2})$ and

$E_t(S_{t+3}) = (1-\delta)E_t(S_{t+2} - Q_{t+2}) + \lambda(S_t - Q_t)$.

The first-order condition is given in equation (5):

(5)
$$R_t - P_t(Q_t) - (A'/N)Q_t - (A/N)\left[(1-\delta)E_t(Q_{t+1}) + \lambda E_t(Q_{t+3}) \right] = 0.$$

For simplicity, we assume adaptive expectations (see Koyck (1954) and the application of this assumption in Maude-Griffin et al. (2004)), with $0 \leq \alpha, \beta \leq 1$ expectations parameters, to obtain

(6)
$$E_t\left(P_{t+1}\right) = E_t\left(P_{t+3}\right) = \sum_{k=0}^{\infty} \alpha\left(1-\alpha\right)^k P_{t-k} \text{ and}$$

(7)
$$E_t\left(Q_{t+1}\right) = E_t\left(Q_{t+3}\right) = \sum_{k=0}^{\infty} \beta\left(1-\beta\right)^k Q_{t-k} .$$

Using equations (4) through (7), we find the equilibrium price of cattle as given in equation (8):

(8)
$$P_t^* = B_1 R_t + B_2 S_t + B_3 \sum_{k=1}^{\infty} \alpha\left(1-\alpha\right)^k P_{t-k} + B_4 \sum_{k=1}^{\infty} \beta\left(1-\beta\right)^k Q_{t-k} ,$$

where

$$B_1 = 1 \Big/ \left\{ 1 + \left[A' + A\left(1-\delta+\lambda\right)\beta\right]\left[1-\left(1-\delta+\lambda\right)\alpha\right] \big/ \left(NA'\right) \right\} \in (0, 1],$$

$$B_2 = -\left[AA' + A^2\left(1-\delta+\lambda\right)\beta\right] \Big/ \left\{ NA' + \left[A' + A\left(1-\delta+\lambda\right)\beta\right]\left[1-\left(1-\delta+\lambda\right)\alpha\right] \right\} < 0,$$

$$B_3 = \left(1-\delta+\lambda\right)\left[A' + A\left(1-\delta+\lambda\right)\beta\right] \Big/ \left\{ NA' + \left[A' + A\left(1-\delta+\lambda\right)\beta\right]\left[1-\left(1-\delta+\lambda\right)\alpha\right] \right\} > 0, \text{ and}$$

$$B_4 = -AA'\left(1-\delta+\lambda\right) \Big/ \left\{ NA' + \left[A' + A\left(1-\delta+\lambda\right)\beta\right]\left[1-\left(1-\delta+\lambda\right)\alpha\right] \right\} < 0 .$$

Although simple, the implications of the conceptual model are several. First of all, from equation (8), if cattle are only consumption goods and have no investment (capital) characteristic, then the equilibrium price of cattle reduces to equation (9):

(9)
$$P_t^* = B_1 R_t = \left[N \big/ \left(N+1\right)\right] R_t .$$

Second, in both equations (8) and (9) as the number of packers grows, B_1 approaches one, whereas as concentration increases, B_1 approaches zero.[2] The rationale is that as N increases, the price paid for cattle will just equal the difference between the price earned selling the boxed beef (V_t) and the per-unit processing/marketing cost (c_4): a perfectly competitive procurement price for cattle. On the other hand, as packer concentration increases to its monopsony level ($N=1$), the price paid for cattle becomes a smaller and smaller fraction of the competitive price. Given the bounds of B_1 and the implications on market power therein, this function will be important in the empirical model that follows.

Other implications of the conceptual model are that the adult cattle stock at time t, S_t, has a negative effect on the cattle price ($\partial P_t^* / \partial S_t = B_2 < 0$). This is not surprising and conforms to common sense. However, what the model further shows is that this negative effect is magnified by the market concentration of beef packing since as N declines, this negative effect becomes larger. Thus, the cycle of adult stock not only implies a cycle of "bargaining power" between cattle producers and beef packers, but that the fluctuation of this bargaining power is greater if the packing industry becomes more concentrated.

The major implication of the model, however, is in showing that beef packers may actually use the special feature of cattle as both consumption and capital goods to lower their purchasing price of cattle. As shown in the comparative statics, the emergent cattle price is actually lower if cattle represent both consumption and investment than it would be in the hypothetical case if cattle are only consumption goods. To our knowledge, this is the first

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[2] As N cannot be less than 1, the bounds of B_1 are actually ½ and 1 in equation (9). However, if cattle are both consumption and investment goods, then the lower bound of B_1 in equation (8) can be less than 1/2 depending on the magnitudes of the other parameters.

theoretical model to show how packers' procurement decisions could be used to manipulate cattle prices by altering producers' stocking decisions.

An Empirical Application

Based on the results of our conceptual model, our empirical study will examine the effects of cattle stocks, market concentration, futures markets, and type of marketing arrangement on the cattle price and, finally, the bargaining power of producers and packers. We will also test whether market concentration magnifies the negative price effect of the cattle cycle. Packers have increasingly used non-cash methods to procure cattle, including forward contracts and marketing agreements. Thus, we examine how the share of non-cash cattle affects the bargaining power of producers and packers. Data are obtained from various sources and include data on the price of feeder cattle; AMS boxed-beef prices; price of fed cattle; price of fuel and energy; price of feed corn; price of alfalfa hay; interest rates for cattle feeding loans; annual estimates of packer concentration; and various cattle inventory data. The theoretical model lays out the estimating functions from the first-order conditions of the underlying systems of equations, and the degree of bargaining power between buyers and sellers is parameterized in a way that allows discernment of factors most important in affecting the bargaining power. In this way, we can add insight into why researchers may be getting different results in the previously mentioned marketing studies that only sought to measure the degree of market power, rather than to measure market power as a function of underlying production and industry variables.

The price for live cattle sold to beef packers in year t, P_t^* is obtained from USDA AMS price reporting. Examining the conceptual model shows that parameters B_1 through B_4 in equation (8) are actually functions of underlying cost, industry and production variables or

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parameters. Costs include variable feeding costs which we denote by the vector $\mathbf{c}_t$ and marketing costs at both the production and processing sectors $\mathbf{m}_t$. These include the average annual price of feeder cattle (\$/cwt); the average annual price of number 2 corn (\$/bu); the average annual price of alfalfa hay (\$/ton); the average annual national interest rate for cattle feeding loans (%); the average annual price of fuel; the average annual price of hourly labor at packing houses (\$/hour); the annual average national price of electricity (\$/kwt); the annual average price of water (\$/gallon). The boxed beef price (V_t) is reported by the AMS and we use the annual average price. Other variables used are S_t, the annual stock of cattle, and Q_{t-k}, the quantities of live cattle sold in previous years, live cattle futures prices and annual percentages of captive supplies. Finally, the number of packing plants each year, N_t, is also included.

Adapting Maude-Griffin et al. (2004), we assume that equation (8) is measured with error. We first add to equation (8) a mean zero, normally distributed error term ε_t. Next, we lag equation (8) by one period and multiply it by $(1-\gamma)\widetilde{B}_t/\widetilde{B}_{t-1}$. Subtracting the result from equation (8), we obtain:

$$P_t^* = B_{1,t}R_t - \theta_t B_{1,t-1}R_{t-1} + B_{2,t}S_t - \theta_t B_{2,t-1}S_{t-1} + \gamma(1-\gamma)\widetilde{B}_t Q_{t-1} + \theta_t P_{t-1}^* + \varepsilon_t - \theta_t \varepsilon_{t-1},$$

which can be reduced to

$$(10) \qquad P_t^* = B_{1,t}R_t - \theta_t B_{1,t-1}R_{t-1} + B_{2,t}S_t - \theta_t B_{2,t-1}S_{t-1} + \widehat{B}_t Q_{t-1} + \Delta\varepsilon_t,$$

where $\quad B_{1,t} = \dfrac{\exp(x'_{1,t}\mu_1)}{1+\exp(x'_{1,t}\mu_1)} \in [0,1], \quad B_{2,t} = -\exp(x'_{2,t}\mu_2) < 0, \quad \widetilde{B}_t = \widetilde{x}'_t \mu_{\widetilde{B}}, \quad \widehat{B}_t = \widehat{x}'_t \mu_{\widehat{B}}, \quad$ and

$\theta_t = (1-\gamma)\widetilde{B}_t/\widetilde{B}_{t-1}$. The various x_t vectors are composed of the variables discussed above and μ_j, j=1, 2, B, are parameters to be estimated. The error term in equation (10) is autocorrelated.

Estimation of equation (10) will allow us to examine the effect on buyer market power in cattle markets over a long period of time. Equation (10) will not only show us how cattle prices have changed over time as the stock of cattle have changed ($B_{2,t}$), but more importantly how market power as measured by equation $B_{1,t}$ changes during the cattle cycle. As previous studies have either treated the market power parameter as fixed (Azzam and Pagoulatos; Morrison Paul) and/or have examined a time series too short to take the cattle cycle into account (Morrsion Paul; Crespi and Sexton), this model allows flexibility and a long time series to provide an estimate of market power throughout the cycle.

Conclusion

The motivation for this work is twofold. First of all, there is a well documented effect known as the cattle production cycle. Secondly, cattle markets, especially the procurement of fed cattle for slaughter has been studied at length by economists trying to discern the amount of buyer market power, with mixed results. Nonetheless, whether there is any relationship between the areas of research seems to have been mostly overlooked.

The purpose of this paper is to provide a theoretical model that incorporates first, producers' decisions to sell female adult cattle to be slaughtered or to keep these cattle for breeding, and, second, packers' decisions to purchase cattle knowing that the amount purchased will affect future stocks. All of these decisions are functions not only of current inventories, but also of expectations of future prices, successful weaning of calves, number of buyers, etc. and, of course, the strategies of other firms. The theoretical model yields the following results.

Not surprisingly, a larger cattle stock reduces producers' market power, which results in a lower fed cattle price. More importantly, however, we show how the cattle stock's negative

effect on price is magnified by the market concentration in beef packing. Thus, the cycle itself is very importantly related to a posited cycle of bargaining power between cattle producers and beef packers. Furthermore, the effect of the cycle on buyer power increases with the market concentration of beef packers. The intuition behind these results is that, in a more concentrated market, each beef packer's marginal expenditure will increase at a higher rate for purchasing an additional unit of cattle. The cattle stock reduces the price through its positive effect on packers' marginal expenditure. The higher increasing rate of marginal expenditure in a more concentrated market magnifies the negative price effect of the cattle stock.

Secondly, the conceptual model also shows how beef packers may use the special feature of cattle as both consumption and capital goods to lower the cattle price. In essence, the fact that cattle are both consumption and capital goods increases packers' perceived marginal cost of procuring cattle in the current period because purchasing one more unit of cattle now not only raises the current cattle price, but also increases future cattle prices by reducing future stocks due to a lower current breeding stock. Thus, packers may procure fewer cattle and the equilibrium cattle price is lower than that what would exist if cattle were only consumption goods. The result demonstrates how an anticompetitive effect of buyers' oligopsony power is exacerbated in markets of goods that are both consumption and capital goods (i.e. livestock animals) than in markets of goods that are only consumption goods (i.e. vegetables). Claims that packers use their positions in futures markets to affect spot market prices have been made by some producer groups, but this is the first model of which we are aware to demonstrate that spot purchases may be rationally used to affect futures markets and, in fact, the two markets are linked in the packer's procurement function.

Thus, on its own, the conceptual model is a valuable contribution to an understanding of market power in cattle markets. One should expect that in periods of large national and regional supplies, feedlots have lower bargaining power than when supplies are tight. We are aware of no study that examines whether this explains why different researchers come to such different conclusions, but if it is indeed the case, it may go a long way to explaining why in this particular market when stakeholders pressure legislators to examine the issue, by the time data are assembled and studied, the effects may not be seen. To test this idea, the conceptual model lends itself to an empirical specification that allows for a parameterization of buyer market power that can change throughout a time series estimation.

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