CHAPTER 1: PRICING AND COMPETITION ISSUES IN CONCENTRATED LIVESTOCK MARKETS

PRICING AND COORDINATION IN CONSOLIDATED LIVESTOCK MARKETS
Captive Supplies, Market Power, IRS Hedging Policy

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The consolidation of the meat industry during the 1980s has been extensively documented. Table 1 shows the widely quoted 4-firm concentration ratios for sheep and lambs, steer and heifer slaughter, hogs, and boxed beef. In a historical context, the ratios in cattle and in sheep are high, and the 1990 measure for hogs suggests that the hog sector is also starting to consolidate. It is clear that the mergers/acquisitions in the beef sector during the mid 1980s brought a dramatic change to that sector. In the 1990s, it could be hogs that show a significant increase in concentration at the processing level. Instead of consolidation primarily via mergers and acquisitions, however, the change in hogs could come in a different form. As older and smaller independent packers succumb to pressures on margins and find it harder to compete, they are likely to exit the industry at an accelerating rate. That capacity will tend to be replaced by the large plants of the national firms. The Waterloo, Iowa plant built by IBP is an example.
Change always brings uncertainty and the continuing developments in the meats sectors are no exception. There is concern over what all this means to price levels, to producers, to price variability, to consumers, to the viability of the family farm, and to the competitive position of the U.S. in a world market. All these concerns have manifested themselves in a number of different ways, but there tends to be a broad and consistent theme. There have been consistent calls for new policies and/or new initiatives in the policy arena.

The U.S. General Accounting Office (GAO) was requested by Senators Leahy and Baucus to investigate the impact of the mergers by beef packers on cattle producers. Implicitly, the requests to GAO mirrored concerns by constituent producers and producer groups that the market power of large packing plants would be detrimental to the producer of cattle. The specific charge to GAO reflected the concern that the largest firms will pay lower prices for cattle than would have been the case if the markets for cattle were less concentrated.

Table 1. The 4-Firm Concentration Ratios for Selected Classes of Livestock Slaughter and Meat Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Steers and Heifers</th>
<th>Sheep and Lambs</th>
<th>Hogs</th>
<th>Boxed Beef</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Percent)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1978</td>
<td>30</td>
<td>56</td>
<td>34</td>
<td>50</td>
</tr>
<tr>
<td>1979</td>
<td>35</td>
<td>64</td>
<td>34</td>
<td>51</td>
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<tr>
<td>1980</td>
<td>36</td>
<td>56</td>
<td>34</td>
<td>53</td>
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<tr>
<td>1981</td>
<td>40</td>
<td>52</td>
<td>33</td>
<td>57</td>
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<tr>
<td>1982</td>
<td>41</td>
<td>44</td>
<td>36</td>
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<td>1983</td>
<td>47</td>
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<td>29</td>
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<td>1984</td>
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<td>1985</td>
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<td>1989</td>
<td>70</td>
<td>74</td>
<td>34</td>
<td>79</td>
</tr>
<tr>
<td>1990</td>
<td>72</td>
<td>70</td>
<td>40</td>
<td>80</td>
</tr>
</tbody>
</table>

The GAO responded in a December 1990 report. In the report, the GAO reviewed the economic theory and the empirical investigations surrounding the issue. The investigators noted that economic theory suggests, other things equal, that a higher level of market concentration in the beef-packing industry could result in lower cattle prices than would prevail with less concentration. But they concluded that the empirical evidence does not convincingly support the theoretical inferences. There were, according to the report, only a few empirical studies reflecting conditions in the 1980s and those studies tended to give inconsistent results.

In the report, the GAO summarized 10 major empirical studies and offered the results of their interaction with researchers and industry representatives. Some observers apparently felt that the consolidation might have resulted in higher cattle prices being paid to producers because of the economies of size in the large plants and the advantages of multiple-plant firms. Others expressed concerns that the


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market power in the hands of the very large firms would eventually and predictably work to the detriment of producers. But neither the positive nor the negative opinions were supported conclusively by the review of the research efforts, and the GAO report offers no firm conclusion or recommendation.

The GAO report was criticized in some corners, praised in others. Actually, the report may have reached the only legitimate conclusion when it declined to infer whether the net impact of the consolidation has been positive or negative to cattle prices. The GAO had neither the time nor the resources to conduct its own in-depth analysis, and the available research literature was both limited and inconsistent.

The discussion and the dialogue continue. The GAO report is arguably the most important recent release in terms of possible impact on governmental actions and policy prescriptions, but it is not the only effort that should be considered. The 10 studies reviewed by the GAO span the continuum of available work. The traditional analyses that seek to measure the empirical relationship between measures of structure (such as concentration ratios) and measures of industry performance (such as price) were covered. Also covered were relatively recent “new empirical industrial organization” studies. These studies focus on the behavior of firms, using indices of competition, market power indices, or conjectural elasticities to measure the impact on other firms of changes in a firm's output or input levels.

One game theoretic study was also reviewed by the GAO. The study was designed to isolate cooperative behavior by firms in cattle procurement markets and to relate any evidence of cooperative behavior to the level of concentration in the market.

Brief reviews of the studies are provided in the GAO report. Depending on methodology, the time period studied, and the level of aggregation in the data, the various studies did in fact reach different results. The GAO concluded there was no consistent evidence of a causal flow from high levels of concentration to price and the investigators reported those conclusions to the Senators who had requested the study.

In a February 1990 conference coordinated by the Research Institute on Livestock Pricing, researchers raised the possibility that the economies of large size plants and multiple-plant firms had, to that point, been potentially positive to the cattle industry. Figure 1 updates some of the evidence presented in support of that hypothesis in a book distributed at the conference. Inflation adjusted farm-to-retail price spreads for beef declined during the 1980s, and such declines can be positive to prices for slaughter cattle. If the price spread in Figure 1 is divided into farm-wholesale and wholesale-retail components, it is clear that it has been the farm-wholesale portion that declined and pulled the total spread lower through 1990.

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A report by the Center for Rural Affairs in Nebraska, released in April 1990, was much more critical of the consolidation that had been allowed to occur in the 1980s. Calling the cattle industry a "shared monopoly", the report asked for government involvement to protect and enhance the level of competition in cattle markets. The report was especially critical of packer feeding and contracting, the primary techniques employed by packers to generate "captive supplies of cattle." Calls for Congress to prohibit packer feeding, to limit captive supplies to 15 percent of needs, to regulate contracts, and to pass legislation making price reporting mandatory are examples of the positions taken in the report.

The Center for Rural Affairs looked at the same research literature examined by the GAO, but came to sharply different conclusions. The primary study quoted covered the 1971-80 period and the Center recognized (p. ii of the Center report) that not all studies have reached the conclusion that high levels of concentration lead to lower cattle prices. The Center report has been criticized for drawing conclusions that were not supported by a preponderance of the research, but the report does call attention to the need to continue monitoring the situation. It is perhaps the case, as the report argues, that the implications of highly concentrated markets will not be apparent until the period of transition is over and the few large firms are no longer caught up in a battle for market share.

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3 Competition and the Livestock Market, Task Force, Center for Rural Affairs, Walthill, Nebraska, April 1990, 53 pages plus a bibliography.
A task force established by the National Cattlemen's Association adapted a moderate posture in an October 1989 report. The Task Force recommended that no additional mergers or acquisitions by the three large beef packers be allowed, but it stopped short of calling for more government involvement or for new policies. The report specifically recommends that no action be taken to stop the "contractual integration" that is occurring and it sanctions voluntary reporting of information on prices and captive supplies, not mandatory reporting. Overall, the report favored an open and competitive marketplace versus one regulated by governmental actions, and there is no evidence of major concerns about the market power in the hands of the large firms. Rather than suggesting reversal of the consolidation or supporting government involvement, the Task Force preferred to move to a system of monitoring firm behavior and industry performance.

The theme of "effective monitoring" that was advanced by the NCA Task Force has been broadly supported. Congressman Stenholm, Chairman of the Livestock, Dairy, and Poultry Subcommittee in the House Agricultural Committee, charged the GAO to examine the activities of the Packers and Stockyards Administration (P&SA) to see whether industry performance is being adequately examined. The GAO responded in a October 1991 report.

In the report, the GAO documented the significant changes in the livestock industry. Concern was voiced over the continued demise of competitive terminal and auction markets, and the importance of access to objective price information was stressed. With regard to P&SA, the report suggested that P&SA has not adjusted procedures adequately in a changing marketplace. Referring to its earlier efforts to look at the implications of consolidation, the GAO strongly recommended that P&SA move to define regional markets, especially regional livestock procurement markets, and to develop the data bases and analytical capability needed to identify non-competitive behavior.

In that environment, and drawing on testimony at public hearings, Congress appropriated $500,000 to P&SA during fiscal year 1992. Part of the money was to be used to support investigations by outside agencies, and a request for comments on research needs was published in the Federal Register. The comment period ended February 7, 1992 and P&SA is in the process of preparing a request for proposals.

In early 1992, then, there is an increased awareness of the need to have a solid base of research, an analytical capability that allows P&SA (and others) to effectively monitor the marketplace, and an enlightened policy formation process. The Research Institute on Livestock Pricing has responded to this broad set of needs. The later chapters of this book deal with selected dimensions of the needed research programs that have been supported financially by the Institute. The remainder of this chapter will deal with the conceptual issues and continuing research needs in the areas of captive supplies, market definition, inter-market pricing patterns, and buyer behavior in highly concentrated livestock procurement markets.

Captive Supplies

The consolidation has brought many operational changes, but the rapid move by packers to "capture" supplies of livestock has been arguably the most controversial. Already growing in hog production, the consolidation in beef packing apparently created the sufficient condition for moves to contractual procurement of slaughter cattle. Efforts by one of the large packers to buy by contract have been matched by the other large firms, and cattle feeders have cooperated, perhaps to protect access to a limited number of buyers.

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In a November 1989 study partly financed by the Research Institute on Livestock Pricing, Ward and Bliss looked at contract procurement of cattle.\textsuperscript{6} Survey results indicated roughly two-thirds of the contracts used were basis contracts, while one-third was flat price contracts. About 13 percent of fed cattle in the 13 leading feeding states were contracted in 1988, the study period.

Cattle feeders felt the contracts were useful to individual feeders in helping secure financing and in locking in a known buyer, but they felt contracting was bad for the industry as a whole. There were beliefs that contracting leads to lower fed cattle prices and more volatile cash and futures markets, and the feeders felt that the level of buyer competition was reduced by the contracting. Feeders believed the benefits to packers came from being able to lock in a known supply and to schedule the cattle into the packing plant.

A November 1991 study conducted jointly by Oklahoma State University and the Research Institute on Livestock Pricing looked at the basis contracts in more detail.\textsuperscript{7} The hypothesis that basis levels employed in the basis contracts were to the disadvantage of cattle feeders was tested by comparing basis levels in past contracts with hedging opportunities in the futures markets. When the basis levels were corrected for transportation costs, there was no significant difference between the results of the basis contracts and the hedging opportunities. The basis contracts have not apparently been a serious disadvantage to cattle feeders, but the 1991 survey indicated lenders do not like basis contracts. Lenders, recognizing that basis contracts leave feeders exposed to price risk, preferred flat price contracts, hedging directly in futures, or buying put options to the basis contracts.

In spite of varying and often negative attitudes toward contracting, the use of contracts continues. Contracted cattle become a component of captive supplies, cattle under the control of packers in terms of eventual ownership and the timing of shipments, and constitute a measure of control that does not require investment in feeding facilities or custom feeding fees. Contract cattle, cattle fed by or for packers, and business arrangements between packers and feeders make up all "captive supplies". The level of captive supplies at any point in time can and does vary from very small to 30-40 percent of total fed marketings to virtually 100 percent of the immediate needs for an individual packer.

The controversy surrounds the assertions that packers who hold captive supplies need not come into the market and bid aggressively, and prices to producers are therefore lower than they would be without the captive supplies. Claims of lower prices because of reduced demand are sometimes countered by the assertion that the supply of cattle available to the market is also reduced, and that the impact on price will be neutral.

Both claims or assertions are too simplistic. Chapters 2 and 3 will deal with empirical research efforts designed to estimate the relationship between the level of captive supplies in regional markets and prices paid to producers. Conceptually, such studies take the following general form:

\[ P = f(K; EP_1, EP_2, ..., EP_n; CS) \]

where

- \( P \) = a measure of price paid to producers;
- \( K \) = a constant term;
- \( EP_1, EP_2, ..., EP_n \) = traditional economic explanatory variables such as measures of total supply, carcass beef prices or boxed beef cutout values, quality of the cattle, etc.; and


CS = a measure of captive supplies in the marketplace where the observations on price are being generated.

The hypothesis being tested is that the coefficient on the CS term will be negative and significantly different from zero. If that coefficient is in fact negative and statistically significant, an inference is possible. In the presence of other economic factors which would be expected to influence cattle prices (the EP_1, EP_2, ..., EP_n), a negative sign on the CS measure indicates that an increase in captive supplies will reduce cattle prices. The size of a negative coefficient on CS is then used to assess how much cattle prices will be reduced if the measure of captive supplies, CS, increases 1 unit. If, for example, the CS variable is expressed in whole percent and cattle prices in dollars per hundredweight, the coefficient on CS will indicate how many dollars per hundredweight cattle prices will go down if captive supplies increase 1.0 percent.

In examining the results of empirical work, including those presented in Chapters 2 and 3, a number of issues should be kept in mind. The issues would include:

1. Model specification and estimation. If the model is not specified and estimated correctly, any conclusions drawn from the coefficient on the CS variable can be flawed. If a co-linear relationship exists between CS and any one of the EP variables, for example, there can be little confidence placed in the size or even the sign of the coefficient on the CS variable. Correcting for such problems of multicollinearity or for problems such as autocorrelation of the model residuals is never easy and can sometimes be essentially impossible.

2. The nature of the CS measures. Ideally, the CS variable would measure the captive supplies for an individual buying firm rather than an aggregate across firms. Conceptually, a firm's buying behavior would be more nearly influenced by its own captive supplies rather than the level of captive supplies in the market area in which it buys.

3. The level of aggregation in the data. Surveys and observation suggest packers attempt to "line up" supplies of cattle for a week. But this does not mean weekly average price data or even weekly average measures of captive supplies would be adequate. The influence of captive supplies, if it can be measured at all, might show up only in the day-to-day buying behavior and dynamics of the packers.

A still broader issue is present, and it deserves separate attention. A model specification with \( P = f(CS) \) will, if all the modeling and data needs are met, capture the relationship between changes in price associated with changes in the level of captive supplies. The estimated coefficient on the CS variable does not, however, adequately capture any long-run change in the overall level of prices.

To clarify this point, assume that prior to the advent of captive supplies, the relationship between price and captive supplies could be captured by the following overly simple expression:

\[
P = a + b_1S + b_2D
\]

where

- \( P \) = cattle price;
- \( a \) = a constant term;
- \( S \) = a measure of supplies; and
- \( D \) = a measure of demand.

\(^8\)Such firm-specific data are not generally available. The Packers & Stockyards Administration completed a study of captive supplies during 1991, but the results were announced to be inconclusive and the study was not published. P&SA would presumably have access to proprietary and confidential firm-level data.
After captive supplies become a significant force in the marketplace, the expression changes conceptually to the following:

\[ P = a^* + b_1S + b_2D + b_3CS \]

where

- \( a^* \) = a new constant term, and
- \( CS \) = captive supplies.

All other variables are as previously defined.

Keeping in mind that the intent here is illustrative and not one of specifying an actual model to be analyzed, it is nonetheless important to reflect on what "\( P \)" is measuring. It is perhaps the case that \( P \) should be the weighted average of all cattle being delivered to the packer, including the contractual cattle. Though such data may be hard to get, ignoring the contracted cattle in examining the prices to be paid for cattle is, arguably, a mistake in a conceptual context.

While granting that what \( P \) is measuring is important, this is not the key point to be made at this juncture. It is conceptually possible for price to be at a higher average even if the estimate of \( b_3 \), the coefficient on \( CS \), is negative if \( a^* > a \). That is, the overall level of price could be up in the presence of captive supplies even if the captive supply measure is negatively related to short-run price movements. If such an hypothesis is supported empirically, then a negative and statistically significant \( b_3 \) is being more than offset by the upward shift in the overall price structure.

This latter possibility has not been examined empirically, but it is something that needs to be done and research on this should be a part of the expanded P&SA research agenda. It is relatively easy to garner conceptual support for higher average prices in the presence of captive supplies. This possibility was introduced in the February 1990 conference organized by the Research Institute on Livestock Pricing, but there has been no publicly available research on the issue to guide P&SA efforts and to integrate into the policy formation process.

Figure 2 shows a possible source of increased efficiency associated with captive supplies. If contracting and other means of scheduling cattle (or hogs) into the packing plant keeps the plant operating near its designed (and low-cost) capacity, then packers have more dollars to bid into the prices of slaughter livestock. To test this hypothesis, research will be needed to estimate the cost functions of the packing plants and to convert alternative scenarios in terms of scheduling of livestock to cost savings on a per head basis. If there is sufficient competition between packers, these savings will be at least partially passed back to the producer in the form of higher cattle or hog prices.

Presented another way, Figure 3 shows an MVP curve for an added head of capacity. It takes its shape from the declining portion of the cost curve in Figure 2, with the MVP of an added head of cattle moving to zero as the u-shaped cost curve flattens out at designed capacity.

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Figure 2. U-Shaped Cost Curve for Packing Plants.

Figure 3. The Marginal Value Product of an Added Head of Livestock by Percent of Designed Capacity.
It is imperative that this unknown impact on cattle or hog prices, an impact accruing from captive supplies, be thoroughly researched before policies or legislative moves to control captive supplies are even seriously discussed. It would appear that, with effective monitoring to preclude the taking of excessive profits, the benefits of large firms and coordinated flows of slaughter livestock can be garnered without the pain of excessive market power. At any rate, it needs examining, and this area of work is beyond the scope of what is being reported in later chapters. It should be a part of the research agenda during the remainder of 1992 and into 1993.

Research to date has not clarified the precise impact of captive supplies on price to producers. It is important that we get better estimates of the impact of the efficiencies of the large plants on the overall price level, and effectively separate this impact from any negative relationship that might be identified between captive supplies and short-run price variability.

Market Definition

The Gao report on P&SA stressed the need for delineation of regional markets. One of the consistent criticisms of the work by industrial organization economists in their attempts to relate measures of structure (such as concentration ratios) to measures of performance (such as price) is the level of aggregation employed in the analyses and in the data. A statistically significant negative relationship between concentration levels and cattle or hog prices, when national or broad regional averages of price and/or concentration are used, may be worse than useless. It may lead to policy prescriptions that actually damage the performance of markets on a disaggregated level.
A recent effort by Azzam and Pagoulatos reaches a similar conclusion about the problem of aggregation. One of the "new industrial organization" efforts reviewed by the GAO in its study of industry structure and its implications, the authors analyzed the U.S. meat policy sector. In their conclusions, the authors observed (p. 369):

...the relevant unit of observation in a model of oligopolistic interdependence is the firm. Until such data are available, little can be known about how the presence or absence of market power is obscured by too much or too little aggregation.

Cattle and hogs are not bought on a day-to-day basis in a national market, and they are not bought in a broad multi-state region. Competition between buyers, if there is competition, does not stop at state boundaries. The competition between buyers is in those geographical areas from which livestock are pulled for specific plants. This might be an area within 50 miles, 150 miles, or even farther, of the plant. It is in these areas that the competition between and among buyers will work itself out and it is in these areas that collusion and cooperation between and among a small number of buyers, if there is collusion, will be present and potentially observable.

Without question, defining the pertinent regional markets will require access to data that are not currently available to the public. The GAO report indicated that data will be needed by individual packing plant, not just the firm, and by feedlot or farm where the cattle or hogs originate. The report emphasized cattle, and it would appear to be correct in its call for detailed data on purchases by procuring plant and sales by location of feedlot. Such data will allow the delineation of flows and spatial market areas in terms of where and how often buyers participate and it will allow the identification of competitive zones in terms of number of competing buyers. Concentration ratios can be developed in terms of a market area in which the buyers actually compete, or can compete, and estimation of the statistical relationships between those concentration ratios or other measures of concentration and factors such as captive supplies, pricing patterns, and the level and variability of prices will be very revealing.

The issue of "defining the market" is considered in Chapter 3. It is a difficult issue. Analysts such as Schultz have used statistical correlations to define markets. Price changes in relatively small geographical areas are analyzed to determine which areas move together in terms of price changes, and similarly impacted areas are defined as a "market". Other analysts criticize the "price correlation" approach. Scheffman and Spiller, for example, argue that the price correlation approach will not adequately define markets for antitrust purposes. For antitrust purposes, a market is a geographical area in which market power can be exercised, and these markets could be significantly smaller than the markets defined in terms of correlated price movements.

In moving toward a workable definition of a "market," it is important that the definitions and related analyses be firmly grounded in a consistent theoretical framework. A December 1990 paper by Marion et al., demonstrates why this is so important. The analysis updated through 1986 an earlier analysis by the group that had reported evidence of a significant negative relationship between measures of concentration and cattle prices. The Center for Rural Affairs in Nebraska, in its very negative assessment of the consolidation in cattle, quoted widely from the earlier effort and used specific measures of the price impact of a 10 percent increase in the 4-firm

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The update employed the 13 market regions established in the earlier study. The average level of the 4-firm concentration ratio across the 13 regions was 87 percent. Yet, the analysis found no conclusive evidence of a negative relationship between concentration and price in the 1981-86 period, the period in which much of the consolidation occurred. Having earlier identified a 4-firm concentration ratio of 60 as the critical level beyond which the use of market power would be expected to emerge in a dramatic way, average concentrations of 87 gave no significant evidence of market power at work.

What is the explanation? It is obviously possible that market power was being employed in the 1980s but was not identified because the market definitions were wrong. The regions were broad, with 4-5 states in many. The entire state of Colorado was combined with Western Nebraska, and all of Texas, the number 1 feeding state in the mid-1980s, except the High Plains area was in one "market". All of Kansas except the southwest corner was combined with eastern Missouri. Based on earlier delineations by Willard Williams of Texas Tech, the regions may have been totally inappropriate in identifying the markets in which market power would be expected. And there is always another possibility: No evidence of market power was identified because there was none being exercised.

Marion and his colleagues suggest the industry was in a state of disequilibrium in the 1980s with changes such as decreases in demand for beef working themselves out. Implicitly, the authors were suggesting that the state of disequilibrium concealed the expected negative relationship between concentration and price. Even if that assertion is possibly true, it is not good enough. An equally plausible alternative is that the economies of size that were being captured enabled the large firms to capture the margins they needed, perhaps even wield a degree of market power in doing so, without pushing cattle prices lower.

As the dialogue and discussion continue, it is important that a definition of "market" be developed that will be either independent of what is happening in the industry or will be capable of adjusting to changing industry conditions. The latter alternative is perhaps the more practical one. The industry will change. No matter what criteria are employed in defining a market, that definition is not likely to be independent of basic economic facts of life such as cattle supplies relative to industry slaughtering capacity. If there is significant excess capacity in an industry where total cattle numbers have declined from 132 million head (1975) to 100 million head (1992), then the competitive interplay between packers and therefore the true underlying "market" is likely to extend, at least occasionally, over broad geographical areas so long as that excess capacity exists.

How the "market" is defined is very important. Results of empirical work designed to measure the relationship between measures of concentration and price appear to vary with how the market is defined. Both conceptual and analytical progress is needed in defining a market area in such a way that effective monitoring of firm behavior and performance of the entire sector will be possible.

Concentrated Markets in Livestock Procurement

There is a significant body of research literature dealing with the implications of a limited number of buyers. There will be no attempt to summarize that literature here. The issue is discussed in Chapter 4 for feeder cattle and a reference list is provided at the end of the chapter. There is some reason to question whether the existing literature, especially the older literature, is relevant in an electronic era with video sales via satellite transmissions and computerized auctions. Further, in an era with growing use of electronic marketing techniques, what is in fact a "market" can be influenced.

As the number of packers declines, there will by definition be fewer buyers. In an industry characterized by a few large packing plants, 14Gwen Quail, B. Marion, F. Geithman, and J. Marquardt, The Impact of Packer Buyer Concentration on Live Cattle Prices, NC-117, Working Paper 89, University of Wisconsin, 1986.
there will eventually be fewer and larger cattle feeders as well. This suggests fewer buyers of feeder cattle.

In the feeder cattle markets, there is less evidence of negative pressure on price due to high levels of concentration in the video sales. Chapter 4 deals with this research in detail, and it will not be covered extensively here. The objective here is to briefly explore what this finding can mean for the policy makers.

In the late 1970s and early 1980s, the Agricultural Marketing Service of USDA supported a number of exploratory efforts in electronic marketing. Electronic systems were investigated for feeder cattle, hogs, eggs, and slaughter lambs. With the consolidation in the livestock sectors in the 1980s, there has been a rebirth of interest in electronic systems. Several conferences have been held with the general objective to look at what electronic marketing systems can mean in concentrated markets.

The essence of the concentrated market problem is, of course, too few buyers or too few sellers. Most of the concern in the livestock markets is over the issue of too few buyers. There is a prevailing sentiment that the exercise of oligopsonistic power by a few packers buying slaughter cattle or a limited number of feedlots buying feeder cattle is more likely than the exercising of oligopolistic power when they sell. Feedlots have to deal with large packers and packers have to deal with the large retail chains, so a countervailing power exists on the selling side.

It is generally easy for added buyers to enter the electronic markets. Buyers who do not traditionally buy in a particular market area can often access the electronic sale as an interested observer and turn into a buyer if an attractive opportunity presents itself. Thus, buying power is available in a "ready reserve" context in the electronic markets and any exercise of market power by a limited number of consistent buyers will be constrained by what might also be seen as a persistent latent demand. Distance is not an impediment to participation in that buyers do not need to travel to where the livestock are located or hire an agent, with all the related uncertainty about buying performance, in the distant market area. Price differentials between markets can become:

\[ P_D - P_S = f(HC, TC) \]

where

- \( P_S \) = price in a surplus supply market;
- \( P_D \) = price in a deficit supply market;
- \( HC \) = hauling costs for the livestock; and
- \( TC \) = transaction costs via electronic access.

Without the electronic access, the equation would be extended to:

\[ P_D - P_S = f(HC, D, TC^*) \]

where

- \( D \) = distance that must be traveled to gain access to the livestock or buying agent costs to eliminate the need to travel, and
- \( TC^* \) = transaction costs when electronic access is not used.

All other variables are as defined above.

The impact of electronic access is important in many "hybrid" markets. Graded feeder cattle or feeder pig sales often supplement the buying power in the auction ring with a conference telephone hook-up to more distant buyers. Instead of 2-3 order buyers at a relatively small auction sale constituting the buying side of the equation, it may be 2-3 buyers in the ring plus 10 or more possible buyers on the phone system.

The researchers reporting in Chapter 4 indicate that evidence of market power is more likely to be found when reference is to a small
subset of livestock—such as light feeder heifers, or feeder steers in weights over 900 pounds. But there is a catch 22 here. That evidence was present for the video sales because the video sales provided detail on cattle types. It may be that the problem would be much more acute in the auction ring sales if comparable detail in terms of breaking out groups and types was available. It may be the case that the video sales actually perform better in this case, but the comparative performance cannot be measured.

Most observers of livestock auctions have seen dramatic drops in price on atypical sets of cattle or hogs. It happens in the graded yearling steer sales when one small lot of 550 pound steer calves is sold. The buyers who are present are looking for the larger yearling cattle, not the light calves. Prices will often drop until a local producer, perhaps the same producer who hauled heavier cattle to the sale, sees a bargain and bids or until a dealer sees an opportunity to buy and haul the cattle to another sale the next day.

Conceptually and logistically, it is much easier for the observer in an electronic auction to become a buyer and provide the much needed buying resiliency for the atypical set of calves. There are comparable potential applications across a wide range of markets and livestock sales. As the policy discussions continue, it is important that the empirical research reported in Chapter 4 be examined in the proper perspective. The electronic markets, like the video feeder cattle sales that were examined, can be examined from many pro and con viewpoints. But there can be no doubt that the electronic markets must be included in any discussion of concentrated markets and in any discussion of policy moves to address the problems of market power in concentrated markets. It is an obvious way to expand the set of potential buyers who have access to the livestock.

The evidence on the impact of a declining number of buyers, which raises the concentration ratios, is mixed. Empirical results may often be a function of how much detail is available and of the level of aggregation employed in the analysis. The findings reported in Chapter 4 suggests the ability to move to individual sales and even to subsets of cattle in the analyses will be important in isolating the impact of concentrated procurement markets for livestock.

CHAPTER 2

Implications of Captive Supplies in the Fed Cattle Industry

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Agricultural Economics, Kansas State University and
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Introduction

During the past decade, in conjunction with the increased concentration noted in Chapter 1, a new wave of vertical integration occurred in beef slaughtering. The vertical integration of the late 1980s and early 1990s consisted of packers finding new ways to coordinate cattle procurement practices with their need to operate plants at capacity. Much of this coordination has occurred through beef packers becoming progressively more vertically integrated by finding ways to control supplies of procured cattle in advance of slaughter. The impact of this recent wave of vertical integration on prices received by cattle feeders has been much debated in the industry, yet remains unclear.

15In some literature, use of the terms “vertical integration” is restricted to instances in which two or more of the interrelated activities of production, processing, etc. are controlled by ownership. In this chapter, the terms are used more broadly to refer to the various ways the stages of activity or the functions can be operationally integrated.
CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY

This chapter (1) reviews what we currently know about vertical integration between feedyards and packers and its effect on cattle prices, (2) outlines how vertical integration may impact fed cattle markets, (3) reports the results of a recent empirical study that analyzed the determinants of fed cattle transaction prices, and (4) examines possible impacts of forward contracting on value-based marketing of fed cattle.

Captive Supplies

Captive supplies refer to cattle procured by the packer well in advance of slaughter. Captive supplies take any of three forms: (1) packer feeding of cattle in either packer-owned facilities or custom feedyards, (2) cattle procured using forward contracts, or (3) cattle procured using exclusive formula marketing agreements.

Figure 1 illustrates recent patterns of captive supplies as a percentage of slaughter for the largest 15 packing firms. Packer-owned fed cattle accounted for approximately 5% of the 15 largest steer and heifer packers' annual slaughter each year from 1988 through 1990 according to surveys conducted by the U.S. Department of Agriculture (USDA). The USDA also reported that 15% of cattle slaughtered by the four largest firms in 1990 were cattle purchased under forward contracts or marketing agreements.

![Figure 1. Annual Packer Feeding and Contracting as a Percent of Slaughter by the 15 Largest Packers, 1988-90.](image)

Contractual deliveries as a percentage of slaughter vary by packing firm and across time. For example, as much as 50% of Excel Corporation's fed cattle procurement has been contracted for delivery several months in advance (Ward and Bliss 1989). The largest beef packer, Iowa Beef Processors (IBP) has exclusive formula purchasing agreements with two of the largest cattle feeding companies,
Cactus Feeders and National Farms and is developing similar arrangements with other feedyards. The Cactus arrangements alone represents up to 800,000 head (Cactus' 1987 marketings), roughly 10% of IBP's total annual slaughter (Cornett 1988).

Contracting also exhibits noticeable seasonal patterns. Figure 2 shows the seasonal pattern of the percentage of cattle slaughtered that were purchased via contracts or marketing agreements in Kansas during 1988-91. Contracting as a percent of slaughter was highest in late November and December, averaging almost twice the annual average. In addition, contracting during June and July was 30 to 60 percent higher than the annual average. March and August through October had the lowest contracting activity, averaging 40 to 60 percent of the annual average.

The use of captive supplies appears to be growing. There is a seasonal pattern, but packers apparently benefit from the ability to schedule cattle and cattle feeders benefit by securing a buyer and reducing exposure to price risk.

Forward Contracting

Forward cattle contracts are now offered by all major packers. Although forward contracts differ in some respects across packers, there are many similarities. Forward contracts typically specify the delivery month, number of head and sex, yield grade, quality grade, basis (and/or the flat price), carcass weight, and delivery location (e.g., feedlot or buyer's plant). Price adjustments for cattle not meeting contract specifications are usually indicated in the contract, although they often simply indicate discounts will occur at "current market prices". Unlike most feedyard-to-packer cash market sales, forward cash cattle contracts are usually priced f.o.b. the packing plant instead of f.o.b. the feedyard. This means the seller, rather than the buyer, pays the shipping cost.
Individual packers use different carcass quality standards in their contracts. Some packers require that 70% of the cattle attain a quality grade of Choice with discounts incurred if cattle fail to meet this standard. Other packers merely require that cattle attain a quality grade of Select or better with market discounts applying to carcasses that grade below Select. Most packers require that no more than a pre-specified percentage of the carcasses attain yield grade 4 or 5, typically 5%, although some contracts require all carcasses to reach a yield grade of 3 or better. Weight specifications vary slightly over time and across packers, but generally require steer carcass weights to fall in a range of 600-to-900 pounds and heifer weights to fall in a range of 550-850 pounds. Discounts are applied to carcasses outside these weight ranges. Finally, most forward contracts also specify a number of other undesirable carcass characteristics to be discounted such as bruises, grubs, dark cutters, or yellow fat.

Forward contracts are typically basis contracts which specify the cash-futures basis but not the price level. The seller can convert the contract to a flat price contract by locking in the futures price (by selling futures) any time the futures market is open. Packers generally require that the futures price be established by the last business day prior to the month in which the cattle will be delivered to the packer. If the cattle delivery month is not a futures contract expiration month, it is sometimes possible to establish price as late as the day prior to the delivery of the cattle to the packing plant.

Forward contract prices are normally identified as a liveweight price, but the technique for computing total revenue for forward contracts differs from that used under cash-market pricing. Under cash-market pricing in Kansas, total revenue equals total cattle liveweight (adjusted for 4% shrink) times live price. Forward contract total revenue, however, is typically calculated by multiplying the contract price per hundredweight times the "derived liveweight". The derived liveweight is the total dressed weight of the pen divided by the dressed yield percentage stipulated in the contract. As a result, cattle that have an actual dressing percentage higher than that specified in the contract will be paid using a derived liveweight that is greater than the actual liveweight. In effect, a premium is paid which is directly tied to the additional pounds of meat produced by the cattle, above that specified in the contract. Similarly, cattle with an actual dressed yield lower than that specified in the contract will receive a "discount" tied directly to the lower meat yield of the pen.

Survey Results

An informal survey of 7 feedyard and marketing managers was conducted in March of 1992 to obtain more information on the mechanics of forward contracting. All the managers were either operating or consulting with commercial feedyards in Kansas or Colorado. Although the sample size was small and not randomly selected, the survey results provide insights regarding forward contracting activity.

Although standard packer forward contracts contain detailed cattle specification clauses, the feedyard managers indicated a large percentage of cattle marketed via packer forward contracts were sold with specifications waived. Two broad distinctions must be drawn. Contracts made on dairy cattle (Holsteins) virtually always carry carcass specifications whereas contracts on beef cattle often have all (except carcass weight) specifications waived. The percentage of forward contracted cattle that were marketed without specifications varied from as little as 25% to as much as 75%, depending on the feedyard.

Most feedyard managers indicated that packers were more willing to waive contract specifications in the summer than during the winter and early spring. However, this relationship generally did not hold in 1991-92 as packers were often willing to contract cattle for winter or spring 1992 delivery without carcass specifications. Most managers indicated that if a packer is willing to waive any contract specifications, all will be waived. The principal exception to this is the carcass weight specification which is rarely waived. If contract specifications are not waived, the feedyard managers indicated that packers stringently follow contract price adjustment schedules. The willingness to waive contract specifications appears to be dependent on the individual packer and, possibly, on the feedyard's location and/or operating characteristics (including the type of cattle typically fed).

The decision to contract cattle with or without specifications is heavily influenced by both the feedyard manager and the packer. However, managers were divided over whether packers or feedyard managers exerted more control over the decision to contract cattle with or without specifications. Approximately half of the feedyard managers surveyed indicated that the yard manager had the most
influence regarding whether specifications are waived and the other half felt packers exerted the most influence. Managers who felt packers had the most influence indicated they routinely request specifications be waived. The decision to waive or not waive specifications is therefore made by the packer. Survey respondents who felt managers had the most influence indicated that packers were routinely willing to waive contract specifications according to the feedyard manager's preference. The only obvious reason why a manager would prefer to retain the specifications would be if he expected the cattle to have a higher dressing percentage than that specified in the contract, in which case the cattle would bring a premium.

Timing of cattle delivery to the packer has been a controversial topic. Concerns about timing of cattle pickup within a contract month revolve around the impact of timing on a feeder's ability to meet contract specifications. In particular, if cattle are picked up early, they might not meet contract grade specifications thereby subjecting the cattle to a discount. Late delivery could result in price discounts if cattle become too heavy or have too high a percentage of yield grade 4s. Several yard managers confirmed that timing of cattle delivery can have a significant impact on their ability to meet contract specifications. However, nearly all of the managers in the survey indicated that timing has not recently been a pervasive problem.

The current approach to scheduling delivery dates for contracted cattle provides feedyard managers with some flexibility regarding the slaughter dates of contract cattle, particularly for cattle contracted with specifications. All of the surveyed yard managers indicated that slaughter schedules are generally established for contract cattle near the end of the month prior to the slaughter month (e.g., March contract cattle are scheduled for slaughter by the end of February). In most cases the feedyard manager identifies the week or, in some cases, two weeks when cattle will be ready for slaughter. If the proposed slaughter dates are unacceptable to the packer, slaughter dates are negotiated between the feedyard manager and the packer. Several feedyard managers indicated they allow packers more scheduling flexibility on cattle contracted without specifications since the cattle owner will not be discounted if cattle do not grade or yield well.

The procedure for scheduling slaughter dates for contract cattle has changed over the last several years, at least among the feedyards in this survey. Prior to the last two years, packers routinely exerted a greater degree of control over the slaughter dates of contract cattle than they have more recently. Several yard managers indicated that packers' scheduling of cattle for slaughter sometimes made it impossible to meet contract carcass specifications. The current procedure of allowing feedyard managers more input into the slaughter scheduling of contract cattle has apparently evolved as a response to the forward contracting problems initially experienced by feedyards.

**Contract specifications and the timing of deliveries are related issues surrounding contracting. Who benefits is not always clear, but the timing of the delivery can have significant implications to the ability to meet contract specifications.**

**Captive Supply Conceptual Issues**

Although the use of captive supplies, especially forward contracting, as a means of packer cattle procurement has grown in recent years, the impact of this market development has not been examined in depth. Captive supplies may have important market implications. Theoretical price impacts of captive supplies differ between the short run and long run. The short run refers to the time period during which cattle are delivered on contracts. The long run reflects the time over which contracts can be initiated. In the long run, both packers and feedyards benefit from the presence of a liquid forward contracting market. However, in the short run the benefits may be asymmetric with packers gaining increased flexibility relative to feedyards.

**Long Run**
In the long-run, through contracting, packers secure cattle purchases well in advance of slaughter. Similarly, cattle feeders secure a price and a buyer long before the cattle are ready for market. As such, both packers and cattle feeders benefit from additional marketing flexibility and reduced market uncertainty with the existence of contracts. Barkley and Schroeder (1991) applied Carlton's (1979) theoretical model to the fed cattle industry to predict long run market impacts of captive supplies. The remainder of this section on long run impacts of captive supplies is drawn from the Barkley and Schroeder (1991) model.

Barkley and Schroeder (1991) start with the premise that cattle feeders contract cattle with packers to reduce price uncertainty. As such, real costs to cattle feeders of revenue variability are reduced through contracting. The notion that contracting reduces real costs of price uncertainty for the cattle owner is supported by evidence from a recent survey. Ward and Bliss (1989) indicated that the primary motivation for cattle feeders to forward contract is to secure financing. The "ease of selling" and "assurance of a known buyer" are causes of contracting among cattle owners (Schroeder et al. 1991). Therefore, it follows that in the long run the average contracted price should be less than the average cash market cattle price. If it were not, cattle owners would contract all cattle, which does not occur in actuality.

Instead, cattle feeders as a group allocate a percentage of cattle to forward contracts and a percentage to the cash market. This does not imply that the cash cattle price is always greater than the average contracted price, only that the expected value of the average cash price is greater than the average contracted price. The key is that cattle feeders are willing to accept a lower price in return for reductions in selling costs and costs of variability by forward contracting. This hypothesis has not been tested directly because sufficient data on private contract prices are unavailable.

As price variability (either real or perceived) in the cash market increases, or as the costs associated with revenue risk increase, cattle feeders prefer to contract more. These actions tend to increase the supply of contracted cattle and drive the contract price down. Again, no statistical evidence of this is available, although anecdotal evidence is present from discussions with packers and feedyards. This hypothesis would be testable with sufficient proprietary data. If the future cash price is expected to be relatively high, this will reduce the quantity of cattle sold on contract. Finally, as the contract price increases relative to the expected future cash price, the number of cattle contracted would be expected to increase.

Since forward contact prices are expected, on average, to be below the long-run expected cash price, one might suspect that packers would prefer to contract all cattle. However, uncertainty in the demand for beef products may preclude this. In addition, by contracting well in advance of slaughter, finished cattle quality is unknown. Packers may therefore increase uncertainty regarding the types of cattle they are procuring by contracting. This uncertainty likely increases as the length of the contract increases.

If demand for cattle on forward contracts increases, both the forward contract and cash prices will increase with the larger increase occurring in the forward market. The forward contract price would increase from the increased demand, and because cash market cattle are a substitute for forward contracted cattle, packer demand for cash market cattle will also increase. Likewise, if the demand for cash market cattle increases, then both cash and contract prices will increase with the cash price increasing more.

**Short Run**

In the short run, during the delivery month of contracted cattle, packers ultimately determine the timing of delivery. One incentive for purchasing cattle in advance of slaughter may be attempts by beef packers to increase their ability to control slaughter schedules (Ward and Bliss 1989). Changes in the level of captive supplies may influence the level of competition among beef packers in cash markets. At the extreme, if all rival firms held 100% of slaughter in captive supplies, then cash markets would no longer exist. When a packer has a large fraction of slaughter needs in the form of captive supplies, the captive supply cattle serve as a near-perfect substitute for cash market cattle. That is, captive cattle can be called for delivery this week if needed to meet slaughter scheduling or held until a later week.

Packers indicate that delivery timing decisions for forward contracted cattle are made in part based upon current basis strength and cattle availability. During periods of weak basis, packers have incentives to purchase more cattle on the cash market. With a strong basis, packers have the incentive to bypass the cash market and acquire cattle from previously contracted supplies to the extent that contracted cattle are available. As such, in the presence of captive supplies, the short-run demand for cash market cattle is more elastic than it would otherwise be. The short-run supply elasticity is unaffected by captive supply deliveries in that the cattle on the show list are ready for market at the same time either way.
The net short-run effect of captive supplies, then, is increased flexibility in procurement scheduling in the cash market by packers with a more elastic demand, and no short run increase in flexibility by cattle feeders. Packers likely benefit in the short run from this ability to substitute captive supply cattle for cash cattle when it is favorable to do so. Whether this increased flexibility also gives packers additional pricing power at the expense of cattle feeders can only be determined empirically.

Conceptually, there is no clear and evident set of implications to contracting. Day-to-day demand in the cash market will be influenced by contract activity, and the demand for cash cattle may be more elastic in the presence of significant volumes of contract cattle. But this and other conceptual implications must be examined empirically before inferences as to impact are merited.

Recent Empirical Results

As noted in the previous section, many of the net impacts of captive supplies are not theoretically conclusive. As such, the impacts can only be determined empirically. Two studies have compared forward contract prices to hedging. Elam (1992) collected primary data on contract prices during 1987-89 and concluded that forward contract prices were lower than simple hedged prices would have been. However, Eilrich et al. (1991) performed a similar study and concluded that no significant price differences were present between basis contracts and hedging opportunities. To date only three publicly available studies (in addition to the results presented later in this Chapter) have explicitly estimated empirical impacts of captive supplies on fed cattle market prices. A summary of these studies is presented in Table 1. These studies have been completed using different methods and data sets. Only through close examination of the methods and data can conditional statements be made regarding the conclusions of these earlier studies.

Hayenga and O'Brien (1990) used weekly contract cattle shipments as a percentage of monthly slaughter from Colorado, Kansas, Nebraska, and Texas during October 1988 through 1989 to investigate the impacts of captive supplies on weekly average prices in the four states as reported by the Agricultural Marketing Service (AMS). They concluded that forward contracting in Kansas had a positive influence on prices whereas contracting in Texas had a negative impact. Forward contract activity in Colorado and Nebraska had no perceptible influence on prices in any of the four regional markets.

Table 1. Summary of Previous Studies Examining Impacts of Forward Contracting on Cash Fed Cattle Prices

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16 The Packers & Stockyards Administration completed a study during 1991 concluding simply in news releases that results were "mixed". This study has not been made available publicly.
<table>
<thead>
<tr>
<th>Study</th>
<th>Period</th>
<th>Date</th>
<th>Contracting</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elam (1992)</td>
<td>10/88-5/91</td>
<td>AMS Monthly State Data</td>
<td>Cattle-Fax For each 1,000 head contracted U.S. price was lower by $.01/cwt.; KS price lower by $.02/cwt.; CO lower by $.05/cwt.; no effect in TX or NE.</td>
<td></td>
</tr>
<tr>
<td>Hayenga and O’Brien (1990)</td>
<td>10/88-12/89</td>
<td>AMS Weekly Prices State Data</td>
<td>Cattle-Fax State Data</td>
<td>Contracting in KS has positive price impacts in KS, CO, TX, NE; contracting in TX has negative price impacts on CO, KS, TX, NE; CO and NE contracting has no price impacts.</td>
</tr>
<tr>
<td>Ward (1990)</td>
<td>6/89</td>
<td>Feedyard Transaction Prices Feedyards in sample</td>
<td>Feedyards in sample</td>
<td>No significant impact.</td>
</tr>
</tbody>
</table>

Elam (1992) regressed monthly average AMS fed cattle prices on wholesale beef prices, a by-product allowance, a marketing cost index, cattle slaughter, and contract cattle shipments during October 1988 through May 1991. He concluded that a 1,000 head increase in forward contract shipments reduced the national average cash price by less than $0.01/cwt. He also concluded that a 1,000 head increase in monthly contract cattle shipments within each state reduced cash price by $0.02/cwt. to $0.05/cwt. in Kansas or Colorado. No statistically significant impacts of captive supplies were found in Texas or Nebraska.

Ward (1990) regressed feedlot transaction data, collected from feedyard manager surveys, on demand factors and a measure of captive supplies in the feedyards from which the transactions were collected. His data included transactions from a total of 152 "feedlot weeks" (feedyards times number of weeks of data from each) from across the Midwest and Southern Plains during June 1989 representing approximately 650 pens of cattle. He concluded that captive supply shipments from these yards up to three days prior to the sale date had no significant impact on transaction prices.

These three studies, using different techniques and data sets, found mixed results. Ward (1990) found no influence, Hayenga and O'Brien (1990) had mixed results, and Elam (1992) found some negative and some insignificant impacts of captive supplies on cash fed cattle prices. The differences in conclusions amongst these studies must be interpreted relative to the techniques, time periods evaluated, locations, and data. Important considerations and distinctions amongst these studies must be kept in mind.

First, the studies by Hayenga and O'Brien (1990) and Elam (1992) used aggregate prices reported by the AMS as dependent variables. Individual pen transaction prices and associated data may provide a more effective and more complete pricing model. During any particular week, and especially on any particular day, changes in cattle quality need to be accounted for to find the actual relationship between captive supplies and price. AMS prices may be correlated with the average quality of cattle being sold each week and, as such, relative changes in these prices across regions or market levels could be related to the quality mix of cattle sold that week. Hayenga and O'Brien (1990) and Elam (1992) assumed constant aggregate cattle quality over time when estimating the influence of captive supplies. Ward (1990) did adjust somewhat for quality in his models.

These three previous studies have not matched captive supply shipments with the delivery dates of cattle being sold. Elam (1992) regressed monthly prices against concurrent monthly captive supplies. Hayenga and O'Brien (1990) regressed weekly average prices on

CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY
concurrent weekly captive supplies. Ward (1990) used captive supplies up to three days prior to the sale date as his measure. These may be flawed measures of captive supplies. One could argue that captive supply deliveries as a percent of slaughter should be matched with the delivery date of the pen of cattle being sold rather than the sale date. Matching captive supplies with the delivery date is reasonable because packers know the captive supply shipments that they will be receiving over the next several weeks as they bid on cattle today. In addition, as Purcell noted in Chapter 1, measures of captive supplies identified by firm rather than in the aggregate provides additional insights that need to be considered in evaluating price impacts of captive supplies.

Finally, one must consider the length of time necessary to estimate the impacts of captive supplies. The Elam (1992) and Hayenga and O'Brien (1990) studies cover several years which provides credibility to their findings, but other aspects of their methodology leave their results open to question. Ward (1990) used a richer data set but was limited by the intense cost of collecting transaction and bid data from feedyards and considered only a one-month time period. The problem with such a short time period is that captive supplies may not vary enough relative to other factors to have a discernable price impact even though captive supplies may influence prices.

In summary, one must be careful in interpreting captive supply research results conditional on the assumptions, modeling techniques, data, aggregation levels, measures of captive supplies, and time periods used. Many of these same concerns should be kept in mind when evaluating the following empirical study.

The available studies give different results with the results a function of time, location, level of aggregation in the data, etc. There remains a need for substantial research in this area to focus in on the implications of captive supplies.

Empirical Study

Motivated by the importance of captive supplies to the cattle industry and concerns with previous work, an additional empirical investigation was undertaken to determine the short-run price impact of captive supplies. Although similar to the analysis conducted by Ward (1990), in that transaction data were analyzed, this study used a more complete measure of captive supplies and a more comprehensive data set covering a longer time period. Regional USDA contract and formula shipments data were used as the measure of weekly captive supply. This is a more complete measure of regional captive supply than a sample comprised only of those feedlots in the study.

Ward (1990) collected data from four different states during June 1989. Here, data covering a longer time period (May to November 1990) from a single market region (southwestern Kansas) were used. A longer time period allowed for more variation in the level of captive supplies. Moreover, data were collected on a broader set of factors likely to impact fed cattle prices, thereby minimizing the likelihood of model mis-specification. The logistics of collecting consistent data on quality characteristics by pen necessitated the study of a smaller geographic region. In addition, analysis of captive supplies by region, given the relatively small geographic area (150 mile radius) from which packers typically acquire cattle, is justified. Finally, matching cattle price with captive supply shipments during the week the cattle were delivered provides a more realistic model of the interdependence of captive supplies with cash markets than do the previous studies.

Model

The price of an individual pen of cattle can be expressed as a function of the demand for cattle characteristics and the number of cattle supplied in a regional market. The demand for fed cattle by packers is derived from the demand for beef products by consumers. The demand for fed cattle in cash markets can be specified as:
CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY

(1) Fed Cattle Price = f(Quality Factors, Market Conditions, Captive Supplies).

Quality factors include animal weight, finish uniformity, percentage of cattle expected to grade Choice and Select, estimated dressing percentage, percentage of cattle expected to yield grade 4, number of brands, sex, and breed.

Market conditions refer to supply and demand in the local fed cattle market. Market conditions include prices of Choice and Select grade boxed beef, nearby live cattle futures prices, and local marketings of fed cattle. Other factors related to the short-run demand for fed cattle are also included as market conditions. The number of cattle purchased by the packer from the feedyard on the same day, the packer purchasing the cattle, the distance from the packer to the feedyard, the day of the week the cattle were sold, the number of bids received on a pen of cattle during the week sold, and the number of days between sale date and the packer delivery date are all included as possible price determinants.

Finally, changes in the level of captive supplies are included in the model to determine their impacts. Two different measures of captive supplies are examined for possible price impacts. The first measure is the formula and contract shipments from Kansas feedyards reported by the USDA during the delivery week of each pen divided by total weekly Kansas slaughter. This measure provides for estimation of the impact of regional aggregate captive supplies on cash market prices. The second measure of captive supplies is each individual packer's share of captive supplies as a percentage of Kansas slaughter. This includes three separate variables; the captive supplies of firm A, firm B, and firm C as a percentage of the total Kansas cattle slaughter. Of the five packing firms that are represented in the southwestern Kansas region, only two had appreciable levels of captive supplies. Thus, captive supply shares for firms A and B are shares for individual firms whereas, firm C’s share represents the sum of the captive supplies of the remaining three firms.

Data

Data were collected on individual transactions from 1407 pens of cattle representing 166,338 of cattle head from May 21, 1990 through November 24, 1990 from 13 feedyards in southwestern Kansas. For each pen of cattle sold, a record was made of price bids, feedyard and animal characteristics, market conditions, and the level of captive supply.

The number of captive supply cattle shipped for slaughter each week from Kansas feedyards was collected from the USDA’s Agricultural Marketing Service in Dodge City, Kansas. The Dodge City regional office conducts a weekly telephone survey of feedlots in Kansas to determine the number of fed cattle scheduled for shipment under formula arrangements and contracts (packer-owned cattle are not included). The number of captive cattle ranged from 20,000 head during the week ending July 13 to less than 3,000 during the week ending November 2. The percentage of Kansas cattle slaughter represented by formula and contract cattle during May through November 1990 is presented in Figure 3. Captive supplies ranged from 2% to 15% of weekly slaughter.

17 Private industry analysts supplied estimates based on feedyard surveys of the firm shares of captive supplies.

18 Because of resource constraints, 5 of the 13 feedlots were dropped from the data survey at the end of August 1990. Thus, 8 of the yards participated in the survey from September through November 1990.
Captive supply shares by firm were variable: Firm A and firm B each controlled over 80% of the total captive supplies during some weeks, and controlled less than 10% in other weeks. All other firms combined generally had less than 20% of the captive supplies. Average aggregate captive supplies represented 5.9% of Kansas slaughter during May through November 1990. However, during May through July, contracting was approximately 50% greater than during the entire 6-month period, averaging 9.3% of slaughter (Figure 3). Firm A had the largest share of contracting over the entire period and from May through July; firm B had the largest share during August through November. The largest single firm’s captive supply as a percentage of Kansas slaughter was 12.8% during July.

**Cattle Characteristics**

Weight had a nonlinear influence on price (Figure 4) with the highest prices received for steers weighing approximately 1100 to 1200 pounds and heifers weighing 1000 to 1100 pounds. Price premiums were received for pens of cattle with a higher percentage of cattle grading Choice. Figure 5 shows the price impact and the packer liveweight value of a 10 percent increase in the number of cattle grading Choice in a pen at the average Choice to Select price spread during the period. For each 10 percent change in the number of cattle grading Choice in a pen, the packer value of the cattle on average changed $0.43/cwt. The transaction price changed by about $0.25/cwt. in the same direction.

The premium/discount structure for quality grade differences for live cattle is small relative to the estimated value differentials. Concerns regarding cattle being bought on the average instead of price differences reflecting end-use value differentials have been expressed for some time. At the 1990 Research Institute on Livestock Pricing Conference, Vermedahl (1990) argued that packers do not offer significant premiums for higher quality cattle or discounts for lower quality cattle and that their pricing structure distorts price signals to producers. Similar concerns have been echoed by others including the National Cattlemen's Association. These results tend to support those concerns.
Reasons why cattle are priced on the average are many. Among them, transaction costs to both the packer and the feedyard manager may be too high to negotiate price on each pen. Cost reductions are gained by both the feedyard and the packer when several pens are marketed in groups with no or little price differentiation among pens based on quality differentials.

The influence of other cattle quality variables on price is reported in Table 2. Dressing percentage had a positive influence, with each percentage point increase in dressing percent increasing price $0.32/cwt. As the percentage of yield grade 4 cattle increased, the price for the pen declined $0.04/cwt. Pens having uniform finish received premiums of $0.22/cwt. relative to nonuniform pens. Sex influenced price. Pens of steers and pens of heifers received premiums of $0.43/cwt. and $0.35/cwt. respectively, relative to pens containing both steers and heifers. Pens containing heiferettes received discounts of almost $1/cwt.
Figure 4. Estimated Price Changes Associated with Varying Cattle Weight Relative to Base Heifer Weight of 1,060 lbs. and Base Steer Weight of 1,200 lbs.

Figure 5. Comparison of Estimated Transactions Price and Packer Value Changes for a 10% Increase in Number of Cattle Grading Choice in a Pen
Table 2. Estimated Price Impacts of Selected Fed Cattle Quality Traits

<table>
<thead>
<tr>
<th>Quality Trait</th>
<th>Price Impact ($/cwt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% Increase in Dressing %</td>
<td>+0.32</td>
</tr>
<tr>
<td>1% Increase in Yield Grade 4s</td>
<td>-0.04</td>
</tr>
<tr>
<td>Uniform Finish</td>
<td>+0.22</td>
</tr>
<tr>
<td>Steers only Relative to Mixed Pens</td>
<td>+0.43</td>
</tr>
<tr>
<td>Heifers only Relative to Mixed Pens</td>
<td>+0.35</td>
</tr>
<tr>
<td>Heiferrettes Present</td>
<td>-0.98</td>
</tr>
</tbody>
</table>

Market Factors

The price impacts of live cattle futures prices, the distance from the packer to the feedyard, the number of bids per pen, the days between purchase and delivery of cattle, which packer purchased the cattle, and the impact of changes in local fed cattle marketings are shown in Table 3.

The nearby live cattle futures price had a positive influence on transaction price, with magnitudes similar to those of Ward (1992). The distance from the packer to the feedyard influenced price. For each 10 miles the cattle needed to be shipped for slaughter, the average price declined $0.013/cwt. Local fed cattle supplies had a negative influence on price. For each 10,000 head increase in cattle marketed in Kansas during the week of sale, the price declined by $0.11/cwt. as packers likely had to cover less area to procure cattle.

The days between cattle purchase and delivery had a small influence on price. For each additional day cattle were held by the feedyard after purchase by the packer, the price increased $0.013/cwt. The days between cattle purchase and delivery to the packer were quite variable ranging from same-day delivery to 17 business days (Figure 6). Over 80% of the pens were delivered within 2 to 7 days. Ward (1992) estimated that each additional day the feedlot held cattle after the sale date increased price by a similar $0.025/cwt. Packers may have been willing to pay feedyards to hold cattle to facilitate management of packing plant slaughter schedules.

Table 3. Estimated Price Impacts of Selected Market Factors

<table>
<thead>
<tr>
<th>Market Factor</th>
<th>Price Impact ($/cwt.)</th>
</tr>
</thead>
</table>

CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY
$1/cwt. Increase in Nearby Live Cattle Futures $0.56
Additional 10 Miles from Feedyard to Packer -0.013
Additional 10,000 Head of Cattle Marketed in KS -0.11
Additional Day Between Cattle Purchase and Delivery $0.013
Additional Bid Received on Pen $0.07

Figure 6. Number of Business Days Between Cattle Sale Date and Delivery Date
The number of bids received had a positive influence on price. Each additional bid resulted in a price increase of $0.07/cwt. This is consistent with the findings of previous studies (Ward 1989). Ward (1992) estimated that each bid from different buyers increased fed cattle price by $0.05/cwt. to $0.07/cwt. Over 60% of the pens were sold on the first bid (Figure 7) with as many as seven bids received during the week of sale.

Nearly 70% of the pens were sold on Monday or Tuesday (Figure 8). Cattle sold early in the week received $0.30/cwt. to $0.50/cwt. higher prices relative to the national market than cattle sold later in the week (Figure 9). Ward (1992) found similar day-of-the-week effects. Stronger demand earlier in the week, together with increased desire by feedyard managers to dispose of unsold pens later in the week, may explain the downward pressure on prices. Jones et al. (1991) reported that feedlot managers asking prices also decline as the week progresses.
Figure 8. Day of the Week Cattle Were Sold

Figure 9. Estimated Basis Change by Day of the Week Cattle Were Sold
Differences in the prices paid by packers were present. On average, packer 3 paid $0.17/cwt. and packer 2 paid $0.19/cwt. less for cattle than the default packer, packer 1. Average prices paid were not associated with packer size.

**Captive Supplies**

The level of captive supplies had a statistically significant negative influence on price (Table 4). For each one percent increase in contract and formula cattle shipments from Kansas feedyards as a percentage of Kansas slaughter, the transaction price declined by $0.026/cwt. over May to November 1990. The captive supplies of individual firms had significant negative influences on price as well, with the exception of firm A. A 1% increase in captive supplies as a percent of total Kansas slaughter by firm B reduced price by $0.10/cwt., and a 1% increase in the captive supplies of firm C reduced price $0.21/cwt. Over the six-month period as a whole, the total impact of captive supplies was to reduce prices in the surveyed feedyards by $0.15/cwt. to $0.31/cwt., depending upon whether captive supplies were measured by firm or in the aggregate. These coefficient estimates must be interpreted with care. As with any regression result, the parameter estimates should not be interpreted as being valid for captive supply levels outside the bounds of the data set.

Because of the changing level of contracting activity during the study period, the models were re-estimated for two-month intervals to provide insight into the price impact of the level of captive supplies over different time periods (Table 4). The impact was not constant: when captive supplies were highest (May through July) price was reduced by $0.22/cwt. to $0.34/cwt. depending upon whether captive supplies were measured by firm or in the aggregate. All of the parameter estimates on captive supply measures during May through July (with the exception of the captive supplies of firm B) were negative and significant. During August through November, total captive supplies had no influence on price when measured in the aggregate. However, when measured by firm, captive supplies for firm B had significant negative price influences during August through September and October through November. Captive supplies for firm C had a positive influence on price during October through November. Given these results, it is unclear whether captive supplies influenced price during August through November.

**Limitations**

Several caveats to the results of this study are important. First, the results may be sensitive to the market conditions during the data collection period. In May through November 1990, fed cattle supplies were relatively low which may have provided a safety net against any packer market power. Second, estimates of the price impacts of captive supplies are based on only 26 weekly observations of captive supplies. Third, the results could be sensitive to the southwestern Kansas marketing region. The market

**Table 4. Estimated Price Impacts of Captive Supplies**

<table>
<thead>
<tr>
<th>Captive Supply Variable</th>
<th>Time Period</th>
<th>Aggregate KS Market Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full Period</td>
<td>Sub-Period</td>
</tr>
<tr>
<td></td>
<td>May-November</td>
<td>May-July</td>
</tr>
</tbody>
</table>

---

**CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY**
Impact of 1% Increase in Captive Supplies as a % of Slaughter

<table>
<thead>
<tr>
<th></th>
<th>Impact of 1% Increase</th>
<th>Total Average</th>
<th>Price Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in Captive Supplies</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>as a % of Slaughter</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.026</td>
<td>-0.036</td>
<td>NS*</td>
</tr>
</tbody>
</table>

Firm Specific Impacts

Impact of 1% Increase in Captive Supplies

Shares of:

<table>
<thead>
<tr>
<th>Firm</th>
<th>Shares of:</th>
<th>Total Average</th>
<th>Price Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm A</td>
<td>NS</td>
<td>-0.022</td>
<td>NS</td>
</tr>
<tr>
<td>Firm B</td>
<td>-0.104</td>
<td>+0.045</td>
<td>-0.161</td>
</tr>
<tr>
<td>Firm C</td>
<td>-0.207</td>
<td>-0.232</td>
<td>NS</td>
</tr>
</tbody>
</table>

Total Average

Price Impact  

-0.31  
-0.22  
-0.17  
+0.16

*NS indicates estimate not statistically different from zero.

structure, local supply and demand, and other factors unique to the area make it difficult to generalize beyond this region. Fourth, although detailed data were collected on cash market transactions, we have no knowledge of the characteristics or of the prices received for cattle in the captive supplies delivered to the packers. Depending upon the price these cattle received, the net price effect of captive supplies across all cattle slaughtered is indeterminate. Finally, the feedyards surveyed were not a random sample. With the amount of data requested from feedyard managers, the sensitivity of the topic, and the logistics and time necessary to collect individual pen data, only willing feedyards in the region participated.

Clearly, there are a number of forces which influence cattle prices. The analysis does provide evidence that captive supplies often exerts a negative influence on transaction prices, but a number of caveats to this result are offered and caution should be exercised in generalizing the results. At the worst, the price impact would be $3-4 per head. It may be that any such negatives are offset by related values to the feedlots in guaranteeing a buyer, etc. Further, this analysis does not consider the possible impact on the overall level of prices, the issue introduced by Purcell in Chapter 1. It is an important area, and more work in this overall area of captive supplies and their impact is needed.

Conclusions
Captive supplies have become an important source of cattle for packers. Contracts serve to reduce price risks for cattle feeders. However, captive supplies may influence market prices in both the short and long runs. Research results on the impact of variations in captive supplies on cash prices are mixed. Recent research suggests that when captive supplies are large, the impact on short run cash market prices may be negative. However, the estimated magnitudes of these negative price influences have been relatively small (i.e., less than $0.40/cwt. in local markets at any point in time).

Theoretical impacts of captive supplies on prices are uncertain. As such, empirical studies provide the primary insight into possible impacts of captive supplies. Unfortunately, research conducted to date is incomplete, primarily because of data limitations. Collecting transaction data necessary for examining impacts of changing cattle procurement methods is time consuming and expensive. In addition, researchers have very limited data on (1) prices received for forward contracted cattle, (2) prices received for marketing-agreement formula-priced cattle, and (3) quantity of packer-owned cattle feeding. Without knowledge of these factors it is difficult to assess the total impact of captive supplies on the fed cattle market. As a result, policy implications of research results regarding captive supplies are uncertain. Although some recent research suggests a negative price impact of captive supplies, these results must be tempered given the data limitations present.

Our research indicates that end-use beef value differentials were not fully reflected in live cattle prices. Although premiums were present for higher dressing percentage and several other cattle quality traits, premiums for Choice grade and discounts for Select grade cattle were less than 60 percent of the estimated wholesale value differentials. These results suggest that the cash fed cattle market in southwestern Kansas offered cattle feeders less incentive to improve carcass quality than wholesale prices would have suggested.

The implications of forward contracting activity on value based marketing are somewhat ambiguous. Contract specifications outlined in various packers' forward contracts suggest that discounts will be applied to cattle failing to meet weight, quality grade, and yield grade specifications. This provides cattle feeders with an incentive to produce carcasses capable of meeting the minimum specifications, but provides no incentive to produce cattle exceeding these specifications. The sole exception is yield or dressing percentage. A premium will be earned if cattle have a carcass yield greater than the dressing percentage stipulated in the contract or a discount if the cattle carcass yield is less than the dressing percentage specified in the contract. Consequently, forward contracting fed cattle provides a limited price incentive to produce higher quality cattle.

Our informal survey of feedyard and marketing managers in Kansas and Colorado suggests that contract specifications, except the carcass weight or dressing percentage, are often waived. Although the forward contract system has the potential to improve price transmission from the wholesale level back to the cattle feeder, it falls short of its potential. For forward contracting to have a significant impact on cattle carcass quality, a higher percentage of contracts need to retain specifications and, perhaps more importantly, contracts may need to be restructured to provide cattle feeders positive incentives to exceed the base specifications.

Future research needs to consider more completely how vertical integration of packers impacts live cattle prices and prices of meat products to consumers. More information is needed that specifically identifies the types and magnitudes of packer integration into the cattle feeding sector. Without increased information regarding prices of cattle procured using forward contracts or marketing agreements it is impossible to assess the price impacts of changing packer procurement methods. At the very least, the USDA should consider the possibility of reporting current forward contract basis bids and formulas for marketing agreements, that include large amounts of cattle. Without increased disclosure of such commodity trade, smaller cattle feeders will continue to operate with important market information shortages relative to their larger counterparts.
References


CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY


CHAPTER 3

**Packer Competition, Forward Contracting Price Impacts, and the Relevant Market for Fed Cattle**

Marvin Hayenga and Dan O’Brien
Professor of Economics and Extension Associate
Iowa State University

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**Introduction**

In the wake of the continuing consolidation of the livestock sectors in the 1980s, increasingly strident questions are being raised about the implications of what has happened. What will it mean to the prices livestock producers receive? What about the viability of the small producer? As packers get larger relative to the producer they buy from, will they dominate the pricing process and dominate the marketplace? And what about the move to “capture” supplies of livestock? Does a high level of captive supplies in the hands of a packer in a particular market area mean lower prices to producers?

These are all interesting and relevant questions. Answers will be needed as the policy makers reflect on the deregulation days of the 1980s and try to decide whether corrective action is needed or whether it will be sufficient to just bolster the monitoring activity and analytical capability of agencies like the Packers and Stockyards Administration (P&SA). Changes are already being made. Congress has directed money toward P&SA and the GAO has responded to Congressional requests in looking at the state of readiness of P&SA as a monitoring agency.

The research to be briefly reported in this chapter will not provide all the answers, but it will make a contribution to the dialogue and discussion. Specifically, this research program was initiated to analyze three important issues in the market for fed cattle:

1. What impact, if any, a sharp reduction in the number of buying packers in a particular state or marketing area has had on prices to producers;

2. What effect captive supplies have on the level and variability of prices to livestock producers; and

3. Related to the other issues, what is the relevant geographic market for fed cattle when researchers try to determine the price impact of consolidation or captive supplies.

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*A more detailed exposition which includes the review of literature is available in Research Bulletin 5-91 from the Research Institute on Livestock Pricing, Agricultural Economics, Virginia Tech, Blacksburg, VA 24061. Contact Wayne Purcell at that address or call him at (703) 231-7725.*

CHAPTER 2: IMPLICATIONS OF CAPTIVE SUPPLIES IN THE FED CATTLE INDUSTRY
Data Sources

To analyze these related issues, USDA reported Choice 1100-1300 lb. steer prices were acquired for a large number of geographically dispersed markets (weekly averages--1973-1989; daily--1987-1989). Arizona prices were for 900-1100 lb. steers due to insufficient price data on heavier cattle. In addition, Cattle-Fax estimates of weekly forward contract cattle deliveries to packers from 4 states (October, 1988 to December, 1989), USDA statistics on weekly state cattle slaughter for the same period, and USDA-FSIS statistics on the number of beef slaughter plants above 100,000 head capacity in each state, annually for 1973-1989, were collected. While packer market shares and concentration indices might be preferred, the number of relatively large active competitors located in the state may serve as a reasonable index of packer concentration at the state level. The percentages of cattle marketed annually from feedlots with less than 1000 head capacity and from feedlots with greater than 32,000 head capacity by states were calculated from January USDA Cattle on Feed reports and annual state livestock slaughter statistics. These data were used as measures of changes in feedlot concentration and the countervailing power of cattle feeders in fed cattle markets.

Impact of Changes in Number of Sellers and Buyers

Have changes in the number of beef slaughter plants or the number of beef slaughter plant owners in major cattle feeding states had an effect on fed cattle prices in those states? While analysis of this issue based on the number of plants within a state or market area is relevant to market performance questions, analysis based on the number of plant owners may be even more important. Two plants in the same relevant market with the same owner would not be expected to compete with each other for cattle. Rather, they would be expected to coordinate their fed cattle procurement efforts. For example, there have been three large beef packing plants in operation in Colorado since 1988, one at Greeley owned and operated by Monfort and the other two (at Fort Morgan and Sterling) owned and operated by Excel Corporation. Similar situations exist in other states where either IBP, Excel, or other beef packers either own or have owned at one time more than one beef packing plant.

Of the five large cattle feeding states considered in the study, Colorado had the greatest proportional decreases in both number of large beef packing plants and number of owners of large plants. Iowa was second. Kansas and Texas were fairly stable (see Table 1).

Table 1. Number of Beef Packing Plants and Plant Owners With 100,000 Head Annual Slaughter Capacity in Major Cattle Feeding States, 1972-1988.

<table>
<thead>
<tr>
<th>Year</th>
<th>Colorado Plnt</th>
<th>Colorado Ownr</th>
<th>Kansas Plnt</th>
<th>Kansas Ownr</th>
<th>Texas Plnt</th>
<th>Texas Ownr</th>
<th>Nebraska Plnt</th>
<th>Nebraska Ownr</th>
<th>Iowa Plnt</th>
<th>Iowa Ownr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>1977</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>1982</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>13</td>
<td>13</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>1987</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1988</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>9</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: USDA Food Safety and Inspection Service.

Motivated by the decreases in the number of large packers in Colorado and Iowa, an initial graphical analysis of prices in these states
compared to other states was completed. Figure 1 shows the ratio of weekly Colorado fed steer prices to the average weekly price in eight other major cattle feeding states for the 1973-1989 period. The other states were Nebraska, Kansas, Texas, Iowa, Arizona, Illinois, California and Washington. A similar analysis was completed for Iowa prices relative to the average of those in other states (see Figure 2). These plots show little apparent change in Colorado and Iowa prices relative to those in other cattle feeding states.

Simple graphical analysis suggests no significant change in Colorado or Iowa cattle prices compared to other states. Initially, it appears the reductions in the numbers of plants and/or owners in Colorado and Iowa have not had any measurable impact on relative prices across the states.
Table 2 reports the results of regressions of relative annual state price ratios on annual plant ownership data and the changing relative concentration of fed cattle sellers (the annual percent of cattle marketed within a state from small feedlots under 1000 head capacity). Colorado prices were used because of the greater proportional decrease in the number of competing plant owners in that state. Quadratic functional forms were specified to accommodate possible nonlinear or threshold relationships. The key results, in summary form, were:

1. Generally, changes in the relative number of plant owners had no significant impact on prices between states. One
exception was noted in terms of a slight decline in the number of plant owners in Texas associated with lower prices in Colorado relative to Texas, the opposite of what was expected based on economic theory. The little, if any, effect on prices from falling numbers of plant owners may be due to (a) mis-specification of the plant owner variables as an index for packer competition, (b) the increased efficiency of the larger scale plants still remaining in Colorado or other states, compensating for any potential loss in competition, (c) the inappropriate use of the state as the relevant market area for structural market analysis, which could lead to spurious results, or (d) the possibility that there has not been any reduction in effective competition despite the smaller number of competitors.

2. Changes in the proportion of cattle marketed in a state from the smallest USDA feedlot category reported (less than or equal to 1000 head capacity) had significant effects on relative prices across states, though mostly with unexpected signs, in several equations. As the concentration of feedlot ownership increases, their market power and consequently their ability to obtain higher relative fed cattle prices would be expected to increase, but the results did not consistently support this hypothesis. For example, a decrease in the percentage of cattle marketed from small lots in Colorado decreased Colorado prices relative to Kansas.

The regressions of relative prices across states on measures of the number of buyers and on measures of concentration in the feedlot sector gave mixed results. There is no significant evidence of the exercising of market power by either buyers or sellers.

A seemingly unrelated regressions (SUR) analysis was carried out to examine the impact of structural changes on relative beef prices. Table 3 reports results. This method was used to examine how changes in annual fed cattle prices are related to annual changes in the supply of beef and competing products, income, and population. After accounting for these major price influencing factors, the effect of the changing number of state level plant owners and of changing feedlot structure on state fed cattle prices could be determined.

### Table 2. Effects of Changes in the Number of Plant Owners and Feedlot Size Structure on Relative Colorado Prices.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Signif. Level</th>
<th>R-Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado P/</td>
<td>Colorado Owners</td>
<td>-.0003</td>
<td>.923</td>
<td>.84</td>
</tr>
<tr>
<td>Kansas P</td>
<td>Colorado Owners Sqrd</td>
<td>.0005</td>
<td>.711</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kansas Owners</td>
<td>.0018</td>
<td>.748</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kansas Owners Sqrd</td>
<td>.0031</td>
<td>.443</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Colorado Small Fdlts</td>
<td>.0049</td>
<td>.047*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Col Small Fdlts Sqrd</td>
<td>.0007</td>
<td>.206</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kansas Small Fdlts</td>
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<td>.798</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kan Small Fdlts Sqrd</td>
<td>.0002</td>
<td>.082</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>.9506</td>
<td>.000**</td>
<td>.00</td>
</tr>
<tr>
<td>Colorado P/</td>
<td>Colorado Owners</td>
<td>-.0017</td>
<td>.599</td>
<td>.78</td>
</tr>
<tr>
<td>Texas P</td>
<td>Colorado Owners Sqrd</td>
<td>-.0024</td>
<td>.239</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Texas Owners</td>
<td>-.0089</td>
<td>.044*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Texas Owners Sqrd</td>
<td>.0021</td>
<td>.364</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Colorado Small Fdlts</td>
<td>.0036</td>
<td>.273</td>
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</tr>
<tr>
<td></td>
<td>Col Small Fdlts Sqrd</td>
<td>.0003</td>
<td>.748</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Texas Small Fdlts</td>
<td>.0113</td>
<td>.038*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tex Small Fdlts Sqrd</td>
<td>.0008</td>
<td>.863</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>1.0319</td>
<td>.000**</td>
<td>.00</td>
</tr>
<tr>
<td>Colorado P/</td>
<td>Colorado Owners</td>
<td>-.0019</td>
<td>.645</td>
<td>.51</td>
</tr>
</tbody>
</table>

CHAPTER 3: PACKER COMPETITION AND FORWARD CONTRACTING PRICE IMPACTS, AND THE RELEVANT MARKET FOR FED CATTLE
Nebr. P  Colorado Owners Sqrđ  .0021  .314
Nebraska Owners  -.0009  .861
Nebraska Owners Sqrđ  -.0010  .531
Colorado Small Fdlts  .0063  .131
Col Small Fdlts Sqrđ  .0012  .427
Nebraska Small Fdlts  -.0002  .912
Neb Small Fdlts Sqrđ  -.0000  .839
Constant  .9850  .000**

Colorado P/  Colorado Owners  .0042  .222  .84
Iowa P  Colorado Owners Sqrđ  -.0011  .344
Iowa Owners  -.0002  .967
Iowa Owners Sqrđ  -.0019  .447
Colorado Small Fdlts  -.0053  .224
Col Small Fdlts Sqrđ  .0001  .885
Iowa Small Fdlts  .0006  .031*
Iowa Small Fdlts Sqrđ  .0000  .004**
Constant  .9657  .000**

** 1% significance level; * 5% significance level

The SUR technique was appropriate to use because there likely was same-period (contemporaneous) correlation between the error terms from otherwise separate equations in this system of equations. If some of the endogenous variables appear in all the equations within the system and their effect is thought to be equal across all equations, then across equation equality restrictions can be placed on these regression coefficients. In this study, it seemed likely that annual state beef prices in Colorado, Iowa, Nebraska, Kansas and Texas were equally affected by annual per capita beef, pork, and poultry production and annual per capita disposable income. Preliminary tests confirmed that such is the case. The equation system was estimated subject to cross equation equality restrictions for the effect of beef, pork, poultry and income on prices in all states.

The equation was:

\[ \text{Price}_i = B_{i0} + B_{i1}(\text{BeefQ}) + B_{i2}(\text{PorkQ}) + B_{i3}(\text{PoulQ}) + B_{i4}(\text{Incm}) + B_{i5}(\#\text{State-i Owners}) + B_{i6}(\% \text{Small Feedlot Mktgs}) + B_{i7}(\% \text{Large Feedlot Mktgs}) \]

where:  
\( i \) = Colorado #1, Kansas #2, Texas #3, Nebraska #4, Iowa #5,  
\( \text{BeefQ} \) = Per capita Beef Production,  
\( \text{PorkQ} \) = Per capita Pork Production,  
\( \text{PoulQ} \) = Per capita Poultry Production,  
\( \text{Incm} \) = Per capita Disposable Income,  
\( \% \text{Small Feedlot Mktgs} \) = Small feedlot annual marketings as a proportion of annual  
\( \% \text{Large Feedlot Mktgs} \) = Large feedlot annual marketings as a proportion of annual

The key results, in summary form, of the SUR analysis as reported in Table 3 were:

1. The across-equation restricted coefficients for per capita beef consumption were negative and significant at the 1% level, while the effects of per capita pork and poultry supplies were not significant. Per capita disposable income had a small positive significant effect on beef prices.
2. Changes in the number of owners of larger beef packing plants in each state over time had no significant impact on state average beef prices.
### Table 3: The Effect of Changes in the Number of Plant Owners on Annual Average Fed Beef Prices Using Restricted Seemingly Unrelated Regressions, 1973-1988

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Variable</th>
<th>Coefficient</th>
<th>T Stat</th>
<th>R Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>BeefQ</td>
<td>-1.23</td>
<td>-5.99**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PorkQ</td>
<td>.27</td>
<td>1.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChixQ</td>
<td>-.26</td>
<td>-0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inc .01</td>
<td>2.30*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colorado Price</td>
<td># Colorado Owners</td>
<td>.09</td>
<td>0.24</td>
<td>.89</td>
</tr>
<tr>
<td></td>
<td>% Col. Small Fdlt Mktgs</td>
<td>.59</td>
<td>1.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Col. Large Fdlt Mktgs</td>
<td>.07</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>78.06</td>
<td>3.37**</td>
<td></td>
</tr>
<tr>
<td>Kansas Price</td>
<td># Kansas Owners</td>
<td>-.15</td>
<td>-.28</td>
<td>.87</td>
</tr>
<tr>
<td></td>
<td>% Kan. Small Fdlt Mktgs</td>
<td>-.07</td>
<td>-.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Kan. Large Fdlt Mktgs</td>
<td>-.13</td>
<td>-1.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>89.20</td>
<td>3.93**</td>
<td></td>
</tr>
<tr>
<td>Texas Price</td>
<td># Texas Owners</td>
<td>.96</td>
<td>1.95</td>
<td>.96</td>
</tr>
<tr>
<td></td>
<td>% Tex. Small Fdlt Mktgs</td>
<td>-1.91</td>
<td>-3.15*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Tex. Large Fdlt Mktgs</td>
<td>-.30</td>
<td>-3.57**</td>
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<tr>
<td></td>
<td>Constant</td>
<td>94.93</td>
<td>4.33**</td>
<td></td>
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<tr>
<td>Nebraska Price</td>
<td># Nebraska Owners</td>
<td>.14</td>
<td>.36</td>
<td>.88</td>
</tr>
<tr>
<td></td>
<td>% Neb. Small Fdlt Mktgs</td>
<td>.05</td>
<td>.35</td>
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<tr>
<td></td>
<td>% Neb. Large Fdlt Mktgs</td>
<td>.11</td>
<td>.40</td>
<td></td>
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<td></td>
<td>Constant</td>
<td>79.88</td>
<td>3.45**</td>
<td></td>
</tr>
<tr>
<td>Iowa Price</td>
<td># Iowa Owners</td>
<td>.79</td>
<td>1.23</td>
<td>.87</td>
</tr>
<tr>
<td></td>
<td>% Iowa Small Fdlt Mktgs</td>
<td>-.06</td>
<td>-1.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>83.97</td>
<td>3.70**</td>
<td></td>
</tr>
</tbody>
</table>

* The effects of BeefQ, PorkQ, ChixQ and Inc were restricted to be equal across the five state price equations.

* = 5% signif. level (2 tail)

** = 1% signif. level (2 tail)

3. Changes in the proportion of cattle marketed by the largest or smallest feedlots typically had no significant impact on cattle prices. Only in the case of Texas were significant price impacts noted. Coefficients for size groupings of feedlots
were negative, but only one was consistent with theoretical expectations.

The more sophisticated analysis gave similar results. There is no evidence that changes in the numbers of owners of large beefpacking firms influenced price relationships across states. The percentage of cattle sold by large and/or small feedlots also failed to exert a significant influence on the relative prices. It appears other factors, such as the economies and efficiencies in larger plant size, may be offsetting any reduction in competition due to fewer buyers.

The Effect of Captive Supplies

Conceptually, forward contracts reduce the quantity needed and the quantity supplied on the cash market equally, so no change in price level should be expected due to forward contracted cattle deliveries. However, some cattle feeders argue that high levels of contract deliveries reduce the interest of bidders in their cattle, and weaken cash price bids. Further, some suggest that the effect is more pronounced on the fringe (and presumably higher transportation cost) procurement areas for packers with high volumes of contract deliveries. The effect would be expected to be strongest on prices for cattle to be delivered in the same time period as the contract deliveries, but since cattle purchased today often are delivered 3 to 7 days later, the price effect may be most noticeable in the same week or one week earlier than contracted deliveries. Cash market variability might be increased if high volumes of contract deliveries take some packers out of the cash market temporarily. In this case, price incentives must increase to bring fringe area packers to feedlots that are not part of their normal market area. Alternatively, packers with few contract deliveries scheduled for a specific time period may find that most of the cattle ready for market are committed to others, resulting in panic buying to fill slaughter needs. The unevenness in the "matching up" process could affect cash price variability on a day-to-day basis.

To measure the effect of forward contracting on fed cattle prices, Cattle-Fax weekly state estimates of forward contract deliveries from October, 1988 through December, 1989 were transformed into percentages of state weekly slaughter for Colorado, Texas, Nebraska, and Kansas. Correlation in weekly contract volumes between the four states was generally low. For example, the correlation between COLCONT (percentage of weekly Colorado slaughter that is contracted) and TEXCONT was .24, whereas correlation between KANCONT and NEBCONT was .56. Near-VAR (VARX) models were used to determine the effects of one- and two-week lagged prices for each state and weekly contract deliveries for each of the four states on each state's current weekly fed cattle prices. Results for Colorado are reported in Table 4. (The results for other states were very similar.)

<table>
<thead>
<tr>
<th>Table 4. Effect of Lagged Weekly Prices and Contract Deliveries as a Percent of Monthly Slaughter on Colorado Fed Cattle Prices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>COLORADO(-1)</td>
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<td>COLORADO(-2)</td>
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<td>NEBRASKA(-1)</td>
</tr>
<tr>
<td>NEBRASKA(-2)</td>
</tr>
<tr>
<td>KANSAS(-1)</td>
</tr>
<tr>
<td>KANSAS(-2)</td>
</tr>
<tr>
<td>TEXAS(-1)</td>
</tr>
<tr>
<td>TEXAS(-2)</td>
</tr>
<tr>
<td>COLCONT</td>
</tr>
<tr>
<td>KANCONT</td>
</tr>
<tr>
<td>TEXCONT</td>
</tr>
<tr>
<td>NEBCONT</td>
</tr>
</tbody>
</table>
**1% significance level; *5% significance level

The key results:

Because of conflicting signs on the significant contract volume variables, and no statistically significant effects of the other state contract volumes on Colorado prices, contract deliveries had no clear impact on price levels.

Initial efforts show no clear impact on price from contracted cattle or "captive supplies".

SUR Analysis of Forward Contracting Effects

SUR analysis was also used to test the effect of forward contracting on state fed cattle prices for October, 1988 through December, 1989. Weekly fed cattle prices across the various states in the main fed cattle feeding region would likely be affected in a similar manner by conditions and resulting price movements in the wholesale beef market. The U.S. weekly average gross beef carcass cutout value (in dollars per hundred weight, based on fabricated beef cuts for a Choice 1-3 550-700 lb. carcass) was used as a proxy for wholesale beef market prices. Weekly state level forward contracting as a proportion of state weekly federally inspected slaughter was used as a proxy for the overall proportion of forward contracting for Colorado, Kansas, Texas and Nebraska. SUR analysis allows one to restrict the effect of boxed beef price variation on state fed cattle prices to make it equal across states, and to improve the efficiency of the estimation process by allowing for contemporaneous correlation of the error terms across the system of equations. This is intuitively appealing because any errors are likely to be related across states.

Table 5 reports the results of a SUR estimation of current week effects of boxed beef prices and forward contract deliveries on fed beef prices.

The key results, in summary form, were:

1. Forward contract deliveries in Kansas during the current week had a significant negative effect on Kansas fed cattle prices. Forward contract deliveries in other states had no significant effects on prices within those states.

2. The effect of boxed beef prices on fed cattle prices was positive and highly significant across the system of equations.

A similar SUR estimation of the effect of forward contract deliveries one week into the future and of current week boxed beef prices on current week fed cattle prices had similar results.

Assuming that the Cattle-Fax survey data are an adequate proxy for total forward contract deliveries in these four states, the inconsistency in the results among the three states where contracting volume (and Cattle-Fax coverage) were highest leads to the conclusion that any negative impact of contracting has not been clearly shown in these analyses.

The effect of forward contracting on the variation of daily prices within a week and the range of prices offered during a week was examined within a SUR framework similar to Table 5 (not reported here). Price variability was measured as the standard deviation of the daily price range mid-points within a week. An alternative weekly price variability measure was the range of lowest to highest reported prices offered within a

CHAPTER 3: PACKER COMPETITION AND FORWARD CONTRACTING PRICE IMPACTS, AND THE RELEVANT MARKET FOR FED CATTLE
Table 5.  SUR Analysis of Effect of Current Period Cattle Forward Contract Deliveries on Weekly Fed Cattle Price Levels (October, 1988 to December, 1989)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Variable</th>
<th>Coefficient</th>
<th>T Stat</th>
<th>R Squared</th>
</tr>
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<tr>
<td>Weekly Boxed Beef Price (1)</td>
<td>Weekly Boxed Beef Price</td>
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<td></td>
<td>13.47**</td>
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<tr>
<td>Colorado Price</td>
<td>Colorado Contracting / Fed. Insp. Slaughter Constant</td>
<td>-0.30</td>
<td>-0.63</td>
<td>.62</td>
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<tr>
<td>Texas Price</td>
<td>Texas Contracting / Fed. Insp. Slaughter Constant</td>
<td>-0.60</td>
<td>-0.58</td>
<td>.56</td>
</tr>
<tr>
<td>Nebraska Price</td>
<td>Nebraska Contracting / Fed. Insp. Slaughter Constant</td>
<td>-0.96</td>
<td>-0.32</td>
<td>.73</td>
</tr>
</tbody>
</table>

* The effect of Weekly Boxed Beef Price was set equal across the five state price equations.
** 1% significance level; * 5% significance level

The more sophisticated analysis shows a negative impact on prices in Kansas due to high levels of contracting, but that finding does not hold up across other states. There is no evidence to support the hypothesis, offered by some, that high levels of captive supplies bring significant downward pressure on prices.

Relevant Market

The relevant geographic market for industrial organization and antitrust analysis often is based on the trade areas of the firms dealing in closely related products, and some marginal attention is then paid to the potential competitors who might fairly easily move into those trade areas if prices move up (or down in the case of procurement markets) to make entry more attractive. Cross elasticity estimates are usually impractical due to data shortages, but market prices from various firms or geographic markets can often be obtained. Fairly simple correlation analysis often is relied on as one of the tools to characterize product, firm or geographic market interrelationships. However, simple correlation analyses may mislead, especially in markets where many other common factors influencing general supply and demand conditions may be stronger influences on price behavior than the competitive arbitrage.
process, or lack thereof, among geographic areas.

How can the relevant geographic market for livestock be characterized? Long observation suggests that the procurement area of an individual livestock buyer can be viewed as having an amoeba or sometimes a tear drop shape around a slaughter plant. Each procurement area typically overlaps with others, with more significant influences from other areas as you approach the fringe of the amoeba. Further, the fringe of the procurement area ebbs and flows in response to changing geographic cattle supply patterns, product demands, slaughter capacity utilization, cutting margins, and competitive pressures. As a shock occurs in the system (e.g. a new plant opens), one competitor begins taking more cattle from the fringe of another's procurement area, who in turn does the same thing to an adjacent competitor on another fringe of his/her procurement area, and the domino or ripple effect is transmitted well beyond those packers actively involved in the initial trade area where the shock occurred. Thus, the procurement or trade area may not be the appropriate focus of analysis. Rather, the area where the price reverberations from shocks to the system are quick, strong, and measurable would appear to be the best candidate as the relevant geographic market for subsequent structure-performance analysis.

If the firms competing on the periphery of a target firm's procurement area were quickly and strongly affected by a third firm outside the target firm's area, the third firm would have to be included in the ideal collusive group for the group to be effective in exerting market power. The speed and strength of geographic market price arbitrage should therefore be a good preliminary indicator of the relevant market geographic scope that would be appropriate. The absence of significant relationships among prices in different geographic locations should be a reasonable basis for excluding competitors in those areas from the same relevant market. Apparent arbitrage that was due to spurious correlation would have to be determined through further and more in-depth analysis of competitor interactions.

Since it seemed likely that different statistical analysis and data selection choices could potentially lead to different results when analyzing the speed and strength of geographic market price interactions, we explored alternative types of price data (weekly, daily, regular and differenced price series). In addition, we examined the degree of correlation among prices in geographically dispersed markets, as well as the strength of lagged price interrelationships among these markets. Both simple econometric and vector autoregression techniques were used. The cointegrated nature of geographically dispersed daily prices were also examined using augmented Dickey-Fuller unit root tests.

In the following tables, the simple correlation matrices are reported for weekly average USDA direct price reports from the states indicated during 1973-1989 (Table 6) and daily USDA price reports during 1987-89 (Table 7). There were fewer states with frequent daily reports than with frequent weekly reports for use in the analysis. The states are denoted by their abbreviation. OM in Table 7 is the Omaha terminal market price.

The primary results were:

1. The weekly average price correlations are quite high for all states included in the analysis, ranging from .89 to .99. However, part of that high correlation was associated with a strong upward trend in prices during 1973-89.

2. A separate examination of first differenced weekly prices (not shown here) exhibited lower, but still fairly high correlations between all markets studied (.76 to .93). The differencing process should eliminate the impact of trend.

3. Daily prices were also highly correlated (.77 to .996).

4. The lowest daily price correlations occurred for those states most spatially separated.

5. While the prices were relatively highly correlated for both the differenced and the undifferenced series, potentially different conclusions could arise due to the choice of either raw or first differenced daily or weekly data in other cases where geographic markets had slightly weaker price linkages.

Contemporaneous price response measured by the simple correlation of prices may not be a sufficient test of price interrelationships in some situations. Even if contemporaneous correlation was low, a strong price response within a reasonably short time period to a shock in another area may be sufficient to consider those areas all part of the relevant market. Thus, the strength of same-time period price linkages and the speed and strength of lagged price linkages need to be considered in making a judgement regarding the appropriate relevant market.
Table 6. Correlation Matrix of Weekly Prices, 1973-1989

<table>
<thead>
<tr>
<th></th>
<th>NB</th>
<th>TX</th>
<th>KS</th>
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<th>IL</th>
<th>CA</th>
</tr>
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<tbody>
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<td>0.98</td>
<td>0.97</td>
<td>0.97</td>
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<td>0.97</td>
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<tr>
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Table 7. Correlation Matrix of Daily Prices, 1987-1989

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<td>0.99</td>
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<td>0.97</td>
<td>0.81</td>
<td>0.94</td>
<td>0.97</td>
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<tr>
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<td>1.00</td>
<td>0.98</td>
<td>0.98</td>
<td>0.97</td>
<td></td>
<td>0.81</td>
<td>0.94</td>
<td>0.97</td>
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<tr>
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<td></td>
<td>0.81</td>
<td>0.94</td>
<td>0.97</td>
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One statistical procedure which may be useful in evaluating lagged price interaction speed and strength among several geographic areas is vector autoregression. VAR models were estimated for each of the weekly, daily, and differenced price series described earlier. Due to space constraints, we will illustrate the results from one model focusing on Colorado prices as the selected endogenous price variable.
Vector autoregression analysis was used to determine the effect of lagged weekly average fed steer prices in Colorado and other states on prices in Colorado during 1973-89. First differences effectively eliminated the upward trend in prices during this time period and provided a stationary series. Only the significant coefficients of a VAR analysis of the effect of lagged price changes in Colorado and other geographically dispersed states on price changes in Colorado are shown in Table 8.

Similar analyses were carried out for each state. Those lagged first differenced weekly prices which had a significance level of at least 5% are summarized in Table 9.

The key results were:

1. Colorado weekly price changes were significantly related to one- and three-week lagged price changes of Colorado prices, one-week lagged values of Kansas, Nebraska, Arizona, Iowa and Illinois prices, and one- and two-week lagged values of Washington prices.

2. The significant weekly lagged price effects were primarily in the first two weeks among the centrally located cattle feeding states. California prices exhibited no significant lagged linkages to the midwest, but Arizona and Washington prices did.

Lagged daily price relationships also were estimated by VAR analysis. A trend variable was added to the equation to induce stationarity. Table 10 shows the results of VAR analysis using, in turn, each state's daily steer price as the dependent variable and 10 daily lags of the same state and other major cattle feeding state's daily prices as dependent variables.

The daily VAR results show:

1. There were relatively short-term significant lagged price relationships among daily prices in the major cattle feeding states. Many significant lagged price relationships occurred within 10 business days, with a high proportion within 1 to 3 business days. This is consistent with the weekly VAR price analysis in Tables 8 and 9.

Table 8. The Significant Lagged Weekly First Differenced Fed Steer Price Relationships With Fed Steer Prices in Colorado

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lag</th>
<th>Coefficient</th>
<th>T Value</th>
</tr>
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<tr>
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<td>-6.715**</td>
</tr>
<tr>
<td>COLORADO</td>
<td>3</td>
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<td>-2.757**</td>
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<td>1</td>
<td>0.365</td>
<td>2.994**</td>
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<td>1</td>
<td>0.671</td>
<td>6.649**</td>
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<tr>
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<td>1</td>
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<td>ILLINOIS</td>
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<td>-3.741**</td>
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R-Squared = 0.296, Durbin-Watson statistic = 1.948

<table>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

2. Impulse response functions represent the responses of a VAR system of equations to initial shocks of particular variables. The impulse response functions of daily price changes indicated that prices in Kansas, Nebraska, Colorado, Arizona and Illinois were most responsive within the first two days to initial price change shocks in their own state. However, daily price changes in Texas and Iowa were more responsive in the first two days to changes in Kansas prices than to price changes in their own state. Price changes in all states except Arizona were at least somewhat responsive to prices in Kansas.

The linked nature of spatially related fed cattle marketing regions can be analyzed through the use of pairwise cointegration tests. Engle and Granger (1987) presented seven such tests which were later applied to weekly state level fed cattle prices by Goodwin and Schroeder (1990). Engle and Granger identified an augmented Dickey-Fuller test as the recommended approach. The augmented Dickey-Fuller test was used here to determine whether daily fed cattle prices reported in eight states for 1987-1989 are cointegrated.

The cointegration test was applied to pairs of nonstationary state fed cattle price series (P1 and P2) which become stationary after taking their first differences. The results of augmented Dickey-Fuller unit root tests for 1987-1989 daily state average fed cattle prices are given in Table 11. Only the calculated t-ratios of Phi are presented. Since the tests are not symmetric, both results for the regression of P1t on P2t and P2t on P1t are given.

The augmented Dickey-Fuller test results were:

1. Nebraska was highly integrated (1% significance level) with Iowa, Texas, and Illinois, and also with Kansas (5% level).

2. Colorado was highly integrated with Texas, Kansas and Illinois (1% significance level), Iowa (5%), and not integrated with Nebraska.

3. The Arizona and Omaha prices were the exceptions, as they were not as closely integrated with each other or with other states. Arizona is highly integrated with Illinois (1% level), and less so to Kansas and Texas (10% level). Omaha was highly integrated (1%) or nearly so with Nebraska, Iowa, and Illinois.
Table 10. Significant Daily Lags in VAR Price Analyses (1987-89)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>CO</th>
<th>KS</th>
<th>NB</th>
<th>TX</th>
<th>AZ</th>
<th>IA</th>
<th>IL</th>
<th>OM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>1, 2, 5, 10</td>
<td>1.4</td>
<td>3</td>
<td>8</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KS</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NB</td>
<td>4</td>
<td>5</td>
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<td>5</td>
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<tr>
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<td>1</td>
<td>1.8</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>AZ</td>
<td>9</td>
<td>1, 2, 6</td>
<td>2</td>
<td>3, 4, 8</td>
<td></td>
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<td></td>
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<tr>
<td>IZ</td>
<td>10</td>
<td>1</td>
<td></td>
<td>1</td>
<td>7</td>
<td>1.4, 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>8</td>
<td>10</td>
<td>3.4, 8, 10</td>
<td>23, 4, 8</td>
<td></td>
</tr>
</tbody>
</table>

Only lagged daily prices that had a significance level of at least .05 are reported.

Table 11. Augmented Dickey-Fuller Unit Root Test Results.
Daily State Average Prices, 1987-89.

<table>
<thead>
<tr>
<th>IA</th>
<th>TX</th>
<th>KS</th>
<th>CO</th>
<th>NB</th>
<th>IL</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>-</td>
<td>4.04&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.91&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.78&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>TX</td>
<td>3.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-</td>
<td>7.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>KS</td>
<td>2.94&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7.89&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-</td>
<td>5.12&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.36&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>CO</td>
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<td>4.96&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>-</td>
<td>2.11&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>NB</td>
<td>4.07&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.93&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.39&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.42</td>
<td>-</td>
</tr>
<tr>
<td>IL</td>
<td>8.14&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.63&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.08&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.97&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Significance levels:  
<sup>a</sup> = 1% level, Critical Value = 3.77  
<sup>b</sup> = 5% level, Critical Value = 3.17  
<sup>c</sup> = 10% level, Critical Value = 2.84

Test statistics are presented in absolute values.

Overall, price behavior in these primary cattle feeding states shows a significant amount of integration. These results support the findings from the correlation analysis and the regression.

CHAPTER 3: PACKER COMPETITION AND FORWARD CONTRACTING PRICE IMPACTS, AND THE RELEVANT MARKET FOR FED CATTLE
techniques. The price linkages and measurable responses indicate (1) a state is too small to be considered a relevant procurement market for fed cattle, and (2) the relevant market is larger than the normal procurement area for a particular firm because an "outside" firm can buy at the fringe or in a distant area and send a lagged price response across a broad geographical area.

Summary and Conclusions

Several different models were employed to test the impact of the changing number of competing packers on feedlot prices in Colorado and other major cattle feeding states. Our results suggest that fed cattle prices in Colorado have not declined relative to other cattle feeding states during 1973-89 when the number of resident large slaughter firms declined from eight to two. The results were generally similar for other large cattle feeding states where less dramatic changes occurred in the number of large packers. The impact of changing feedlot concentration on fed cattle prices was generally statistically insignificant or had unexpected signs.

The impact of forward contracted cattle deliveries on weekly price levels was usually insignificant or had mixed signs, though the higher levels of contracting were associated with lower fed cattle prices in a small number of situations. The same basic conclusion applies to the impact of higher contract deliveries on cash price volatility–usually an insignificant or unclear effect, though a few cases had higher price volatility associated with higher contract volumes. One potential contributor to these insignificant results may be our use of the state as the focus of analysis when the state may not be the appropriate geographic market.

In examining price behavior among geographically dispersed states to determine whether the state is or is not the appropriate relevant market, several tests of price linkages were performed. The contemporaneous correlation among weekly and daily prices among the widely dispersed cattle feeding states was high, as was the correlation of weekly first differenced price series.

The vector autoregression analysis of weekly and daily lagged prices suggested that many of these state prices are also significantly affected by recent price changes in other states. These relationships were especially strong within the first two weeks for weekly data.

The daily VAR results are consistent with the weekly results, with many strong lagged price relationships within a few days. Tests for cointegration of daily state prices reveal that these price series are highly linked together in their price movements. These results give support to the idea that the relevant geographic market for structural and competitive analysis is much larger than any state, and is much larger than the trade areas of individual firms due to the indirect competitive effects on and through the behavior of "third-party" firms in the dynamic arbitrage process in fed cattle markets. The combination of correlation and vector autoregression approaches may be useful preliminary tests which could suggest the appropriate geographic market areas for products such as fed cattle. Areas with weak contemporaneous or lagged price linkages might be excluded from a particular market. Areas with stronger contemporaneous or lagged price linkages might deserve more in-depth analysis in the process of delineating a relevant market in antitrust cases or for purposes of structural analysis.

CHAPTER 4

A Test for Market Power at Feeder Cattle Auctions

DeeVon Bailey, B. Wade Brorsen, and Chris Fawson; Associate Professor of Economics, Associate Professor of Agricultural Economics, and Assistant Professor of Economics, Utah State University

Introduction
Evaluating livestock markets for the existence of market power has traditionally been undertaken at the industry level. The goal of most of the past research has been to determine if average aggregate (industry) prices or processing margins are affected by the presence of buyer concentration or a limited number of buyers (Ward; Schroeter and Azzam; Marion et al.). While this research is valuable, since it indicates the overall impact of buyer concentration, it fails to address issues related to strategic behavior on the part of buyers in their procurement programs.

In the case of cattle markets, buyers have several alternative sources for purchasing cattle, including direct sales, forward contracting, and auctions. Past research suggests that buyers probably select outlets for cattle and the price they pay based on the number and relative quality of cattle available from each source, and relative transactions costs including commissions and transportation costs (Buccola; Schroeder et al.; Bailey et al.). However, buyers may also develop procurement strategies (select markets) based on their ability to exercise market power in a given market on a given day. If this is the case, evaluating aggregate measures of concentration on average industry prices may not yield the true impact of buyer concentration on prices paid in individual markets, such as auctions.

This study analyzes the influence of buyer concentration on feeder cattle prices in individual auctions on given days. In this respect, this study's approach more closely parallels that of auction studies in the economics literature than in the agricultural economics literature. While measures used in this study to evaluate concentration are basically the same as in the traditional studies, the market definition is much less aggregated. Buyer concentration is analyzed as the relative dispersion of sales volume among all buyers at a single feeder cattle auction on a given day. Concentration during a particular auction is also calculated and analyzed for weight and sex categories.

Recent consolidations in meat packing and an increase in the number of large feedlots (Purcell) may cause buyers in local markets to become larger and fewer in number. This study reports the concentration of feeder cattle buyers participating in two large cash auctions between 1987-89 inclusive, and determines the effect on auction prices when a small number of buyers purchase most of the cattle.

Buyer concentration in feeder cattle auctions has received little attention because reliable data have not been available. The data sets analyzed here provide accurate information about buyer concentration in feeder cattle auctions, not only in a traditional feeder cattle auction, but also in a video auction using anonymous bidding.

The two auctions selected for this analysis represented the largest traditional regional auction in the United States (Oklahoma City National Stockyards) and the largest satellite video auction (Superior Livestock Auction in Brush, Colorado). Reporting concentration in two types of auctions added another dimension to the analysis since the number of buyers, areas served, and bidding methods for the two auctions were different.

Studies Dealing With Concentration in Livestock Markets

20 The four-firm concentration ratio for steer and heifer slaughter increased from 46.6 percent to approximately 70 percent between 1983 and 1988 (USDA, P&SA).

21 A division occurred at the Oklahoma National Stockyards Company in April 1989 and a competing auction was established in Oklahoma City. This may influence the future level of concentration at this market.
Buyer concentration and its affect on agricultural prices has been an item of intense interest to researchers during the past fifteen years, and research has centered on changing concentration in livestock markets. Studies dealing with the impact of aggregate (industry) buyer concentration on average prices are more numerous than those dealing with localized or regional markets.

**Studies of Livestock Industry Market Power**

The existence of market power in livestock markets at the industry level continues to be discussed in the literature. For example, Schroeter and Azzam (p. 998) recently concluded, based on analysis of processor and farmer input costs and consumer demand, that the farm-to-wholesale price spreads for hogs "were quite consistent with competitive performance in the 1980s but less so fifteen years ago."

Oellermann and Farris examined the influence of both buyer and seller concentration, as measured by the four-firm concentration ratio (CR$_4$), at the Chicago Mercantile Exchange on futures prices for both live and feeder cattle. They resolved that, although the CR$_4$ was as high as 88% for all contracts in these markets, no evidence existed to suggest prices had been significantly affected by concentration.

While Henderson and Schwart did not analyze the influence of concentration on feeder cattle prices, they suggested the direction of structural change in the industry (more small producers and large feedlots) indicated a growing need for vertical integration between the segments of the marketing channel. This appears to be happening with the increasing contractual arrangement between feedlots and packers (Ward, 1990), but it is unclear if vertical coordination is increasing among cow/calf operators, stocker operators, and feedlots. Structural change, like that occurring in the cattle sector, does suggest a need to examine the influence of buyer concentration at each level of the marketing channel.

Government studies in the late 1970s and early 1980s indicated that considerable concern existed then about market power as a result of the consolidation in meatpacking that began in the 1970s (Williams; P&SA). These studies suggest that increasing concentration, based on concentration ratios, at the national and regional level might result in market inefficiencies.

Schroeter developed a theoretical model for testing the existence of market power in the beef processing industry. His study was unique since it tested for packer market power both in purchasing inputs (cattle) and in selling output (beef). Schroeter did not develop measures of market concentration but assumed that marginal processing costs were the same across all firms in the industry (allowing for aggregation across all firms in the industry). His measures of market power were defined as: the quotient of the conjectural elasticity and the elasticity of market demand, for the test for monopoly (selling) price distortions, and the quotient of the conjectural elasticity and the elasticity of material input supply, for the test for monopsony (buying) price distortions. Schroeter's empirical model indicated that packers are not price takers in either the input or output market, but that the price distortions caused by any non-competitive behavior were small.

Quail et al. analyzed the influence of packer concentration on fed cattle prices in 13 separate regions, using both the CR$_4$ and the Herfindahl Index. Their results suggested that increasing packer concentration between 1971 and 1980 resulted in a loss to sellers of between $45 million and $50 million in the 13 regions. Further, they

---

22The conjectural elasticity (Schroeter, p. 159) "is the firm's perceived rate of change of market output (material input) with respect to its own output (material input), expressed as an elasticity." In a competitive market, firms do not perceive that changes in their own output will affect price or market quantity. Hence, conjectural elasticity is expected to be zero in a competitive market.
Marion et al. examined packer concentration in seven different regions to determine the critical level for the CR4. They concluded that "regional packer concentration was negatively related to live cattle prices," and that the critical CR4 level (level at which market power could be exercised) was present when the CR4 was 60% or higher (p. 34). However, Marion et al. also found that the price effect of concentration was less during the 1979-86 period than during 1971-78. They attributed this result to changes in the demand for beef and ensuing structural changes in the industry during the 1979-86 period. The structural changes may have forced packers to be aggressive to maintain their market share.

Studies of Market Power at the Sub-Industry Level

In the past, researchers have speculated that the price effect of buyer concentration in local cattle markets was not accounted for when prices and concentration were analyzed at the industry level. For example, Connor (p. 227) has stated that, "When there is a high level of buyer concentration in a given local market for agricultural produce, price fixing, price leadership, price discrimination, and other forms of collusive pricing are likely to occur." In response to some of the concerns about increasing beef packer concentration in the late 1970s and early 1980s, Ward (1982) examined the influence of buyer CR4 on prices for individual fed cattle lots in several major cattle feeding and slaughter markets. Ward concluded that there was no evidence to support the hypothesis that large buyers pay lower fed cattle prices than small buyers in the geographic markets he analyzed.

Menkhaus et al. investigated the influence of packer concentration on average state fed cattle prices, using the CR4 as the measure of buyer concentration on a state-by-state basis. They concluded that increasing packer concentration depressed average state fed cattle prices, and that the effect was greater in 1972 than 1977 (the latest year in the study period).

Ward (1990) reported that no definite conclusions about the influence of packer concentration on fed cattle prices could be reached, since the results of various studies were mixed. He also stated (p. 100) that "more work is clearly needed. Our current models may not 'fit' the situation of the 1990s, and progress is needed in both conceptual development and in empirical analyses."

These studies and others illustrate that using different quality data and market definitions produce different results regarding the existence and influence of buyer market power. But, the studies that have been completed did not examine the influence of concentration on prices for individual cattle lots on particular days and locations due to data constraints. The "best" measure of market power would be the influence of concentration at a particular moment and location. This, of course, is very difficult to evaluate. However, assessing market power at individual auctions on given days, or during short time periods, comes close to measuring the influence of concentration on the price for a specific lot of cattle.

Analyzing market power at auctions is different than at the industry level, or even within geographic markets. Measures of market power are usually calculated at the market (industry) level or for a geographic region (Ward, 1982; Menkhaus). Market power is usually defined as the market share of the largest firms, the difference between price and marginal costs, or the relative dispersion of sales within the industry (Koch). The method used here to define concentration is the same as the traditional, but a much less aggregated market is used.

If concentration is a concern in large cash markets for feeder cattle, then it is probably an even greater concern in smaller markets. Auction operators need to know if concentration levels have changed over time since, if a
concentration level problem exists, they may wish to act to reduce buyer concentration.\textsuperscript{23} Other studies have tested the influence on price of the number of buyers bidding for agricultural commodities in auctions (Sporleder and Colling; Meyer). A measure of concentration, rather than the number of buyers (or bidders), is used in this study (as in Meyer).

Research at aggregated levels may not get to the impact of buyer concentration on price level and price variability across individual lots of cattle. Sellers are concerned about what the declining number of buyers means to their prices and their relative bargaining position.

\textbf{Auction Market Literature and the Structure of Feeder Cattle Markets}

The economics literature contains numerous studies dealing with the theoretical underpinnings of the design and operation of auctions. Much of this work has compared the theoretical expected revenues for different types of auctions such as English, Dutch, first-price, and second-price auctions (McFee and McMillan; Milgrom and Weber). While auctions are a major pricing method for many different items (e.g., U. S. Treasury bills, paintings, mineral rights, and livestock), relatively few empirical studies of buyer and seller behavior at auctions have been completed compared to theoretical norms (McFee and McMillan).

Theoretical bidding models suggest auction prices are directly related to the number of bidders participating (Gilley and Karels; Kuhlman and Johnson; Smith). In addition, many of the completed empirical auction studies, including studies dealing with agricultural commodities, suggest prices do increase as the number of buyers increases (e.g., Meyer; Russell; Kuhlman and Johnson).\textsuperscript{24} However, these studies did not measure the influence of individual market share or the dispersion of market shares across buyers on price. In other words, prices may be affected not only by how many buyers are bidding but also by the relative volumes they are purchasing (Meyer).

As the number of feedlots decreases, the number of potential buyers of feeder cattle likely also decreases. This may result in increased buyer concentration at individual markets.\textsuperscript{25} Although other studies analyzing the impact of increasing buyer concentration on prices and efficiency in fed cattle markets have been completed, this is the first study that examines the influence on prices of buyer concentration in individual feeder cattle auctions.

\textbf{Methodology Used to Test for Market Power in the Feeder Cattle Auctions}

\textsuperscript{23}For example, Graham and Marshall suggest that the impact of cartel pricing by buyers in an English auction can be reduced by establishing reservation (minimum) prices that are a decreasing function of the number of cartel members.

\textsuperscript{24}However, Smith also suggests that buyers, in some instances, may bid less aggressively if the ". . . magnitude of the highest competing bid and the value of the contested item . . ." are uncertain (p. 385) since substantial risk exists that the winning bidder may overestimate the true value of the object. This phenomenon is also referred to as the "winner's curse".

\textsuperscript{25}While this may not be true if more buyers custom feed than before, the existence of fewer and larger feedlots does lead one to suspect that concentration has increased.
The methodology employed in any analysis is important to the usefulness and credibility of the results. In this study, the need was a methodology that was appropriate for examination of buyer behavior in the specific feeder cattle market being analyzed.

**Market Power and Cattle Price Differentials**

McAfee and McMillan (1987) evaluate a baseline English auction in which the following assumptions are made (page 706):

A1: Bidders are risk neutral.

A2: Any one bidder's valuation is statistically independent from any other bidder's valuation, (independent-private-values assumption). This assumption suggests that "learning about another bidder's valuation will not cause him to change his own valuation (although he might, for strategic reasons change his bid)."

A3: Bidder characteristics are not recognizably different (symmetric bidders assumption). This assumption suggests that all bidders are basing their valuations on the same probability distribution.

A4: Payment is a function of the winning bid alone (no royalties are assessed on after sale revelation of "true" value).

Each bidder in the auction is assumed to maximize their surplus, the difference between the value of the auctioned commodity (cattle) to the buyer and the bid price the bidder offers in the auction.

Participants in regional feeder cattle auctions purchase cattle as an input into the production of feedlot beef or resold cattle. As a result, value to the buyer is governed by the marginal contribution of the input (the feeder steer or heifer) to the value of the firm. We call this the value of marginal product to the i\(^{th}\) bidder and denote it by VMP\(_i\). Determinants of VMP\(_i\) include technological characteristics of the firm, relative price of other inputs, and final product price or the price of fed cattle when the cattle are sold. Let b\(_i\) denote the bid received from the i\(^{th}\) bidder at the auction. Each bidder attempts to maximize expected surplus by selecting their bid in a manner consistent with optimizing the following function:

\[
S = (VMP_i - b_i),
\]

where

\[
S \text{ denotes bidder surplus (value above bid) associated with a bid of } b_i.
\]

In an English auction governed by the above assumptions, McAfee and McMillan demonstrated that each bidder's dominant strategy was to remain in the bidding until the price reached the bidders own valuation (VMP\(_i\)). This strategy results in a winning bid equal to the actual valuation of the bidder with the second highest valuation.

\[
b_{im} = VMP_{j(2)} = VMP_i - S,
\]

where b\(_{im}\) denotes the successful bid for lot m, and VMP\(_{j(2)}\) denotes the second highest valuation for lot m associated with bidder j. At the limit, as the number of bidders participating in the auction becomes large, the difference between the winning bidder's valuation and the second highest valuation becomes small, suggesting
that the final bid price approaches the highest possible valuation. However, when there are few bidders in the auction, it is not clear that the addition of the marginal or last entrant has a significant impact on the surplus obtained from a successful bid on a particular lot. In other words, as long as bidders are drawing from similar distributions of "value", it is not clear that another bidder coming into an auction with a limited number of bidders moves the final bid price toward the highest possible valuation of the feeder cattle.

It is arguable that in regional feeder cattle auctions, several of the above assumptions may be violated, suggesting that final bid price may not only be a function of the determinants of VMP, but may also be a function of auction-specific characteristics that systematically influence the surplus captured by the successful bidder (such as the concentration of successful bidders in the auction). In particular, the relative concentration in an auction may suggest that bidders:

(i) have informational asymmetries, and, as a result of concentrated buying behavior, signal pertinent value information to other participants in the auction; and

(ii) do not have symmetric characteristics, (technologies of scale) and, as a result, draw from a different "value" distributions when making their bids.

If market power is not present, then price distribution, assuming bidders follow the dominant strategy, should not be affected by market concentration over different auctions and average surplus should be similar across auctions. In other words, winning bid data provides a distribution of second highest valuations for lots offered at each auction. If there is no market power, then the distribution, corrected for market and lot specific characteristics, should not be influenced by successful bidder concentration. If, however, some degree of market power is exerted, it is hypothesized that the distribution of "second best valuations" is influenced by auction concentration because of bidders' ability to capture more surplus.

Bidders get a "surplus" if they can buy the feeder cattle below estimates of the value of the cattle. Looking at the size and distribution of measures of that surplus will help determine whether market power is present.

**Different Measures of Market Concentration**

Two methods of measuring buyer concentration in feeder cattle auctions are reported in this study. The first method, the CR4, is a partial index of concentration that indicates the market share for the four largest firms (Koch). The CR4 is one of the most commonly used measures of concentration (Marion et al., 1979; and Ward 1990).

The CR4 is the most popular method for measuring concentration due to the limited information needed to calculate the measure and because some information is available to interpret the level of market power based on the CR4. For example, studies with aggregate data suggest buyer market power exists when the CR4 is greater than 40 percent (e.g., Bain; Rhoades; Scherer). The CR4 can be defined as follows:

\[
CR_4 = \frac{\sum_{i=1}^{4} MS_i}{T},
\]

(3)
where MS
i
is the market share of the ith firm and T is the size of the total market. The CR4 requires only knowledge of total market size and the market shares of the four largest firms, not market shares for all firms participating in the market.

A summary index, the Herfindahl Index (HI),\textsuperscript{26} is also reported for buyer concentration in the two auctions, and measures the relative concentration of all firms in a market rather than only a portion (Koch, pg. 177). The HI is defined as:

\[
HI = \sum_{i=1}^{N} (MS_i^2).
\]

The HI gives a measure of the dispersion and size of all firms in a market, and its value ranges between zero (atomistic competition) and one (monopsony).

Several studies have examined the relative desirability of using market share ratios and summary indices, such as the HI, to measure market power from both a theoretical and empirical standpoint (Kwoka; Stiglitz; Schmalensee; Cotterill). Cotterill's (p. 385) study of concentration in the retail food industry concluded that the HI "outperform(ed) all concentration-market share specifications and individual market share ..." in predicting the influence of market share on prices. The HI captures more information about all firms participating in a market than the market-share ratios. Although the HI was the principal method used in this study to measure buyer concentration, the CR4 is also included to facilitate comparisons with other studies and industries, such as in meat packing.

The CR4 and HI were calculated for each video auction sale for four categories: steers and heifers weighing 600 lbs. or less, and steers and heifers weighing more than 600 lbs. Concentration measures were calculated for the traditional auction by month for all lots, since sex and weight information were not available for each sale. These categories (weight and sex) were natural breaks, since most cattle weighing over 600 lbs. purchased at auctions go directly to feedlots, demand for heifers is more elastic than for steers, and the market for heifers typically has fewer buyers than the market for steers (USDA; AMS, Dodge City; Schroeder et al.; Bailey and Peterson).

Both the CR4 and HI measures of concentration were used. There is some evidence that the HI measure is the superior measure, but using the CR4 measure of buyer concentration facilitates comparison with other studies.

Price Model and Test for Market Power

Successful bids (b) at cattle auctions are expected to be a function of cattle quality characteristics, market conditions, merchandising strategies, and market structure (Schroeder et. al; Buccola; Bailey and Peterson; Faminow and Gum). However, the presence of oligopsonistic pricing by a limited number of large firms depresses prices when concentration increases (\(v > b\)). A simple (hedonic) model for successful feeder cattle bids could be written as:

\textsuperscript{26}The Herfindahl Index is also referred to as the Hirschman-Herfindahl Index in some literature, but for simplicity it is referred to as the Herfindahl Index in this study.
where \( b_i \) is the price paid for the \( i^{th} \) lot for \( i = 1, 2, 3, \ldots, I \), where \( I \) is the number of lots sold in a particular market; \( \text{LOT}_{ij} \) is the \( j^{th} \) lot characteristic for the \( i^{th} \) lot of cattle (including merchandising strategies); \( \text{MARKET}_{ik} \) is the \( k^{th} \) market condition; \( \text{YEAR}_{il} \) is the dummy variable for the \( l^{th} \) year, \( l=1988, 1989 \); \( e \) is the error term; \( a_0 \) is the intercept; and the \( c \)'s, \( d \)'s, \( f \)'s, and \( g \) are parameter estimates.

If the parameter estimates for HI is not significantly different than zero, then \( H_0: v_i = b_i \) cannot be rejected. However if the parameter for HI is significantly negative, it implies that \( v_i > b_i \) and that market power exists. Consequently, the test for equality between the buyer's bid and the VMP is a one-tailed statistical test since there is a priori reassuring that the estimate of \( g \) will be 0 or a negative number.

More limited information was available for the traditional auction (OKC) and the regression analysis specified in equation (5) used only the market condition measures (future prices and seasonality) and the HI as independent variables. Average monthly prices at OKC were weighted by the volume of steers and heifers sold during each week of the month as reported by USDA (USDA, AMS). Futures prices for the traditional auction price model were the simple average of all futures price quotes for the nearby contract for the corresponding month.

Table 1 presents the independent variables used to estimate the parameters of equation (5). Equations 5's parameters were estimated using ordinary least squares (OLS), and were calculated by weight and sex category as well as using the pooled data for the video auction.

**Table 1. Independent Variables Used in Video Auction Feeder Cattle Price Model**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Location at time of sale:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot Characteristics</td>
<td>Western States (West)³</td>
</tr>
<tr>
<td></td>
<td>South⁴</td>
</tr>
<tr>
<td></td>
<td>Midwest⁵</td>
</tr>
<tr>
<td></td>
<td>Upper Midwest (Upper)⁶</td>
</tr>
<tr>
<td></td>
<td>West Coast (WCoast)⁷</td>
</tr>
<tr>
<td></td>
<td>Lower Southwest (LSW)⁸</td>
</tr>
<tr>
<td></td>
<td>Market Characteristics</td>
</tr>
<tr>
<td></td>
<td>Futures price (Futures)</td>
</tr>
<tr>
<td></td>
<td>Sorting: Lots unmixed by sex (Unmixed)</td>
</tr>
<tr>
<td></td>
<td>Lots mixed by sex*</td>
</tr>
<tr>
<td></td>
<td>Seasonality: 1st quarter</td>
</tr>
</tbody>
</table>

³The SLA data are cross-section time series, but with unequal numbers of cross-section observations. The parameters of equation (5) were also estimated using feasible, generalized least squares to correct for the random effects associated with time. The results were similar to the OLS estimates and only the OLS estimates are reported in this paper.
The expected signs for the lot characteristics and market conditions were similar to those found in other empirical studies examining the influence of cattle quality and market characteristics on price (e.g., Schroeder et al.; Bailey and Peterson; Faminow and Gumm; Buccola). No space is devoted here to a discussion of the expected signs of the parameter estimates in equation (5) since the theoretical and empirical relationships between quality and market characteristics are discussed at length in the literature. The emphasis of this study is on the influence of concentration on prices at auctions.

Relative premiums and discounts for cattle located in different regions, but sold at a national auction (i.e., the SLA) were also examined. This permitted comparisons of the relative value of reputation for cattle from different regions. Reputation of cattle from a particular location may offer important information to buyers, resulting in different prices based on location.

Superior Livestock Auction (SLA) of Brush, Colorado provided price and buyer information for cattle sold at 41 separate auctions between January 1987 and December 1989 except the sales held on September 1 and December 9, 1989. Lot characteristics were obtained from SLA’s sales catalogues for the same time period. Mileage was calculated between the location of the cattle at the time of SLA’s sale and the destination specified by the buyer after sale to account for price differentials due to buyer transportation costs. Average distances for lots shipped from each state were calculated and used for lots shipped from a particular state but for which the destination was unknown.

Data obtained from the OKC feeder cattle auction included the total volume for buyers in a given month.
between January 1988 and July 1989, inclusive. The OKC data included all lots of cattle sold at the auction during that time period. Buyers were identified by rank order of volume for a given month and no buyer type was provided.

Concentration measures were calculated by month for the OKC data and by sale for the SLA data. Annual average concentration levels were calculated for each market. Since only seven months of data were available from OKC for 1989, an average for the first seven months of each year was calculated to examine trends at OKC and to facilitate comparisons for more than one year with the SLA.

The focus of the analysis was to specify and estimate models to see whether buying power was present. Thus, time and attention were paid to the model specification so that the estimate of the parameter on the measure of buyer concentration was "clean" and was not being distorted by other factors not included in the models.

Results

Buyer concentration is seasonal at both auctions. Concentration levels are larger in the first six months of the year (between 50%-65% at OKC and 40%-55% at SLA) than in the last six months. This phenomenon mirrors the seasonality of cattle placed on feed during the study period (USDA, NASS). This pattern implies that large buyers (feedlots) and order buyers purchase larger volumes of feeder cattle during the first half of the year. Placements are usually lowest during August-October (sales 8-12 for SLA) indicating relatively less participation by feedlots and large order buyers in the market during that period. Concentration levels are therefore lower since the large buyers purchase a smaller percentage of the cattle.

Oklahoma City had its highest volume during the springs of 1988 and 1989, while SLA's volume was highest in the fall (September and October). Consequently, SLA sells proportionately more calves than OKC (under 600 lbs.). This may help to explain SLA's slightly smaller concentration measures since the SLA is probably not as dominated by feedlot buyers. Some of the lowest sales volumes at SLA were for their November auction (sale 13). This corresponds to SLA's highest concentration measures, indicating a relatively small number of buyers are participating when volume is small thus increasing concentration measures.

Table 2 reports the yearly average CR₄'s and HI's for all lots at OKC and all steers and heifers at the SLA. The concentration measures are also reported by weight and sex at the SLA. A paired t-test analysis was performed to determine if statistically different concentration existed in the markets in 1989 than in 1987 (between 1988 and 1989 in the case of OKC).

Although the average annual CR₄ at the SLA for steer and heifers showed an upward trend between 1987 and 1989, the difference in concentration was not statistically significant. This suggests substantial variability existed in concentration between the different sales. In addition, no significant upward trend in average concentration during the first seven months of each year, also shown in Table 2, was found at the SLA.

The average CR₄'s for OKC were larger than those for SLA in all cases. But, the figures in Table 2 should be compared with caution since no statistical test for a difference between the two markets can be performed with these data. The CR₄ for OKC was about 4 percent larger for the first seven months of 1989 than the
corresponding period in 1988. The difference between the CR$_4$'s at OKC in 1988 and 1989 are statistically significant. However, since only two years of data were analyzed, no reliable information about the trend in concentration can be ascertained at the OKC auction.

Table 2. Average Four-Firm Concentration Ratios and Herfindahl Indices, 1987-89

<table>
<thead>
<tr>
<th>Measure of Concentration</th>
<th>Location/Unit</th>
<th>CR$_4$(%)</th>
<th>HI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12-Month Averages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLA:</td>
<td>Steers and heifers</td>
<td>43.6</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>Steers under 600 lbs.</td>
<td>67.8</td>
<td>54.6</td>
</tr>
<tr>
<td></td>
<td>Steers 600 lbs. and over</td>
<td>64.5</td>
<td>64.2</td>
</tr>
<tr>
<td></td>
<td>Heifers under 600 lbs.</td>
<td>64.7</td>
<td>55.3</td>
</tr>
<tr>
<td></td>
<td>Heifers 600 lbs. and over</td>
<td>70.4</td>
<td>68.3</td>
</tr>
<tr>
<td>OKC:</td>
<td>All lots a N/A b</td>
<td>56.2</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>7-Month Averages c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLA:</td>
<td>Steers and heifers</td>
<td>44.7</td>
<td>46.2</td>
</tr>
<tr>
<td></td>
<td>Steers under 600 lbs.</td>
<td>77.3</td>
<td>60.8**</td>
</tr>
<tr>
<td></td>
<td>Steers 600 lbs. and over</td>
<td>58.8</td>
<td>67.2</td>
</tr>
<tr>
<td></td>
<td>Heifers under 600 lbs.</td>
<td>74.0</td>
<td>61.7</td>
</tr>
<tr>
<td></td>
<td>Heifers 600 lbs. and over</td>
<td>59.3</td>
<td>70.1</td>
</tr>
<tr>
<td>OKC:</td>
<td>All lots N/A</td>
<td>59.9</td>
<td>63.7</td>
</tr>
</tbody>
</table>

* Statistically different than 1987 at the 5% level.
** Statistically different than 1987 at the 1% level.
a 1988 was the only year when 12 months of information was available for OKC.
b Not applicable.
c Information for the first seven months of 1988 and 1989 was available for OKC. The averages for the first seven months are consequently calculated for both auctions to give more information for comparisons.

While the market shares of the four largest firms (CR$_4$) participating in each auction (SLA) or each month (OKC) were basically equal in 1987 and 1989, the concentration of all purchases of steers and heifers (HI) did
increase during the first seven months of the year at the SLA (Table 2). These results suggest that some increase in concentration was occurring in these auctions during the study period, although this increase was not pronounced. The concentration levels found in these markets are high enough that market power is a concern, but they are still smaller than in beef processing.

**Buyer concentration shows a seasonal pattern in the markets. Large feedlots tend to buy more directly or through order buyers in the first half of the year, and measures of buyer concentration increase accordingly if they buy large percentages of the cattle. This seasonal pattern in buyer concentration mirrors the seasonal pattern in placements seen in USDA data.**

### Parameter Estimates and Test for Market Power at the SLA

Table 3 presents the OLS parameter estimates for the hedonic price model measuring the impact of buyer concentration on feeder cattle prices at the SLA (equation (5)). Parameter estimates and signs for the lot and market characteristics are similar to the results of past studies using hedonic price models of feeder cattle prices (e.g., Buccola; Faminow and Gum; Schroeder et al.; Schultz and Marsh). The test for buyer market power at the SLA reveals that increasing concentration had a significant negative impact on overall prices. Buyer concentration also had a significant negative impact on prices by weight and sex category, with the exception of heifers weighing 600 lbs. or more. However, the sign for heifers weighing 600 lbs. or more is also negative (HI in Table 3).

The impact of increasing concentration on average prices at the SLA was small during the study period. For example, if one considers that the average HI at the SLA during the first seven months of the year increased from 0.074, in 1987, to 0.113, in 1989, then average overall prices at each auction over the three years were depressed only $0.05/cwt. [-1.294 (0.113-0.074)]. This result implies the SLA auction is basically a competitive market.

While average prices at the SLA across the study period were not greatly affected by increasing buyer concentration, prices at individual auctions could have been depressed substantially more than $0.05/cwt. For example, the HI for steers weighing 600 lbs. or more ranged from 0.045 to 0.38 over the 41 auctions held by SLA. This suggests prices

**Table 3. Ordinary Least Squares Parameter Estimates for Feeder Cattle Price Model Measuring the Impact of Market Concentration (Equation (5)), a**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Overall</th>
<th>600 lbs.</th>
<th>Steers Under 600 lbs.</th>
<th>Steers 600 lbs. and Over</th>
<th>Heifers Under 600 lbs.</th>
<th>Heifers 600 lbs. and Over</th>
<th>Steers Under 600 lbs.</th>
<th>Steers 600 lbs. and Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>56.278</td>
<td>73.894</td>
<td>51.174</td>
<td>63.020</td>
<td>24.639</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Futures price</td>
<td>0.978</td>
<td>1.214</td>
<td>0.775</td>
<td>1.118</td>
<td>0.803</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

28The CR4 for steers weighing 600 lbs. and more ranged between 32 percent and 100 percent at the SLA during 1987-1989, inclusive.
Table 3. (Continued)

<table>
<thead>
<tr>
<th>Model</th>
<th>Heifers独立变量</th>
<th>Heifers</th>
<th>Steers</th>
<th>Steers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Overall</td>
<td>Under and Over</td>
<td>Overall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600 lbs.</td>
<td>600 lbs.</td>
<td>600 lbs.</td>
</tr>
</tbody>
</table>

FRAME:

<table>
<thead>
<tr>
<th></th>
<th>Heifers独立变量</th>
<th>Heifers</th>
<th>Steers</th>
<th>Steers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Overall</td>
<td>Under and Over</td>
<td>Overall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>600 lbs.</td>
<td>600 lbs.</td>
<td>600 lbs.</td>
</tr>
</tbody>
</table>

CHAPTER 6: ANNOTATED BIBLIOGRAPHY
**Horns:**

<table>
<thead>
<tr>
<th></th>
<th>No Horns</th>
<th>Some Horns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.835</td>
<td>1.320</td>
</tr>
<tr>
<td></td>
<td>(4.439)**</td>
<td>(3.164)**</td>
</tr>
<tr>
<td></td>
<td>1.952</td>
<td>1.041</td>
</tr>
<tr>
<td></td>
<td>(3.357)**</td>
<td>(1.787)</td>
</tr>
<tr>
<td></td>
<td>0.235</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>(0.337)</td>
<td>(0.091)</td>
</tr>
<tr>
<td></td>
<td>1.823</td>
<td>1.350</td>
</tr>
<tr>
<td></td>
<td>(2.613)**</td>
<td>(1.934)</td>
</tr>
<tr>
<td></td>
<td>2.518</td>
<td>1.933</td>
</tr>
<tr>
<td></td>
<td>(1.481)</td>
<td>(1.132)</td>
</tr>
</tbody>
</table>

**Seasonality:**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Heifers</th>
<th>Steers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Quarter</td>
<td>-0.759</td>
<td>-1.778</td>
</tr>
<tr>
<td></td>
<td>(-2.404)**</td>
<td>(-3.732)**</td>
</tr>
<tr>
<td>3rd Quarter</td>
<td>-0.080</td>
<td>-1.468</td>
</tr>
<tr>
<td></td>
<td>(-0.378)</td>
<td>(-3.250)**</td>
</tr>
<tr>
<td>4th Quarter</td>
<td>-2.533</td>
<td>-4.727</td>
</tr>
<tr>
<td></td>
<td>(-11.804)**</td>
<td>(-9.987)**</td>
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</table>

**Location:**

<table>
<thead>
<tr>
<th>Location</th>
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<th>Steers</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>-0.287</td>
<td>-0.248</td>
</tr>
<tr>
<td></td>
<td>(-1.719)</td>
<td>(-0.784)</td>
</tr>
<tr>
<td>South</td>
<td>-6.017</td>
<td>-7.023</td>
</tr>
<tr>
<td></td>
<td>(-24.579)**</td>
<td>(-14.985)**</td>
</tr>
<tr>
<td>Upper</td>
<td>1.234</td>
<td>0.334</td>
</tr>
<tr>
<td></td>
<td>(2.989)**</td>
<td>(0.484)</td>
</tr>
<tr>
<td>W. Coast</td>
<td>-3.131</td>
<td>-4.561</td>
</tr>
<tr>
<td></td>
<td>(-11.685)**</td>
<td>(-7.438)**</td>
</tr>
</tbody>
</table>

**Table 3. (Continued)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Heifers</th>
<th>Steers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>Overall</td>
<td>Under 600 lbs. and Over</td>
</tr>
<tr>
<td>LSW</td>
<td>-2.427</td>
<td>-3.716</td>
</tr>
<tr>
<td>Truck</td>
<td>-0.146</td>
<td>-0.103</td>
</tr>
<tr>
<td></td>
<td>(-0.693)</td>
<td>(-0.297)</td>
</tr>
<tr>
<td>Unmixed</td>
<td>1.537</td>
<td>1.421</td>
</tr>
<tr>
<td></td>
<td>(9.311)**</td>
<td>(5.238)**</td>
</tr>
<tr>
<td>Date</td>
<td>0.020</td>
<td>0.024</td>
</tr>
</tbody>
</table>

68
<table>
<thead>
<tr>
<th></th>
<th>Wrisk</th>
<th>Miles</th>
<th>MARKET STRUCTURE AND YEAR DUMMIES:</th>
<th>Hi</th>
<th>D88</th>
<th>D89</th>
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<tbody>
<tr>
<td></td>
<td>-0.104</td>
<td>-0.000</td>
<td></td>
<td>-1.294</td>
<td>0.811</td>
<td>0.491</td>
</tr>
<tr>
<td>p-value</td>
<td>(-3.287)</td>
<td>(-4.021)</td>
<td></td>
<td>(-4.021)</td>
<td>(4.029)</td>
<td>(1.915)</td>
</tr>
<tr>
<td></td>
<td>-0.342</td>
<td>-0.000</td>
<td></td>
<td>-1.681</td>
<td>0.412</td>
<td>0.299</td>
</tr>
<tr>
<td></td>
<td>(-4.191)</td>
<td>(-3.116)</td>
<td></td>
<td>(-2.333)</td>
<td>(1.172)</td>
<td>(0.720)</td>
</tr>
<tr>
<td></td>
<td>-0.008</td>
<td>-0.002</td>
<td></td>
<td>-2.320</td>
<td>1.764</td>
<td>2.354</td>
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<tr>
<td>p-value</td>
<td>(-0.191)</td>
<td>(-0.002)</td>
<td></td>
<td>(-3.903)</td>
<td>(5.975)</td>
<td>(5.681)</td>
</tr>
<tr>
<td></td>
<td>-0.358</td>
<td>-0.000</td>
<td></td>
<td>-1.828</td>
<td>1.081</td>
<td>0.734</td>
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<tr>
<td>p-value</td>
<td>(-4.316)</td>
<td>(-0.000)</td>
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<td>(-2.121)</td>
<td>(2.675)</td>
<td>(1.441)</td>
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<tr>
<td></td>
<td>-0.227</td>
<td>-0.001</td>
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<tr>
<td>p-value</td>
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<td>(-1.812)</td>
<td></td>
<td>(-0.502)</td>
<td>(1.471)</td>
<td>(-0.883)</td>
</tr>
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</table>
Table 3. (Continued)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Observations</th>
<th>Steers 600 lbs.</th>
<th>Heifers Under 600 lbs. and Over</th>
<th>Heifers 600 lbs. and Over</th>
<th>Steers 600 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>6251</td>
<td>1766</td>
<td>1789</td>
<td>1518</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>1789</td>
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<td>Observations</td>
<td></td>
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<td>1766</td>
<td>1789</td>
<td>1518</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>0.867</td>
<td>0.832</td>
<td>0.864</td>
<td>0.778</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>0.832</td>
<td>0.864</td>
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<td>0.670</td>
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<tr>
<td>F-Test For Breed</td>
<td></td>
<td>49.840**</td>
<td>33.017**</td>
<td>119.868**</td>
<td>2.801*</td>
</tr>
<tr>
<td>F-Test For Flesh</td>
<td></td>
<td>3.093*</td>
<td>2.935*</td>
<td>7.683**</td>
<td>1.458</td>
</tr>
<tr>
<td>F-Test For Frame</td>
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<td>9.197**</td>
<td>12.867**</td>
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<td></td>
<td>15.576**</td>
<td>11.039**</td>
<td>0.648</td>
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<td>F-Test For Location</td>
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<td>94.480**</td>
<td>21.682**</td>
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</tr>
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<td>F-Test For Years</td>
<td></td>
<td>10.275**</td>
<td>0.742</td>
<td>9.763**</td>
<td>(4.231*</td>
</tr>
</tbody>
</table>

* Denotes statistically different than zero at the 5% level.

** Denotes statistically different than zero at the 1% level.

t-values are in parentheses.

This is a one-tailed test of H₀: vᵢ = bᵢ.

Test that parameter estimates for characteristics in this category are simultaneously equal to zero. For example, Breedᵢ = 0 for all i, i=English-Cross, English-Exotic-Cross, Exotic-Cross, Angus, Dairy.

may have been depressed by as much as $0.78/cwt. [-2.320 (0.38-0.045)] in relative terms from one auction to another as a result of differences in buyer concentration. This illustrates the importance of analyzing concentration on a submarket as well as on an industry level. Although average price impacts resulting from buyer concentration can be small across time, the influence of buyer concentration in individual auction sales may be important.

The analysis indicates a statistically significant but very small negative impact due to buyer concentration on average prices at the SLA. For particular subsets of the cattle, however, the negative impact could be more substantial. It appears that looking at the influence of buyer concentrations at a disaggregated level, dealing with individual sales and subsets of the cattle, is important.

Parameter Estimates and Test for Market Power at OKC

Table 4 presents the parameter estimates for the model testing the influence of buyer concentration on monthly prices at the OKC feeder cattle market. The parameter estimate for buyer concentration (HI in Table 4) suggests that increasing buyer concentration significantly depresses prices in the OKC market. For example, the
increase in concentration during the first seven months of the year between 1988 and 1989 is estimated to have decreased prices an average of $0.44/cwt. [-24.630 (0.133-0.115)]. This is a much larger impact on price than observed at the SLA. This might be expected, however, since buyers at OKC are bidding more directly against each other than at the SLA, and are not bidding anonymously.

Since the OKC data are so highly aggregated, much of the variation in prices for individual lots is removed. As a result, a definitive conclusion regarding the relative impact of buyer concentration at the OKC and SLA markets cannot be reached. The results do suggest that effects of buyer concentration are not equal across markets. Consequently, the type of market, cattle, and buyer size may all influence the impact of buyer concentration on prices.

However, since the results indicate the magnitude of the impact of concentration is probably different at the two auctions, it suggests that lot-specific information about quality characteristics could be important when estimating the impact of concentration on prices. If the price effect of concentration is smaller than before, after correcting for quality differentials, some of the alternative conclusions found in the literature could be explained (e.g., Menkhaus et al. versus Ward (1982)).

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It is also possible that the SLA is simply a more competitive market than OKC. Electronic markets offer one way of dealing with market power since the relevant market area can be expanded.\(^{29}\) This also implies that the next research step should be to examine whether market power varies in different types of markets on given days, and, if so, why? In any case, individual markets should be examined to discover the strategic behavior of buyers when they are able to exercise market power in a particular market.

The impact of buyer concentration on overall average prices was more negative at the OKC market than the SLA market. Why these results differ is not clear, but it could be due to different bidding processes in the two auctions or to a competition enhancing dimension of the electronic auction at SLA. The results emphasize the need to analyze the impact of buyer concentration in individual markets and on specific days to the extent such is possible.

Conclusions

The feeder cattle auctions analyzed here have become slightly more concentrated since 1987. Buyer concentration is seasonal and appears to reflect the relative level of placements in feedlots.

Increasing buyer concentration has depressed feeder cattle prices over time. For example, increasing buyer concentration between 1987 and 1989 reduced sellers' revenues for steers and heifers by about $0.05/cwt. at the SLA and by about $0.44/cwt. at OKC. However, buyer concentration at individual auction sales may impact prices by over $1/cwt. from sale-to-sale. Concentration appears to have a larger impact on prices at the traditional auction (OKC) where bidding is not as anonymous as it is with the SLA sale. These results suggest that the price effect of buyer concentration is less after correcting for quality differentials and/or that the SLA is a more competitive market than OKC. However, more complete information on cattle weights, sex, and quality would need to be made available by OKC before a definite conclusion could be made about the relative impact of concentration at the two auctions.

Concentration may also be of concern in smaller markets or for direct sales. If further consolidation is experienced in the aggregate cattle feeding and meatpacking industries, concentration in individual auctions or other markets will likely continue to increase. Additional research should examine the differences in market power for separate markets that are competing for the same buyers. If buyers are able to recognize and selectively apply market power in separate markets, then the reasons buyers select procumbent strategies for specific markets, and why they behave as they do during auctions on particular days may be explained.

\(^{29}\)There are some limits to this, of course, since transportation costs will establish boundaries between regions for the buyer purchasing cattle at electronic markets.
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CHAPTER 5

IRS Policy on Hedging vs. Speculation: 
Possible Implications to Market Efficiency 
and Price Discovery in the Cattle Markets

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Introduction

Trade in cattle futures provides a risk transfer mechanism and contributes to the process of price discovery. The two functions are closely interrelated. The price that is being "discovered" for some later time period by the live cattle futures is the forward price, the hedging opportunity, being offered by the market.

Hedgers enter the cattle futures markets with an objective of transferring exposure to the risk of variable cash prices to someone else. Speculators accept that risk, entering the markets with a profit motivation. The distinction between the two types of traders is very important. Losses from futures trades that meet the criterion of a hedge are deductible for income tax purposes. Speculative losses are treated differently. Deductible losses are limited to $3,000 for the individual and to $0 for most types of corporate entities.30

Over time, court cases have generated information on what types of transactions will be treated as a hedge. In a May 14, 1990 overview prepared for the Chicago Mercantile Exchange by a representative of the national firm Arthur Andersen & Co., hedging was defined as a transaction entered into by the taxpayer in the normal course of the taxpayer's trade or business, primarily (1) to reduce risk of a price change or currency fluctuation with respect to property which is held, or to be held, by the taxpayer, and (2) to reduce risk of interest rate or price changes or currency fluctuations with respect to borrowings made, or to be made, or obligations incurred, or to be incurred, by the taxpayer.31 Within this generally accepted definition, however, there is room for uncertainty about precisely how a particular transaction would be treated by IRS and/or the tax courts. IRS has generally restricted its concept of a hedge to a simplistic "hedge and hold" approach. The futures position needs to be equal and opposite the current cash position or the planned cash position in both quantity and temporal contexts.

Cattle feeders, with cattle on feed, are long cash cattle and a legitimate hedge would require a short position in live cattle futures. If the trading program is audited by the IRS, they will tend to look for short positions in the futures contracts that match, in terms of numbers and timing, the cash cattle scheduled to be sold at later time periods.

30A speculator in commodity futures can use losses to offset capital gains in other areas such as capital gains from a real estate transaction. If trade in commodity futures is the only capital activity, then the losses are not deductible or are limited to $3,000. Any added losses must be carried forward to the next tax year(s) where they again are subject to the $3,000 limit.

The other futures transactions by cattle feeders that the IRS would likely view as a legitimate hedge would be long positions in feeder cattle futures to cover later purchases of feeder cattle. Relative to later needs, the cattle feeder is short in the cash feeder cattle market. A properly matched, in terms of quantity and timing, set of long positions in feeder cattle would generally be considered a hedge.

Transactions that extend beyond this type of simplistic matching have tended to fall into the uncertain category. In January, a cattle feeder with 20,000 cattle scheduled to be sold in July and August might prefer to place short positions in the more actively traded April and June futures contracts. The short positions would then be "rolled" to the August futures later in the year when the August contract becomes more actively traded and can more easily handle the volume of trades the cattle feeder needs. Would IRS view such a program as a legitimate hedge? There are no clear guidelines.

Many users of the futures markets would prefer a selective or multiple approach to hedging. The astute manager would like to "select" the periods when protection is needed. A cattle feeder, to illustrate, would use abilities as a market analyst to identify periods when the price movement is likely to be down. During such periods, short hedges would be placed in the live cattle futures. At a later time period, if prices drop to levels that appear to be low given perceptions of the fundamental supply-demand balance, the short hedges might be offset. The cattle feeder is positioned as a cash market speculator, and will benefit from any increase in prices. Thus, the feeder is either hedged using the futures or is a cash market speculator. The same approach can be followed using periodic long hedges for feeder cattle.

The approach appears logical, and it is an approach that allows the decision maker to take advantage of abilities as a market analyst. Some cattle feeders use sophisticated technical indicators, such as moving averages or oscillators, to guide the placing, lifting, etc., of hedges during the production period. Even though such a program would appear to be consistent with the day-to-day business activities of the firm in the cash market, it is not clear how IRS would view such a hedging program. Most observers feel that IRS would not rule the "selective" program to be a hedge, and that the current courts would be likely to uphold such an IRS position.

In 1981, a pilot program in trade in options on futures was launched at the major futures exchanges. Options trade has increased rapidly. The advent of trade in options brought with it added uncertainty about tax ramifications, however. One widely used options strategy is to sell a call option, usually at some price above the current futures market, and buy a put option at a price often at or below the current futures market. There have been and are cases in which IRS rulings have disallowed any losses associated with selling the call options. Such losses have been treated as capital losses by the IRS and the losses do not qualify for business deductions.

An even broader area of concern emerges for the cattle feeder who owns feeding facilities but who is facing a situation in which, given the current costs of feeder cattle plus feed costs and the forward prices being offered in futures, could "lock in" only a large loss by placing the feeder cattle and selling the distant live cattle futures. The feeder must either (1) place the feeder cattle and speculate in the cash market and, in the process, risk the investment in facilities, or (2) leave feedlot pens empty and absorb the costs of the fixed investment. Any attempt to gain protection against such an onerous market situation by selling nearby feeder cattle futures and buying distant live cattle futures has tended to be viewed as speculative transactions by the IRS.

The uncertainty regarding tax treatment of futures trades was accentuated by a 1988 Supreme Court ruling on the Arkansas Best case. Arkansas Best was a diversified holding company with stock in a national bank. In 1971, the bank was classified as a problem bank by federal regulators and attempts to sell holdings in the bank were proving difficult. In 1972, Arkansas Best bought more bank stock in an attempt to block sanctions against the bank by regulatory authorities. In 1975, Arkansas Best sold the stock at a loss and claimed the losses as a business deduction. The IRS disallowed the claims and their position was eventually supported by the Supreme Court.
Writing about the ruling and the uncertainty it created in Corporate Risk Management, Gregory Millman offered the following:

For more than 30 years before Arkansas Best, hedgers knew if they bought futures or options for a business purpose, they could get hedge treatment on their tax returns. This meant they could match gains or losses on the contracts against ordinary income instead of taking capital treatment... But in Arkansas Best, the Supreme Court said a business purpose was not enough to make a financial transaction a hedge. The decision opened a Pandora's Box of tax liability issues for hedgers who thought their actions had been legal.

While the Supreme Court reversed the old rule, it didn't clearly establish a new one. So far, Millman notes, neither has anyone else.32

Clarifications on the implications of the Arkansas Best ruling will be sought in a variety of ways. The commodity exchanges, commodity groups, and other interested parties are asking for clarifications from the IRS. Dialogue with members of Congress is raising the possibility of modification of existing legislation to remove the perceived burden to business interests associated with IRS policies. The generally consistent request in all the discussions is to allow business firms to enter futures and options transactions consistent with their business interests to protect the viability of their investment.

In the long run, new legislation or a significant modification of existing legislation will likely be considered. When discussion of legislation starts, there will be interest in the implications of what is and is not seen as legitimate hedging by IRS to the effectiveness of the markets. Does a narrow and restrictive interpretation interfere with the futures markets' capacity to offer a risk transfer mechanism and to contribute to the process of price discovery? Is the price discovery process being left primarily to speculators because those with cash interests, and access to proprietary information, are being discouraged from participating in any way except strictly as "hedge and hold" hedgers? If cattle feeders are essentially blocked from participation in the price discovery process, what is the impact on the effectiveness and efficiency of the markets and to the economic wellbeing of producers, processors, and consumers?

There is a need for information on how IRS policies influence the markets and the price discovery process. In the wake of the Arkansas Best ruling, what is and is not a legitimate hedge will be roundly discussed. As that discussion progresses, a solid base of research information will be needed.

The Price Discovery Process

Price discovery is the dynamic process by which markets absorb available information on supply and demand, and through a competitive interaction by buyers and sellers, generate a price. The discovered price for distant live cattle futures is especially important to the cattle feeding sector. It is the price that cattle feeders watch for forward pricing or hedging opportunities and it is the price that will determine, to a significant extent, the current

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cash prices that can be paid for feeder cattle.

The concept of market efficiency is widely used in the research literature as a measure of the overall effectiveness of the price discovery process. In general, an efficient market is a market that incorporates and registers the impact of all available information. The highest rating of efficiency, called strong-form efficiency, is reserved for the markets that are capable of incorporating both public and privately held information. To the extent that IRS policies might block full participation by cattle feeders in the price discovery process, it is difficult to see how the feeder cattle and live cattle futures markets could ever be strong-form efficient. The privately held information in the hands of cattle feeders cannot flow directly into the price discovery process.

The level of market efficiency and the effectiveness of the price discovery process in the cattle futures markets are important to society. Cattle feeding is an inherently risky business, but any excessive variability that can be attributed to constraints on participation in the price discovery process are costly to the cattle feeder, to the cattle sector, and to the final consumer in the form of variable product supplies and prices. In 1991, quarterly beef production ranged from 3 percent higher to 3 percent lower compared to 1990. Choice steers in the direct Nebraska trade averaged $80.09 per hundredweight in quarter 1, $69.15 in quarter 3. Much of this price variability was passed up through the system, putting processors' margins at risk and making prices to consumers variable within the year.

Figure 1 demonstrates the presence of the significant variability at the feedlot level. The monthly average per-head margins for cattle feeding in the Southern Plains, as estimated by the USDA, are plotted for 1980 through mid-1991.33 The range is in the magnitude of $350 per head, from -$200 to +$150. In most instances, it is the variations in fed cattle marketings that prompt significant variations in price and in profits.

The environment in which cattle feeders make decisions on how many cattle to place, whether to place, whether to forward price, etc. is very complex. It is not only the forward pricing opportunities being offered by the futures that influence those placements and related decisions but the forward prices, and therefore the feeding margins, being offered are important factors. Research efforts have shown that cattle feeders respond to changes in distant futures by changing placements of cattle.34 All of this is part of the price discovery process.

Figure 2 shows a type of variability that is directly related to the price discovery process. The margins being offered by the appropriate distant live cattle futures prices (midpoint

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33Livestock and Poultry Situation and Outlook, Commodity Economies Division, Economics Research Service, USDA.

Figure 1. Net Profits Per Head in the Great Plains Feeding Area by Months, January 1980 - July 1991

Figure 2. Margin Over Variable Costs Offered by the Midpoint of Distant Futures Prices, January 1980 - July 1991
of futures price range during month the cattle would be placed) over variable costs, as estimated by the USDA in the Situation and Outlook reports, are plotted by months from 1980 through mid-1991. Some observers argue that the USDA estimates of costs are higher than can be realized by a large and efficient feedlot, but whether the average of the series is at the correct level is not the critically important point here. The important point is that the series is highly variable with prolonged periods, as long as 14 consecutive months, when the distant futures prices are not offering prices that cover even the projected variable costs of feeding. During such periods, the cattle feeder presumably either (1) does not place cattle and absorbs the fixed costs of the feedlot investment, or (2) places cattle at varying percentages of feedlot capacity acting strictly as a cash market speculator. Whichever strategy is pursued, cattle feeders are not likely to be in the market as hedgers because the feeding margins being offered are negative.

When large negative margins are being offered, and little or no hedging is being done, cattle feeders would not be expected to enter the market to contribute to the price discovery process. That type of participation is discouraged by IRS policies. The cattle feeder, apparently, must either function as a cash market speculator or sit on the sidelines as an observer of the price discovery process and wait for other participants in the futures market to correct any market imbalances.

Cattle feeders may be discouraged or blocked from participation in the price discovery process by IRS policies. To the extent that such barriers to participation are present, the market is being denied access to information held by cattle feeders. This denial could, in turn, have significant implications to the effectiveness of the price discovery process and to the effectiveness of the futures markets.

A Working Hypothesis

It is hypothesized that IRS policies interfere with the efficiency and effectiveness of the cattle futures markets by blocking participation by cattle feeders in the price discovery process and that such interference results in a more volatile cash cattle market and increased variability in prices and product availability to consumers.

Conceptualization of the Problem

Figure 3 provides a conceptualization of the patterns that tend to develop with regard to the margins being offered by the markets. The zero line represents a zero margin in terms of net returns, suggesting that the long-run equilibrium situation is one in which there are zero excess profits and all costs of the efficient cattle feeder are being covered. In a competitive industry with little or no product differentiation and no barriers to entry, the markets would be expected to move back to such a base-line equilibrium.
In the area marked by A, positive margins are being offered. Cattle can be forward priced at a profit. If the industry is characterized by excess feeding capacity, then the market would expect to occasionally offer forward prices above the variable costs of feeding. The positive margins in Figure 3 are therefore based on variable costs with some contribution being made to overhead. Confronted with such positive margins, the presence of price expectations that will cover variable costs, cattle feeders will tend to place cattle. The Koontz-Purcell research cited earlier clearly documents this reaction. If they are a user of the futures markets, cattle feeders can sell distant live cattle futures to forward price cattle and/or buy feeder cattle futures to gain protection against rising costs of feeder cattle. Either or both actions tend to constrain the positive margins being offered by the market. Buying feeder cattle futures helps to "discover" a higher feeder cattle price in nearby futures and selling live cattle futures helps to "discover" a lower fed cattle price for the later time period. The positive margins will start to decrease and will eventually disappear. Cattle feeders can, in these situations, be involved in the apparent need to discover a lower distant live cattle futures price and/or higher cash (and nearby futures) prices in feeder cattle.

As placements start to increase, anticipation of increased future supplies starts to filter through the industry and the futures market starts to discover a lower price for the distant live cattle futures. But this process takes time, and the time required can be longer if the cattle feeders do in fact only get involved in the market as hedgers. Even if the margins being offered by the markets are becoming large negative numbers and the cattle feeder,
drawing on proprietary knowledge, recognizes a developing market imbalance, the feeder cannot get involved in helping to discover a more nearly appropriate set of prices (and margins) without risking treatment as a speculator. Figure 3 implies that the periods of imbalance that are characterized by negative margins can be more extreme. The area around B may also last longer than the area around A.

It is true that speculators would be expected to react to a market imbalance in the form of large and negative margins. Speculators could sell the nearby feeder cattle futures and/or buy the distant live cattle futures and profit if the market does in fact move back toward the zero-margin equilibrium. In addition, packers could be involved as long hedgers. Positions data provided by the Commodity Futures Trading Commission indicate packers participate in the live cattle futures as long hedgers only at a very modest level, however. Before either the speculator or the packer will enter, they have to be convinced that the market is in a state of imbalance. The zero-margin base is correct in a conceptual context, but it will be impossible to always precisely and accurately identify what set of prices will be consistent with that equilibrium margin. The important point is that cattle feeders, using their own proprietary information on costs and performance, are arguably in the best position to recognize a major imbalance when it starts to emerge. The negative margin imbalances might be less sustained and of smaller magnitude if cattle feeders participated in the price discovery process.

Cattle feeders' initial reactions to this discussion might be that they approve of the occasionally excessive and positive margins. But those excesses bring with them a penalty. Even short-run positive and large margins tend to bring a surge in placements. Bidding up the prices for cash feeder cattle and, to the extent the increased placements are hedged, selling the distant live cattle futures starts to diminish the margins. But time is required for this realization to spread through the market. Significant short-run variations and overreaction in fed cattle prices are the typical result. Figure 4 shows year-to-year percentage changes in quarterly placements of cattle and the associated year-to-year percentage changes in quarterly average fed steer prices two quarters later at the Omaha terminal market. The percentage declines in price have been as large as 25 percent.
Such large price variations work to the detriment of the producer and the final consumer. Volatile selling prices raise producers’ costs over time in the form of increased capital requirements and higher interest rates because of the risk of loss. Consumers are exposed to more variability in product availability and in price than might otherwise be necessary. The working hypothesis suggests that if cattle feeders were involved in the markets in the price discovery mode as well as the hedging mode, such fluctuations would be tempered.

The issue of cattle feeder involvement is even more important during periods of negative margins in the area around B in Figure 3. If only large negative margins are being offered, then the cattle feeder is forced to either be a speculator in the cash commodity or to allow pens to remain empty (or partly empty) and absorb the fixed costs of the investment. The plot in Figure 2 suggests this decision situation is often the case: the margins being offered are often negative and the cattle feeder must make the difficult and forced choice of being a cash market speculator and either carrying a major risk exposure or absorbing fixed costs on the investment.

When feeding margins are negative, the market needs that realization to be quickly and efficiently incorporated into the discovered prices. Actions to sell nearby feeder cattle futures and/or buy distant live cattle futures would push the feeding margins back toward an equilibrium position and eliminate the imbalance in the markets. To the extent that IRS policy blocks cattle feeders’ involvement in the price discovery process, the imbalance will persist until it attracts speculative action and/or long hedges by packers.

This is the reason for the hypothesis that IRS policy slows the corrective process. Observation of what happens in the marketplace tends to justify the hypothesis. In the summer months of 1991, with the feeding margins being offered by the markets varying in a -$5.00 to -$12.00 per hundredweight range, cattle feeders reduced placements. Placements in the 13 major feeding states during July, August, and September were 15 percent below the same period in 1990. Slowly, more reasonable feeding margins were restored. A February 1992 live cattle futures that traded as low as $71 in early August of 1991 rallied to the $76 level and higher in the fourth quarter as the monthly cattle on feed reports released by the USDA made publicly clear what feedlots had already known: that the markets were in a state of imbalance.
There is reason, then, to hypothesize that IRS policies that block cattle feeders participation in the cattle futures markets reduce the efficiency and effectiveness of the markets and imposes a cost on everyone in the sector from the original producer to the final consumer. A solid base of research will be needed as discussion and dialogue dealing with the possible need for legislative action proceeds. There is a body of research on the broad topic of price discovery. The needs are in terms of looking specifically at the implications of IRS policy to the effectiveness of that process.

The Research Program

The issue needs to be investigated in phases, with each successive phase based on what has already been learned. Any economic costs imposed by IRS policies that block cattle feeders from participating in the price discovery process will be present only if those policies do in fact become barriers to participation.

**Phase 1** of the research thus involved a survey to determine whether cattle feeders' participation is influenced by IRS policy and whether cattle feeders would be likely to get involved in price discovery processes if IRS policy were changed. The results of that survey are reported in this chapter. In general, the results confirm the hypothesis that fear of being treated as a speculator, with non-deductible losses, does in fact block and/or constrain cattle feeders' involvement in the price discovery process.

**Phase 2** of the research involved an analysis of the behavior of various groups of traders. If given special status, because they are in the cash business, such that any losses in futures trades would be deductible, cattle feeders who choose to participate would enter the market in a different way than the historical hedge and hold positions. They would, for example, tend to sell nearby feeder cattle futures and/or buy distant live cattle futures when their market analysis indicates that the markets are in a state of imbalance and are showing excessive negative margins. But that is also the market positions that large speculators would be expected to take. What is the record in terms of what large speculators have brought to the price discovery process? Do they extend the imbalances in areas A or B of Figure 3 or do they start, as the imbalances worsen, to take positions to correct the situation? The results of an analysis to examine the impacts and influence of large speculators in the price discovery process are also reported in this chapter. Looking at the responses and contributions of the large speculators starts to establish a base on which inferences about the influence of cattle feeders can be built.

**Phase 3** is in the planning stages. Efforts to measure the nature and magnitude of any costs and benefits from cattle feeder participation in the price discovery process and to assess how any such costs and benefits will be distributed to system participants will be required. Special attention will be paid to the economic implications for cattle producers, cattle feeders, and to consumers in the form of changes in price and/or product availability.

**A Survey of Cattle Feeders**

An extensive annotated bibliography of available historical research on price discovery is offered by John Rowsell in Chapter 4 "Annotated Bibliography," Structural Changes in Livestock: Causes, Implications, Alternatives, Research Institute on Livestock Pricing, Agricultural Economics, Virginia Tech, Blacksburg, February 1990, pp. 166-178. That bibliography is updated and offered as Chapter 6 of this book.

Reference is to Research on Implications of IRS Policies to the Effectiveness of Cattle Futures Markets: Part...
Approximately 150 survey forms were delivered to Kansas feedlots and to members of the Texas Cattle Feeders Association during the third quarter of 1991. A total of 53 were completed and returned, with roughly a 50-50 split between responses from Texas and Kansas respectively. Figure 5 shows the distribution of the responses by size of feedlot. The larger categories dominated the responses with 7, 19, and 22 from the 5,000-10,000, 10,000-20,000, and the greater than 20,000 head sizes respectively. Information on the size of the feedlots was included to allow analysis to determine whether responses and attitudes differ by size of operation.


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Figure 5. Size of Responding Feedlots in One-Time Feeding Capacity

Figure 6. Distribution of Average (Variable) Costs of Gain for Cattle Finishing in August and September 1991
There was a large spread in response to a question on variable costs of gain. Figure 6 shows the distribution for the responses to a question on the variable costs of cattle finishing during August and September of 1991. The cost information allowed analysis to see whether responses varied between high-cost and low-cost feeders.

Cattle feeders who have contracted cattle to packers, either by cash contracts or by basis contracts, might view IRS policies surrounding futures trades differently. Including a question about contracting allowed the possibility of different response patterns tied to experience with contracts to be examined. Figure 7 shows the percentage of cattle contracted to packers via either cash forward or basis contracts.

![Figure 7. Percent of Cattle Contracted to Packers Via Cash Price Contracts or Basis Contracts Across Past 5 Years](image)

Figure 8 shows frequencies on how cattle feeders respond to market conditions with forward pricing opportunities that offer only negative margins. This question was deemed to be very important. The specific question was as follows:

_What do you tend to do when the futures contract you would hedge cattle in, after adjusting for basis, is only offering a price equal to the cost of the feeder cattle you can buy plus the expected cost of the feed, or even less? In other words, the feeding margin being offered is negative. If you mark more than one, rank them in importance with 1=most important, 2=next most important, etc._

___ Buy and place cattle because the situation will often get better.
___ Let the pens stay empty until the situation improves.
___ Reduce the number placed until the situation improves but try to continue operating.

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Keep buying and operating and count on things to average out over time.

Other. Please explain.

Twenty of the 52 feeders responding to this question ranked the alternative of reducing the number of cattle placed as being number 1 in importance. The two alternatives involving “continued placing of cattle in anticipation that conditions will get better” and “keep buying and operating and count on things to average out over time” were each ranked first in importance by 10 respondents.

Eight respondents indicated they would tend to leave the pens empty. Both this response and the response involving reduced placements are consistent with the observed industry behavior. If feedlots are not allowed to get involved in the price discovery process, the only way the feedlots can ensure that the situation will get better is by reducing placements. As the realization that placements are being reduced filters through the industry, the projections for fed cattle supplies 4-6 months into the future start to be reduced. The distant live cattle futures tend to move up as those supply projections are reduced, and the margin being offered by the market tends to move back toward zero or even to positive levels and cattle feeders see some improvement.
This reaction by cattle feeders was very much in evidence in the third and fourth quarters of 1991. Placements in the 7-major feeding states were down 10 to 20 percent in June, July, August, and September relative to year-earlier levels as the industry reacted to large losses on cattle coming out of the feedlots and to the prolonged existence of negative feeding margins being offered by the futures markets. Based on USDA estimates of breakeven prices for cattle placed in July of 1991, the midpoint of the prices offered by the appropriate live cattle futures contract was offering a margin of -$8.00 per hundredweight for July placements (assuming a zero cash-futures basis). This is the source of the concern that was introduced earlier. The correction process can be slow when cattle feeders are not involved directly in the price discovery process and must restrict their futures trading activities to those involving hedging. When the margins being offered are negative and short hedges are not feasible, the feedlots are out of the futures markets and are functioning as observers. They are involved in the price discovery process, but only indirectly as they adjust placements and wait for the markets to recognize what they are doing and to register the impact of their actions.

There was a statistically significant negative correlation \( r = -.34, P = .08 \)\( ^{37} \) between size of the feedlot and the response involving reducing placements and trying to continue operating. The large feedlots may reduce placements, but they try to keep operating. There was a positive correlation \( r = .35, P = .08 \) between the tendency to forward price cattle in futures or options and the tendency to keep buying and count on things to average out over time. A negative correlation \( r = -.40, P = .09 \) exists between the tendency toward being a high cost producer and the option of letting the pens stay empty. That is, the higher the costs of the feedlot, the more likely they were to opt for a strategy that allowed the pens to be empty when the market is offering only negative margins. The negative correlations between costs and this particular strategy indicates that as costs go up, the lower (with 1=most important) rankings were selected.

This statistical analysis is not sophisticated and should be seen only as evidence of general tendencies. The most significant finding is that the reactions of the feedlots tend to confirm the hypothesized pattern. Of 52 responses, 28 ranked reducing placements or eliminating placements first in importance. Changing the placements does appear to be the cattle feeding sector's way of correcting a market that is offering only negative margins.

Figure 9 provides the responses to the question:

When you buy and go long cash feeder cattle and sell or go short distant live cattle futures, you are forward pricing your cash cattle feeding operation. Presumably, you do this when the prices being offered are attractive or at least cover your variable costs. If the prices being offered are not good enough to justify feeding cattle, you could sell or go short the nearby feeder cattle futures and buy or go long the distant live cattle futures with the expectation that the market will restore a more attractive feeder cattle to fed cattle relationship. This might earn you profits and help protect your feedlot investment when you feel you cannot feed cattle. If you did this (sell feeder cattle futures and/or buy distant live cattle futures) which of the following are

\( ^{37} \)In reporting results of a statistical correlation analysis of the survey results, \( r = \) the simple correlation coefficient and \( P = \) the statistical probability level. A non-zero level of \( r \) means the events tend to be associated, with the level of association greater as the absolute size of the correlation coefficient increases. The association can be direct (positive\( r^+ \)) or inverse (negative\( r^- \)). The statistical probability \( P \) can be interpreted as a measure of how likely the observed relationship might just be due to chance. The smaller the value of \( P \), the more important the relationship is in a statistical context.
It is important to know what cattle feeders who pursue this policy believe they are doing. Under current interpretation of the tax code and court rulings, the IRS would see this type of market action as speculation.

The correlation analysis of response patterns indicated that lower cost operators were more likely to interpret this action as hedging. There was also a very strong positive correlation for feedlots who tend to forward price their own cattle in the futures \((r = .44, P = .002)\) or who forward price cattle they feed for customers \((r = .33, P = .04)\) to see these actions as hedging. Cattle feeders who currently use the markets to hedge would thus tend to see the "reverse feeding" positions as hedges.

The tendency to see such actions as speculating was highly correlated \((r = .55, P = .01)\) with the earlier response by feeders who react by buying and placing cattle with the belief the situation will get better. This result would be expected. Some feedlots buy, place cattle, and do not use the futures market because they feel they are
protecting themselves from price risk by buying and selling in the "same market". The implied lack of familiarity with use of futures and options by those feeders would be consistent with a tendency to see any such action in futures as speculation.

There were no significant statistical correlations between responses to this question and size of operation. There was a negative correlation ($r = -.28$, $P = .07$) between higher feeding costs and the tendency to see these actions in the futures markets as hedging. Higher cost operators tended not to select the "hedging" alternative.

A surprising 21 of 49 respondents to this question see actions involving selling nearby feeder cattle futures and/or buying distant live cattle futures as hedging. Under current IRS policy, it will almost certainly be ruled as speculative. Many of those who feel this is hedging are current users of the futures markets as hedgers. Among comments accompanying their answers were some that suggested that any actions in futures designed to protect a legitimate interest in feedlot activity in the cash market should be seen as "hedging" and treated accordingly by the IRS.

The responses, Figure 10, on which group of traders or potential traders would be effective in correcting market imbalances provided some surprises. The question and the alternatives offered were as follows:

Assume the nearby feeder cattle futures or cash feeder cattle are too high relative to distant live cattle futures to hedge in a profit. Of the following groups of people, who is most knowledgeable and could be the most effective in recognizing the imbalance and helping to restore a more acceptable relationship between the cash feeder cattle or nearby feeder cattle futures and the distant live cattle futures? Use 1 for the best group, 2 for the second, and rank any you feel could be effective.

1. Large futures speculators
2. Small futures speculators
3. Packers
4. Cattle feeders
There were several motivations behind this question. Research by Rowsell provides evidence that the large speculators are the group that have, historically, taken positions that "turn" the futures market during sharp price dips in the futures markets and start the process of restoring more reasonable margins. Seventeen of the respondents ranked the large speculators first in importance.

Twenty of the respondents ranked feedlots first. Underlying this entire research thrust is the assumption that (1) feedlots are well informed on what the margins being offered should be, and (2) the effectiveness of the futures markets as price discovery mechanisms are constrained by IRS policies which block feedlots' participation and thereby block the market's access to the valuable and proprietary information on costs and returns that the feedlots possess. The number 1 ranking for feedlots by 20 respondents tends to support this working assumption.

There were no statistically significant correlations between the responses on who would be most effective and size of feedlot, feeding costs, tendency to use the futures to hedge, or how they react to negative margins. There was a negative correlation \( r = -.36, P = .03 \) between responses indicating feedlots would be effective market participants and the tendency to see programs involving selling feeder cattle/buying live cattle futures as hedging. This negative correlation suggests that those who rank the potential of feedlots high tend to understand such actions would not be viewed as hedging. They did not mark the "hedging" alternative.

The response pattern to this question is revealing. It tends to support the implicit hypothesis that feedlot operators, if allowed to trade the markets for price discovery purposes, might be very productive market participants. It is clear that a

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significant number of the respondents believe participation by cattle feeders would improve performance of the futures markets.

Figure 11 suggests the response to negative margins is distributed about 2 to 1 toward "no action" in futures. The complete question was:

When feeder cattle are so high relative to the distant live cattle futures and relative to your expectations about future prices for fed cattle that you are reluctant to buy and place the feeders, have you ever not placed the cattle and both sold nearby feeder cattle futures and bought the distant live cattle futures or either sold nearby feeder cattle futures or bought distant live cattle futures?  

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Yes</td>
</tr>
<tr>
<td>30</td>
<td>No</td>
</tr>
<tr>
<td>25</td>
<td></td>
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<tr>
<td>20</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Sixteen of the 49 respondents have, when margins offered by the markets were bad, taken action by selling nearby feeder cattle futures and/or buying distant live cattle futures. Comments generally indicated these actions were taken to protect the investment in feedlot facilities and/or to try to profit from the expected correction of the market imbalance since feeding cattle did not appear to make sense.
The responses did not vary by size, but they were related to feeding costs. Interestingly, the higher cost feeders were inclined to take such actions in the futures markets \( r = .24, P = .07 \). This result suggests that the higher cost feedlots, the operations that would be most likely to see buying feeder cattle and feeding as not being profitable, show a greater tendency to take the "reverse feeding" positions in the futures markets.

The tendency to answer "yes" was negatively correlated \( r = -.26, P = .08 \) with the tendency to contract via cash price contracts with packers. It is perhaps the case that these feedlots look for cash contracts that offer a price that at least covers variable costs and tend to keep the pens full in that way. They do not then need to protect their position in the futures because pens do not tend to be empty. The tendency to sell feeder cattle futures/buy live cattle futures as a strategy was negatively correlated \( r = -.45, P = .04 \) with the reaction of "let the pens stay empty--" discussed earlier. This result appears to be inconsistent. A positive correlation would have been the expected result, suggesting a willingness to allow the pens to be empty and taking actions in the futures to help correct the market imbalance.

There was a strong negative correlation \( r = -.40, P = .01 \) between "yes" responses and the tendency to see these actions as hedging. Those feedlots who have pursued the "reverse" strategies that do not involve placing cattle are not inclined to think that they are hedging. They understand they are speculating given current IRS policy, and tended to not mark the "hedging" alternative in the question reported in Figure 9.

There is, then, some existing involvement by cattle feeders as "speculators" in the current markets. Whether they are trying to correct market imbalances so that they can get back to feeding cattle or whether they are trying to earn profits based on the expected market correction is not known. It appears that the feedlot managers who understand that what they are doing would be seen as speculative in the current policy environment are the ones who tend to pursue speculative strategies involving selling feeder cattle futures and/or buying live cattle futures.

The responses to a question on why they do not get involved in selling feeder cattle/buying live cattle futures, Figure 12, were revealing. The question and alternatives were:

*Rank (with 1=most important) any of the following that constrains or limits your selling of the nearby feeder cattle futures and/or buying of the distant live cattle futures, as discussed above, as a strategy to protect your investment or interest in cattle feeding operations.*

- Lack of available money for futures margins
- Banker or lender disapproves
- Fear IRS will call it speculating if I am audited and losses would not be deductible
- Have no active futures account
- Other. Please Explain.
More respondents ranked the alternative involving “fear IRS will call it speculating...” than any other alternative and the mean ranking on the alternative was the lowest (where a ranking of 1 indicates most importance). Implicit in this entire area of analysis is the assumption that fear of being treated as a speculator by IRS and being denied deductions for losses discourages feedlots from participating in the price discovery process to correct existing imbalances and/or prevent imbalances from occurring. The results to this question support the validity of that assumption.

There were no significant correlations between these answers and feedlot size, feeding cost, or other areas already discussed. It is apparently the case that, across the board, there is concern about IRS reactions, banker disapproval, and the ever-present concern about money to finance such trading programs.

Specific questions were asked with the respondents being asked to assume that any losses from selling feeder cattle/buying live cattle futures would be treated as speculative and therefore not deductible. Under this assumption, the overall question and first sub-question was:

Currently, IRS policy and the courts would almost certainly treat any losses by cattle feeders from selling nearby feeder cattle futures and/or buying distant live cattle futures as speculative activity and would therefore deny deductions for any losses. Assume here any such losses would be treated as speculative and not deductible and answer each question.

(a) Does concern about such a policy by IRS stop you from participating in the futures market to help the process of discovering prices for feeder cattle and fed cattle and to help
correct the imbalances that occur, (ie, stop you from selling nearby feeder cattle futures and/or buying distant live cattle futures)?

Nearly one-half the responses in Figure 13 were "yes", the IRS policy does block any such actions in the markets. This finding is consistent with analyses by the Commodity Futures Trading Commission that indicates some cattle feeders do typically hold positions that would be ruled as speculative. This set of results again confirms the implicit assumption that IRS policies block at least a significant number of feedlots from injecting their proprietary knowledge on costs, margins, etc., into the futures markets by blocking their participation in the price discovery process. There is no information on how large the speculative positions taken by cattle feeders might be and therefore no basis for inferring what, if any, impact they are already having on the price discovery process.

There was a statistically significant negative correlation between the tendency to answer "no" to this question and the tendency to be involved in forward pricing cattle in futures and/or the tendency to contract with packers. For example, the correlation between an earlier question on percent of cattle hedged and "no" answers was negative and very significant (r = -.36, p = .01). Thus, those feedlots who have been involved in using the futures markets and/or cash or basis contracts would be more inclined to say "yes, the IRS policies do tend to stop me." There was a negative correlation between "no" answers and the inclination to call such activities hedging in response to the earlier question (r = -.28, p = .05). The feedlots who say "no, concerns about IRS do not stop me," understand it would be speculating and not hedging. They tended not to mark the "hedging" answer to the earlier question.

It appears that the current IRS policy, a policy which would tend to see selling feeder cattle futures/buying live cattle futures as speculation, does block some feedlot participation in the futures markets. This finding tends to confirm the hypothesis that IRS policy is a factor in feedlot participation in the price discovery process and the finding tends to legitimize research to look further at the economic implications of current IRS policies.
Part (b) of the general question that asks feedlots to assume all actions to sell feeder cattle/buy live cattle futures would be treated as speculative with any losses not deductible was:

(b) If IRS treatment were changed, would you be more active in the markets to restore more normal relationships between feeder cattle and live cattle futures?

A majority of the respondents indicated they would in fact be more active (Figure 14). These responses again confirm the implicit assumption that current IRS policy is blocking participation of feedlots in the price discovery process.

There was a negative correlation between the tendency to use futures markets to hedge cattle and the tendency to answer "no" here. For example, the correlation between "no" answers and the tendency to hedge cattle fed for customers was quite large in absolute value and highly significant in a statistical context ($r = -.31, p = .04$). Feedlots who have used the markets for hedging would, therefore, be more inclined to get involved in the price discovery process if allowed to do so and they tended to avoid the "no" response to more participation in this question.
There was a significant negative correlation ($r = -0.28$, $p = 0.05$) between the tendency to say "no" to more participation and the earlier response that selling feeder cattle/buying live cattle futures was hedging. Written comments again indicate that these feedlots tend to argue that anything in the futures market that is meeting a need of the cash business firm should be seen as "hedging" or at least treated so that any losses are deductible as a business cost. These feedlots tend to say that selling nearby feeder cattle futures and/or buying distant live cattle futures makes more economic sense than insisting on buying and placing feeder cattle as a cash market speculator when any feeding margins being offered are large negative values. The negative correlation indicates they avoided the "no" response to participation in this question.

It appears, again, that IRS policies constrain or prevent feedlot involvement in price discovery processes. There are a number of feedlots who would be more actively involved in the futures markets if current IRS policy was not in place.

Continuing to assume that IRS would treat such programs as speculative, Figure 15 indicates that a large majority of respondents believe cattle feeder involvement would improve the situation. The specific sub-part question was:

(c) **Do you believe that if cattle feeders were allowed, even encouraged, to get involved in the markets by selling nearby feeder cattle futures and/or buying distant live cattle futures when adequate feeding margins are not being offered that the markets would change and there would be fewer long periods when the feeding margins being offered are negative?**
This response pattern is important. It continues the line of reasoning that has developed across the survey responses: cattle feeders are well informed, would bring information and perspective to the price discovery process and would, if allowed or encouraged to do so, improve the effectiveness of the live cattle and feeder cattle futures markets. The responses were 2:1 in favor of "yes".

The statistical correlations follow a now familiar pattern. Feedlots who have been involved in using the futures markets to hedge cattle tend to say "yes, feeder cattle participation would improve the markets". Those feedlots who have been active in selling feeder cattle/buying live cattle in the past tended, predictably, to say "yes".

Responses to parts (a), (b), and (c) of the question that assumes IRS would treat selling feeder cattle/buying live cattle futures as speculation are especially important. There is clearly a significant portion of the responding feedlots that feels IRS policy does in fact block cattle feeder participation in the markets and that the blocking of that participation is detrimental to the performance of the markets.

Figure 15. Responses as to Whether Feedlots Involvement in Price Discovery Would Reduce Frequency, Longevity of Negative Feeding Margins Being Offered

CHAPTER 6: ANNOTATED BIBLIOGRAPHY
Implications of the Survey Results

The survey was prompted by the broad need to know more about how feedlots are involved in the feeder cattle and live cattle futures markets. A more specific objective was to determine whether there is any empirical support to the hypothesis that current IRS policy and its enforcement either block or constrain activities by feedlots to contribute to the price discovery process in cattle futures. The answer to the implied question is definitely "yes". IRS policy does block and/or constrain feedlot involvement.

Such findings offer support to the need for a research program designed to identify and measure the implications of current IRS policy to the efficiency and effectiveness of the feeder cattle and live cattle futures markets. To the extent that IRS policy blocks feedlots participation in the price discovery process, proprietary and presumably high quality information on cattle performance, on costs of inputs, and on breakeven costs is denied to the markets. Conceptually, this could lead to a more variable market than could otherwise be the case, variability that could have negative implications to producers and to the consuming public.

Longer term, it is likely that Congress will be asked to consider changing the statutes regarding what is and is not hedging/speculation. When that important question is addressed, there will be a need for a research base that has attempted to identify and measure the implications of current policy. This set of survey results would appear to authenticate the need for additional research.

The second phase of the research was designed to examine the impact of large speculators on the price discovery process. In conceptualizing the process in Figure 3, both positive and negative "imbalance"s were presented. In the area surrounding "A" in Figure 3, margins are positive and growing larger. If this is in fact an imbalance with margin levels that cannot and will not be sustained, then a well informed speculator would be expected to sell distant live cattle futures and/or buy the nearby feeder cattle futures. Whether the large speculators do in fact take such positions as the margins increase is a researchable issue.

When margins are positive and excessive, cattle feeders can constrain or correct the "imbalance" by selling distant live cattle futures to place short hedges and lock in profitable margins. They would, under current IRS policy, be able to contribute to the price discovery as they come into the markets to place hedges.

The situation is significantly different, however, when the margins being offered are negative. As margins become more negative, the survey results reported in this chapter indicate cattle feeder activity to help restore a "balance" is constrained by IRS policy. Conceptually, the large speculators would be expected to react to a decrease in margins (a move to more negative margins) by selling nearby feeder cattle futures and/or buying live cattle futures. Is this, in fact, what they do? Again, how the large speculators behave is a researchable issue.

Phase 2 of the research focused on the behavior of large speculators. If large speculators behave so as to constrain the negative imbalances and turn the markets back toward an equilibrium, then allowing cattle feeders to fully participate in the price discovery process, perhaps by taking positions up to the equivalent of their investment as measured in feedlot capacity, takes on added importance. With immediate access to proprietary information and with a related reduction (or elimination) of the time lags before the markets recognize an imbalance, cattle feeders might be even more effective than large speculators in the process of correcting imbalances and stabilizing quantities and prices. A report on analysis of the role of large speculators in the price discovery process...
provides a base for inferences about the possible role of cattle feeders in that process.

Role of Large Speculators in Price Discovery

The working hypothesis for the study was as follows:

Large reporting speculators play an important role in the price discovery process for large cattle futures and tend to take positions that would correct significant imbalances in the markets.

The objectives of the research were:

1. To describe the impacts of differential behavior across types of traders on the process of restoring market equilibrium in the live cattle futures market,

2. To demonstrate the possible impact of denying cattle feeders' participation in correcting the imbalances in the feeding margins being reflected by the live cattle futures markets, and

3. To present the possible implications of IRS policies on hedging/speculation to the price discovery process and to the efficiency of the live cattle futures market.

A relatively simple conceptual framework for the research was developed by an extension of the margin pattern shown in Figure 3. The result is shown in Figure 16.
Conceptually, trader group would be expected to differ for the following subsets of the margins being offered:

1. Positive margins,
2. Negative margins,
3. Positive and increasing margins,
4. Positive and decreasing margins,
5. Negative and decreasing margins, and
6. Negative and increasing margins.

The zero margin line is presented as the baseline or equilibrium margin. Over time, the market would be expected to return to this level where all variable costs of the efficient cattle feeder are being covered. To the extent that large speculators can, analytically, generate an estimate of the futures price that is consistent with the zero-margin balance, they would tend to take positions designed to profit from a return to the market balance or equilibrium. Obviously, different traders will employ different strategies in terms of entry and exit and abilities as analysts will differ. There will thus be a variation around the equilibrium that will be inevitable, will persist, and is indeed necessary for active speculator participation. How effective the traders, including speculators, are

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39Using variable costs reflects an implicit assumption that excess capacity in the feedlot sector tends to prevent all costs from being covered. What costs are being included does influence the level of futures prices that would be associated with a zero base-line equilibrium margin, but the exact level of the true (and unknown) equilibrium is not critical to the analysis.
in recognizing a present or developing imbalance and in taking action to correct it will determine how effective the market is in discovering a price that is not characterized by prolonged and extreme levels that threaten the viability of the entire beef sector.

As suggested above, trader behavior would be expected to differ depending on the level and direction of the margins. In general, behavior will be different in some band of undetermined magnitude around zero, denoted by $U_L$ and $L_L$, where the departure from equilibrium does not meet risk/reward objectives of speculators to attract them into the market. At the margin, as the margin levels move away from the equilibrium level, speculators would be expected to take positions that would earn profits if the markets restore the equilibrium. But speculators would also be expected to react differently to positive and increasing margins as opposed to positive and decreasing margins. When the pattern is positive and increasing, the market has not "turned" and abandoning long positions and/or taking short positions involves "picking a top" in the market. When margins are positive and decreasing, the market has "turned" and speculators' activity might be what caused the reversal.

To analyze the impact of trader groups, the margins being offered by the distant live cattle futures were estimated weekly for the period January 1983 through November 1987. Costs of feeder cattle, feed, conversion rates, etc., were based on the Great Plains western feeding program offered by the USDA in its Situation and Outlook reports and modified to fit a program feeding steers from 750 lb to 1,150 lb. Interest charges were assessed on the investment in the feeder steers and feed, and the input costs and interest charges were held constant for the length of the feeding period. Thus, the margin being offered by the distant live cattle futures varied directly with changes in the futures prices.

Information on daily activity of large traders, who are required to report to the Commodity Futures Trading Commission (CFTC) because they hold over 100 contracts, was available from a report for the January 1983 - November 1987 time period. A data set consisting of week-to-week changes in the positions (open interest) of large speculators and large hedgers was developed to coincide with week-to-week changes in the calculated feeding margins being offered by the distant live cattle futures market. Detailed analysis of the margin and trading behavior relationships was performed, but the emphasis was on model specifications of the following general form:

$$CHFM = f(CHLONGH, CHSHORTH, CHLONGS, CHSHORTS)$$

where:

- $CHFM$ = change in the feeding margin being offered by the appropriate distant live cattle futures contract,
- $CHLONGH$ = change in the open positions of long hedgers,
- $CHSHORTH$ = change in the open positions of short hedgers,
- $CHLONGS$ = change in the open positions of long speculators, and
- $CHSHORTS$ = change in the open positions of short speculators.

In the estimation process, a lagged version of the dependent variable was typically included as an explanatory variable to correct for problems of autocorrelation. Tests for correctness of specification and statistical stability were then acceptable.

A priori expectations with regard to the signs of the beta coefficients vary with the level and direction of change in the margins. Expectations were developed using a thought process such as the following:

**CHSHORTH:** Positive sign when margins are positive and increasing, negative when margins are positive and decreasing as short hedges are added after signs of market topping. Positive sign for margins that are negative and decreasing as short hedge positions are increased in a declining market and negative for margins that are negative and increasing as short hedge positions are reduced or offset.

Table 1 provides a matrix of the expected signs for changes in trading groups by level and direction of movement in the feeding margin being offered by the distant live cattle futures. The expected signs are based on theory and on the anticipated behavior of a profit maximizing decision maker with some aversion to risk.

<table>
<thead>
<tr>
<th>MARGIN</th>
<th>SHORTH</th>
<th>LONGH</th>
<th>SHORTS</th>
<th>LONGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive, Increasing</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Positive, Decreasing</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Negative, Decreasing</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Negative, Increasing</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

The expected signs are similar for hedgers and speculators as would be expected. If the markets are to be restored to an equilibrium position, then positions must be taken that would be consistent with that restoration. It is this logic that underlies the expected signs. A priori, it would be expected that the actions of speculators might be more important in terms of statistical tests of the significance of the relationships. Position data indicate a larger portion of the total open interest is held by speculators than hedgers (roughly a 2:1 relationship) and if they act with profit motivations and have the capacity to recognize a serious market disequilibrium, they would be expected to exert a significant influence on the price discovery process and thereby on the margins.

Table 2 provides estimates of the coefficients and related t-ratios in ( )'s, for the trading groups. The variable CHFM was regressed on CHFM$^{-1}$, CHLONGH, etc. as introduced earlier. All data were first differences, suggesting R² measures will not be large. The subset of data showing positive and decreasing margins was relatively small with only 19 observations.
Table 2. Beta Estimates for a Regression of CHFM on CHSHORTH, CHLONGH, CHSHORTS, and CHLONGS

<table>
<thead>
<tr>
<th>N</th>
<th>CHFM</th>
<th>CHSHORTH</th>
<th>CHLONGH</th>
<th>CHLONGS</th>
<th>CHSHORTS</th>
<th>R²</th>
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</thead>
<tbody>
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The results shown in Table 2 were generally consistent with alternative measures of the variables. The CHFM was calculated by using Wednesday-to-Wednesday changes and week-to-week changes where the daily futures prices were averaged to generate weekly observations. The trading groups were calculated using both the Wednesday-to-Wednesday changes and the weekly averages, with changes in open interest for all live cattle futures contracts and, also, the changes in open interest for the specific futures contract in alternative specifications. Table 2 is based on Wednesday-to-Wednesday changes in margins and in open interest across all live cattle futures contracts being traded.

Overall, focusing on behavior of the large speculators for expository purposes, the changes in the large speculator positions tended to be associated with the turns back toward market equilibrium. For example, for the subset of the margins that were negative but increasing (positive first differences) the coefficient on CHSHORTS is -0.00019, with a t-ratio of -1.847. The relationship is significant in a statistical context (less than 10 percent probability the relationship is just due to chance) and the relationship is negative. This means a reduction in short speculative positions is associated with positive margin changes, and positive changes in margins push the level of the margins back up toward zero. For all negative margins, the coefficient is negative for short speculators (-0.00045) and the t-ratio is very large at -5.038. Overall, then, any increases (positive first differences) in those negative margins are being prompted by reductions in short speculative positions.

For all negative margins, the coefficient on long speculative changes is positive (0.00021) and highly significant (t-ratio of 3.806). Positive changes in the negative margins are prompted by increases in long speculative positions, and the buying pressure from the long speculators turns the market and starts to push the margins being offered back up toward zero.

The only unexpected result is the negative (-0.0004) but insignificant (t-ratio of -0.639) coefficient on the CHLONGS variable for the data set when margins are negative and decreasing. This negative coefficient means that long speculators are decreasing their long positions as margins that are already negative are declining to still lower levels, but the response is not statistically significant. The margin apparently has to drop below some Lₜ or lower limit before long speculators would be expected to come into the market, but the small t-ratio was
unexpected. The negative sign on CHLONGS for negative and decreasing margins was as expected.

At some point, however, the long speculators conclude the margins are becoming excessively negative and they step in and aggressively buy the futures. The margins start to increase and turn back up toward zero and eventually, perhaps, even positive levels in reaction to the buying of long speculators.

Efforts to determine the level of the negative margins at which speculators enter the market and start to restore a market balance met with only moderate success. When the negative margins were divided into $1 intervals, the simple correlations between CHFM and CHLONGS were positive and significant until the declining margins reached levels of -$6.00 per hundred weight. These results suggest that as feeding margins declined to more negative numbers, long speculators were reducing their long positions until the margin reached -$6.00 per hundredweight. For margins of -$6.00 and worse (more negative), the long speculators then tended to increase long positions—the actions needed to "turn" the market.

There were no significant and negative correlations for long hedgers at these extremely negative margins. There were significant negative correlations for the intervals in the $-3.00 to -$6.00 range when the response to change in feeding margins (CHFM) was lagged three to four weeks. This suggests that (1) long hedgers reacted slowly to sustained negative moves in the margins, and (2) a large cumulative move in margins was required for the long hedgers to act. As the margin levels deteriorate to -$6.00 or worse, it tends to be the large speculators that come into the market with actions that turn the market. Table 2 shows no statistically significant and negative estimates for CHFM and CHLONGH for any of the subsets of negative margins. It does appear that the long speculators are the group that reacts to the extreme negative margins.

It is worth repeating that the "zero line" in the margin calculations may not represent a "true" equilibrium. The zero line is the margin being offered over variable costs of feeding as adopted from the USDA series in the Situation and Outlook reports. The markets, during the 1983-87 period, could have been seeking to discover the price associated with some equilibrium margin above or below the one used in this research. A 95 percent statistical confidence interval, calculated using the model which generated the results of Table 2, gave similar indications about the limits. The lower "limit", comparable to $L_L$ in Figure 16, was estimated at -$6.76 per hundredweight. There is at least limited additional evidence, therefore, that it is the -$6.00 to more negative margins that prompt action, primarily by long speculators, to move the market away from a major negative imbalance.

For the negative imbalances, it is the large speculators who turn the market back toward equilibrium. This appears to be especially true when very negative (- $6.00 or worse) margins are being offered.

For a market that is showing large positive, perhaps excessive, margins the evidence as to who "turns" the market is not as clear. The relationship between CHFM and CHSHORTS when margins are positive and decreasing is negative, but it is not statistically significant with a t-ratio of only -0.463. For the positive/decreasing subset of the margins, a negative relationship between CHFM and CHSHORTS would be consistent with the actions needed by short speculators to return the market toward equilibrium or balance. Increases in short positions would then be associated with negative first differences in the margins, or declining but still positive margins.

The coefficient on CHSHORTH is negative and the t-ratio, while still relatively small, is greater than 1.0 in absolute value for the positive/decreasing subset of margins. There is thus limited statistical support for the hypothesis that short hedgers are the most effective group in recognizing and responding to excessive positive
margins. The relationship for short speculators is correct (negative) but the statistical measure is too weak to place confidence in any conclusions.

A correlation analysis involving the data sets disaggregated to discrete $1 intervals helps to clarify the situation. For positive margin levels above $2.00 per hundredweight, the correlation between CHFM and CHSHORTS is negative, quite large in absolute value (-0.514), and is statistically significant. For changes in feeding margins lagged across two and three weeks, the negative correlations are even larger in absolute value (-0.76 to -0.77) and are extremely significant statistically speaking with a probability of the relationship being due just to chance as low as 0.0018.

There is some evidence, then, that the upper limit (UL) in Figure 16 is around margins of $2.00 per hundredweight. The large short speculators were apparently active at margins of $2.00 and greater in the 1983-87 time period in turning the market back toward equilibrium. The correlations between CHFM and CHSHORT are negative at the $2.00 margin level, but are not statistically significant. For the CHSHORT measure, those correlations continue to be negative for the $1 to $2 and the $0 to $1 intervals and they are statistically significant. This suggests short hedgers tended to enter the market with increased selling pressure at small positive margins after the market had "topped", with their increased positions tending to turn the margins lower given the negative correlation.

For market imbalances characterized by positive margins, it is the actions of large speculators that turn the market back toward equilibrium. Hedgers add to the selling pressures that restore equilibrium, but some of their actions come after the market has been turned in terms of the margins being offered.

The -$6.00 and +$2.00 start to appear as the "limits." It is not apparent why the margins do not average zero, with less tendency toward high frequencies at the negative levels. It could be that the margin calculations are too high, but they are based on variable costs. Alternatively, it could be that the cattle feeding sector was heavily burdened with excess capacity in the mid-1980s. The total cattle inventory was down sharply from the record high of 132 million in 1975, and there were fewer light cattle to go into the feedlots than was the case prior to 1980. If the excess capacity argument is accepted as valid, it may be that the market was equilibrating toward a zero margin, using variable costs in calculations, for the very best cattle feeders in the 1980s. Any average series, such as the USDA Series used in calculations, might then overestimate the variable feeding costs and show a preponderance of negative margins.

Regardless of the true level of the limits, it does appear that trading group behavior changes as the market moves to extreme imbalances. This is especially true for large speculators. For negative margins, long speculators show no strong inclination to increase their positions in the presence of declining margins until the margin is -$6.00 per hundredweight or more negative. Then, long speculators add to their positions and large short speculators show a tendency to reduce their positions, both at a statistically significant level, and the market moves back toward equilibrium. (It is possible that the increase in long speculative positions is being fueled by decreases in the short speculative position, but then data do not allow that level of specificity.)

The behavior of long hedgers shows less apparent reactions to margin changes. Long hedge positions tend to increase as the margins decrease in the -$2 to -$5 range, but the lagged reaction tends to come only after the margins have decreased across a two- to three-week time period. The only group that shows statistical evidence of reacting to the situation, as the market dips to -$6.00 margins and lower, within the same week, or on a week-to-week basis, is the large long speculators.
The -$6.00 to +$2.00 is a very "loose" set of limits. More work is needed before any major conclusions are drawn from these levels. If the equilibrium or baseline level were reduced by $2.00, then the limits would be -$4.00 to +$4.00. But the division into positive and negative, etc. would then change and the results would change.

The discussion of results to this point implies that large traders, especially large speculators, respond to changes in trading levels of the futures market and related margin levels. The presence and nature of that response was further analyzed by regressions of the following general form:

\[
\text{LONGS} = f(\text{LONGS}(1); \text{CHFM}; \text{TREND})
\]

where

\[
\begin{align*}
\text{LONGS} &= \text{positions held by long speculators}, \\
\text{LONGS}(1) &= \text{LONGS lagged 1 week}, \\
\text{CHFM} &= \text{week-to-week change in feeding margin, and} \\
\text{TREND} &= \text{a linear time trend variable.}
\end{align*}
\]

Across the subset of all negative margin changes, the coefficient on CHFM was positive and highly significant (t-ratio = 3.743). The results indicate long speculators tend to react to increasing margins by increasing long positions. This response is especially important when the margins are negative because it tends to move the market back toward a balance. It is also the case, it should be noted, that the coefficient on CHFM for long speculators was positive for all positive margins. This suggests increased long positions in response to increasing positive margins, and that would tend to be de-stabilizing by pushing the margin up to possibly excessive positive levels.

For both positive and negative subsets of the margins, the coefficients on CHFM for short speculators was negative and highly significant (t-ratios above 3.0). For negative margins, short speculators decrease their positions in response to increasing but negative margins, helping to move the market back toward a zero-margin level. For positive margins, short speculative positions are increased in response to decreasing margins, again pushing the market back toward a zero-margin level.

Hedgers show a less pronounced tendency to respond to margin changes. Earlier, when the margins were expressed as a function of trading group behavior, long hedges were seen to exert at least a modest restraining influence as margins dropped below zero and started to decline still further. But in a formulation where CHLONGH was expressed as a function of a one-week lag of CHLONGH, CHFM, and TREND, the coefficient on CHFM was not statistically significant for either the subset of positive margins or the subset of negative margins.

As would be expected, short hedgers show a significant response to changes in margins when the margins are positive. The coefficient on CHFM is negative and highly significant with a t-ratio of -3.135. As positive margins increase, the negative relationship suggests short hedgers tend to reduce positions, and this action would be de-stabilizing. When the positive margins are declining, however, short hedgers respond with increased short hedges, helping to push the market back toward a zero-margin equilibrium. These results do, of course, tend to be consistent with what happens in practice. Short hedges are "covered" in an upward trending market that is offering larger positive margins and then are replaced (or placed) when the market "tops" and starts back down.

Analysis of trading group behavior indicates that large speculators are the most active group in turning the
market back toward some equilibrium level. This is especially true when the feeding margins being offered are negative. But the "turns" tend to be at a low -$6.00 per hundredweight (given costs used in the analysis) and therein lies an important question. If cattle feeders, with their access to proprietary information, were allowed to participate in the price discovery process would they be even more effective in recognizing and correcting market imbalances?

There is every reason to pursue this area of work. It is reasonable to hypothesize that a change in policy to allow, even encourage, cattle feeders to get involved in the price discovery process would yield significant benefits to producers and to consumers in the form of a more efficient, effective, and less volatile and risky beef sector.

CHAPTER 6

Annotated Bibliography

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Introduction

This chapter presents reviews of recent research in the area of livestock pricing. The bibliography is structured under the following general headings: Livestock Price Forecasting, Demand Analysis, Livestock Price Discovery, Structure/Concentration, Efficiency of Livestock Futures Markets, Basis and Basis Risk, and Futures Markets Research Reviews. Literature included in this bibliography dates primarily from the latter half of the 1970s through early 1992. The citations in the section "Futures Market Research Review" provide historical reviews going back into the 1950s and 1960s. Material comes from a broad range of international, national, and regional journals, as well as conference proceedings, research bulletins, and presented papers. Each annotation is intended to provide a brief summary of the article or paper. Any errors in reporting on the work reviewed is the responsibility of the bibliographer.
Livestock Price Forecasting


Cointegration techniques are applied to daily price series for live cattle futures contracts and live cattle direct trade. The authors seek to identify if live cattle futures and the Texas-Oklahoma cash market for slaughter cattle are cointegrated. Data over the period August 1985 through August 1986 are examined. Tests of long range forecasting were also analyzed. Examination and tests of the data indicate that cash and futures prices represent a random walk series. Marginal support was found for cash prices and nearby futures prices being cointegrated. However, no evidence of cointegration was found for cash prices and distant futures contract prices. The results of this analysis suggest cointegrated based models outperform univariate autoregressive based models in out-of-sample forecasts. This analysis confirms previous research which suggests the greater the distance over time (cash and distant futures prices), the greater the independence between the series.


The imputed carcass value on the boxed beef cutout has become an alternative reference price for processed beef since the USDA did away with carcass quotes. This article examines the use of boxed beef prices as a leading indicator of fed cattle prices. Temporal relationships between boxed beef cuts, carcass prices, and fed cattle prices are examined. Daily USDA wholesale beef price quotations for central U.S. f.o.b. and daily fed Choice 900-1100 pound steer prices for Texas-Oklahoma direct trade are analyzed. The period 1980 through 1983 is used to fit vector autoregression models and then 1984-1985 is used as an out-of-sample test period to evaluate the forecasting ability of models. Model performance was evaluated relative to a random walk model based on the last period's price. The boxed beef cutout price tended to reflect market conditions more quickly than individual cuts. A 15-day lag of boxed beef prices was consistently present in the models estimated, suggesting that custom or storage arrangements may influence individual beef cut prices. Strip loin prices and other `middle cut' prices were found to lead fed cattle prices.


The pork cycle has been the focus of many research efforts. The authors contend that a pork cycle in its basic concept is disturbing to economists. If a predictable cycle exists, producers could respond in a countercyclical fashion and earn economic profits. This countercyclical behavior, though, would smooth out the cycle, causing the cycle to disappear. This paper examines if using a linear systems model of the hog-corn ratio is inappropriate if the underlying system is actually a nonlinear system. The concept of "chaos" is introduced, and it implies a random output for certain nonlinear dynamic systems. The implication of chaos is that linear approximations of nonlinear systems can produce erroneous results. In the context of commodity forecasting, linear models will not make a worthy base from which to extrapolate. The authors examine if the hog-corn ratio can be represented by a linear or non-linear dynamic system. Quarterly data from the period 1910-1984 are
analyzed. Using an autoregressive form and a GARCH form, the authors test if the pork cycle as a linear model appropriately represents the price dynamics of the hog market. Traditional tests suggest the linear model is appropriate. Using tests to distinguish between a random process and a deterministic chaotic process, the autoregressive estimation does not capture nonlinear dynamics. The GARCH process does capture some of the nonlinearities of the dynamic process. Specifically, the authors find evidence to support the existence of asymmetries between the expansion and contraction phase of the pork cycle.


This research evaluates the forecasting performance of nine alternative techniques of generating monthly and quarterly predictions of Kansas City feeder cattle prices. The authors contend that, given the range of alternative forecasting techniques available, a competition between alternatives provides important information on how techniques differ and which applications they are best suited to. The evaluation of techniques is based on out of sample forecasts using quantitative analysis of mean error, root mean square error and Theil's Inequality Coefficient. A qualitative measure of accuracy, based on contingency tables for classifying turn points, is also used. The nine forecasting techniques evaluated were; a decomposition of trend where cyclical and season elements of the data are identified and then reintegrated into the data to generate forecasts, an exponential smoothing of data based on age of observation, a univariate Box-Jenkins model, parsimonious regression models, bivariate stochastic models, two vector autoregressive system models, and finally two multi-equation structural systems models.

The evaluation of these models results in conclusions consistent with similar research conducted in other sectors that suggests econometrically sophisticated methods do not necessarily produce more accurate forecasts than simpler methods.


The forecasting performance of the major methods currently employed by the USDA to forecast production and prices are examined in this paper. The analysis is conducted on forecasting one year ahead production and average prices for beef, pork, and chickens. Forecasts are made for 1981 through 1990 and, where appropriate, models are re-estimated each year to incorporate new data. The techniques and forecasts analyzed are the World Agricultural Outlook Board Interagency Committee forecast, the ERS Annual Livestock Model, and an autoregressive moving average (ARIMA) model estimated for the analysis. Two composite weighted averages forecasts were constructed, one of previous forecasts and a second of time series and econometric models. Forecasts are compared to a naive model, which assumes no change from the previous year's actual levels. None of the methods or techniques exhibit any bias. For beef production and prices, simple naive predictors were superior to any of the forecasting techniques analyzed. For pork production, none of the techniques are superior. The World Outlook Board and a weighted average of previous forecasts are superior for predicting pork prices. The World Outlook Board provides superior forecasts of broiler production while none of the methods provide superior forecasts of broiler prices.


CHAPTER 6: ANNOTATED BIBLIOGRAPHY
In this paper, a new technique for building Vector Autoregressive (VAR) forecasting models is developed and applied to the U.S. hog market. VAR forecasting models tend to be afflicted with a great deal of variability associated with over-parameterization. The author provides a thorough discussion of the strengths and weaknesses of the two main approaches to dealing with over-parameterization—the Exclusion-of-Variables approach and the Bayesian Estimation approach. Based on this discussion, the author develops an alternative approach that uses the data to specify the ordering of the series for potential entry into an equation but allows the researcher to use prior knowledge to partially or totally specify the ordering. The approach is known as IDLAGS (Identity Lags). Using data from the second quarter of 1961 through the fourth quarter of 1976, six alternative models include an unrestricted VAR, a Tiao-Box VAR, two Bayesian VAR models, and two IDLAGS. Out-of-sample forecasts are generated for the first quarter of 1977 through the fourth quarter of 1984. The performance of the forecasting models is evaluated using absolute errors and root, mean-square errors. Based on these criteria, the IDLAGS model with prior knowledge provides the best forecasts.


This paper reports on a study examining the impact of physical characteristics on feeder cattle auction prices. Data on prices and physical traits of feeder cattle is collected from seven weekly Kansas feeder cattle auction markets during the fall of 1986 and the spring of 1987. Data on cattle weighing 300 to 899 pounds for 17,121 lots of 138,027 head are analyzed. The authors stratify the data by sex and weight into four categories to yield a relatively more homogeneous set of prices and physical characteristics for analysis. The stratifying of the data implies that buyers would be bidding on certain types of cattle and the impact on price of specific physical characteristics will, as a result, be more discernible. In addition, the models estimated in this research explicitly incorporate market expectations by including feeder cattle futures prices as an explanatory variable. The variables that are found to be important in explaining feeder cattle prices are: weight, lot size, health, muscling, frame size, condition, fill, breed, presence of horns, and time of sale. Fall buyers tend to bid up the price on heavier and bulkier animals and discount lighter on their cattle while spring buyers tend to do the opposite.


This paper reports on the estimation of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models for the retail price of beef, pork, and chicken. The GARCH method allows lagged values of the conditional variance to enter the estimation process. This implies that conditional variances can change over time. Therefore, an adaptive learning process is allowed. The authors provide a thorough discussion of the assumptions underlying the GARCH process, and key factors for consideration in using this technique. Retail prices for beef, pork, and chicken are modeled using this approach. Given the relative stability of meat prices in the 1960s and early 1970s and then the volatile prices of the late 1970s and 1980s in conjunction with evidence of structural change in demand for meat, it is reasonable to expect that the forecast variances associated with these prices would not be constant. The authors estimate GARCH and autoregressive models using quarterly USDA data from the first quarter of 1967 through the fourth quarter of 1986. the GARCH process does not necessarily improve forecast performance, but it does provide more information concerning the precision of forecasts. Analysis of confidence intervals highlights the improvement in precision of forecasts. Conclusions from this analysis indicate that retail meat prices were nonstationary during the 20-year period analyzed.

The authors apply a nonparametric statistical procedure known as "bootstrapping" to the problem of building confidence intervals for point price forecasts of pork supply. The thrust of this article is a description of why and how bootstrapping confidence intervals on single equation forecasting equations can be performed. An appendix details the bootstrapping approach to construction of confidence intervals. Bootstrapping is a computer-intensive method of generating probability distributions when the precise small sample distribution of forecasts are unknown. In this case, the approach taken is to generate a simple OLS model in the form of \( y = Xb + e \) and then randomly select with replacement \( n \) residuals from the vector \( e \) and place the drawing in the \( n \times 1 \) vector \( e^* \), then estimate the dependent variable with the OLS estimated coefficient and the artificial residual. The additional data are then used to re-estimate the OLS coefficient. These re-estimated OLS coefficients are used to construct the joint probability distribution of the OLS estimates. Bootstrapping draws random samples from the available sample with replacement to estimate population variance. In the example reported here, the resampling procedure was conducted 1,000 times. The major limitations to this procedure are cost of computer time and lack of software.


This report examines alternative forecasting methods for quarterly retail price of beef, pork and chicken. Because of the over predicting of livestock prices in the 1980s by econometric models, the authors contend there is a need for models that offer greater flexibility. For beef and chicken, stochastic coefficient models were superior to the standard fixed coefficient econometric models. The Cochran-Orcutt and maximum-likelihood procedure enhanced the forecasting of pork prices. This report indicates that a constant relationship between explanatory variables and endogenous variables in livestock demand is not correct. The authors suggest that the own-quantity coefficients for meats are relatively stable which suggest fairly stable consumer preference for meats. In addition, they suggest that the real expenditure coefficients of beef and pork alter their value in line with the business cycle. The macroeconomic conditions, the authors suggest, may have a profound effect on determining red meat prices.


The authors demonstrate the limitation to using the turning point method of qualitative evaluation for forecasting models. Naik and Leuthold define turning point (TP) as existing if \( P(t) > P(t-1) < P(t-2) \) or \( P(t) < P(t-1) > P(t-2) \), and define no turning point (NTP) as existing where neither of the above conditions are observed. Standard turning point qualitative performance evaluations have employed a 2 x 2 contingency table which compares natural and forecasted turning points and no turning points. The qualitative accuracy of forecasts is measured by comparing the number of consistent actual and forecasted turning points and no turning points with the total numbers of forecasts. The authors point out that this method fails to account for peak and trough NTPs and upward or downward NTPs. The failure to consider these differences could result in misleading interpretation of forecasts. Naik and Leuthold suggest an alternative is to develop a 4 x 4 contingency table that distinguishes no peak TP from trough TP and upward NTP from downward NTP. They define the categories as follows: peak turning points (PTP) \( P(t) < P(t-1) > P(t-2) \), upper and no turning point (UNTP) \( P(t) > P(t-1) > P(t-2) \),
Qualitative accuracy is measured by comparing the number of forecasts that were indicating correct directional movement with the total number of forecasts. The authors contend that this form of analysis provides more information about the accuracy of forecasts.


This report describes in detail econometric models of the cattle, hog and broiler industries. The objective of the model building effort was to provide a tool to situation and outlook analysts and to emphasize identification of a structured model to aid outlook analysts in making decisions. The model is useful in analyzing "what if" scenarios. Ordinary least squares (OLS) was used to estimate models over the period 1970-81. The model were validated for 1970 through 1981 and then tested via an out-of-sample test for 1982, 1983 and 1984. Validation criteria used were turning point errors, mean absolute percentage error and Theil's inequality (U2) coefficient. Models proved to have some reliability problems in the out-of-sample time periods. The author attributed the problems to government programs and drought. This bulletin provides a comprehensive detailing of biological and economic factors to consider in modeling the livestock industry.


The article attempts to overcome weaknesses in previous research which has modeled the complex dynamics of cattle inventories in the post World War II period. In order to avoid problems associated with using the same data to select an appropriate model and estimate parameters, a preliminary analysis was conducted in Montana. The authors did not impose apriori restrictions on the lag structure. They attempted to include variables that have indirect effects based on the rational expectations hypothesis. Stochastic and nonstochastic components were partitioned to permit clearer interpretation of the dynamic structure. The authors identified a cyclical path in cattle inventories of about eleven years. This cyclical behavior is the result of a cyclical path in cattle prices that pictures a supply response that has both economic and biological constraints. The authors note that in modeling cattle inventories, researchers need to be cognizant of regional shifts in cattle production that suggest it may be more appropriate to develop regional rather than national models.


Bessler uses vector autoregression to identify economic relationships in the U.S. hog market. The vector autoregressive technique estimates reduced-form relationships across every variable in a multi-variable system. This approach offers flexibility in that most economic relations are dynamic. The variables and lag lengths used ought to be more practical with vector autoregressive analysis than with static econometric analysis. A system of U.S. hog prices, sow-farrowings, hog slaughter, corn prices, and disposable income, for quarterly data from 1958 through 1981, was analyzed. Sow farrowings were affected to the largest extent by hog prices at lags of six quarters or less. The effect of corn prices on sow farrowings lasted eight to 10 quarters. As would be expected, hog slaughter is affected by sow farrowings at lags of four quarters and less.
Dunlap, Lawrence E., John R. Franzmann. "Estimating the Quarterly Number of Cattle on Feed." 

Dunlap and Franzmann develop a very simple model to forecast the 13-state quarterly cattle-on-feed inventory. The model specifies the 13-state cattle-on-feed inventory as a function of the number of cattle-on-feed in seven states the month prior to the quarterly report and the quarters of the year. The model explained over 93 percent of the variations in cattle-on-feed at the 13-state level for the period estimated 1972 to 1979. In 14 quarters outside of the sample period, this model's largest error was 4.7 percent and smallest error was .1 percent.


This study updates Meikle's study (American Journal of Agricultural Economics, February 1977.) The authors added quarterly data from 1976 through 1982. Using the same polynomial distributed lag models as Meikle developed, the authors estimate the two models over the 1970-82 time period and over the two shorter periods of 1970-75 and 1976-82. The time period 1970 through 1975 was a period of highly volatile prices. For 1970-75, the hog-corn ratio equation produced a coefficient of determination of .551 compared to .991 for the hog-feed equation. During the 1976-82, period the hog-corn ratio equation produced a coefficient of determination of .931 compared with .957 for the hog-feed equation. For the 1970-82 period, the hog-corn ratio equation had a coefficient of determination of .498 and a marginal F-statistic while the hog-feed equation had a coefficient of .908 and a very significant F-statistic. These results tend to confirm Meikle.


A rational distributed lag model of quarterly fed cattle and feeder cattle prices is presented in this article. Systematic components of the lag structure are estimated using nonstochastic difference equations. The approach minimizes problems from lack of proper error structure identification. The rational lag models are compared to autoregressive moving average error processes and static specifications with serially correlated disturbances. The author contends that adjustment of quarterly cattle prices to changes in exogenous variables is not instantaneous, suggesting the market is constrained by psychological, economic and technical factors. The results of Marsh's analysis indicate that a $1.00/cwt. increase in the price of slaughter cattle will raise contemporaneous feeder cattle price by $.85/cwt. The long-run effect (the period of time in which a change in the exogenous variable was completely felt in the dependent variable) was $1.50/cwt. An increase of $1.00/bu. in the corn price reduced contemporaneous feeder prices by $1.00/cwt., but over the long-run the reduction in feeder cattle prices was $7.87/cwt. The effect of a change in placements on feeder cattle prices peaked out in two quarters and stabilized in ten quarters. The impact of a change in fed cattle prices peaked out in one quarter and stabilized in four quarters.


To address problems econometric forecasting models have had in making accurate intermediate-term forecasts of pork supply and hog prices, the authors employ a stochastically and systematically time-varying parameter specification. The framework used in this analysis is a quarterly recursive equation of U.S. hog supply vs. a

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function of hog and feed prices and quarterly intercept shifters. A randomly and systematically varying coefficient model (RSVC) as well as an ordinary least squares (OLS) model, were used. The RSVC model was employed because economic relationships are not static over time, and the use of intercepts and slope shifters is not adequate in modeling gradual changes. The authors sought to test three specific hypothesis concerning changing economic relationships in hog production. The first is that there has been a systematic decline in production responses to hog prices over time due to the move to capital intensive confined production units, resulting in a smaller amplitude to production cycles. The second hypothesis tested is that because of confined production and increased specialization, seasonal variation is production has declined. Finally they examined an hypothesis that when grain prices rise, producers market their grain directly rather than indirectly as hogs. The authors concluded that their empirical evidence rejects the hypothesis that hog production has become less responsive to price. They found no random or systematic variation in the coefficient for hog prices. Their results do suggest that there has been a decline in season variation of hog production. The analysis carried out showed some inverse responsiveness to grain prices when grain prices rose, but feed prices appeared to be an insignificant explanatory variable. The RSVC model provides more accurate forecasts for the short and intermediate periods than the OLS model.


This article demonstrates the usefulness of modifying economic forecasting models of price to include a forecast of direction of price movement. The models developed forecast the price change between fall feeder calf prices and spring yearling prices. The implicit contention is that price change is made up of two components: direction and magnitude. Forecasts of prices can be enhanced if the direction of the price movement has also been forecasted. Discriminant analysis is carried out for the period 1925 through 1969, and the period 1970 through 1980 was used as an out-of-sample test of the forecasting ability of the model. In forecasting the direction of price movement, the authors concluded that the discriminant model performed slightly better than the regression framework. If the correct directional variable is used, forecasts of price magnitude are improved. However, if incorrect forecasts of direction are used, the forecast of price change was worse than if no directional variable were included.


This article compares four simple methods used to predict hog prices 16 weeks ahead and 46 weeks ahead. The 16-week period reflects the time required to finish a 50 lb. pig. The 46-week period reflects the time required to breed a sow and finish the pigs at 230 lbs. The author compared a naive regression equation which says future hog prices are dependent on current hog prices with regression models and with future price dependent on the current futures market quote for delivery in 16 weeks or 46 weeks. The other two methods compared were a harmonic regression model that identifies cyclical trends and an economic regression model that relates price to supply factors. Results indicate that the futures market provides superior predictive ability over the naive model. The harmonic regression predicted the best and suggested a 2.75-year short cycle and a 9-year long cycle for hog prices.


This study examined and compared the estimation variability of eight methods of forming price expectations for fed cattle and slaughter hogs. Hypothetical feeding situations for eighteen continuous four-month feeding
programs between June 1969 and February 1975 were examined. The models examined were:

1. The expected livestock price for feeding period is equal to the corresponding weekly price from the previous year.
2. Forecasted price for the end of the feeding period is the price at the beginning of the feeding period.
3. The expected prices were randomly selected from the previous 52 average weekly quotations.
4. Expected price was a one-year average of previous prices.
5. The expected price was based on an eight-month linear trend of prices extrapolated four months into the future.
6. Expected price was the futures quote for the relevant month at the beginning of the feeding program.
7. The price expectation was drawn from the Successful Farming outlook.
8. Expected price was drawn from the USDA Livestock and Meat Situation outlook.

The price expectations were evaluated based on a measure of bias and the variability of the estimate. For cattle, the USDA outlook provided the least bias and lowest variability, the Successful Farming outlook provided the greatest bias and the highest variability.

The analysis for hogs indicated the USDA had the lowest variability but was fifth in bias, whereas a simple linear trend provided the least bias in expectation and the second lowest variability.


In this note, Meilke updates the work done a decade earlier that suggested the hog-corn ratio was a deficient proxy for profitability in the pork sector. Meilke's objective was twofold. First, to determine the supply response of US pork producers to changing hog and feed prices over time, and second to determine if the hog-corn ratio is an adequate predictor of hog supplies when the prices of hogs and feed are volatile. Polynomial distributed lag models for two time periods, 1960-69 and 1970-75 were used. Two equations were estimated for commercial pork production. In one, the hog-corn ratio and seasonal dummies were explanatory variables. In the second equation, the price of hogs and feed prices along with seasonal dummies were the explanatory variables. For the 1960-69 period, both functions explained over 90 percent of the variation in hog supply. For the 1970-75 time period, the hog-corn price ratio equations dropped to explaining 67 percent of the variations in hog supply while the hog and feed price equation explained 98 percent. Meilke notes that over the time periods examined, the response of hog supply to change in hog and feed prices has become more rapid. The elasticity of supply response with respect to both hog and feed prices are three times as large in 1970-75 as in the 1960-69 period.


The authors set out to develop a quarterly prediction model for live hog prices based on the structural relations that are the price determining forces in the sector. Quarterly simultaneous equations models for predicting live hog prices consisted of a stochastic price consumption relation for pork, a stochastic relation between live hog prices and retail pork prices, a stochastic cold storage stock of pork products valuation, and a market-clearing identity for pork product. The models were estimated separately for each quarter with 15 years of data beginning in 1957, with 1972 through 1974 reserved for an out-of-sample test. It was concluded from this work that the predictive accuracy of structural models improves when a subset of all exogenous variables are used based on
the consistency of coefficient signs.


This article develops quarterly three-equation models designed to predict wholesale cash prices for fresh pork bellies at Chicago. The models were fitted to quarterly data for April-June 1957 through January-March 1971. Separate equations were estimated for each quarter. The authors felt it would be inappropriate to use dummy (or 0-1) variables to distinguish between quarters. The models fitted were a price consumption relationship, a demand for storage relationship, and a supply-demand identity. The demand for storage is unique in this study. The authors suggest that it is the major contribution of the models in terms of methodology and a major factor in the success of the equations in predicting prices. Storage stocks are presumed to be held because of expectations of storage profits. Estimation problems resulted in the April-June model being estimated with total data while the three remaining quarterly models were estimated with per capita data.
Demand Analysis


Three alternative methods of estimating demand elasticities for Choice beef are compared and evaluated. The author seeks to gain insights into the tradeoff between estimating demand elasticities with elaborate complete systems approach or a less complex econometric system. The first effort is a traditional marketing margins approach with a processor market. Margins are hypothesized to be either a linear absolute constant or a fixed percentage. The criticism of this approach is that it is invariant with respect to volume traded in markets. The estimated demand elasticity may underestimate the true elasticity because of the assumption of fixed proportions of marketing inputs to farm output. The second approach is a modified margin. This method allows for simultaneous change in retail demand, farm supply, and marketing costs. An elasticity of price transmission is derived from this approach as well. The final method evaluated is to econometrically estimate the inverse demand function for retail and farm level prices. The period 1977-1987 is examined using quarterly data on beef supply, disposition, and prices. While the demand elasticity estimated with the modified margin on the incomplete demand system or inverse demand function differ, the difference is not pronounced. The author compares these results with other researcher's results using complete demand systems approaches and finds large differences in elasticity estimates. The modified margin approach underestimated the demand elasticity by as much as 52 percent relative to those estimated with a complete demand system approach.


The authors examine previous results of empirical studies of meat demand and conduct analysis of their own on the stability of meat demand. They start from the contention that the literature on meat demand is littered with whimsical specification choices and fragile results. The choice of demand function specification is vital because results are always conditioned on that specification choice. Because empirical results are subject to the untested hypothesis that the chosen functional form is correct, something which economic theory provides little information about, the choice of functional form is always whimsical. The analysis in this study first shows how easily specification errors lead to erroneous conclusions. They generate data using a stable model and then fit a linear demand equation and test for stability, finding erroneous evidence of structural change using this "test". The authors also examine the power of nonparametric tests for finding evidence of structural change. In general, nonparametric tests are capable of detecting structural change. If many trends or factors are occurring simultaneously, the power of the tests is lower than desired. The authors conclude that using aggregate per capita time-series data makes it difficult to learn much about demand. Aggregate data do not permit the rejection of hypotheses about stable preferences without evidence concerning functional form.


This study used a procedure developed by the Western Livestock Marketing Information Project to allocate beef production to table cut production and ground beef production. The procedure is based on time invariant factors for the production of ground beef from different classes of beef animal. Using this information, the authors develop a data base for the period 1962-1989. The absolute price version of the Rotterdam model is employed.
to derive a system of demand equations. The analysis is then conducted on the new data set, based on allocations of production to ground and table cut beef, and on a data set for fed and non-fed beef production. Non-fed beef in previous research has been used as a proxy for ground beef production. A non-nested test for specification error indicates the ground beef-table cut specification was superior to the non-fed beef specification. Ground beef was found to be a substitute for poultry and its cross-price elasticity to table cut beef is small.


With the use of flexible functional forms in demand analysis, consumer preferences can be modeled with restrictions on the substitution or complementary relationships of goods. The authors contend that the results from this form of analysis will often conflict with prior beliefs. For example, partial demand systems are expected to satisfy the conditions of symmetry, homogeneity, monotonicity, and concavity. Violations of these conditions suggest either a misspecification problem or a structural shift in the demand system. The authors develop a Bayesian procedure that produces constrained parameter estimates along with an estimate of the probability that the restrictions are valid. An empirical analysis using an Almost Ideal Demand System is employed on Canadian data for beef, pork, poultry, and fish from 1960-1988. The authors note that while Canadian beef and pork markets are similar to the U.S., the poultry market is not similar because of supply management systems. Evidence to suggest a negative trend in beef and pork demand is found, while the poultry and fish demand trend is positive.


Given that variety meats have declined in terms of per capita consumption and as a percent of total red meat consumption in the U.S., the authors seek to identify characteristics of consumers who do consume variety meats. The authors seek to identify and quantify the effects of factors on the consumer's willingness to purchase variety meats. The analysis is conducted on a data base collected by surveying 3,340 consumers in three Kansas metropolitan areas between September 1985 and April 1986. The authors employ logit analysis to evaluate whether an individual's ethnic heritage, age, income level, household size, education, and sex influence the purchase decision concerning variety meats. The results of the analysis suggest ethnic heritage has a positive effect on the decision to purchase, as does size of household. Household income level is negatively related to the purchase decision. Sex and education do not exhibit a significant influence. Likelihood to purchase increases with age up until about age 54, and then starts to fall.


The authors focus on the role of "data" in demand analysis for meat. The research was prompted by the number of research papers on meat demand and the lack of a consensus in research results. The authors bring an intimate knowledge of the data and methods of construction to time series of data from being involved first hand in the production of these data series. In terms of meat consumption, data issues, such as how data is adjusted to form the retail consumption series from carcass series, are highlighted. The lack of adjustments in the
conversion factors for certain retail consumption series is a problem. The authors note that what these series represent is not completely consistent across different classifications. The construction of price series and price indexes for meat is discussed. Major changes for methods of producing these series are noted. Because of changes in collection methodology over time, the authors contend that there are limits to the comparability of data over different time periods. A brief empirical test of how differently defined series can influence results is shown by estimating an inverse demand function for broilers. While the differences are slight, there are definite differences in the results because two different series were used to test the same relationship.


Preference changes in consumer demand for meat are analyzed in the context of technological change. This is an extension of the production theory of disembodied technical change. Structural changes in preferences are represented by time-varying multiplicative terms within a translog utility function. Time-dependent parameters follow patterns appropriate to structural change from the diffusion of information. This approach is consistent with analysis in marketing literature concerning the logistical patterns of time-path diffusion processes to describe the adoption of new products. This methodology is at variance with many empirical analysis that use statistical methods to identify points of structural inconsistencies during the period examined. Annual per capita indexes of red meat, poultry, and other food for 1953 through 1989 are analyzed. Based on estimations of smoothed logistic function models of translog functional form utility functions with a multiplicative term, evidence of structural change in demand for red meat is found.


This paper was prepared for a lay audience and is designed to stress basics of demand for meats. Emphasis was placed on the distinction between a change in quantity consumed (per capita consumption) and a change or shift in the entire demand schedule. Purcell documents what happened to the demand for beef and pork between 1977 and 1988, and demonstrates how the observed decreases in demand prompted industry contraction, especially in beef. He shows that the inflation-adjusted price for beef had to drop over 30 percent between 1979 and 1986 to entice the consumer to accept essentially a constant per capita supply. Citing this development as a "textbook" case of declining demand, Purcell suggests strategies that the industry needs to pursue to reverse the negative trends. Increased activity in product development to match the needs of a changing consumer is cited as a necessary condition to improve the demand situation.

The demand for beef, pork, lamb, and broilers is analyzed across the 1960-1987 time period. Quarterly data are employed, and the four quarters of 1988 are employed as an out-of-sample test of the models. Purcell indicates that the traditional economic demand shifters, such as prices of competing products and consumer incomes, are inadequate to explain the developments in beef, pork, and lamb during the 1977-87 time period. Single equation price and quantity dependent models are analyzed, and time-related patterns in the model residuals indicate preference-related shifts in demand. Yearly shift dummies were included, and are found to be statistically significant and increasingly negative for beef from 1977 through 1987 and for pork from 1977 through 1986. Out-of-sample tests suggested the demand for pork, which increased in 1987 for the first time in the 1980s, continued to increase in 1988. The same tests for beef suggested the demand for beef was starting to stabilize, but had not increased. During the 1980s, the same type of analysis suggested the demand for ready-to-cook broilers recorded several year-to-year increases as increased per capita supplies are moved into consumption at higher inflation-adjusted prices.


This paper examines the evidence of the existence and nature of structural change in meat demand. The authors assume weak separability in order to examine only beef and veal, pork, chicken, and fish. Quarterly price and quantity data for these goods are examined at retail for 1967 through 1987. A linear version of the almost ideal demand system (AIDS) model is estimated. The model is estimated using first differences and an interactive, seemingly unrelated regression procedure, which converges to a maximum likelihood estimator. The model estimated provides a transition function to identify a structural change path. Structural change was allowed to affect all parameters simultaneously. The results suggest a structural change took place between the fourth quarter of 1975 and the third quarter of 1976, indicating a fairly rapid transition to a new demand regime. The authors examine estimates of elasticity but can not find statistically significant evidence to indicate elasticities have changed. In this finding, the authors suggest that emphasizing the effect of structural change on estimated elasticities may be unjustified. As an alternative to examining elasticities, the authors suggest focusing on biases in consumption patterns. By examining expenditure shares, a measure of bias is developed. Their analysis suggests the presence of a significant bias against beef in favor of chicken and fish, resulting from structural change. Structural change is found to be neutral on pork.


This article addresses two questions. First, do consumers choose among broad groups of meats or meat products? If they choose among products, meats need to be disaggregated into their constituent products. Secondly, does disaggregation of meat into products in a meat demand model provide insight into causes of structural change? The authors employed Deaton and Muelbaner's Almost Ideal Demand System to answer these questions. The models were estimated with annual data covering the period 1965-1985. Their results suggest that consumers choose across all meat products at once or possibly among high quality and low quality products of different meats. This suggests the use of aggregate chicken and beef in demand analysis could create bias in estimated demand parameters. The authors suggest a preference change has occurred since 1974 that has resulted in the substitution of chicken parts for beef table cuts. The preference change has apparently been motivated not by health concerns but by product convenience.
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This study sought to determine whether possible changes in consumer preferences for different types of meats have caused structural changes in U.S. meat demands. The author takes a less restrictive view of structural change in that he suggests structural change occurs whenever the parameters of an economic model change a small number of times in response to forces within or outside of the model, providing the model is consistent with the theory of constrained utility maximization. Multi-equation price dependent models, producing price flexibilities, are estimated using annual data for 1950 through 1985. Weak separability was assumed and thus price and quantity data at retail were examined for beef, pork, chicken, and implicitly a fourth commodity--"all other foods". Plots of cumulative sum of squares (CUMSUMSQ) were used to detect evidence of structural change. This analysis suggested evidence of structural change taking place in the 1973-77 period. The author examined the 1951-72 time period and the 1977-85 time for evidence of behavioral structural change between the two periods and variance of structural change between the two periods. Using the likelihood ratio tests, strong statistical significance was found for concluding that both behavior and variance changes are present. During the latter period examined, higher cross price flexibilities for beef, pork, and chicken were found. The author suggests that the finding implies consumers now view these meats as closer substitutes. The finding of increased meat demand variability implies that beef and pork demand will be more variable than they were previously. This factor suggests adjustments in the meat producing, processing, and retailing sector are required to manage increased price risks in marketing red meats.


The approach to meat demand analysis in this paper is to analyze demand for specific cuts of beef. The specific cuts analyzed were steak, roasts, and ground beef. The authors made use of the 1977 USDA Household Food Consumption Survey data to conduct their estimation. Use of this data set allowed for conclusions to be drawn regarding demographic effects on the demand for these beef products. An Almost Ideal Demand System (AIDS) was estimated for this analysis. Demographic effects were incorporated into the system through specifying the intercept as a linear function of demographic variables. The results indicated the demand for steak and ground beef was inelastic while the demand for roast was elastic. An increased proportion of black or Hispanic households increased the demand for steak and decreased the demand for ground beef. Demand for roasts was inversely related to the proportion of Hispanic households and directly related to the proportion of black households. The employment status of the female head in the household was not significant nor was the sex of primary food shoppers. Household size was inversely related to demand for steak and roast and positively related to demand for ground beef.


This paper reports on a study that examines qualitative factors related to consumer demand of fresh meats. Eight fresh meats (beef steak, beef roast, ground beef, pork, lamb, chicken, turkey, and fish) are examined for frequency of purchase and consumer preference based on taste and quality. Data analyzed was from a telephone survey of 200 shoppers from a retail firm in Houston, Texas during the second quarter of 1987. The demographic profile of the individuals in the survey suggests the sample is not representative of any particular
region. The sample was dominated by college educated individuals with above average incomes between the ages of 30 to 39 coming from a household of two to three members. The analysis was conducted using Kruskal-Wallis tests and Dunn's multiple comparison procedures. Analysis of frequency of purchases produced the following order from most frequent to least frequent: chicken, ground beef, fish, beef steak, pork, beef roast, turkey, and lamb. Taste and quality ratings were more ambiguous. Chicken and beef steak were preferred over ground beef, turkey, pork, and lamb. Fish and beef roast were preferred over turkey, pork, and lamb. No preference rating between chicken, fish, beef steak, and beef roast was identified. Lamb was the lowest rated fresh meat based on the taste and quality analysis. Along with providing objective nutritional information, the authors suggest the industry needs to focus on product leanness, convenience, and ease of preparation.


This paper investigates the role of economic variables in explaining the historical changes in meat consumption patterns using a complete Rotterdam demand system. Annual data from 1950 through 1985 for beef, pork, chicken, and other food is used in the estimation of the system. The time path of possible structural change is studied by including a structural change regression model. Using either a logit variable or an exponential variable to represent structural change, the results of the analysis indicates that the changes in demand system parameters were consistent with increased substitutability between beef and chicken, but these changes in the early 1970s were transitory and do not provide evidence of a permanent change in consumer's preferences. The results indicate that the meat demand elasticity structured changed in the 1970s but re-established itself in the 1980s, suggesting the 1970s structure as an aberration. Analysis of price flexibilities suggest prices in the 1980s will vary more due to supply changes than in the 1960s.


This article reports on a test marketing study of a branded, lean, fresh beef product. The test marketing was conducted using laboratory test markets by the market research firm of Yankelovick, Skelly, and White in the San Francisco Bay area during the fall of 1985. The objective of the laboratory test market was to examine the appeal of a branded, lean, fresh beef product in comparison to the typical beef products purchased by consumers. While not the direct intention of this study, the study does provide insight into areas of consumer tastes and preferences as related to the demand for meat. The test beef was from 1,000 to 1,100 pound, grass fed steers producing either a Good or Standard yield grade 1 or 2. The control beef was quality grade of Good and a yield grade of 2, trimmed to .3-inch of external fat. For test purposes, the laboratory market test was conducted with the price per pound the same for the test and control beef. The results of the tests indicate consumers are concerned with freshness, leanness, and appearance. Consumers were concerned about fat content and leanness, and indicated a receptiveness to a lower fat, lean product. Informing consumers through marketing support of nutritional aspects and claims of low-fat beef and natural products stimulated sales. The research found evidence that consumers were willing to adapt or compromise standards on taste and palatability if the product is leaner and more nutritious. This study highlights the importance of tastes and preferences in the consumer's buying decision.

This paper examines the impacts of shifts in the distribution of income on the demand for meats. The researcher encounters a problem of aggregation bias because of the limited available information on distribution of income. The moment generating function of the logarithm of income is employed. The author used annual CPI deflated income and a ratio of mean and median family income and the unemployment rate data for 1960-1984. Time trends were explicitly incorporated in the model to prevent income distribution from coincidentally picking up trends. Hahn submits that aggregation bias will decrease the income elasticity for beef and increase the income elasticity of demand for chicken. Using the moment generating technique to correct for aggregation bias and incorporating the variable mentioned above should improve demand estimation.


The authors examine the influence of the downward trend since the 1960s in at-home expenditures as a percentage of total food expenditures. An attempt is made to identify what forces influence where the away from home expenditures are made and the authors seek to link the type of food facility with household income, value of time, and household size. The data source for the research is the 1977-78 Nationwide Food Consumption Survey (USDA). Tobit analysis was used rather than OLS because many households had zero expenditures on food away from home during the survey period. Total food away from home expenditures were examined as well as expenditures at restaurants, fast food facilities, and other commercial facilities. The findings suggest that individuals eat at restaurants for reasons aside from saving time and eating at fast food facilities depends less on income than on value of time. The researchers suggest that marketing efforts of the food service sector should focus on larger household and the middle income class, the groups that provide the greatest potential for the industry.


This paper addresses two questions. First, do consumers choose among broad groups of meats or meat products? If they choose among products, meats need to be disaggregated into their constituent products. Secondly, is the increased preference for chicken due to the development of preferred chicken products? The authors employed Deaton and Muellbauer's Almost Ideal Demand System to answer these questions. The models were estimated with annual data covering the period 1965-1985. Their results suggest that consumers choose across all meat products at once or possibly among high quality and low quality products of different meats. This suggests the use of aggregate chicken and beef in demand analysis could create bias in estimated demand parameters. The authors suggest a preference change has occurred since 1974 that has resulted in the substitution of chicken parts for beef table cuts. The preference change has apparently been motivated not by health concerns but by product convenience.


This book is a compilation of papers presented at a "demand conference" at Charleston, South Carolina in August of 1986. Topics range from largely conceptual discussions of what constitutes a shift in demand and how such shifts can be identified to reports of empirical results of analysis. The Almost Ideal Demand System
approach to modeling demand is covered, and the need to consider all foods (or all expenditures) at the consumer level is discussed and demonstrated. This is a useful reference for a professional economist who works in this area and for private sector professionals who conduct demand analyses and/or need to stay abreast with the latest methodology and analytical technique.


This book is a collection of 15 papers dealing with food demand issues with implications for future consumption. The book is edited by Capps and Senaver and was sponsored by the Southern Regional Research Project S-165 and the Farm Foundation. The papers and authors presented in this book are:

1. **Market Demand Functions.** S. R. Johnson, Richard A. Green, Zuhar A. Hassan and A. N. Safyurtlu.
3. **Food Expenditure Patterns: Evidence From U. S. Household Data.** Chung L. Huang and Robert Raunikar.
4. **Projecting Aggregate Food Expenditures to the Year 2000.** Kuo S. Huang and Richard C. Haidacher.
5. **Implications of Factors Affecting Food Consumption.** Robert Raunikar and Chung L. Huang.
7. **The Effects of Household Size and Composition on the Demand For Food.** David W. Price.
9. **Effects of Increasing Elderly Population on Future Food Demand and Consumption.** Ronald A. Schrimper.
12. **Orange and Grapefruit Juice Demand Forecasts.** Mark G. Brown and Jong-Ying Lee.
15. **Implications for Food Demand of Changes in Competitive State Within Marketing Channels.** Barry W. Bobst.

Reed and Robbins develop a theoretical model of retail pricing of meat products. The authors examine two hypotheses concerning store level retail pricing of meat. First, because consumers react differently to price changes of products depending on how often they purchase the product and the share of total expenditures the product accounts for, the elasticity of price transmission depends on the nature of the product. Secondly, retailers attempt to spread retail price change resulting from wholesale price changes over time. These hypotheses were tested on data from two supermarket chains in Lexington Kentucky on a weekly basis for six different meat items between February 1981 and February 1982. Three-stage least square estimation was used for the six individual product regressions. On a weekly basis, no evidence was found to support a link between wholesale prices and retail prices and prices in week t were found to be poor predictors of the price in week t+1. The analysis indicated that for the more expensive cuts, retail prices adjusted much more slowly to wholesale price changes than for the less expensive cuts. Even in the long run, changes in wholesale prices are not totally passed on to the consumer for expensive and inexpensive meat cuts.


Wohlgenant analyzes structural change in demand for beef in light of the Chavas and the Moschini-Meilke studies. In order to avoid specification bias that the author suspects in the two similar studies, he employs the semi-nonparameters methodology of the Fourier flexible form. The analysis uses annual time series data covering the period 1947-1983. Per capita consumption for beef is specified as a function of per capital income; retail prices of beef, pork, poultry and fish; and retail prices of non-meat consumer goods. The variables were transformed to logarithmic form. Wohlgenant found little evidence of own-price elasticity changes for beef or increases in cross price elasticity with respect to poultry through the 1970's. Wohlgenant suggests findings of structural change in the Chavas and Moschini-Meilke studies were the result of mis-specification, and that changes in quantity demanded for beef can be attributed to changes in real meat prices and real income.


This article examines monthly demand for meat and incorporates a monthly demand framework into forecasting meat prices. An inverse demand relationship (price at which consumers will buy a given quantity) is formulated. This formulation is relevant for meat demand in the short run given the time frame required to adjust supply. The author assumes quantities and income are fixed which implies that meat prices must adjust to clear the market. Data employed were monthly price observations for five beef products and four pork products from the U.S. Department of Labor, Bureau of Labor Statistics and monthly price observations for broilers and per capita quantities for meats from Economic Research Service, USDA, for the period January 1964 to December 1979. Demand flexibilities were estimated using a log linear estimation technique. Monthly variation was identified using a set of monthly binary dummy variables with January as the base. The author concludes the seasonal high in prices for beef is July and August with lows in December and April. Pork prices peak in March and bottom out in the May-July period. Broiler price peaked in July and bottomed out in November. In addition, the statistical estimates suggest that broilers are a significant substitute for pork, but no significant relationship was found between broilers and beef.

This article examines whether changes in consumer's preferences have taken place in the demand for beef. This hypothesis is tested by examining parameter stability in estimated demand equations. Per capita consumption for beef was regressed on the retail price of beef, the retail price of pork, a price index for all other relevant goods, and an income variable. Alternative specifications of the demand function were estimated using a general form of the Box-Cox transformation. Tests of parameter stability involved Chow tests, and Farley-Hinich tests, both based on f-tests and on analysis of recursive residuals. The demand functions were estimated for 1966-1981 with subsets of 1966-1973, and 1966-78. There was some evidence that there was structural change in demand around 1973, but the authors suggest no strong conclusion can be formed. If parameter changes took place, they were confined largely to price coefficients.


The purpose of this paper was to identify and assess selected factors that affect the household demand for meat, poultry and seafood at a regional national level. A generalized linear expenditure system based on the Brown-Heien S(1) branch system was used. This system is based on a direct utility function consistent with traditional demand theory. Data from the 1972-74 U.S. Bureau of Labor statistics Consumers Expenditure Diary Survey were used. The geographical breakdowns were the United States, the Northeast, the North Central, the South, and the West. Demographic characteristics examined were urban and non-urban communities and household size. The results indicated that pork and seafood purchases were most sensitive to household size, and all meat, poultry and seafood purchases were significantly and positively related to household size. The authors concluded meat, poultry and seafood purchases were very sensitive to own-price changes, changes in household size, total expenditure sales, and urbanization and regional location. Though of less sensitivity, cross price changes were important and consistent with economic theory.


In this study, the author attempts to simulate the effect of four scenarios to measure the impact of alternative hypothesis regarding changing consumer preferences for beef, pork, and chicken. If consumer preferences for these meats have changed, then it will still be several years before statistical analysis will confirm the shift. The USDA Food and Agricultural Policy Simulator (FAPSIM) was used for this analysis. The first scenario tested was a decline in consumer preference for all three meats. This was tested by reducing all retail prices by one percent each year for 10 years. The results indicate, at the end of 10 years, a 15 percent decline in retail pork prices, a 25 percent decline in chicken prices, and a 17 percent decline in retail beef prices. The livestock inventory declines, resulting in less demand for feed grains. Farm income declines 29 percent by the 10th year though profitability of livestock production was not as severely effected because feed prices dropped. The second scenario simulated a decrease in preference for beef and an increase in preference for poultry. The result of this simulate was that beef prices fell 11 percent over 10 years, pork price dropped three percent, and chicken price managed a one percent increase at the end of the 10 years. Scenario three saw a decrease in preference for beef and pork and an increase in preference for chicken. Beef and pork prices drop 14 percent and 1 percent respectively and, at the end of 10 years, even though chicken preference had increased, price was pulled down five percent. The fourth scenario increased the preference for beef. This simulation resulted in an increase in income for farmers because of higher consumer prices and a small increase in supply.

A statistical procedure is developed for computing simultaneously the parameters for a complete demand system. The procedure is then applied to the estimation of consumer demand for U.S. composite food categories and a variable representing the nonfood sector. The approach used requires that less than half of the demand parameters are estimated directly. A constrained maximum likelihood method with parametric restriction, based on classical demand theory, is incorporated into the estimation process by substitution. For a large demand system model, this approach economizes on computing time and capacity. In an empirical estimation the following 12 composite food categories were estimated for the period 1950-1981:

1. Meat
2. Poultry
3. Fish
4. Eggs
5. Dairy Products
6. Fats and Oils
7. Fresh Fruits
8. Fresh Vegetables
9. Processed Fruits and Vegetables
10. Cereal and Bakery Products
11. Sugar and Sweeteners

Based on a root-mean square error test of prediction on quantity demanded over the sample period, the error was roughly 4 percent. The estimated own-price elasticity from the constrained model was -.5259 for meat and -.6753 for poultry. The unconstrained model estimation of own-price elasticity for meat was -.4188 and -.5700 for poultry. The authors suggest that a composite demand system provides information about the complete interdependent nature of demand for food, which traditional partial demand analyses cannot provide.


This paper provides an overview of the rules that govern the demand for food and how the demand structure can be assessed for possible changes. The author discusses problems associated with obtaining direct evidence of structural change and proposes an indirect approach that may provide useful information on structural change. Demand structure is defined as a set of parameters that form the function $f(1), \ldots, f(n)$ that are uniquely specified by the utility function $U = F(q)$. The model refers to the individual consumer, but food demand analysis is concerned with an aggregate level and thus aggregate demand is assumed to be represented by the same model. Basically, a demand system will encompass the spectrum of commodities in the consumers budget (income) and a demand function for each commodity. Haidacher points out that the preference function is not directly observable and therefore changes in that function are not observable. In addition, our methods for assessing changes in demand are flawed. Haidacher states that we start with a "Maintained Hypothesis" which represents our assumed demand structure, and an "Alternative Hypothesis." Rejection of the Maintained Hypothesis based on statistical tests implies the acceptance of the Alternative Hypothesis. In fact, there can be numerous Alternative Hypothesis candidates rather than one. Because of the intractable nature of obtaining direct evidence of structural change, Haidacher suggests using an indirect approach. One such approach is to estimate the linear

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expenditure system and use the estimated error between actual and simulated values as a rough approximation of the magnitude of possible structural change. Haidacher provides additional suggestions including: (1) extend the validation outside the period used to estimate the structure, (2) incorporate dynamic aspects in the basic demand structure such as durable goods, and (3) incorporate contemporary developments on time-variant parameters.


This article is a discussion of the Haidacher effort (Southern Journal of Agricultural Economics, July 1983.) Wohlgenant adds to Haidacher's definition of demand structure the opportunity set facing consumers and composition of the population of consumers. Opportunity sets need to be included because in some instances the budget constraint may be nonlinear, such as when the household is both consumer and producer of the commodity. Composition of population is important because when working with aggregate data, the general restriction of consumers behavior only apply to individual consumers. Wohlgenant emphasizes that inclusion of household production theory in explaining demand behavior may provide greater insight into demand structure.


Chavas develops a method for testing whether structural change for meat demand was taking place. A linear model is the base of this investigation. The data used was per capita consumption of poultry, beef, and pork, per capita disposable income, and retail prices for poultry, beef, and pork, and a price index of goods from 1950 through 1979. The analysis was completed in two steps. The model was estimated for 1950-1970 to develop prior information on demand elasticities. This information was then used to investigate structural change in the 1970's. Chavas concluded that structural change for poultry and beef took place in the late 1970's. Income elasticity for beef decreased from +.655 in 1975 to +.183 in 1979, and the own-price elasticity changed from -.870 to -.617 for the same period. During the 1975 to 1979 period, the income elasticity of poultry increased from +.012 to +.275, and the cross-elasticity between poultry and pork decreased from .185 to .001.


Haidacher et al used a complete demand system approach in analyzing demand for meats in the U.S. They go from an aggregate level of demand for food and disaggregate down to the consumption of individual meats. The theoretical constructs behind the analysis is traditional consumer demand theory with consumption decisions related to other commodities or items and constrained by the consumer's budget. This implies that the quantity demanded is determined by the price of a good and price of every other good and income. The aggregate demand for food was estimated for the period 1955 to 1981 while the disaggregated analysis of food was estimated for 1950 through 1977. Cross-sectional analysis of food demand was based on data from the 1977-78 Nationwide Food Survey. The results of this analysis suggest that the overwhelming part of the variation in U.S. meat consumption is explained by changes in retail prices and consumers' income. The researchers conclude that the demand relationship for meat in the U.S. is characterized by a large degree of inherent stability. In
addition, they conclude that at the aggregate and disaggregate level, food and meat are income inelastic. Their analysis of cross-sectional data indicated "at-home" consumption of total red meat and poultry and fish is unresponsive to income, but higher priced meats and highly processed meat items are responsive to income levels.


This paper examines whether the quantities demanded of beef, pork, and broilers have become less responsive to price changes through time. Leuthold and Nwagbo review the literature in this area and present the basic theoretical constructs required for their estimation of price, cross and income elasticities for monthly and quarterly demand relationships. Their basic hypothesis was that as American consumers become more affluent, they become less responsive to price. The analysis was conducted over the years 1964 through 1975. For beef, they found evidence of demand becoming more inelastic around 1969 but the evidence was not statistically strong enough to be conclusive. For pork, there was evidence that demand was becoming less inelastic over time but they could not statistically confirm this. The authors were unsuccessful in developing significant demand relationship for broilers, particularly for the 1972-75 subperiod. The statistical tests used for indicating demand shifts were the Chow Test and the Chow-Fisher test.


This study examined the influence of newspaper advertising on the demand for beef. The analysis was performed at the level of individual supermarket chains for metropolitan Toronto between January 1974 and May 1975. Newspaper advertising was examined because it constituted 60 percent of beef advertising expenditure and it was the only medium in which specific products were highlighted. The data used were weekly sales levels of beef, weekly prices for beef and other meats, and weekly newspaper advertising for beef and other meat products. A single equation (OLS) approach was used. The researchers justified this on the basis of supply being perfectly elastic for a small local market within the North American beef industry. Higher quality cuts were found to be more price elastic. No definitive conclusions were reached concerning the effect of advertising and specials on certain cuts, but evidence of a positive relationship between advertising and specials on sales of individual cuts was found. In general, advertising of pork tended to have a negative effect on beef sales and other meat advertising had a positive effect. Advertising elasticities were in general substantially lower than price elasticities. The advertising of meat by competitors was not found to exert a significant influence on sales of the supermarket chains.


In this note, Chang reviews the impact that the functional form specification in demand analysis will have on estimates of elasticity. The log form implies constant elasticities whereas a linear form will imply an elasticity that is rising. Chang employs a general functional form using the Box-Cox maximum likelihood procedure. Chang lays out the mathematical formulation showing that a log form will result in a constant elasticity and a linear specification will result in an increasing elasticity. By using a maximum likelihood transformation, these two implications can be avoided. Chang estimates his model on annual time series data for per capita consumption of meat (beef, pork, veal, lamb and mutton), per capita real income, price of meat/price of food, from 1935 through 1974 with 1942 through 1947 excluded because of the influence of World War II. The
estimated elasticity of demand for meat from the general form was -.62, while the log form resulted in an estimate of -.53 and the linear form -.44. Chang points out that while income increased from $1,035 in 1935 to $2,846 in 1974, the income elasticity estimate from the linear form went from .351 to .606, the log form provided a constant estimate of .493, and the general form decreased from .647 to .402. The results of the general form are consistent with economic theory.


Purcell and Raunikar contend the inability of agricultural economists to estimate specific price-quantity relationships is a result of inadequacy of data necessary to estimate the relationships. Generally, the data used are time series of national aggregate data. They suggest that these data result in:

1. A limited range in postulated explanatory variates,
2. Multicollinearity in explanatory variates,
3. Lagged adjustment in response, and
4. Gross averages for long time periods that conceal many individual changes.

In order to address these concerns, Purcell and Raunikar estimated demand relationships for meat, poultry and fish based on weekly data collected from 300 households in Atlanta from 1958-1962. Their analysis indicated that except for poultry meat, purchases were not significantly responsive to changes in price of substitutes.
Livestock Price Discovery


This article examines the live cattle and live hog futures within a framework of rational pricing. The purpose is to present a general theory that encompasses the concept of forward pricing. The article contributes to the literature by more carefully identifying why futures markets for nonstorable commodities are not good forecasters of price. The authors point out that futures contract prices can influence production decisions which in turn will affect subsequent contract prices. This factor has tended to be ignored by researchers. The condition examined is that in a competitive industry, where supply commitments are still flexible, output price should be equal to average cost of production. In the context of livestock futures markets, prior to a production commitment being made, futures prices should reflect the cost of production, specifically the cost of feeding. Monthly feeding costs were regressed on futures prices at various months from delivery to test this hypothesis. Live cattle futures price consistently move with feeding cost, from seven months prior to delivery until the delivery month. The relationship begins to deteriorate two months from delivery. For hogs, the results indicated that futures are most influenced by costs during the period when animals are being committed to a feeding program. Live hog futures tend to be more sensitive to changes in variable costs than do the live cattle futures price. The authors postulate this is in part related to a portion of cattle slaughter being derived from nonfed cattle, which does not take place in hog production.


The objective of this article was to determine the short run price leadership roles, and the long term efficiency of the cash to futures price relationship for live hogs. A dynamic regression method is employed to examine the short run price discovery role of the live cash and futures market. Cointegration analysis is used to examine the longer run stability of live hog futures to live hog prices in the Omaha market. The data period analyzed was 1975 through 1989. The authors provide brief and readable descriptions of the dynamic price discovery methodology employed and of the methods for testing for cointegration. The analysis of price discovery indicates that the live hog futures price appears to discover price independently of the Omaha cash hog price. Little feedback from Omaha to the futures price is found. The authors find that at least 60 percent of market information is discovered first in the futures market, then transferred to the cash market. The basic contention of cointegration is that two efficient markets for the same asset whose prices are each nonstationary by themselves will have an equilibrium relationship that is stationary. The alternative is that prices from two efficient markets that are not cointegrated are for different assets. The analysis conducted in this study does not confirm that the live hog futures price and the live hog price in Omaha are cointegrated. The authors postulate that even though there is a causal flow between the two price series, there are sufficient stochastic properties, such as short term demand by packers and time to delivery, such that the two series are not cointegrated.


This article tests whether first and second quarter forecasts of farrowing intentions reported in USDA Hogs and Pigs Reports are rational forecasts of actual farrowings. The author argues that it is plausible to expect that farmer's reports of farrowing intentions should be accurate because a discrepancy between intentions and subsequent actions can have a direct effect on their profits. Because it is not possible to examine actual reported
intentions and subsequent farrowings for individuals, aggregate data must be tested. The authors caution that individual rationality will imply aggregate rationality, but aggregate rationality does not imply individual rationality. A thorough discussion of conditions and testing procedures for rationality is provided. The author tests one- and two-quarter ahead farrowing intentions for the period 1961 to 1989. The hypothesis that one-quarter ahead forecasts are unbiased could not be rejected, and these forecasts are not efficient and therefore are not rational forecasts. Two-quarter ahead forecasts were neither unbiased nor efficient and therefore are not rational. The author suggests that finding that farrowing intentions are not rational forecasts may only imply that farmers are not accurately reporting intentions, not that they are inaccurately predicting their own actions. The author notes that other researchers have found market analysts' forecasts are rational. This may be because the market analyst's success is based upon making accurate forecasts.


This article examines the cointegration and spatial price linkages for regional slaughter cattle markets. The motivation to examine these conditions was the increase found in market concentration of cattle procurers and the decline in relative sales volume in some regions while volume is increasing in others. The authors provide comprehensive explanations of cointegration techniques and tests. Weekly price series for Choice yield grade 1-4, 900-1000 pound slaughter steers for eleven regional markets between January 1980 and September 1987 are analyzed. Overall, the authors find cointegration is limited in regional cattle markets. Fed cattle prices are not fully cointegrated during the 1980s. In examining different time periods, evidence was found that cointegration is increasing in fed cattle markets during the 1980s. A further analysis using bootstrapping techniques was conducted to identify market factors that influence findings of cointegration. This analysis suggests that as packer concentration has increased, slaughter steer markets have become more cointegrated. Whether markets were direct trade or terminal markets does not impact cointegration results. Smaller markets tend to exhibit less cointegration. Greater spatial distance between markets impact negatively upon cointegration.


In this study, the authors examine how unanticipated information in the USDA *Hogs and Pigs* Reports affect price in the live hog, pork belly, live cattle, and feeder cattle futures markets. Unanticipated information is derived by subtracting expectation for changes in breeding and market inventories from actual reported changes. The expectations are based on surveys of market analysis two days prior to the USDA reports. Because futures prices have limit price move restrictions, a two-limit tobit regression model procedure is used to examine the cumulative impact of unanticipated information. The sample period analyzed runs from September 1981 through June 1990. Price changes up to five days following the report release are examined. In addition, various time horizons defined by number of months from expiration for the futures contract are examined. None of the futures contracts react to anticipated information. Unanticipated information results in price responses immediately following the USDA report. Some evidence of overreaction is identified. Live hogs and pork bellies, as would be expected, are impacted by the release of unanticipated information in the *Hogs and Pigs* Reports more than live cattle and feeder cattle.

Approximately nine million cows were culled annually between 1984 and 1988. The authors seek to identify characteristics of the cows that affect their value. The characteristics examined are: weight, breed, grade, dressing percentage, health, pregnancy, time of sale and market location. Data on 4,711 lots of cows, consisting of 7,103 head are analyzed. The data were collected from weekly auctions in Kansas during the fall of 1986 and spring of 1987. Price is modeled as a function of physical characteristics of the cow, and the fundamental market force. This form provides an estimated marginal implicit value of each characteristic. This is accomplished through regressing price on a set of quantitative variables and binary variables. Higher dressing percentage cows sell for higher value, as do larger lot sizes and cows that are pregnant. Cows under 800 pounds receive progressively higher premiums, but for cows above 950 pounds the price received decreased at a declining rate. The presence of health problems produce price discounts.


After the release of inventory reports, live cattle and live hog futures prices exhibit moves greater than $1.00 per cwt. in absolute terms more frequently than the days prior to the release of the reports. This paper examines the responsiveness of live hog, live cattle and feeder cattle futures prices to the dissemination of USDA livestock inventory reports. An event study methodology is employed. Average mean-adjusted returns are used to examine if consistent reactions are evident to the release of the inventory reports. The time period analyzed was 1972 through 1987. No abnormal returns are found for live hog futures though price variability increased for two days after the report release. An interesting phenomenon was that on the day prior to report release for feeder and live cattle, there was evidence of negative abnormal returns. Following cattle on feed reports, live cattle average abnormal returns were negative, though not statistically significant. Price variability is increased only for one day following the report release. VAR tests found a causal flow from futures to cash for both live cattle and hogs. A feedback relationship from cash hogs to futures was also identified. Live hogs futures exerted a stronger than normal influence on the cash market after report release than normal. A similar phenomenon was not identified for cattle.


This study tests the hypothesis of market efficiency for live hog futures by examining if the difference between market expectations for new information and the actual new information is reflected in price changes. Survey data of market analysts expectations for breeding herd and market hog inventories in the quarterly USDA Hogs and Pigs Reports represent expectations. Previous research on the behavior of the live hog markets to inventory reports has never discriminated between anticipated and unanticipated components of new market information. The unanticipated news is defined as the difference between market analysts surveys and the actual inventories reported by the USDA. The analysis was conducted over 28 Hogs and Pigs Reports for the period September 1981 through June 1988. The authors find that expected changes in hog and pig inventories are incorporated into live hog futures prices. Across the spectrum of time, live hog futures react significantly to unanticipated information and in the direction expected. Predicatable price patterns beyond the first day to the unanticipated information are not found.


CHAPTER 6: ANNOTATED BIBLIOGRAPHY
The author tests the applicability of Samuelson's hypothesis that; i) the ratio of the variance of distant futures price changes to the variance of the nearby futures price changes is less than one, and ii) the variance of price changes increases for a futures contract as it approaches maturity in a dynamic sense. This examination is conducted in the context of government announcements. Livestock markets are not examined in this study, but grain, foreign exchange and debt instruments are. The period of analysis for grains was 1960 to 1984. Price activity following announcements is analyzed, and randomly selected non-announcement periods are analyzed as a control. For grain markets, the ratio of the variance of distant futures price changes to the variance of mean futures price was found to be higher for announcement periods than for the control group. For the agricultural markets examined, Samuelson's hypotheses are not confirmed for grains. Samuelson's hypothesis could not be rejected for debt instruments and foreign currency markets.


The price performance of an experimental electronic market for hogs is compared with a terminal market and a direct market. The price levels delivered by the electronic market and the previous and subsequent market alternative are also examined. The Hog Accelerated Marketing System (HAMS) was operated in Ohio between November 1979 and June 1980. The hog prices increased $.94 to $.99 per hundredweight during the operation of the HAMS experiment. Pricing efficiency is measured by two methods, a measure of frequency of price changes and a measure of average price changes. In comparison with the Peoria terminal market and the Indiana direct market, the frequency of price change indicated that HAMS was a more efficient market. The average price change measure indicated that HAMS was statistically more efficient than the Peoria terminal market. This result was not statistically confirmed, however, when comparing the average price changes measured for HAMS and the Indiana direct markets. The authors suggest that the HAMS experiment indicates that electronic trading is effective at enhancing competition and improving price efficiency.


Video cattle auctions are compared to large regional feeder cattle auctions in this study. The objective is to analyze the performance of video cattle auctions and to investigate factors affecting prices in video auctions. Data were examined for the 1987 Superior Livestock Auction in Brush, Colorado. The regional auction markets examined were the Greeley, Colorado market and the Oklahoma City, Oklahoma market. Tests for price differences between the video auction and the regional auction suggest that the video auction provided prices $.34 per cwt. above midpoint reported prices for the Oklahoma City market and $1.38 per cwt. above the midpoint price for the Greeley market. When the high report market price was compared, there was no statistically significant difference between the video auction and Oklahoma City market prices. For the Greeley market, the video auction price was greater by $.75 per cwt., a statistically significant increase. The authors suggest that these price differences are the result of informational and structural differences between video auctions and regional auctions. The analysis found factors such as lot size, origin of cattle, and accuracy of weight to be important to prices offered for cattle. Factors such as offering a slide discount for inaccurate weight reports was found to be an attractive merchandising strategy for video auction cattle.

This paper examines the expected impact that a revision of the USDA Choice and Select grading requirements would have on slaughter prices. The simulated revisions to grades would allow a fixed percentage of Choice to be moved into the Prime grade and a respective percentage of Select and ungraded beef to be moved into the Choice grade. The author estimated geometric distributed lagged models for Choice grade slaughter steers and Select grade slaughter steers in Omaha respectively. The models were estimated using quarterly data for 1976-1985. The estimated models provide information on the relationship between steer prices and cattle of different grades and additional relevant economic variables. The net result of a revision of grades, as simulated in this study, would be to reduce Choice steer prices and increase Select steer prices, thus reducing the discount of Select steers relative to Choice steers. The inclusion of ungraded beef in this analysis is important because the analysis demonstrates how ungraded beef impacts on steer prices and that the role of ungraded beef could bias estimates of grade impacts on live cattle prices if ungraded beef is ignored. The author notes that for public grades to provide price benefits to producers, they must increase primary demand as consumers perceive they are better off.


This article examines the issues relevant to cash settlement of the CME live cattle futures contract. The authors specifically list three criteria that must be satisfied for a change to cash settlement to improve a futures contract. The change to cash settlement must reduce basis variability, the cash price series used for cash settlement must be an accurate representation of cash market values, and the cash price series must be free from the potential for manipulation. For data from January 1980 through December 1986, seven alternative cash price index-basis relations were simulated and variances were estimated. This analysis indicated that a Cattle Fax index would consistently reduce basis variability. Based on this finding, the authors presented a discussion of how accurate a representation of cash market values the Cattle Fax index is. Concern over the accuracy of the Cattle Fax index stems from the influence that an individual outlier sale could have given that sellers of cattle are contacted to obtain price information. An effective audit program of reported transactions would be difficult to maintain. For this analysis, the authors define manipulative influences as the ability of one firm or a small group of firms to behave in a manner that changes market price in their favor. With regard to the potential for manipulative influence of a cash price index, no definitive answer is available. The authors provide the caveat that given increased concentration in the buyers of fed cattle and increased vertical integration, the possibility for manipulative behavior in the cash market for fed cattle increases.


This article analyzes the market reaction in fifteen commodity futures price series to the unanticipated components of thirteen macroeconomic announcements. Of the fifteen commodity futures price series analyzed, feeder cattle and live hogs are included. The analysis is conducted on a data source for the period February 1980 through December 1984. The analysis was conducted in the context of verifying if monetary surprises cause changes in real interest rates rather than in nominal interest rates. The unanticipated component of an announcement was calculated by subtracting the median of forecasts from surveys of active money market participants about their expectation for the announcement. For feeder cattle and live hogs futures unanticipated announcements in the MI figure had a significant impact on price changes. Four monetary announcement
variables (M1, net free reserves, discount rate, and surcharge rate) where tested together and found to significantly impact live hog and feeder cattle prices, an explicit identification of individual variable impacts was not made in these models. The overall analysis found strong evidence to support contention that commodity markets respond to changes in real interest rates rather than nominal rates.


This paper examines the relationship between physical and economic market variables and the composition of traders in the CME live cattle contract. Composition of trade data from the CFTC was augmented with monthly market data for prices of relevant inputs and outputs, and with relevant supply and disposition data for the period 1970 through 1987. A review of trends in the data indicate that trading volume in the live cattle futures grew through the 1970s into the 1980s. Relative to all futures trading on the CME, live cattle volume peaked in 1974 at 55.2 percent of total volume and represented only 6.3 percent of total volume in 1987. Composition of traders was relatively stable. There was a large drop in the 1980s of reporting, long-speculative positions held but this was compensated for by significant growth in the reporting, long-commercial positions held. Evidence of structural change in the composition of traders in the live cattle futures was found. Large-reporting speculators appear to have left the market. While no statistical significant results were obtained when binary variables were used to represent contract innovations such as change in contract specifications, the certificate of delivery and options on live cattle futures, models estimated indicated structural change int he period after those innovations. The results reported in this paper suggest that futures contracts may have a life cycle similar to those present in product markets, and traders that build and establish futures contracts may be different from the ones that sustain the market.


This article examine the price leadership relationship among cash and futures prices for feeder cattle. The analysis was conducted using daily closing pricing for the nearby feeder cattle and live cattle contract on the CME and average daily cash prices for feeder steers and slaughter steers from the Oklahoma City and Omaha markets. The period analyzed was 1979 through 1986. The time period was divided into two sub-periods, 1979-82 and 1983-86. Causality tests were conducted on the price differences between Monday-Tuesday prices and Tuesday-Wednesday prices. Granger causality tests were conducted to identify lead-lag relationships and a dynamic regression testing scheme was applied to investigate price leadership relationships between cash and futures prices. The results of the Granger causality analysis indicated that for feeder cattle, the futures price led the cash price. The strength of this lead was less during the 1983-86 time period than it had been in the 1979-82 period. The results suggested that the futures price leads the cash price in incorporating new price information.


Economic factors affecting the level of deliveries made on the CME live cattle contract were examined in light of the modifications made in the delivery process and contract specifications. In addition, differences in regional delivery patterns were examined. The authors present a discussion of the conceptual dimension of delivery and
relate this to factors expected to influence deliveries on the live cattle contract. The empirical analysis is conducted by estimating functions to explain deliveries for January 1975 through April 1985 using ordinary least squares. Three functions were estimated—total deliveries, deliveries made east of the Mississippi River, and deliveries west of the Mississippi River. The results from the total deliveries function showed basis affected deliveries as did the discount between Yield Grade 3 and Yield Grade 4 prices, and limited seasonal influences were apparent. Modifications to contract specifications that limited deliveries of Yield Grade 4 animals appeared to have a significant influence on reducing deliveries. The certificate of delivery did not have a statistically significant effect on deliveries, though the authors note this system was only in place for 9 of the 63 delivery periods examined. The spread between maturing contract prices and the next nearby contract did not appear to be an important factor in the delivery process. Deliveries in the eastern markets were found to respond to delivery month basis, the spread between the maturing contract and the next nearby futures contract. Price discounts between Yield Grade 3 and Yield Grade 4 animals were not significant in deliveries in eastern markets. It is of interest that the authors found the certificate of delivery variable to have a significant and negative impact on deliveries in the eastern markets. Deliveries in the western markets were consistent with the results for all deliveries though no seasonal patterns were found.


The authors examine in this paper if the USDA quarterly Hogs and Pigs Reports are influenced by price activity preceding the reports, and if there are seasonal errors in reports. A tracking model that begins with barrow and gilt slaughter and slaughter weights, estimates of gilt retention, daily gains, death losses, and a seasonal index to estimate inventory levels is employed. Differences between model estimates and USDA initial (non-revised) inventories are analyzed by regressing the differences of current and lagged hog prices, corn prices, and a seasonal dummy variable. The authors find that the USDA reports estimate of hogs over 180 pounds are, on average, low. Estimates of second-quarter pig crops, and third-quarter inventories of hogs between 120 and 179 pounds have been consistently high. The authors find evidence to suggest that prices at the time of report releases and immediately prior to release are significant predictors of the difference between USDA pig crop estimates and the tracking model estimates.


This paper examines the lead/lag relationship among major cash markets for cattle and live cattle futures prices. The classification of dominant and satellite markets is derived from the possibility that one market leads others in the price discovery process. The dominant-satellite relationship between markets (cash and cash, cash and futures) was examined using Granger causality. The overall period examined was January 1973 to December 1984 with three subperiods within these bounds. The data examined were weekly cash prices for fed cattle and a truncated nearby Chicago Mercantile Exchange live cattle futures price. During the latter two time periods (1977 through 1981 and 1981 through 1984), the futures market on a week-to-week time frame is the dominant force in the price discovery process. All cash markets were satellites of the futures market. Over time, the authors found that there was a decline in the influence of the terminal markets. They found evidence that suggests a regionalization of markets around the country with market centers linked to dominant markets, but becoming increasingly separated from the national supply and demand situation.

The conceptual framework within which the certificate system of delivery was developed and initiated is traced in some detail. Possible shortcomings of the certificate system are identified including the time required to complete the process and the restraints placed on the reclaim option for the short who is delivering. The authors hypothesize the barriers to a smoothly functioning delivery mechanism will lead to a wider and more variable basis. During the first five delivery periods after initiation of the new delivery mechanism, the basis was in fact significantly wider in some delivery areas. The variance of the basis, the important determinant of the success of hedging, was not significantly larger, however. In spite of the expressed concerns, the authors are positive regarding the certificate system because it eliminates redelivery of cattle and does encourage participation by long hedges.


This study analyzes the lead-lag relationships between live cattle futures prices, cash cattle prices, and carcass beef prices. The price data in this analysis went from January 1, 1977 through May 28, 1982 for live cattle futures contracts, Choice steer carcasses, yield grade 3, 600-700 lbs., from the National Provisioner and the midpoint of the high/low range from Amarillo, Texas Choice slaughter steers yield grade 3, 900-1,100 lbs. Causality regressions for all combinations of the three series were estimated using the Geweke procedure. Results of the analysis indicate live cattle futures and cash carcass beef prices are related instantaneously, and show a unidirectional flow from futures prices to carcass beef prices. A similar relationship exists with futures prices and cash steer prices. Of the three market sectors analyzed, the carcass market is the least important source of price discovery activity. All three markets interact and react with relative efficiency to changes in information. In the cash-futures subsector, the futures market is judged to be an important source of price discovery.


The results of an interdisciplinary study of pork carcass composition and value relationships are reported in this article. The authors develop a standardized objective carcass evaluation system for packers that will transmit to producer premiums and discounts for varying carcass merit. In this study, 185 carcasses were measured for characteristics that could be applicable to a grading or hedonic pricing system. A quadratic model specification was estimated that related carcass value to backfat thickness, carcass weight, and muscling score. The authors found that these three variables account for 79 percent of variation in carcass value. Using the results from the estimated model, a matrix of premiums and discounts was developed for carcasses of various merit. The authors conclude that use of a system such as the one they designed would enhance producer acceptance of carcass merit pricing and provide clearer signals where changes in production and marketing procedures are needed.

This paper examined the relationship between changes in cash and futures prices for live beef cattle. The authors sought to identify which market leads the other in price discovery and if that relationship has changed as activity in the futures market has changed. Granger causality testing using ordinary least squares is employed. Data used were the daily closing price of the live cattle contract on the Chicago Mercantile Exchange and average cash price of 1,100 to 1,300 lb. Choice steers in Omaha. The data were divided into three subperiods of 1966-72, 1973-77 and 1978-82. The time span analyzed was two months prior to each delivery month for each contract per year. For nearly every time period analyzed, the futures price led the cash price. Information was incorporated by the cash market with a lag of one day after it affected the futures price. The importance of the futures market to price discovery is heightened by the decrease in instantaneous causality (intra-day flows of influence) observed in the 1978-82 subperiod compared to the previous two subperiods.


The reaction of live hog futures prices to the quarterly release of USDA hog and pig reports is examined in this study. The flow of information to the markets is non-random because of the periodic release of USDA reports. Data used in the analysis covered the period December 1973 through September 1983 for forty hog and pig reports and the live hog futures price changes for 38 days surrounding the release of hog and pig reports for the nearby contract and one maturing in six months. The multi-step event study method of analysis was applied. The results indicate that futures markets adjust to new information from hog and pig reports rapidly. Indications of market inefficiency may in fact be the result of inadequate information and not inefficient markets. Large price adjustments after reports are required because of a divergence in the information set market participants are using and the true but unknown information set.


Bessler and Brandt examine the lead-lag relationships between various variables suggested by economic theory.
for cattle and hog prices. Quarterly price and quantity data for U.S. cattle and hog markets from 1963 through 1979 are used in Granger regression tests. The results of the analysis suggest a strong one-way causal relationship exists running from sow farrowings to hog prices, from income to hog prices, from hog prices to hog slaughter, from cattle price to cattle on feed numbers, and from income to cattle prices. No strong one-way relationship was found to be running from changes in cattle on feed to cattle prices. The authors’ findings suggest an instantaneous relationship between income and livestock prices. They suggest that their use of quarterly data may have prevented detection of actual lead-lag relationships of a duration shorter than one quarter.


This paper examines the U.S. fed beef sector with the use of recently developed disequilibrium theory and estimation techniques. Disequilibrium in this study means market transactions occur at prices which do not clear the market, leaving market participants unable to trade desired quantities at the prevailing prices. The authors contend that four factors in the U.S. fed beef sector seem likely to lead to disequilibrium prices. Those four factors are;

1. non-uniform information,
2. concentration on both the buyer and seller side of the market,
3. lack of short-run production flexibility, and
4. government intervention.

A simple four equation model describing demand and supply is estimated based on quarterly observations from 1965 through 1979. The equilibrium model was estimated with two-stage least squares while the disequilibrium model was estimated using maximum likelihood techniques. Results indicate that the hypothesis of a permanent disequilibrium can be rejected for the U.S. beef sector, but price is not sufficiently flexible to insure continuous equilibrium. The authors suggest disequilibrium models can provide valuable information concerning the effect of institutionally induced price-quantity distortions.


The objective of Faminow was to test for evidence of a lead-lag relationship between the Meat Sheet and the Yellow Sheet price quotes for meat. Given that these two price reporting services provide similar information collected in similar manners and used by market participants in similar uses, they should indicate an instantaneous relationship with nonsignificant residual cross-correlations for time lags. The residual cross-correlation technique was applied to daily closing price quotes for 700-800 pound yield grade 3 steer carcasses (Chicago base) for November 1, 1979 through November 3, 1980 providing 246 observations. The results indicate strong evidence of an instantaneous relationship between the two price quote services. The results additionally provided weak evidence that the Meat Sheet lags the Yellow Sheet by one or two days. The two price quote services are thus closely but not perfectly related. 

Employing Granger's notion of causality, this study examines the extent to which feeder cattle prices and feed costs affect fed cattle prices. Spreen and Shonkwiler define the concept of causality used and use three computing methods (Granger, Sims and Haugh-Pierce) to test their causal hypotheses. Data used in this study were monthly Choice Omaha 900-1,100 pound steer prices, Kansas City 600-700 pound feeder steer prices, and a feed cost index of Chicago corn prices and Decatur soybean meal prices. The data were first differenced and covered the period January 1966 through December 1979, providing 168 observations. The causal relationships were examined over an eight month period, a time period during which almost all cattle on feed would be marketed. The results indicated that slaughter steer and feeder steer prices are determined simultaneously. Feed costs lead both feeder and fed steer prices. Increased feed costs increase fed steer and feeder steer prices in the first two months, then depress them through four months followed by an increase in the eighth month.


Ward examines impacts of wholesale carcass beef and live cattle futures market prices in short period pricing models on individual transaction prices for fed cattle. Ordinary least squares regression was used to analyze data from 26 commercial feedlots operated in Texas, Oklahoma, and Kansas and three markets for cattle feeders in Nebraska and Iowa. A total of 344 pens of cattle or 51,586 head marketed in July 1979 were analyzed. Wholesale carcass prices were collected twice daily from the National Provisioner and futures prices for the August live cattle contract were collected three times per day. Ward points out that modeling short period price (i.e., transaction prices) is very difficult. He did find that sex, weight, quality grade and yield grade for wholesale carcasses were significant in predicting the transaction price. Another variable that was fundamental to explaining transaction prices was the nearby futures price for the live cattle contract.


This study provides an empirical assessment of the lead-lag relationships of pork prices between the retail, wholesale and farm levels. The author uses the Granger causality approach with univariate residual cross-correlation analysis. Conceptually, the analysis is structured such that time ordered variable X is said to lead another time ordered variable Y if Y is better predicted with the use of historical X. The univariate residual cross-correlation statistical method was applied to weekly changes of USDA retail, wholesale and net farm pork values from January 1974 through June 1978. Farm level pork prices were found to lead wholesale prices by up to two-three weeks, and wholesale prices lead retail prices by up to two-three weeks.


The objective of this study was to examine the response of the hog futures market to the release of new market information from the USDA's *Hogs and Pigs* Report. The author looked specifically at sow farrowing information. The analysis used data from 36 *Hogs and Pigs* Reports released from September 1970 through June 1978. Partial adjustment models were estimated using ordinary least squares and seemingly unrelated regressions. Results indicate futures markets respond in the expected direction to new market information, but the response is not instantaneous. For futures three to four months from delivery, one-half or more of the response to new information from the *Hogs and Pigs* Report is completed in one day, for more distant contracts.
(six to seven months), one-half of the price response occurs within a week.


This study discusses how univariate residual cross-correlation analysis is used with the Granger causality concept of lead-lag relationships. Miller provides a detailed description of the methodology of univariate residual cross-correlation analysis. This statistical technique was applied to first differences of weekly USDA retail, wholesale and net farm values for January 1974 through June 1978. As a whole, this analysis indicated that farm level price changes are reflected in wholesale level price changes within a week, and the wholesale price changes are reflected in retail price changes of beef within three weeks. The results imply that rapid price adjustments between farm, wholesale and retail levels are provided by the beef marketing system.


The article examines the lead-lag relationship among prices at the feeder cattle, live cattle, wholesale and retail levels. Causality tests are used to confirm the direction of the influence identified by cross-spectral analysis. The data used were estimates of monthly prices at the feeder and live animal level and the wholesale and retail levels for a series of 288 observations beginning in January 1949 and ending with December 1972. The results of the analysis indicate that prices at the feeder, live animal and wholesale levels move together without a time lag as long as one month. Retail price lags the other three levels by a significant amount. In a quantity-price context, a lag of nine months is required for producers to accept price changes as a non-temporary phenomenon, divert animals, and feed them out.
Efficiency of Livestock Futures Markets


The authors report in this paper the testing of the market efficiency hypothesis by examining if live hog futures prices only react to unanticipated changes in hog inventories. In addition, they test if any predictable price pattern can be found beyond the first day of trading following the release of the Hogs and Pigs Reports. The difference between market survey data of expected changes in breeding and market inventories produced by Futures World News, and the actual inventory data in the USDA Hogs and Pigs Reports is used as a proxy for unanticipated information. The survey data are tested for unbiasedness, efficiency, and superior forecast performance to examine if they have the suitable properties to use in testing the efficient market hypothesis. The sample period examined was September 1981 through June 1988. The results of the analysis find that live hog futures prices incorporated the expected change prior to the release of the actual inventory data. The live hog futures price is found to react significantly in the expected direction to unanticipated information. The nearby futures contract is found to be the most responsive to unanticipated changes in market hog inventories, and prices of contracts at a time horizon of approximately one hog production cycle are most responsive to unanticipated changes in breeding inventory. A predictable price pattern is not evident from four of the five contract time horizons examined.


In this article, the results of a study of the distribution of returns generated from selective hedging strategies using either live cattle put options or futures contracts are reported. The hedging activity is triggered by either profit-margin targets or price-forecasting targets. The strategies are compared with each other by calculating a second degree stochastic dominance ranking. The marketing strategies are developed for an Iowa feedlot and are compared for cattle sold on a monthly basis for July 1978 through December 1985. In that options were not traded prior to late 1984, the authors estimate option premiums using a modified Black-Scholes option pricing model. The dominant strategies were found to be hedging with a $4/cwt. profit margin and a put option strategy using a standard error adjusted forecast. The authors also analyze the alternative strategies on an annual basis. This annual analysis highlights that options tend to be the most useful approach to hedging during periods of rapid cattle price increases. When price stabilizes, hedging strategies using options are less attractive because of the cost of option premiums.


This article addresses the apparent inconsistency between livestock futures being variable in price and thus risky, based on Keynes' definition, and the relatively low rates of return paid to speculators bearing this risk. Instead of using Keynes' measure of risk and price variability, the authors measured risk through the use of the capital asset pricing model (CAPM) approach. The CAPM approach measures risk in terms of systematic risk, the covariance between the return on an asset and the return on a market portfolio of all assets. Systematic risk was measured for the periods 1966-76 and 1975-85. The rate of return used for the market portfolio was derived by using a weighting of .90 to the sum of the monthly log-relative return for the S&P index plus the monthly dividend rate return and a weighting of .10 to the log-relative return for the Dow Jones Index of cash commodity prices. The authors found estimates of systematic risk of live cattle and hog futures to be sensitive to the market portfolio weighting of commodity returns. The estimates of systematic risk for cattle and hogs were -.03 and -
.10 in the 1966 to 1976 period and .20 and -.24 for cattle hogs respectively for the 1975-85 period. The authors conclude that the low rate of return to speculators in cattle and hog futures is consistent with the low level of systematic risk for commodities.


In this article, the authors report on a study that tested and evaluated the pricing efficiency of the live cattle futures market. Semi-strong form efficiency tests were conducted by using econometric, ARIMA, and composite forecasting models, estimated on 1976-81 data, to forecast cattle prices in the 1982-85 period. The forecasts from these models were then compared to live cattle futures prices using the mean-square error framework to measure predictive accuracy. The results of this analysis suggested that live cattle futures were not incorporating all available public information. The authors developed simulated trading strategies based on the most accurate forecasting techniques to measure possible returns available from the identified inefficiencies in the futures market. This simulation process produced small, positive profits but with very large relative variances. The simulation of trading strategies did not account for the cost of building and updating the models. The results of this study demonstrated the mean-square error framework for evaluating futures market pricing efficiency is not a sufficiently rigorous criterion. The mean-square error framework was found to be a necessary condition for evidence of pricing inefficiencies in the live cattle futures market, but the sufficient condition (simulated profits) did not confirm the necessary condition.


The distributions of futures price changes during the period January 1973 through December 1987 for wheat, soybeans, and live cattle are examined. Previous research had indicated the distribution of futures price changes were weighted to the midpoint and tails more heavily than would be expected with a normal distribution. The distribution of futures price changes has implications for market efficiency and for pricing formula for commodity option premiums. Tests for normality and independence were performed on the first differences of the natural logarithms of daily closing prices for each wheat, soybean, and live cattle contract maturing during the time period analyzed. Tests of normality were conducted at the .01 level of significance. The Kurtosis test rejected normality for 42 percent of live cattle contracts analyzed, but this dropped to 33 percent when the time period 1976-1982 was analyzed. The ratio of the range to the standard deviation test rejected normal distributions for 35 percent of the live cattle contracts. This test rejected 28 percent when the 1976-82 period was examined. Characteristic exponent tests found 30 percent of live cattle contracts had normal distributions and the remaining contracts had unbiased means through the validity of their variance as a measure of variability was in doubt. Bartlett tests for homogeneity of variance rejected the possibility of non-normal distributions being the result of heteroscedasticity. Independence was tested using turning-point tests and phase-length tests. For turning-point tests, 23 percent of the live cattle contracts exhibited non-random behavior. The phase-length tests suggested 25 percent of the live cattle contracts had non-random behavior in price changes. The majority of the non-random behavior for both independent tests was found in the 1973-75 periods.

This article reports on an examination of selective profit margin hedging strategies that determine if producers can raise average profits and reduce the variance of the profits. The authors developed a model to simulate production of hogs in six annual lots for a Southeastern Virginia, 150 sow, farrow-to-finish operation for 1975 through 1980. From the simulated production, daily expected profit margins were calculated. Selective hedging strategies were based on fixed margin strategies and variable margin strategies. Fixed margin strategies triggered hedges whenever the daily expected profit margins from the simulation model was above a fixed level. Variable margin strategies were based on a forecast of the cash margins and hedges were triggered whenever the daily expected profit margin exceeded the forecasted cash margin by a certain percent. The authors conducted a post-sample analysis of the hedging strategies for 13 lots of hogs marketed between December 1980 and December 1982. The analysis indicated that it was possible to increase average returns and reduce the variance of those returns through the use of selective hedging strategies. While the fixed margin strategies performed well, it was still possible to increase returns and reduce the variance of returns by using the variable margin strategies. The advantage provided from variable margin strategies stems from reducing the incidence of premature hedging associated with fixed margin strategies.


The study re-evaluates Helmut's trading technique using unrevised USDA breakeven prices and additional basis adjustments over a longer time period. The analysis was conducted over the period July 1974 through December 1982 and encompassed Helmut's test period of January 1978-February 1981. Statistically significant gross profits were generated using Helmut's trading technique on unrevised data. Basis did not appear to impact the results based on the use of alternative basis adjustments. The authors suggest that because this technique is based on economic rationale, it may be correlated with large trader activity and does not necessarily infer trader manipulation. The results suggest the effectiveness of the trading rule constitutes modest evidence of weak-form market inefficiencies in live cattle futures.


Koppenhaver contends that the futures market price does not have to be unbiased to fully reflect available information at a point in time. If a risk premium exists in the live cattle futures markets, then a bias will exist. Koppenhaver attempts to answer to what extent a risk premium does in fact exist in the live cattle futures price. If a risk premium does exist, is the live cattle futures market efficient in reflecting historical spot and futures price, and does the market reflect available public information? Live cattle futures contracts were analyzed from August 1969 through December 1982. Evidence of a risk premium in live cattle futures was found. With the existence of a risk premium confirmed, Koppenhaver rejects the use of the martingale model in favor of the submartingale model for testing market efficiency. The author concludes that use of the submartingale model in testing historic prices one, two, four and six months prior to maturity suggests the live cattle futures market is a weak-form or efficient forward pricing mechanism. At one month prior to maturity, the author found the live cattle futures contract to be semi-strong form efficient.


CHAPTER 6: ANNOTATED BIBLIOGRAPHY
This article develops and applies methodology where prices are aggregated such that peculiarities of one time period may be offset against those of another in evaluating the performance of live cattle futures prices in the process of price discovery. The high volatility and strong price trends apparent in the live cattle futures can result in variable price performance depending on the time period selected for study. Kolb and Gay examine lag-link relatives for 38 live cattle contracts maturing between December 1976 and December 1980. Lag-link relatives are the natural log of the ratio of today's futures price to yesterday's futures price. Hotelling's T tests and regression tests over time were performed to test if futures prices were accurate predictions of spot prices at maturity. The results confirm the hypothesis that futures prices are accurate predictors of subsequent spot prices. They found no reason to conclude that cattle futures fail to perform a price discovery function.


Peterson and Leuthold develop a general framework to test for weak form efficiency in futures market using a mechanical trading system. Two types of filter rules are used for the final 10 months of trading for hog futures contracts between 1973 and 1977. The two filter rules are based on percentage change in price (one percent through ten percent) and a dollar change ($0.50 through $5.00 in $.50 increments). The weak form test is based on testing whether any strategy generates statistically significant profits. For all twenty of the tests, the mean gross profit exceeded zero and was statistically significant at the five percent level. The authors note that mechanical trading methods provide a method to detect nonrandom patterns that are simple and intuitively appealing, and they do not depend on repetitive patterns of price change.


The efficiency of the live cattle futures market is tested by Helmuth with a technique developed for predicting movement in live cattle futures. Helmuth reports on a technique that predicted with 100 percent accuracy certain drops in live cattle futures for the period January 1978 through February 1981. When live cattle futures price covers USDA reported Corn Belt cattle feeding costs plus an interior Iowa-Southern Minnesota basis adjustment, the futures prices will drop. Helmuth suggests that the systematic downward bias in futures price is the result of a lack of commercial long hedgers in the live cattle markets. Commercial short hedgers are primarily commercial feedlots and meat packers all with similar per unit production cost. Therefore, when futures prices exceed production costs, short hedges are placed. In conclusion, Helmuth is concerned the live cattle futures market does not serve a valid economic purpose because it does not offer hedging opportunities to all producers and displays a systematic downward bias. He suggests that the live cattle futures provides limited hedging opportunities but only to those cattle feeders with the lowest per unit costs.


Palme and Graham evaluated and reported on some of the problems with Helmuth's research (Journal of Futures Markets, 1981) on live cattle futures markets. Their critique emphasizes four points:

1. Helmuth's finding that the market operates with a consistent, systematic, perfectly predictable downward bias is not supported by the data used in his (Helmuth's) study;
2. Helmuth's conclusion that hedging opportunities are provided to the low cost producer only is not valid. Data indicate the majority of cattle feeders had profitable hedging opportunities in 59 percent of the months analyzed;

3. Helmuth's trading signal technique was developed on data not available during the period the technique provided signals; and

4. Considering that traders have similar access to fundamental news and technical trading signals, it is surprising that Helmuth reported only 32 out of 1,027 larger traders had highly correlated trading patterns.


This paper compares and evaluates the price forecasting experience and accuracy of the commercial econometric model vendors. Live cattle and hogs are examined in addition to corn, wheat, the soybean complex, and cotton. Specifically, the study addresses the question of whether futures markets are more or less accurate than large scale econometric forecasts. The period examined was December 1976 through December 1978. Results of this analysis indicated that econometric models provided superior forecasts in comparison to the futures market for cattle in two, three and four-quarter time horizons. For hogs, the econometric models provide superior forecasts only in a four-quarter time horizon.


Martin and Garcia attempt to answer the question "Do live cattle and hog futures markets function as price forecasting agencies?" Disaggregated analysis was used because these markets are characterized by seasonality, production and price cyclical behavior, and a significant change in volume and liquidity. The criterion used to test price forecasting performance was whether futures markets systematically over or under estimate the level of cash prices. The analysis also checked the ability of futures prices to explain movements in the cash price series. The analysis was conducted by regressing cash prices and a lagged futures prices series on a lagged cash price series running from October 1964 through December 1977. The results indicated that live cattle futures added little forecasting information over lagged cash prices, while hog futures performed the forecasting function well relative to cattle futures and lagged cash prices. Further analysis led the authors to suspect the performance of cattle and hog futures as a rational price formation agency because, in cases where forecasting performance was originally poor, it did not improve as the contract approached maturity.


This paper examines whether futures market perform a forward pricing function. Specifically, the performance of the futures market forward pricing function of a continuous and non-continuous inventory commodities were
examined. The two commodities examined were Australian wool futures and Australian live beef cattle futures traded on the Sydney Futures Exchange. Data used in this study were monthly averages of daily price observations for wool from 1968-78 and for live cattle from 1975-79. A simple regression model of spot and futures prices was estimated using general instrumental variables estimators. Futures prices were found to be unbiased predictors of spot prices for wool and for live cattle with lags up to three months long. For live cattle, the results indicate that the futures market out performed spot prices as unbiased predictors of subsequent spot prices.


This study conducts a semi-strong form test of the efficiency of the live hog futures market. This test examines whether differences between the futures price in period t and the spot price that evolves in t + j after the receipt of new information is a random number. An econometric model was developed to forecast hog price reflecting available public information to act as a norm against which futures prices were compared. The econometric model was estimated first for 1964-70 then updated and re-estimated annually through 1976. Root mean squared errors and composite predictions were used to evaluate the two cash price predictors. Over the seven year period 1971-78, the futures market provided a smaller root mean square error and larger composite prediction errors. On a year by year basis, these results were not confirmed. The futures market for live hogs, the authors conclude, contains inaccuracies and cannot consistently be relied upon to accurately reflect subsequent spot prices. The authors concluded that the live hog futures market should not be considered efficient.


A weak-form test of the efficiency of the carcass beef market is examined in this study. Tests of market efficiency were employed to identify if the thin market characteristics of this market has implications for the markets performance. Daily price data for 11 beef carcass classes from *The National Provisioner's Daily Market and News Service* for July 19, 1976 to November 16, 1979 were examined. Ward rejected the hypothesis that these prices are a random walk, and this result suggested a degree of market inefficiency was present. In addition, the price series was found to have a leptokurtic distribution. Ward suggests that the results indicate that the carcass beef market does not reflect all available information entering the market from the preceding market period, but there is not conclusive evidence to say the market is inefficient. The author suggests factors such as market psychology, predictability with which new information is disseminated in the market, and the market structure of buyers and sellers contribute to the serial dependence of the price series.


This study is an expansion of the hog market efficiency study by Leuthold and Hartmann (American Journal of Agricultural Economics, August 1979). The study was expanded to analyze live cattle, pork belly, and live hog futures. In addition, though using similar empirical techniques, the analysis was conducted with quarterly models rather than monthly models. Models were estimated over the 1964 through 1977 period with futures market forecasts and econometric forecasts examined for the 1971 through 1977 period. The analysis confirmed the author's 1979 findings for the hog market and indicated that the pork belly and live cattle markets also do not utilize all available information. The authors suggest, however, that growing use of the futures market may imply that information from the futures market is superior to alternative sources.


This paper examines the forward pricing function of live beef cattle futures. Specifically, Leuthold sought to examine the efficiency with which the forward pricing function of the live cattle contract was performed. Cattle and corn contracts were compared in terms of their forward pricing function. The first 36 live cattle contracts traded on the Chicago Mercantile Exchange were examined, contracts with maturity dates of April 1965 through February 1971. The results indicate that from about 15 to 36 weeks prior to delivery, the present cash price is a superior estimate of the future cash price compared to the futures contract price. Evidence suggests that over time, ability of the futures price to anticipate subsequent cash prices decreased. The author suggests that the live cattle future prices estimates subsequent spot prices as efficiently as corn futures prices, however.
Basis and Basis Risk


This study analyzed the impact of cash settlement on feeder cattle futures at the Chicago Mercantile Exchange on the variability and predictability of feeder cattle basis. The impact on basis risk of cash settlement is examined for feeder cattle weighing 600-800 pounds, implying a hedging ratio of one. Basis variance and basis forecast error are examined. A reduction in basis variance does not imply a reduction in basis forecast error. For hedging effectiveness to increase, basis forecast error must decline. The authors note that it is possible for the variance of futures prices to decline when a cash settlement index is adopted, but in the same instance, basis variance can increase if relative cash market variability does not also decline. First, weekly basis variance for a three year period before and after the introduction of cash settlement is analyzed. The basis analyzed was for Oklahoma City and for Southwest Virginia. No statistical difference could be verified in weekly basis variance for these two markets between the prior and post-cash settlement periods. Basis forecast errors are analyzed based on models that predict basis. These models were developed based on an analysis of characteristics of individual lots of feeder cattle marketed in Virginia. Basis forecast error in general did not decline with the adoption of cash settlement. Basis risk for feeder cattle hedgers in Virginia was therefore not reduced.


In this article the authors examine the impact of specific characteristics upon prices received for feeder cattle, imputing a marginal value on these characteristics or traits. The innovation this research contributes is that the analysis was conducted on teleauctions. Because participants in teleauctions do not see the cattle, the importance of information and the composite parts of the information available can be expected to directly impact upon price determination. Data are analyzed separately for three teleauction systems operated in Georgia. The period covered in the analysis was 1976 to 1988. Variables such as sex (steer, heifer), lot size, order in auction, and weight all have significant impacts upon price. This is consistent with previous research on auction processes. The impact of lot order was not as great as in studies on sale barn auctions. Not all auctions respond to futures in the same manner or significance. Those that tend to have more national buyers tend to be the most responsive to futures prices activity. Lot sizes and optimal lot size were found to be significant for teleauctions when compared to previous research results on traditional cattle auctions.


This article compares the net prices to sellers and buyers in video auctions and a traditional regional auction for feeder cattle. The authors attempted to adjust for differences in transportation costs by examining net prices. Descriptive information on the video auction process is incorporated in the article. The Superior Livestock Auction sales data are compared with price data for the Oklahoma City, Greeley, Colorado and Dodge City regional markets. A hedonic specifications model is employed to adjust for quality differences in animals between regional auctions and the video auction. For instance, in comparing Dodge City prices, the video auction prices were adjusted downward by 34 cents per cwt. to reflect quality differences. The analysis indicates sellers receive a higher net price with video auctions and buyers pay a lower net price with video auctions. This is a result of lower transaction costs. The authors estimate the cost of selling cattle through video auctions at 4.4 percent of the value of the cattle. This compares with between 6.1 percent and 7.5 percent in regional auction
Markets. Buyer transaction costs are lower in the video auction. Combined buyer and seller transaction costs average about 8.5 percent in the video auction, compared with 10.4 percent on average in the regional auction markets. Net adjusted cattle prices are estimated to be between $.95 per cwt. and $3.36 per cwt. higher for sellers in video auctions relative to the three regional auctions.


In this article, the authors examine whether feeder steers and heifers that do not meet the par grade weight standard for the feeder cattle futures contract should be hedged based on a hedging ratio. Traditional hedging strategies are defined in a pound-to-pound offsetting position in the futures market, an equal but opposite position in futures relative to the physical position held. A ratio hedge is where a hedging ratio is determined that equates the pounds of futures required to hedge a particular sex and weight of animals. The authors recognize the basic cross-hedge nature of the futures contract. Auction prices of Medium Frame No. 1 steers and heifers between 300 and 1000 pounds between 1977 and 1988 formed the data base for analysis. The hedge ratios are formed by regressing cash price on nearby futures prices. Hedging risk is measured by the standard deviation between net and target prices for traditional hedges, and the standard deviation of the error terms from regression is used to estimated hedging ratios for the ratio hedge strategies. Ratio hedging reduced hedging risk up to 40 percent over traditional hedging strategies. An ex ante simulation confirmed the analysis.


This article reports on research that examined whether hedging risk for feeder cattle is lower with a cash settled contract compared with a physical delivery contract. The author developed an equation that measures hedging risk based on how cash and futures prices move together. The hedging risk was estimated for feeder cattle using weekly average Arkansas auction market prices, weekly average CME feeder cattle futures prices, and a weekly Cattle Fax price. The period analyzed was 1977 to 1986. Because this was prior to cash settlement, the Cattle FAX price was used as a proxy for cash settled futures prices. The results of the analysis found that cash settlement reduced the hedging risk for feeder cattle above 600 pounds. Hedging risk was also lower for feeder cattle less than 600 lbs. with cash settlement when the cattle are marketed in the fall. The analysis examined weight ranges and specific months. The largest hedging risk reduction from cash settlement was 66.1 percent for steers weighting 600-700 lbs. hedged in the September contract. Hedging risk increased with cash settlement by 20-35 percent for steers hedged in the March, April, or May contract.


This article examines the differences between the prices of 300-500 pound steer calves and the prices of 600-700 pound yearling steers on a monthly basis. Marsh uses a rational distributed lag econometric analysis framework to analyze the price differences. The variables impacting on the price differentials were cost of gain, seasonality, and the expected direction of slaughter cattle prices. Monthly USDA data for the period January 1972 through December 1982 were used for estimating the models. Results of the analysis indicate that the price of steer calves are impacted to a greater extent by changes in the cost of gain and by changes in slaughter cattle prices. This greater sensitivity of steer calf prices compared to yearlings was related to the extra time and weight gain and the resultant increased risk associated with raising steer calves to maturity.
The objective of this paper is to measure and analyze within-contract basis risk for cattle and hog futures markets. Basis risk is the unsystematic component of variance in basis over time. The systematic portion and the unsystematic portion of the variance of basis were separated using the variate difference approach. Daily bases were calculated for the December and June contracts for live hogs and live cattle beginning nine months from maturity from 1970 through 1979. With the unsystematic variance of basis isolated, regression analysis was used to identify variables influencing that component of basis variability. Results of this analysis indicates some seasonality in basis for hogs but little for cattle. Basis risk appears to increase when cash prices are high and when the general consumers price level is high. The authors did not find evidence that would suggest basis risk decreases as the contract approaches maturity.


This paper provides a historical discussion and review of cash settlement as a delivery mechanism for commodity futures contracts. A review of cash settlement practices is made and a discussion of specific factors that make cash settlement more or less attractive is included. The authors deal with the issue of how a cash settlement index should be constructed. They then provide a theoretical discussion of how cash settlement would function for futures contracts with heterogeneous grades. Garbade and Silber conclude that cash settlement can improve the futures markets by enhancing the risk transfer function of futures by providing closer convergence of futures and cash prices. The costs of delivery can be substantially reduced with cash settlement and new types of futures contracts are possible. They see cash settlement as bringing greater flexibility in contract design when heterogeneous commodity products are important. The caveat to cash settlement they provide is that the price index has to be a reliable indicator of the true commercial value of the commodity and must be free of potential manipulation.


Buccola examines the hypothesis that in English style auctions, price will decline over time or over lots as buyers become satiated. Buccola examined price trends at an individual Virginia auction market for fall yearling steers from 1958 through 1979. In his regression analysis, he included explanatory variables for lot size, weight, grade, breed and order in which the lot was sold during a day. The results confirm the hypothesis that price does decline during the course of a sale. The negative lot position effect was found to have become more pronounced over time as inflation increased and cattle price reached higher levels.


This article examines whether unexplained price differences occur between markets and what impact lot size, number of buyers, and size of auction market will have on cattle prices. These factors are examined in terms of
the efficiency of livestock auction systems. Regression analysis was applied to data collected from Australian livestock markets collected over a 35 week period in 1977 and 1978. The authors found no conclusive evidence of price premiums in either county or metropolitan markets. The authors concluded that after allowing for transportation costs, weight, time and lot size, there were no differences in price levels at small or large auction centers. Prices at small centers were found to be more variable. A positive relationship was found between price per head and per unit lot size. No relationship was found between the number of buyers and price levels at either the large or small auction centers.


This article develops and empirically tests a theoretical model to identify variables which affect the futures-cash basis for live cattle. Leuthold hypothesized that the basis provides insights about forthcoming changes in cash prices because basis reflects the movement in cash prices resulting from shifting supply and demand conditions. Demand was assumed constant in this study because time spans analyzed never exceed seven months. Ordinary least squares was used to estimate basis equations for monthly data for 1965 through 1977. The models were not effective in explaining basis behavior for contracts close to maturity. Leuthold had somewhat greater success in modeling basis for distant futures contracts based on shifting supply. Some evidences of a seasonal behavior in basis was identified for live cattle. The coefficients of determination for basis models for two to seven months time horizons ranged from .78 to .90. Leuthold concludes that basis does reflect the expected change in cash prices from the current period until maturity of the futures contract resulting from shifts in supply.


Menkhaus and Kearl examine the influence of breed, sex, lot size and weight on feeder cattle prices. Data analyzed were 1,535 lots of cattle sold at special feeder sales in Wyoming during the months of September through December in 1973 and 1974. The yearly data were analyzed independently. Regressional analysis was employed. Breed, lot size, sex and the month of the sale all influence prices paid. Weight was only significant in determining price in 1973. The results also indicated some preference among buyers for cross breeds rather than straight breeds.

Blank provides a brief assessment of the issues, methods, and results reported in recent research literature on agricultural futures and options. This review of literature deals with two broad areas. First, research on social value issues deal with pricing efficiency and resource allocation functions of futures markets. The social value issues were expanded to include price variance and risk levels in futures markets. Second, the firm-level issues deal with hedging, optimal hedge ratios, hedges in a portfolio framework, and marketing decision rules. This review, while highlighting issues in futures market research, also examined methods of evaluation employed by researchers. Since the introduction of The Journal of Futures Markets, scholarly research has dominated research on futures market issues. Blank notes there is a need to pay greater attention to the decision process of real-world firms. The shortcoming of academic research is that it tends to ignore the decision calculus of firms and thus miss significant attributes of futures market prices and the performance process. Blank's article is followed by a discussion by Allen Paul.


This article reports on a comprehensive examination of past studies on the pricing efficiency of agricultural futures markets. The authors have not conducted solely a literature review but have conducted a statistical analysis of reported result so as to draw inferences about the pricing efficiency of agricultural futures markets. The authors analyzed 38 studies on futures market efficiency published between 1970 and 1985. The results of these studies were classified into categories based on the commodity analyzed, whether the study was a forecasting or non-forecasting study, if weak form or semi-strong form tests were applied, type of data used (monthly, weekly, or daily), and the time period analyzed. Logit models were employed in the analysis. Models were estimated for the data from forecasting and non-forecasting studies. The results indicate that when the futures market pricing efficiency is measured by the markets ability to forecast prices, the livestock commodities are more likely to perform less well. The 1973 through 1979 period showed an increased tendency to find inefficiencies based on forecasting tests. The two results were suggested to be attributed to the non-storability of livestock commodities and the instability of agricultural markets during the 1973 through 1979 period, respectively. Similar, but less statistically significant, results were found from the analysis of non-forecasting studies. The authors found time horizons had an important impact on finding inefficiencies in forecasting studies. In addition, studies found more systematic components of price change when daily rather than monthly or weekly price changes were analyzed.


Purcell and Hudson do not set out to provide a review of literature of livestock futures trading. It is one of the by-products of their thorough discussion of the economic function of trade in livestock futures. The specific areas covered in this treatise are; identification of sources of controversy in livestock futures, the functions of risk transfer and price discovery, a description of empirical analysis of causal flows between live cattle futures and cash cattle and carcass beef prices; and finally an identification of areas where there are gaps in the body of
knowledge on livestock futures trading.


Kamara provides an extensive review of literature on futures markets. This review is not confined to livestock markets, but covers all futures markets. The specific areas Kamara deals with are; theory of hedging and speculation, basis in inventory and non-inventory commodities, behavior of futures prices, and the effect of futures trading on the cash markets and the informational role of futures markets. Kamara confined his review to literature published since 1970.


Leuthold and Tomek provide a thorough review of the literature on livestock futures. Concentration is on live cattle, live hogs, pork bellies, and feeder cattle. The subject areas covered by this review were; futures price behavior and the effect of futures on cash prices, the use of futures for livestock hedging, and who uses futures. Emphasis was placed on research published in professional journals and bulletins of universities and governmental agencies between 1965 and 1979.

**Structure/Concentration**


This article provides a historical discussion of the changing structure of the beef and pork slaughter and processing industries. Factors influencing the structural shifts that have taken place in each industry are identified. The article examines the changes in each industry separately and summarizes relevant data on plant capacity and market share for the major firms. The authors describe how the beef packing industry has handled integration through owning cattle feedyards and through the forward contracting of cattle. Data are provided on the number of cattle contracted by firms. Relevant trends in the pork processing industry are highlighted, including the entrance of major beef packers into the pork packing and processing sector. Trends in integration for the pork sector, through contractual arrangements similar to those the major poultry processors have used, are now entering the pork industry. It is noted that hog production by feed companies is the most common form of integration.


The objective of this paper was to examine the impact of captive fed cattle supplies on cash prices for fed cattle.
in southwest Kansas for a six month period in 1990. Captive supplies are defined to include cattle procured via forward contracts and exclusive purchase agreements. Captive supplies were measured based on USDA Agricultural Marketing Service phone surveys of feedlots. For the period analyzed, captive supplies for Kansas averaged 6.83 percent of slaughter but 12.98 percent of Kansas feedlot sales. The authors incorporate a captive supply variable in models that explain prices of individual pens of cattle as a function of cattle quality characteristics, pen traits, buyers, feedyards and market factors. Results of the analysis indicate that increases in the percentage of cattle slaughter that are procured under captive supply arrangement impacts the prices of fed cattle negatively, but the impact is not large. In addition, the researchers suggest that fed cattle prices are positively impacted by the number of buyers bidding and by the number of days between purchase and delivery.


This article examines the impact of an oligopsony regional packer structure in the beef industry. The authors critique the traditional structure-conduct-performance (SCP) analysis by suggesting that models used are neither explicitly connected to behavior at the firm level nor are important theoretical restrictions imposed. Relative to using the conjectural variations approach to testing competitive behavior, previous research has failed to address the fact that the relevant markets are regional in scope for cattle procurement. The authors develop a non-econometric approach to evaluating the impact of packer concentration on procurement prices for cattle. Using previous research to develop a baseline, the authors simulate various concentration and demand conditions to estimate possible impacts of oligopsony behavior. In comparison with results from traditional SCP analysis, this analysis finds a much smaller impact, suggesting that the dangers of declining cattle prices as a result of packer concentration is not as great as previously expected. The results of this analysis are primarily attributed to a high estimate of regional supply elasticity. This high regional supply elasticity limits packers ability to benefit from concentration or input market coordination.


The article explores the connection between output price uncertainty and marketing margins in the context of an oligopoly/oligopsony setting where firms may exercise power over some input and output prices. The U.S. hog packing industry is analyzed for the period 1977-1988. A framework for analyzing market margins in a noncompetitive food industry facing output price risk is developed. Output price risk is measured using conditional forecast variances from an ARCH time series model of prices. The authors find that the farm/wholesale margins for pork have been consistent with a competitive market behavior. The authors note that if output price risk had been ignored, then an erroneous finding of noncompetitive conduct would have been made for the product market.


This article extends Gardner's framework for the analysis of shifts in retail demand, shifts in commodity supply,
and shifts in marketing input supply for perfectly competitive markets to noncompetitive market behavior. Causes and consequences of noncompetitive conduct in the food industry are investigated. Holloway extends Gardner's model to a conjectural-variation oligopoly with endogenous entry and then derives tests for hypotheses of conduct. An empirical examination is conducted for eight commodity groups with annual data on retail and farm prices, quantities of farm commodities, and an index of prices for marketing inputs. The period analyzed is 1955-1983. The author finds evidence to suggest that the beef and veal industry and the pork industry were noncompetitive, though this evidence was neither strong nor conclusive. Overall, the authors conclude that this research indicates departures from competition in the retail markets of major food groups have been insignificant.


The economics of the consolidation in beefpacking are examined in the context of why this occurred and what inferences can be drawn about future research agendas. Purcell maintains that the stimulus for consolidation in the beefpacking industry during the 1980s is based in problems in consumer demand and related pressure on each level of the beef production and processing system to become more efficient. Because of demand side problems the author contends it became cheaper to purchase capacity than to build capacity and the stimulus was created for three giant firms to emerge. Reviewing the actions taken by the Justice Department when mergers in the beefpacking industry were approved, the author suggests the focus was on short term benefits in efficiency. It is the long run implications that require further examination, because it is in the long run that any market power will be exercised. Greater emphasis on conduct rather than simply structure is needed in the analysis of merger applications. Improved methods of measuring cost and benefits of industry consolidation in short run and long run contexts are needed.


This paper develops a methodology to be used in surveillance of cattle markets to identify periods of possible abnormal price activity. Possible abnormal behavior could be attributed to conditions such as weather and labor problems but the authors contend it also could be the result of market manipulations. The goal is to develop a low cost and efficient method to identify irregular market conditions. A series of 783 weekly observations for 900-1000 pound yield grade 2-4 average prices was assembled for the period 1974-1988. A price ratio that links local price to an unweighted average of five major markets was constructed. A price ratio was used because it allows specific market prices to be compared to other markets. Through the use of time series techniques, the systematic components of the price ratios are analyzed. Using a residual series from the time series analysis, periodic large unsystematic behavior in a market can be identified. Once these periods are identified then the special cause of the irregular behavior can be investigated.


A conceptual framework for the potential impacts of meatpacking plant capacity and utilization on livestock prices is developed. The author also presents an analysis of survey results on plant capacity. Meatpackers solve their profit functions for the optimal price they can pay for livestock as an input. Their profit function includes

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an expected price and quantity of output and the average production costs. If production costs vary by plant capacity and utilization, then the author suggests that those with lower production costs can pay higher prices for livestock as an input. This will be the case providing there is sufficient competition from competing packing plants. Results from surveys completed by 108 firms in July 1988 are analyzed to identify differences in plant utilization levels based on plant size. Results showed larger steer and heifer slaughtering and boxed beef plants operate at significantly higher utilization levels than do smaller plants. This was confirmed both on an hourly and weekly basis. Higher utilization levels provide these larger firms with a cost advantage.


The objective of this publication was to examine the extent of forward contracting of fed cattle in 1988. In addition, the authors explored cattle feeders' perception of the benefits and implications of forward contracting. Information on forward contracting was obtained through a mail survey of 3,700 cattle feeders in the 13 leading cattle feeding states. The authors reported a response of 503 questionnaires. Those feeders responding marketed over 750,000 head of cattle in 1988 by forward contracting. This represented slightly less than 13 percent of the cattle the respondents marketed that year. Respondents indicated that forward contracting might increase slightly to about 15 percent of marketings in 1990. Basis contracting was the most common type of forward contracting employed. Feeders indicated the primary benefit of forward contracting related to financing cattle and locking in a buyer. There was little support for the perception that forward contracting enhanced the sale price. Packers were perceived to seek forward contracted cattle to secure a supply of cattle for slaughter. Feeders indicated they felt buyer competition was adversely impacted by forward contracting. Regarding alternatives for government and industry policies on forward contracting, the two most preferred alternatives involved industry programs to monitor contract activity and voluntary reporting of contractual activity.


This paper is part of the National Cattlemen's Association commissioned report on concentration/integration. The objective is to examine the various levels of the beef subsector to see if the change in concentration of ownership has altered the competitiveness of the beef subsector or any of the levels of the subsector. Beef is delineated as a distinct product by the consumer, and boxed beef should be considered as a separate industry from carcass beef. Further, the author suggests that fed cattle are bought in 15 distinct markets in the U.S. While cattle feeding is atomistic by any standard, the three largest box beefpackers account for 75 to 80 percent of the boxed-beef market. The three largest packers control approximately equal market share and are characterized as intense rivals. The author notes that in beefpacking, there is not a pattern of price leadership by any one packer on the selling side of the beef market. Four grocery chains were purchasing 55 to 60 percent of their boxed beef from the three large packers, and the packers thus face countervailing power on the selling side. The author provides the caveat that if beefpacker concentration rises above the current historically high levels, this countervailing power by retailers will count for little. At present, product differentiation and the associated higher margins to the processor are limited by government and retailer assurances of quality to the consumer. The author suggests the direction that the concentration issues take is dependent upon the approach taken by the government policy in this area.

The authors propose an empirical model for testing market power in both the input and output markets. The model is applied to the U.S. meatpacking industry. Through the use of a production function that allows all inputs to be used in variable proportions and the derivation of market-specific conjectural elasticities, it is possible to develop a model that does not impose assumptions of identical market power on the input and output sides of the market. The authors apply this model to annual aggregate data from the U.S. meatpacking industry from 1959 through 1983. Using iterative non-linear three-stage least squares, the model was estimated. Results of the estimation indicate that there are statistically significant but differing degrees of market power in the input and output markets. Results suggest that the U.S. meatpacking industry has greater market power in the input (livestock procurement) market than exists in the output (meat) market.


The authors report on preliminary results of the use of a model of market conduct which uses non-cooperative game theory to explain the interaction among meatpackers in the procurement of live cattle. The analysis used price quotes from direct feedlot-to-meatpacker sales of 900 to 1,100 pound steers. The regions examined were Iowa and Southern Minnesota, Eastern Nebraska, Western Kansas, and Texas. The data employed were daily prices from the USDA's weekly LS-214 publication. The theoretic model requires a stable industry over time. Two time periods were examined—June 1980-June 1982, and June 1984-June 1986. The results of the analysis (though preliminary prior to the model being fully tested) suggest evidence of increasing cooperative pricing across meatpackers. This was most evident in Iowa and Eastern Nebraska during both the periods examined and in Texas during the latter period. Western Kansas which has the most major meatpackers competing for the available supply of cattle, did not provide evidence of cooperative behavior consistent with the game theory model. The results suggest that the non-cooperative game theory model may be useful in examining the existence of short-run market power by meatpackers in the procurement of live cattle.


Prompted by dramatic changes in the U.S. meatpacking industry during the early and mid-1980s, this book attempts to consolidate much of what is known concerning competition and pricing in the meatpacking industry. The structure-conduct-performance approach is taken in the analysis. The author has made a special effort to restrict technical, economic, and statistical components of research and reviewed literature to appendices, thus leaving the chapters understandable to the non-economist. Ward reports evidence of economies of size are clearly present in beefpacking and porkpacking, and suggests that in addition to individual plant economies, multi-plant or inter-plant economies also exist. The price process is reviewed relating procurement practices of meatpackers and in the wholesaling of meat products. The reporting of the pricing process is followed by a review of theories—oligopoly and oligopsony pricing—in evaluating market conduct in the industry. Performance measures are discussed in the context of technical and pricing efficiency. Industry profitability in the meatpacking industry is also reviewed. In summary, Ward suggests meatpacking has trended towards oligopolistic structures. An up-to-date and comprehensive report of current research by the author and other researchers is provided. It sheds light on the current industry organization and suggests that greater resources need to be devoted to monitoring the meatpacking industry and greater effort needs to be made to collect data relevant to competition and pricing in a changed industry. The recommendations are offered to improve the assessment of industry performance and enhance confidence in the competitiveness of the pricing process.

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This publication reports the results of a survey of livestock (cattle, hogs, and sheep) producers in 14 states by the Agricultural Cooperative Service, USDA and the American Farm Bureau Federation in late 1987 and early 1988. The survey sought to solicit producers' perceptions of current market access and competition compared with their recollections of the situation in the early 1980s. Of the almost 7,500 producers surveyed, over 1,700 responded. The majority of respondents were feedlot producers or hog producers. The largest group of those feedlot producers responding marketed less than 50 head annually and 65 percent of respondents marketed less than 500 annually. The largest group of pork producers responding marketed between 1,000 and 9,999 head annually and less than 2 percent of the respondents marketed more than 10,000 head annually. The survey found a marked increase in number of producers receiving only one or two bids on their livestock in the 1987-88 period in comparison to 1982. Consistent with this finding, the paper reports producers were finding a reduction in market outlets available for their livestock in the 1987-88 period compared to 1982. The survey results suggest producers are marketing the majority of livestock to just one packer, and that between the early 1980s and the mid- to late 1980s this phenomenon has been increasing. The survey solicited producers' attitudes regarding packers' systems of paying on grade and yield basis. The majority of producers felt grade and yield selling increased returns. When asked about what should be done about the problem of decreasing numbers of livestock buyers, the producers three dominant responses were:

1. form group marketing program,
2. limit or prohibit mergers, and
3. do nothing.

Overall, this publication integrates administrative data concerning change in market structure with the results of producer's perceptions of how they are being affected by that changing structure.


This article focuses on the factors that affect merger activity and the motives behind current merger activity with an emphasis on merger activity in the food industry. Rather than an empirical analysis, the authors present data to highlight historical trends in mergers and survey the literature on motives for mergers and the impact of mergers. The review of trends in merger activity tends to suggest that activity has been higher in the food and tobacco manufacturing than all U.S. manufacturing and mining industries. The authors review of motives rests upon two primary explanations for mergers. The first is based on neoclassical economics and the assumption of profit maximization. Firms merge because of the expectations that profits from the merged firm will exceed those had the firms remained independent. The higher profits can be expected from economies of scale and scope or from more competent management. Additionally, mergers can be a form of diversification and thus lower the variance of profits. The second motive or explanation for a merger is a non-neoclassical based explanation. The theory suggests managers use mergers because they seek growth or "empire building". This latter explanation suggests merger activity stems from management and is not driven by profit maximization. The evidence of merger motivation indicates that, based on both an industrial organization and a financial
analysis perspective, profit maximization fails to be the primary motivation for mergers. The authors suggest that merger activity results in a loss of public information, and thus creates barriers to entry. They conclude by suggesting that industrial conglomeration appears to have no market driven limits nor countervailing economic forces.


This study examines the impact of input substitution on producers and consumers. The authors develop a two-input (cattle and marketing) and a two-output (beef and byproducts) industry model. The technical change examined is the innovation of tray-ready beef. This technology represents an innovation over boxed beef. This new technology can cause a shift in the inputs demanded and, thus, depending on the substitution between inputs, benefits of technical change will accrue differently. The authors provide a detailed model of the industry that defines how the benefits will be distributed. A representative year in the early 1980s was simulated for the analysis. Average prices for 1984 and average quantity and share data for the 1980 through 1984 period were used. The analysis provides ranges for short run gains from the tray-ready innovation of 51 to 72 percent going to cattle producers, with beef consumers gaining 27 to 48 percent of the benefits. Consumers of beef byproducts gain about 1 percent of the benefits. Their analysis suggests that cattle prices would be 1.8 to 2.3 percent higher from this innovation, and retail beef prices would decline .6 to .9 percent. The new technology was considered as a downward shift in the supply of marketing inputs. This could be considered alternatively as a cost-saving technology. The authors note that by appropriately weighting the estimated shift in supply of marketing inputs, the equivalent results as biased technology change will be found. This study indicates cost information can be used in place of unknown shifts in demand for inputs resulting from technical change.


This study makes use of the U.S. Small Business Administrations U.S. Establishment Microdata file to analyze the growth and decline (micro-dynamics) over time of individual businesses. The analysis was conducted for 1976 and 1982. The analysis of individual firms over time is unique, and differs from the traditional approach of comparing industry averages over time. The objective of the analysis was to trace what industries and regions firms entered, left, expanded, or contracted. The analysis focused on 294 food manufacturing firms that operated in four sectors--agriculture, food, tobacco, and other manufacturing services. The results indicate that diversified producers are the likely source of new entry in capital-intensive industries, and that new entry is mostly by acquisition. During the period studied, food manufacturers grew rapidly with more than half the growth coming from diversification. Divestitures were also extremely important during this period. The diversification that food manufacturing firms made tended to be towards related industries in food service or agriculture. The author suggests that stable industry averages conceal an enormous amount of offsetting diversification and divestiture activity for food manufacturing firms during the period analyzed.


This effort adapts the framework for estimating the degree of monopolistic performance in a market to one that allows assessment of monopolistic and monopsonistic performance. The technique is then applied to annual
data on the U.S. beefpacking for the years 1951-1983. A system of equations was estimated in quasi-first differences using full information maximum likelihood to allow the estimation of conjectural elasticities. These conjectural elasticities were used in conjunction with Lerner's index and an index based on the difference between marginal net revenue product and an index of factor prices to identify monopoly and monopsony price distortions. The results found clear evidence that an assumption of beefpackers being price takers in inappropriate. The magnitudes of price distortion resulting from the monopoly-monopsony structure were estimated to be relatively small, 3 percent from the monopoly side and 1 percent from the monopsony side, for the latter years in the 1951-83 period. The author notes the size of price distortions did not increase with the increase in packer concentration between 1977 and 1983.


Dealing with agriculture and food marketing rather than specifically livestock, this book provides a summary of the current knowledge of economic analysis in this area. The intent is broad as opposed to dealing with specific topics or subsectors of the industry. Implications of economic efficiency for firms and public policy are considered. Conceptual and methodological models for economic efficiency and possible gaps in these models are identified. Chapters are provided on areas relevant to this bibliography such as: Economies of Scale, Efficiency and Market Information, Issues of Grading and Quality, and Futures Market and Intertemporal Pricing. The approach taken is to present a paper and then "discussion" by eminent scholars in these areas.


This article extends work that suggests the presence of welfare gains to society from productivity improvements related to higher concentration levels in the food manufacturing industry to the meatpacking industry. Ward examines changes in productivity and concentration in the U.S. meatpacking industry for a 25-year period, 1958-1982. The data used were derived from Census of Manufacturers and from Packers and Stockyards Administration, USDA. The results of the analysis indicate that neither total factor productivity nor labor productivity was related significantly positively or negatively to concentration in meatpacking. These results tend to conflict with results from analysis of food manufacturing as a whole and with studies showing economies of size in meatpacking. The author suggests that this conflict in results stems from inter-industry analyses masking relationships due to aggregation biases. In addition, this analysis was conducted for meatpacking in general and not for specific species and, thus, may not capture all the possible increases in productivity that may result from economies of scale and size.


Skaggs provides a historical review of the development of the red meat industry in the United States from colonial times up through the early 1980s. This study deals not just with the meatpacking, but with the development of different methods of livestock production, the movement to ranching in the western United States, and the subsequent retrenching and restrictions of the vast range ranchers. The role of government and labor unions in this industry are reviewed. This study provides a brief, but comprehensive, history of the major developments in the red meat industry in the United States. In addition, a very useful and complete bibliography
is included. The author closes with the following caveat after reviewing the development of the early 1980s: "How much further history will go in repeating itself remains to be seen."


The purpose of this article was to examine the behavior of market prices for hogs in local markets after a slaughtering plant closed. The authors examined six plant closings and two subsequent plant-reopenings between 1978 and 1983. Each case that was examined was related to a plant in a major hog producing region. Weekly prices were examined six months prior to the closing of the plant and six months after the closing of the plant. Specific price differences were examined between the local market and high-volume control markets that would not have been affected by the plant closing. Ordinary least squares techniques were used to estimate models relating the price differences with binary variables for time intervals following the closing of a plant. The results indicate that there were no sustained statistically significant impacts on hog prices associated with a single slaughtering plant closing. This suggests that market arbitrage by the remaining participants was quick and effective.


This publication presents an empirical examination of buyer concentration in the fed cattle market. The authors provide a thorough discussion of changes of historical importance in the meatpacking and cattle feeding industry. The methods of cattle procurement of cattle and marketing of beef are described. A detailed review of the literature on meatpacker concentration and fed cattle pricing is presented. The hypothesis tested is that fed cattle prices are lower in markets where packers exercise monopsony power than they are in competitively structured markets. The authors analyze prices for USDA Choice steers weighing 900 to 1,100 pounds in 13 regions of the U.S. The time period analyzed was confined primarily to the decade of the 1970s. Concentration ratios and a Herfindahl index were used to measure market structure. The results suggest that buyer power, as measured by concentration ratios, depressed fed cattle prices in certain regions of the U.S. during the 1970s. The results imply that had the four-firm concentration ratio not risen from 48 percent in 1971 to 67 percent in 1980, cattle prices would have been $.19 per hundredweight higher in 1980. This resulted in an estimated loss to feedlot operators of $45.2 million in 1980. With the Herfindahl index, the 1980 loss to feedlot operators was estimated at $50 million. The authors suggest that in regions with little competitive buying a need exists to examine alternatives such as electronic marketing to broaden market opportunities and reduce the level of buyer concentration.


The examination of the organization and performance of the U.S. food system is approached by focusing on agricultural production sectors, the food manufacturer, and the food distribution system. This book is a comprehensive summary of work carried out by the North Central Regional Committee 117 Project. In addition to dealing with the organization and performance of components of the U.S. food chain, the legal environment (antitrust) affecting the system is presented. The implications of the structure of the food system for performance and public policy encompass the conclusions of this book.

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This book is a comprehensive study of the U.S. food manufacturing industrial organization. The authors make use of the U.S. Standard Industrial Classification (SIC) to examine what is broadly identified as the “food and tobacco manufacturing” industries between 1947 and 1982. The authors rely upon the industrial-organization paradigm, supply and demand conditions determining market structure, and market conduct effecting economic performance in their analyses. Basic data on seller concentration, product differentiation, and conditions of entry and exit are provided for the classical dimensions of market structure. This is followed by an examination of patterns of conduct in the food industries. Cattle procurement by meatpackers is examined as an example of conduct in procurement markets. A review of quantitative market structure-performance research is presented. The authors examine how various public policies affect competition in the food industry and provide suggestions for improving public policy.


This book provides the results of a coordinated review of the economic interrelationships in the entire pork sector from breeding stock to the final consumer. A description of the organizational structure at each stage of the pork sector is presented, along with a description of the evolutionary pattern of the stage. At each stage, the pricing and coordination system is reviewed. The authors employed the structure-conduct-performance paradigm in the review. This paradigm provided a method of relating the structure and overall vertical coordination present in the sector. In addition, the approach provides insights into location of markets at each stage of the sector. The results of this analysis suggest that the pork slaughter/processing industry was weakly oligopolistic in the early 1980s. It was apparent from this research that economies of size are present in large, modern plants killing between 2 and 4 million head per year. The marketing of live hogs directly to packers has expanded because of operational efficiency. The authors offer the caveat that this transition to direct marketing presents problems for the price discovery process and the dissemination of price information. The authors found that wholesaling of pork has been done primarily through negotiations of formula price arrangements based on the Yellow Sheet market report of the National Provisioner.


This report provides a brief review of the dominant issue of concern in the mid-1980s in the meatpacking industry. Concentration was the dominant issue, with further concern relating to the make-up of ownership of the industry and to implications for the pricing process. Of interest is the review of how the beef and pork sectors got to their present (1985) structure. Nelson has brought together an excellent summary of data of identifying trends in the meatpacking industry relative to other food manufacturing sectors. Having provided a synopsis of the industry, Nelson identifies the implications of the changing industry structure and trends. He suggests the future of the industry will be shaped by a broadening of meatpacking to both red and white meats and by further advances in technology in processing and distribution of meat. Specialization of processing and augmentation of markets were also expected to continue.

This bulletin reports on a study of alternative methods of purchasing and handling beef. The study simulated 10 alternative methods of handling beef at the retail level. These 10 alternatives ranged from carcasses delivered by the packer to retail stores, to packer prepared tray-ready beef distributed through retailers’ warehouses. The costs associated with the various alternatives were based on economic engineering and capital budgeting technique cost estimates (including labor costs) and are based on 1984 costs. The results of the analysis confirm that when additional factors such as shelf life and consumer aversion to frozen meat are considered, boxed beef distributed through warehouses to retail stores is the most attractive. Tray-ready beef is attractive, but given the then-present premiums associated with tray-ready beef, its attractiveness was limited in this simulation. The author notes that if tray-ready beef follows the path of boxed beef, competition will drive these initial premiums down. Labor was the significant cost in these systems and the primary differences in the system was due to the location of labor intensive operations. Meatcutting at a warehouse or packing plant had advantages because it allowed for specialization of labor tasks. In the conclusion, there is some estimate of the impact of moving to the more efficient system in reducing beef prices to consumers and stimulating additional movement of beef. The author suggests that savings to consumers could be in the order of $1.4 billion and over 450 million additional pounds of beef would be demanded annually.


This study is an examination of regional development of the pork packing industry. This book is primarily concerned with the development of the industry during the mid-to late 19th century. Walsh provides an in-depth treatment of the pork packing industry and how the development of this industry was an integral part of the industrialization of the region. The book is also important as a resource tool. Fifty percent of the book is devoted to a bibliography and to the identification of reference material on the pork processing industry.


This article evaluates tests for the structural stability of concentration-profit relationships. Food manufacturing firms were used in the analysis. The author analyzes alternative statistical techniques for identifying structural stability in concentration-profit relationships. The concentration-profit relationship is used as a proxy for concentration-performance relationships in the analysis of industry structure. If and where the concentration-profit relationship is discontinuous, it can be used as an indicator of possible anti-competitive behavior of firms in the market. The author notes that in reviewing previous research on concentration-profit relationships, he found that samples were selected so as to include the areas where structure changed. This type of analysis invalidates the usual tests of statistical significance. The author proposes two alternative methods to identify structural change in concentration-profit relationships. First, plot the cumulative sum of recursive residuals against an order variable (CUSUM) and the related plot of cumulative sum of squared recursive residuals against an order variable. Second, a log-likelihood ratio test should be employed. Empirical testing of these methods was conducted using 1950 data on 97 food manufacturing firms from the federal Trade Commission. This data set was used because of the limited availability of data sets that provide profitability data on individual...
firms. The results confirmed the applicability of the alternative testing procedures. The results emphasize the importance of relating critical concentration ratios for specific industries to possible performance impacts.


This article addresses the issue of concentration on productivity in the U.S. food manufacturing sector. The author tests whether productivity and concentration are linked and whether concentration can be considered a source of welfare gain offsetting social losses associated with oligopolistic power. The analysis was conducted using a Census of Manufacturers data set augmented with an annual survey if manufacturers data for the 1963-72 period. The analysis found an unambiguous relationship between changes in concentration levels and an increase in factor productivity in the U.S. food manufacturing. Through the use of a price-leadership model, Gisser found that increases in total factor productivity, which is linked to concentration, roughly offsets the loss to consumer welfare associated with oligopolistic behavior of food manufacturers. The author concludes by suggesting that antitrust activity to restructure the industry might deprive society of benefits from the economies of size that accrue from concentration.


The authors seek to examine the extent and direction of factor substitution, economies of scale, and the ways in which technical change occurs in the meat products industry. This is done by estimating a nonhomothetic cost function for the meat products industry using annual time series data for the 1954-76 period. A discussion of the dual relationship between cost functions and production functions is provided as the theoretical base of using the nonhomothetic cost function approach. The empirical results indicate that all input pairs (capital, labor, energy, materials, and structure) act as if they were substitutes. The scale elasticities indicate that the meat products industry is characterized by increasing returns to scale. This phenomenon is particularly evident in the period starting around 1972. The authors suggest that their results indicate that the meat products industry was not near its long-run competitive equilibrium (in 1976). They speculate that contraction in the industry has contributed to the disequilibrium that existed. Technical change that had taken place was found to be labor saving and material using. Scale economies were being led by higher labor prices and higher labor prices contributed to greater cost reduction from technological advances.


This publication reports empirical evidence on prices paid for fed cattle among beefpackers and on the relationship between market share and prices paid in relatively localized markets. The author sought to test the hypothesis that, in relatively small geographic markets, larger beefpackers pay significantly lower prices for fed cattle than their smaller competitors. Data for the analysis came from sampling 26 commercial feedlots in Texas, Oklahoma, Kansas, and three marketing agents in Nebraska and Iowa. The data collected covered 344 pens of cattle or 51,586 head sold during the month of July 1979. The market shares for the largest buyer ranged from 25 to 48.9 percent, and for the four largest buyers market share ranged from 69.6 to 100 percent in the areas studied. The results of the analysis found no significant evidence to support the hypothesis that larger beefpackers pay lower prices. The empirical analysis considered the effects of quality differences and time of
purchases on the prices paid for the cattle. Ward suggests that price differences were related to access and ability to use information on demand and supply, plant localities and transportation costs, and slaughtering and processing costs.


This book provides a historical treatment of the meatpacking industry from the start of the 19th century up to the early 20th century. This period encompassed the development of meatpacking firms into national firms using new technology with assembly line processes. The period of study also contains the initial appearance of an oligopolistic market structure in meatpacking. In this study, Yeager avoids the biases of earlier studies that were aggressively either pro or anti-packer. The approach taken is to view the economy in terms of a dual economy where a center economy exists with large firms and a peripheral economy with many small firms. The meatpacking industry is examined in an effort to understand why oligopoly structure comes to characterized industries of the center economy and to answer the question on whether the oligopoly structure precedes or follows the monopoly structure. Yeager examines the role of markets and technology in the development of the industry structure and competitive environment. The role of government and the influence it exerts are examined. The consequences of the industry structure and government action for the American economy are considered.


The purpose of this article was to estimate the influence of concentration and other structural variable son the price of slaughter cattle. The authors contend that oligopsony behavior will be evident in prices rather than in profits because profits are influenced by both buying and selling behavior, and the objective is to specifically examine concentration and buying behavior. Models for 1972 and 1977 were estimated for deflated average price of Choice 900-1,100 lb. slaughter steers at specific state markets. The estimated models were cross sectional rather than time series models. The empirical results suggest that concentration is negatively related to the prices paid for fed cattle. The size and significance of this negative relationship increased during the two periods examined. The authors reported that in the 1977 model, there was an indication that larger feedlots were able to exert some countervailing power on price pressure from higher buyer concentration levels.


This bulletin provides a descriptive treatment of the historical events that have contributed to structural change in agriculture, specifically dealing with structural change in the fed cattle sector. The authors suggest that factors outside the sector itself combine to pressure the sector to change. These factors can include:

1. new technology, biology, mechanics, or organization,
2. shifting market forces or demand changes, and
3. government policies.

Given these factors, structural change takes place following the paradigm of innovators adopting new

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technology, production shifting to areas more amenable to the new methods, output rapidly increasing, and finally new institutions emerging to allow the subsector to better manage new risks. For the fed cattle sector, the authors present a scenario of technology, developed during World War II in aluminum and plastic, allowed for increased mechanization in feed handling, animal waste disposal, farming, and irrigation of dry land. Combined with the development of hybrid sorghum production, such technology enabled the Southern Plains to become a major feed grain production area with large feedlots. The combination of government feed grain policies providing stable feed prices, tax advantages providing capital to commercial feedlot operators, and cattle futures markets providing a risk transfer mechanism enhanced the structural shift in the fed cattle sector. This shift also produced a change in the cattle slaughter sector resulting in moves to modern, single-floor facilities close to the cattle production areas. The structural change in cattle slaughter involved the closing of smaller facilities close to urban centers because of efficiencies gained in transporting carcasses rather than live animals.


Based on early indication of rising four-firm concentration ratios in the beefpacking industry, this study examines whether there has been an impact on pricing performance resulting from change in market structure. The authors provide an interesting discussion of what is the relevant market to examine. The focus of the study is narrowed to firms slaughtering heifers and steers in 23 principal cattle-producing states. Concentration ratios developed on a state-by-state basis by the USDA were combined with individual state total slaughter of steer and heifers to produce a weighted concentration as a measure of market power for the combined 23 states. The hypothesis of this study is that increased concentration in beefpacking will lead to larger average firm sizes, higher carcass and boxed-beef prices, higher live cattle and retail prices, and expanded carcass-retail price spreads. The empirical tests were performed by estimating reduced form-inverted demand functions relating price to quantity demand and cost factors at the retail and carcass level using quarterly data for the period 1969-1978. The results of the empirical analysis suggest that when using the weighted average of market share for the 23 largest steer and heifer producing states, there was evidence that concentration levels influenced prices for fresh beef. The authors contend that the concentration levels present in 1980 provide price enhancing power to the largest slaughtering firms and that an oligopoly-oligopsony market structure better characterizes the carcass and boxed-beef markets than would a model of workable competition.


The basic premise of this article is that to analyze competition in agricultural markets, there exists a need to broaden partial equilibrium theory and a related need to develop a theory of disequilibrium. Introduction of time as an explicit dimension of price needs to be made. Time is as important a dimension as is form and place. The three dimensions Paul notes--time, form, and place--tend to change over time. Indirect markets exist in specialized services that transfer commodities in form, place, and time. Paul contends that there is a need for the tantonement process and to evaluate it based on how well it makes prices consistent with quantities demanded and supplied in comparison with other methods. The use of average price levels or profit rates as indicators of market performance may not tell us much about market deficiencies when the markets are in disequilibrium. In
defining market boundaries, Paul suggests defining the length of run of the market and the place and form of the product. Paul contends that institutional innovations are just as important as technical innovations. Institutions often change so as to mitigate economic hazards. Activities firms undertake can be related to the failures of the market. Failures of the firm can result in greater reliance on markets. Paul suggests that if deficiencies in the market exists, there is a question of whether they can be remedied and whether large firms are a help or a hindrance to the process.

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