White Paper on Status, Conflicts, Issues, Opportunities, and Needs in the U.S. Beef Industry

Coordinated by

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May 1999

SP-99-03
Department of Agricultural and Applied Economics
Virginia Tech
Virginia Cooperative Extension
Virginia Tech and Virginia State
Virginia's Land-Grant Universities

Research Bulletin 5-99
Research Institute on Livestock Pricing
Agricultural and Applied Economics
Virginia Tech - Mail Code 0401
Blacksburg, VA 24061

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Section 1: Background Statement

Written by Wayne D. Purcell with input from some of the other researchers, this section traces important developments in the beef industry across recent decades and focuses on why they occurred. Current issues are identified and critiqued, and the continuing demand problems are documented as the primary source of lack of profitability at the producer level. This section is necessary "background" for later emphases and for the set of specific recommendations for policies and/or programs designed to help restore profitability and growth to the business sector.

Section 2: Reflections on Current Issues in the Beef Industry

Written by various researchers, the "reflections" deal with some of the often-controversial issues now being discussed in the beef business.

Understanding Price Determination vs. Price Discovery
Clement E. Ward, Professor
Oklahoma State University

Captive Supplies in Fed Cattle Markets
Ted C. Schroeder, Professor
Rodney Jones, Assistant Professor
Kansas State University

International Beef and Cattle Trade Issues
James Mintert, Professor
Kansas State University

Stable Slaughter and Fabrication Levels: Implications to Costs and Cattle Prices
James N. Trapp, Regent's Professor
Oklahoma State University

Vertical Price Transmission Issues in the Beef Sector
Barry K. Goodwin, Professor
Matthew T. Holt, Professor
North Carolina State University

Section 3: Recommendations to National Cattlemen's Beef Association

Endorsed by the researchers identified at the beginning of this section, a set of nine recommendations on policy positions, programmatic needs, or actions are presented. Coming out of the information base developed in the background section and in recognition of the current issues and opportunities confronting the industry, the recommendations are presented as a base for progressive action for industry leadership. It is intended not as an exhaustive list but as one that captures the most important issues and opportunities.

White Paper

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Status, Conflicts, Issues, Opportunities, and Needs in the U.S. Beef Business

Background

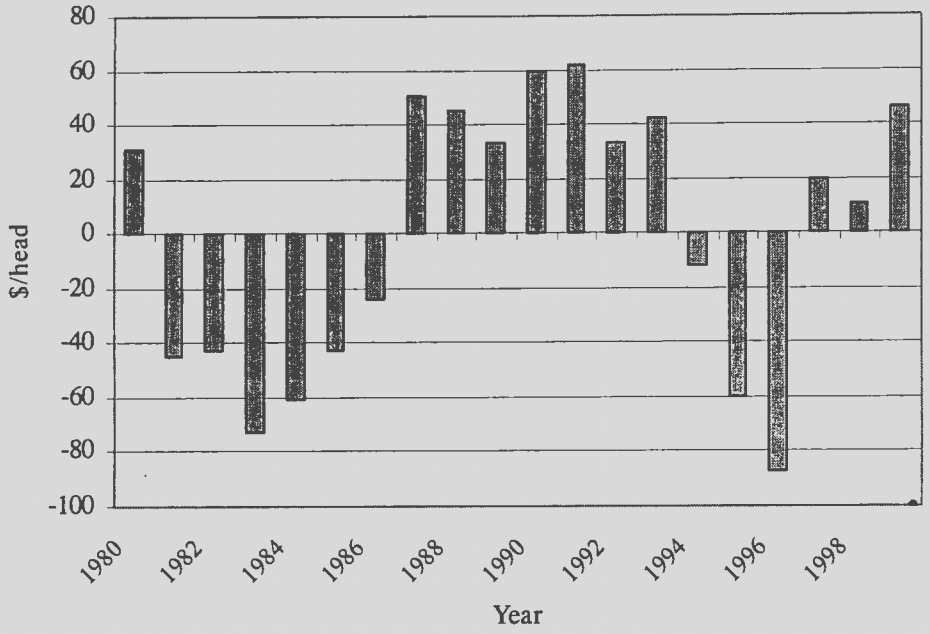
The beef cattle industry is caught up in difficult times. Producers have lost money due to relatively low selling prices, losses that have been greatly exacerbated by the record-high feedgrain prices in 1996. Cattle feeders suffered losses from late 1997 through 1998, and some analysts estimate the losses in the billions of dollars. Packers are experiencing variable earnings with IBP reporting significant profits and ConAgra reporting significant losses from livestock and meat programs during late 1998. As economic pressures intensify, reactions tend to move away from the objective and toward the emotional. Calls for solutions are becoming more strident and many are taking the form of proposed legislative remedies. Increased regulation of how buyers and sellers do business, legislative or world court actions to stop imports of live cattle, laws to mandate the reporting of price information and terms of trade, country of origin labeling, and a host of other "solutions" to low prices and to producer-level losses are being proposed.

There is a danger in all this, and the biggest danger is not in the long history of, at best, mixed results in efforts by the government to legislate solutions to economic problems. The big danger is that all the attention on short-run and highly visible issues will block recognition of the problems that are long run and structural in nature and, in the process, prevent efforts to move to programs and policies that have a legitimate chance of helping.

We need to step back and separate the peripheral and emotional from the core and structural issues. The need is to find the path to a progressive industry that offers the well managed business, at all levels, some chance of making a profit and a respectable return on investment dollars. If we do not get to that point, then investment dollars will continue to flee the industry. The observable symptoms of underlying problems, in the form of decreasing inventory numbers and loss of market share, will continue and accelerate.

The losses are very real and they are indeed painful. Figure 1 shows returns to cow-calf operations that picture the cyclical nature of the cattle business. The sharp losses during 1995 and 1996 came primarily from the impact of the record high corn prices. In some of the most acutely deficit feedgrain areas, cash corn costs were above $6.00 per bushel in the summer months of 1996. It takes roughly 50 bushels of corn to feed a steer during his feedlot stay. Corn costs that move up $3 per bushel add at least $150 to the feed costs the feedyard faces (protein supplement and other components of the ration tend to go up as well). For a 750-lb steer, that increase in corn cost decreases what the feedyard can pay for the steer by $20 per cwt., or $150 divided by 7.5 cwt. For a 500-lb calf, the reduction is $30 per cwt. if the 50-bushel need is still roughly correct. The selling prices for calves that dropped to $50 and lower in the summer of 1996 in some cow-calf areas were therefore no surprise at all. The culprits were the weather problems that reduced the corn crop during the 1995 growing season and the earlier controversial and debated USDA decision to enforce a 7.5 percent set-aside requirement

in corn acreage in the spring of 1995. That policy decision took over 5 million acres out of production and reduced the crop by some 700 million bushels. Record prices followed.



*Adapted from Cattle-Fax. Projected by Cattle-Fax for 1998-99.

Figure 1. Per-Head Profits and Losses for Cow-Calf Programs, 1980-1999

Figure 2 pictures the extensive losses in the feedlot sector during late 1997 and much of 1998. Estimates by Kansas State University show losses of $176 per head in February of 1998 when the cash cattle prices in the Southern Plains feeding area were in the low $60s per cwt. In the fourth quarter of 1997, the March-April cattle for 1998 could have been forward priced above $75 per cwt. But those forward pricing opportunities were only break-even or slightly better for many of the cattle scheduled to finish in the first quarter of 1998 and very few of them were forward priced. As prices drifted lower into late 1997 and early 1998, weights climbed and beef tonnage swelled. Carcass weights moved to over 15 lb on average above year-earlier levels and cash prices tumbled as weight problems persisted and packers' bargaining power and operating margins improved. In late 1998, cash prices were still in the high $50s, and as losses in the feedlot sector accumulated, prices of yearlings and calves moved sharply lower. Steer calves weighing 500 to 600 lb were selling in the $60s, even the $50s, in some outlying market areas in late 1998.

The producer-level problems are very real. Losses are more persistent and often larger than have historically occurred due to cyclical swings in inventories, production, and prices. There is, it would appear, a more substantive and more nearly long term problem at work, something that extends beyond the problems associated with industry wide cycles. Figure 3 suggests that this is indeed the case. Total inventory numbers and beef cow numbers peaked at the end of a prolonged cyclical buildup in 1975. Some four to five years later, a traditional cyclical liquidation appeared to have come to an end and numbers started to build again. Calf and yearling prices zoomed higher, helped by cheap corn, and the industry appeared to be headed into another 5-6 years of herd building, good prices to producers, and profits at the cow-calf level. But the return to good times was to be short lived. The numbers turned lower again as herd liquidation came back with a vengeance and it was near the start of

the decade of the 1990s before the inventory numbers finally bottomed near 95 million head. What happened to abort the cyclical buildup of the early 1980s and return us to herd liquidation much sooner than had been the case in past cyclical buildups?

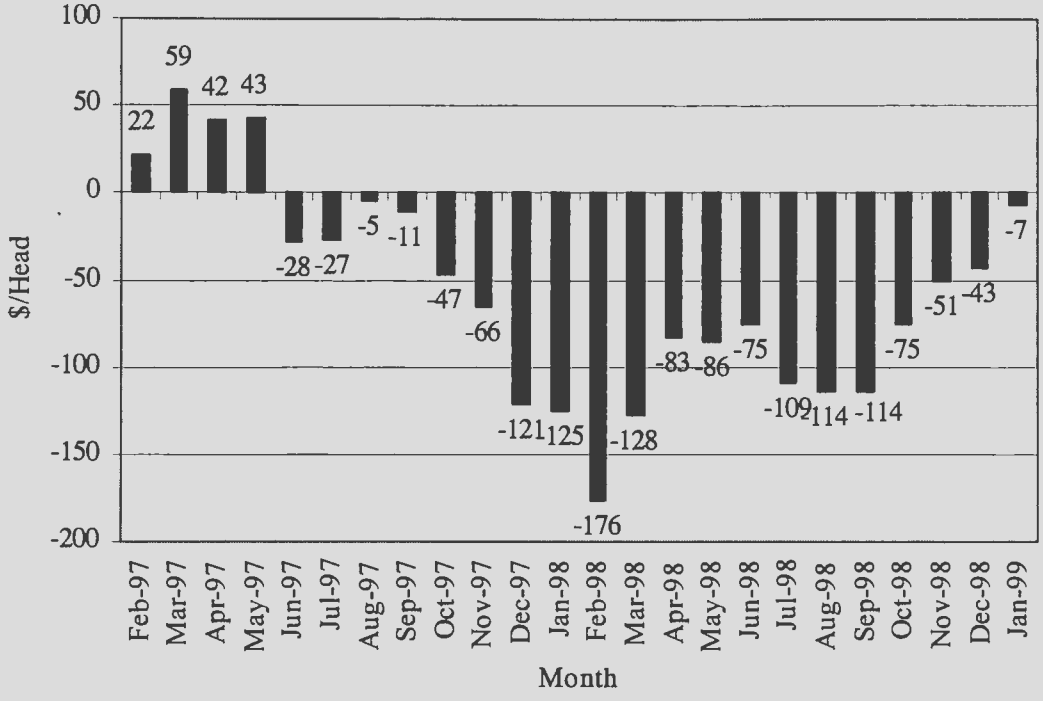


Figure 2. Monthly Returns for Finishing 700 to 800-lb Steers in Kansas

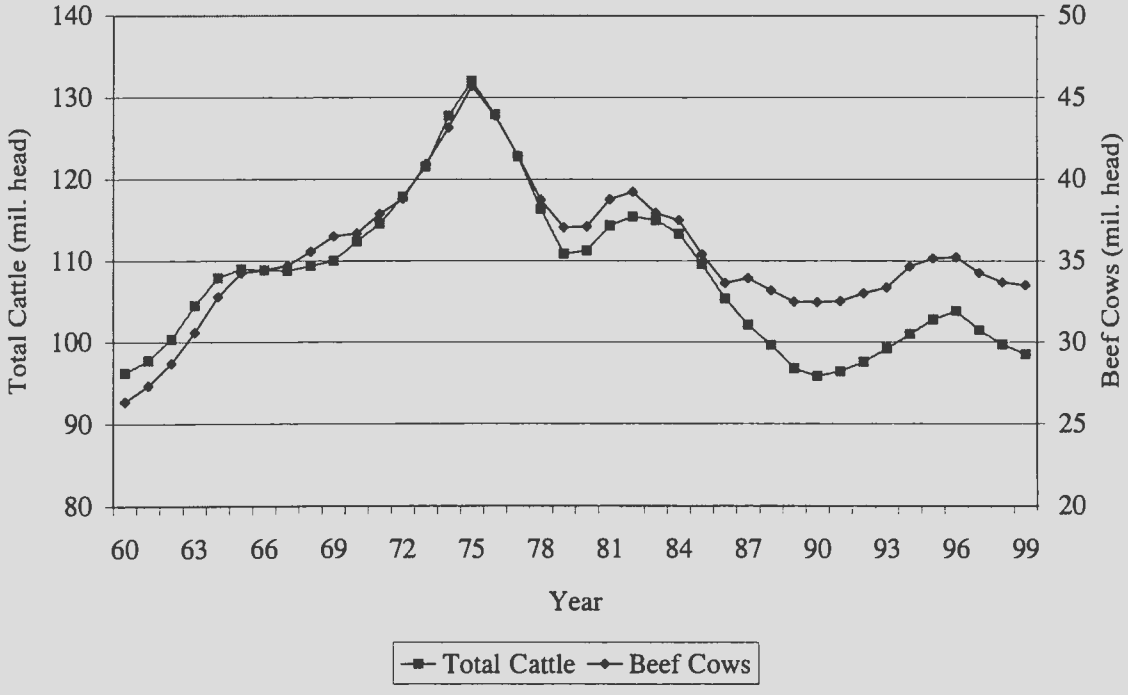


Figure 3. Cattle and Beef Cow Inventory, January 1, 1960-99

Figure 4 starts giving an indication that something not as easily observable as inventory numbers was at work behind the scenes. Nominal prices of Choice beef at retail are shown. The prices worked higher over time, moving above $3.00 in 1993 before drifting lower to the $2.80 level in recent years. But intuitively we know something is wrong with this picture. Every cattle producer has experienced the upward spiraling costs of machinery, trucks, pasture rent, ration supplements, herbicides, fertilizer, taxes and insurance since the 1980s. Intuitively, we know the costs of many of these inputs have increased faster than the selling price of beef, the final product the sector offers to consumers. The recent $2.80 beef prices are up only some 16% from the $2.40 levels of the early 1980s. The Consumer Price Index (CPI) that the government uses to measure overall price inflation is up around 65% since 1982-84. And we know what happens when costs go up faster than selling prices. Profits disappear or are cramped and some producers, especially the younger operators operating on borrowed money, get pushed out of business. That has to be the case--there are far fewer cattle today than the 132 million plus January 1 inventory of 1975, and the beef cow herd of 45.7 million in 1975 dropped to 32.4 million in 1990 and was at 33.5 million head on January 1, 1999.

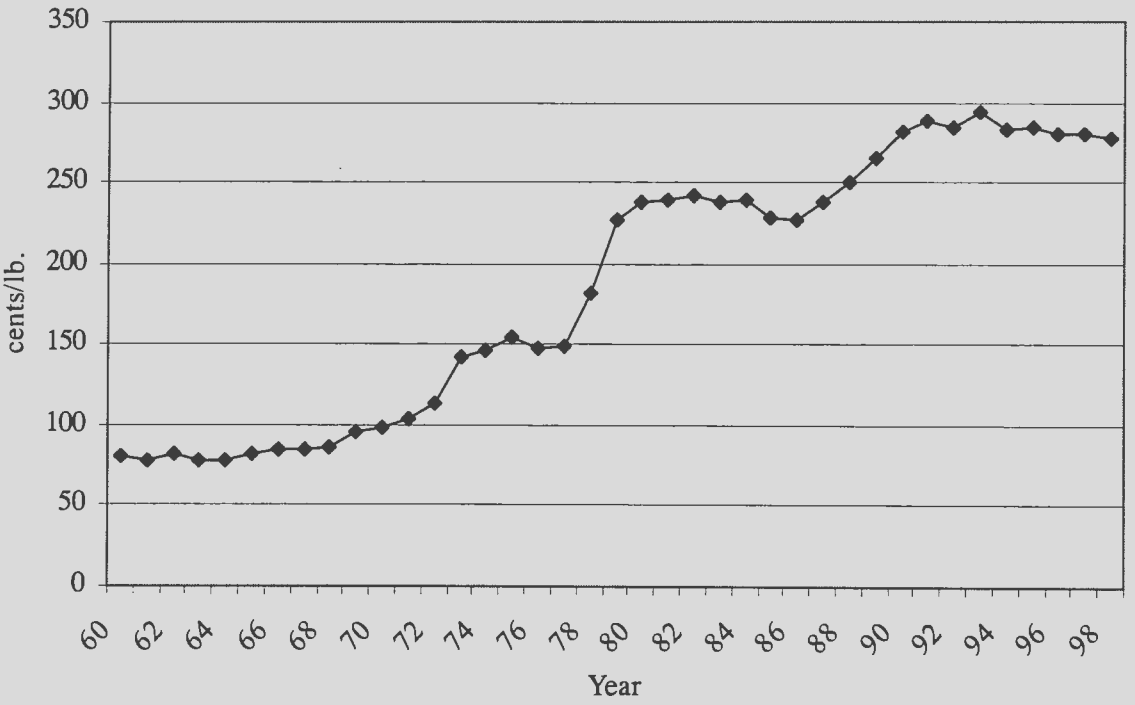


Figure 4. Choice Retail Beef Prices, 1960-98

Figure 5 presents a more revealing picture. The beef prices in Figure 4 have been adjusted for inflation. Now, the direction of price trend is clear--sharply lower. And as noted above, we know the costs of most inputs have not gone down. They tend to go up with overall price inflation and, in the case of machinery and many other critically important inputs, costs have more than doubled since the mid-1970s. It is true that the machinery of today is more efficient than it was 20 years back and that helps mitigate the per unit costs of producing beef, but if you do not have enough cost-reducing increases in efficiency, then a cost-price squeeze is inevitable.

Figure 6 adds another bit of clarity to the picture. Per-capita consumption, which is per-capita supply, has trended lower with the downward trending inflation-adjusted prices. *That is a most*

negative pattern, one not often seen in other agricultural commodities and one that communicates a powerful message when combined with the discussion about costs: Producers have apparently not been able to offset the "squeeze" imposed by declining beef prices by reducing costs. The result has been an obvious and ominous flight of resources and investment dollars from the beef business, and that downsizing is clear in the persistent reductions in per-capita consumption--expected to approach 64-65 lb in 1999.

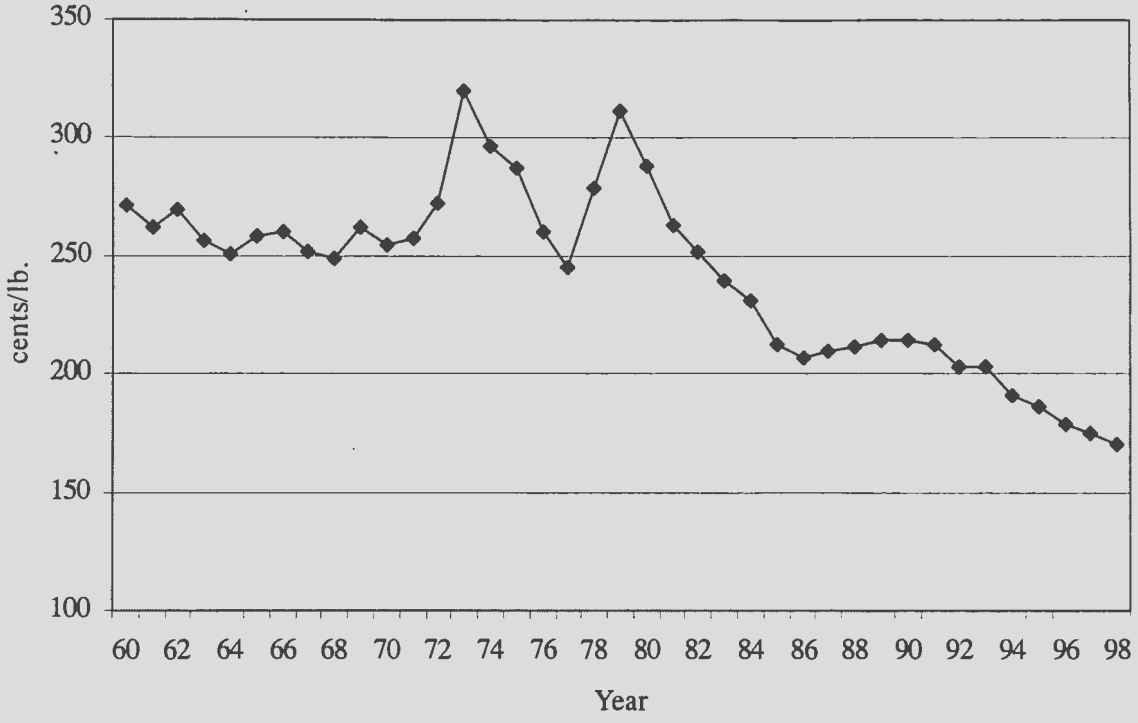


Figure 5. Inflation-adjusted (CPI, 1982-84=100) Choice Retail Beef Prices, 1960-98

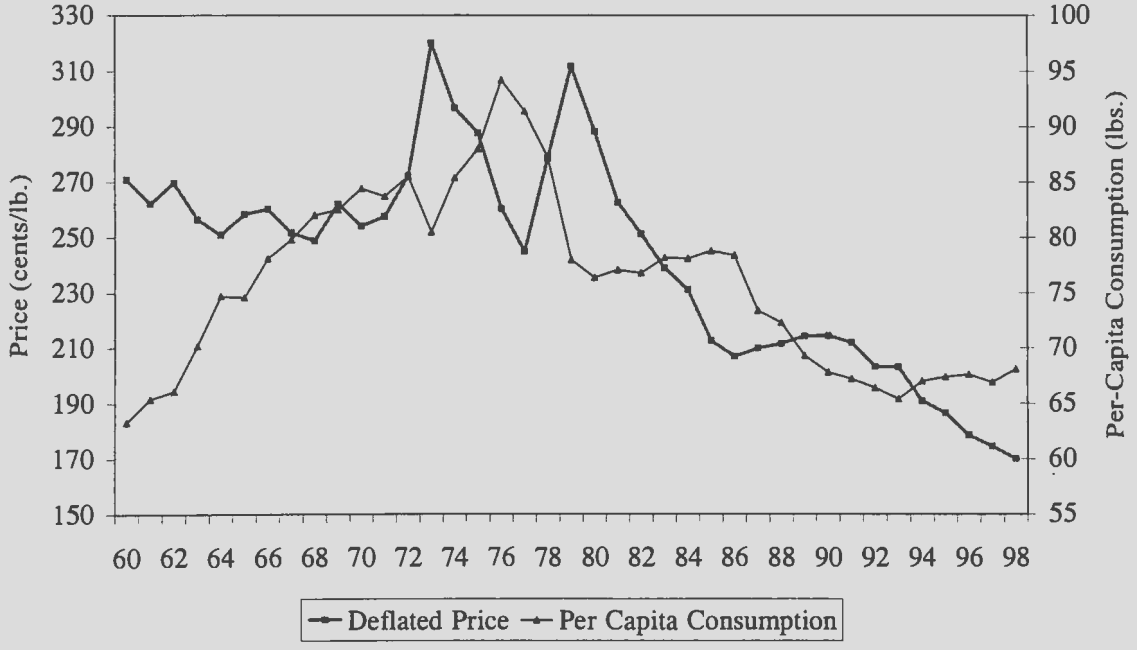


Figure 6. Per-capita Consumption and Deflated Choice Retail Beef Prices (CPI, 1982-84=100), 1960-98

There are two important sources of downward pressure on prices to the cow calf operator. Calf and yearling prices are essentially derived prices. They are what is left after all middlemen's margins are deducted from the price consumers are willing to pay for beef in the various forms in which it is consumed. *If the price that consumers will pay is declining, and we saw above that after removing the influence of overall price inflation to allow legitimate year-to-year comparisons, prices have been coming down, then producers' prices are forced lower.* If middlemen's margins are constant (more on this below) then we have

Decreasing consumer level price
Less middlemen's margins
Equals lower prices to cow-calf producers

This is important and is a start of an information base that moves us toward deciding what progressive actions will be needed to improve the current situation. We will need to come back later and look at why the consumer level prices are coming down, of course. But it is clear at this point that one of the sources of the current economic misery at the producer level are the lower and declining prices of beef at the consumer level.*

The second source of pressure on the producer, one that exacerbates the problems associated with declining consumer level prices, is expanding middlemen margins. Directly and indirectly, we have heard much about this possibility in recent months. Large packers like IBP have been blamed for the dismal situation facing the producer with accusation of profiteering, excessive profits, and exploitation. There has also been, especially during 1998, a rising tide of sentiment that problems exist at the retail level as well. Prices to consumers have stayed up while cattle prices plummeted to disastrous levels.

Figure 7 shows producer-to-packer (farm-wholesale) and packer-to-retailer (wholesale-retail) price spreads for beef as calculated by the USDA. The dollar levels used here are in nominal terms, meaning they have not been adjusted for inflation. It is apparent that the total farm-to-retail spread (add the two spreads plotted) is going up over time primarily because of the increases in the wholesale-to-retail spread. This is a measure of the margin that the retail segment has extracted. It is made up of retailers' costs and their profit margins, and while it is impossible to infer whether the expansion is due to increasing costs or to increasing profits, it is clear that their total operating margin is expanding significantly and persistently.

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*Only fresh beef prices are typically examined. There is usually no direct consideration given to beef moving into the hotel-restaurant-institute (HRI) trade and no direct coverage of prices of beef being exported. Data on prices in HRI and export activities are not publicly available, but this inability to include significant beef "disappearance" does not invalidate the analysis of fresh beef prices. These are but alternative markets or outlets for beef, and beef can flow easily from any one to the others. We would expect prices and price changes in all the major outlets to be correlated, and they are.

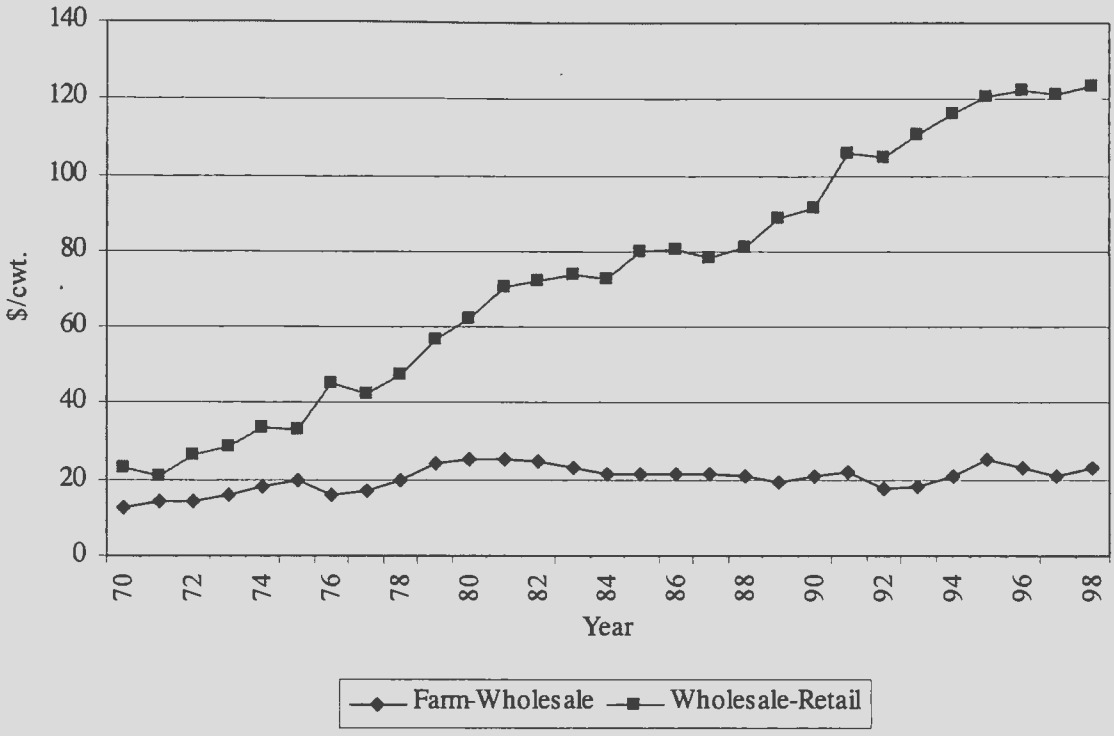

Figure 7. Farm-Wholesale and Wholesale-Retail Price Spreads for Beef, 1970-98

A more nearly correct way to look at the spreads would be to remove the influence of inflation and then examine the patterns. If packers, for example, are able to keep the increase in the margins they extract to an amount exactly equal to cost inflation as measured by indices such as the Producer Price Index (PPI) or the CPI, then the inflation-adjusted spread would be flat and would be a horizontal line on the graph over time. If increased efficiencies, especially the significant economies of size associated with the large plants with line speeds up to 350 head per hour are realized, then the inflation-adjusted margins could actually trend down over time. Conversely, of course, if middlemen have not been progressive and have not accumulated cost reducing efficiencies, then the inflation adjusted spread will trend higher. *An upward trend in an inflation-adjusted spread means that the middlemen are extracting a margin that is growing more rapidly than would be appropriate given the level of price inflation, and they are either taking a larger profit margin or are extracting a larger margin to cover rising costs they are unable or unwilling to control.*

If inflation-adjusted price spreads *are* increasing, there are several ways an increase could be justified and thereby avoid any charges of exploitation and/or inefficiency. It is possible that the costs of the particular set of inputs that a packer, retailer or other middleman is using are increasing faster than overall selling price inflation as measured by the CPI. This could be happening with regard to material costs, energy, insurance, and selected other costs that packers and retailers pay. But labor costs are a major cost item for both packers and retailers, and the data show that labor costs across the past 10 years have not increased as rapidly as overall price inflation. Rapidly rising costs of key inputs like labor are not likely, upon examination, to prove to be an acceptable reason for the expanding margins.

A second and arguably more important reason a spread could be increasing rapidly and more rapidly than overall price inflation is the acceptance by the sector of a larger share of the contribution to the final consumer product. If the retailer, for example, has taken on more transportation, trimming, and packaging responsibilities in recent years, then the margin extracted by the retailer may justifiably increase because of added costs associated with added contributions and responsibilities. But on the surface, that would not appear to be the case in beef. In recent years, the industry has moved to close trim which means the packer/processor is doing more of the labor-intensive trimming on the kill floor and along the fabrication line and less low-value fat and bone are being shipped to the retailer's back room. This is an area that need further examination, perhaps, but it would not appear that the retailer has much claim on expanded contributions and expanded responsibilities as reasons for larger margins. In some product lines, the retailer receives a case-ready package and packers will be shipping much more case-ready product in the near future. If there is a legitimate claim to the need for expanded margins associated with taking on a larger part of the overall value-added contribution to consumers, it would appear that it rests with the packers.

Figure 8 shows the inflation-adjusted spreads, and the message they offer is revealing and important. Though they have spiked higher periodically during recent months in the presence of low fed cattle prices, the packer spread (as reflected by the USDA in the farm/wholesale spread) averages lower in the late 1990s than in the mid 1980s. This pattern would suggest that at least some of the economies of size and the cost efficiencies associated with large plants and multiple plant economies have been passed back to the producer in the form of higher fed cattle price than would otherwise have been the case. Research confirms the fact that large plants pay more for cattle (*Concentration in the Red Meat Packing Industry*, Packers and Stockyards Programs, GIPSA, USDA, February 1996). And since the price of calves at the cow-calf producer level is a derived price associated with the selling price of fed cattle out of the feedyards, then the producer has likely seen some price boosting influence as well.

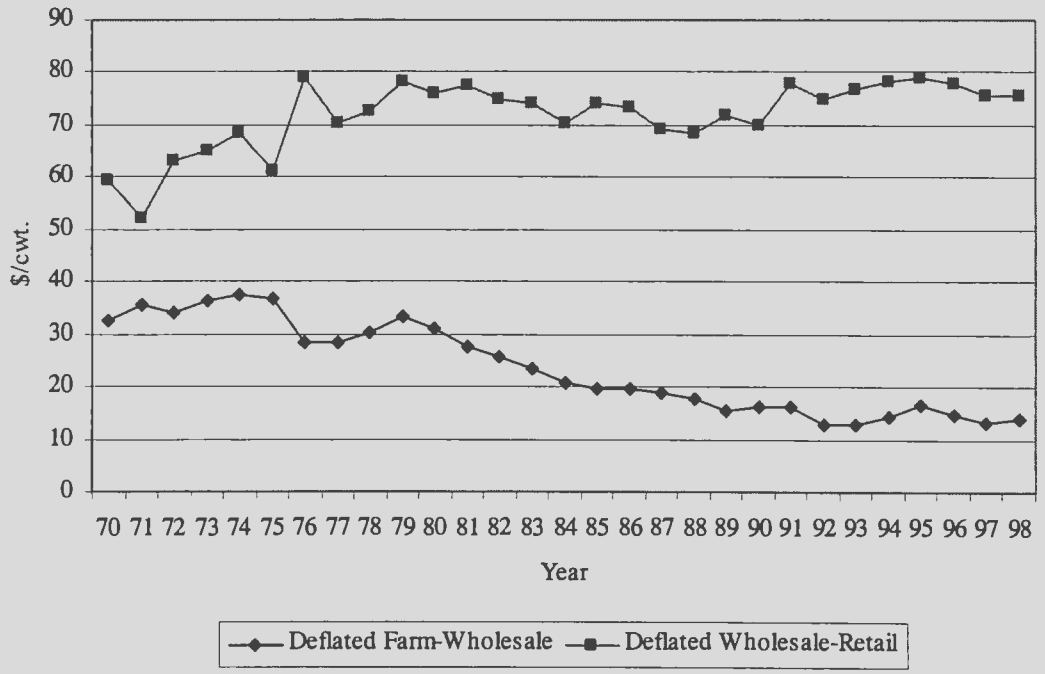

Figure 8. Farm-Wholesale and Wholesale-Retail Deflated Price Spreads for Beef (CPI, 1982-84=100), 1970-98

The picture is different at the retail level. The USDA's wholesale/retail price spread reflects the margin retailers are extracting. These margins have increased in inflation-adjusted terms compared to the 1980s even though it appears the retailer may be contributing less in terms of contributions to the final consumer product than in prior years.

Attention should be paid, it would appear, to efficiency and to performance of retailers, the primary source of pressure on producers coming from expanding middlemen's margins. These spread patterns do not mean that there is no use of market power at the packer level. In net, however, there is no basis for the assertion that producers' price level problems are solely because packers are extracting huge and growing margins. And we need to remember that in 1998 and 1999, packers are getting lower contributions from hide and byproduct credits--a development that would support the need for a wider spread between beef cutout values and live prices, what the USDA calls the farm-to-wholesale spread.

Figures 9 and 10 present data that show implicitly the spreads in a format that many analysts use to monitor what is happening. Fed cattle prices are expressed as a ratio of retail prices (Figure 9) and of boxed beef cutout values (Figure 10). These data can be captured weekly, even daily, if there is significant volume in the fed cattle market, and they show essentially the same picture captured by the USDA spreads. If the ratio of retail prices to fed cattle prices is increasing, for example--and it is--this shows that the retail price is increasing in percentage terms faster than the fed cattle price. To illustrate, let retail price be $2.60 per lb and fed cattle prices be $.65 per lb. The ratio is 4:1, or $2.60 divided by $.65. If both prices increase by 10 percent, we have $2.86 and $.715 at the retail and fed cattle levels respectively. The ratio, or $2.86 divided by $.715, is still 4:1, however. The only reason the ratio would increase as it clearly does over time in Figure 9 is if the retail price is going up faster than the fed cattle prices in percentage terms. (Steer prices are also shown via the dashed line.)

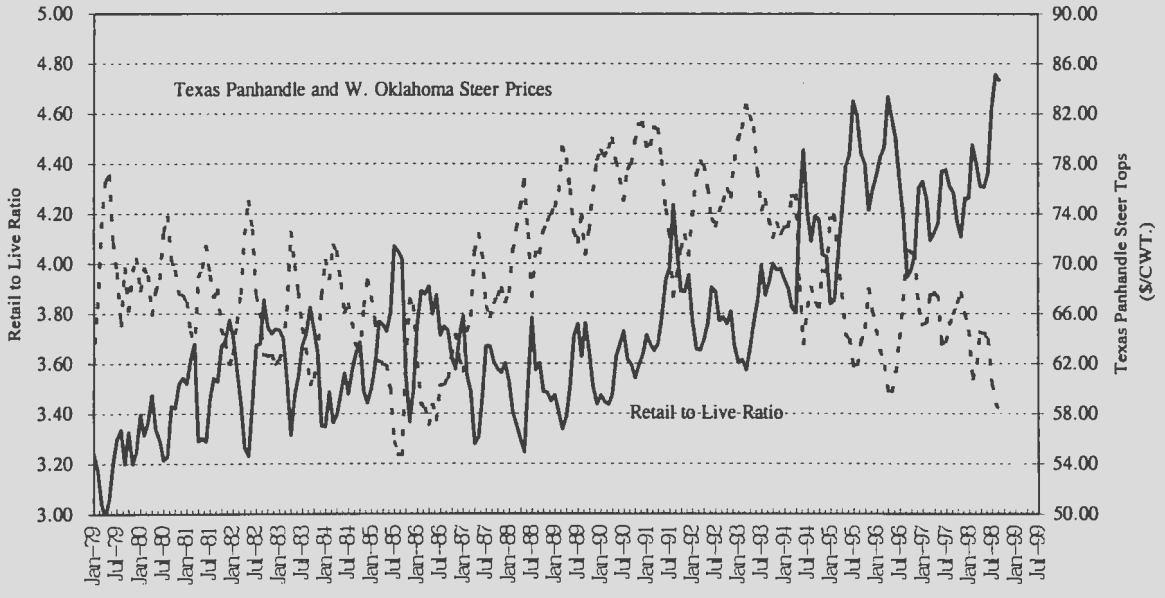

Figure 9. Monthly Beef Retail-to-Live Ratio and Texas Panhandle and W. Oklahoma Steer Prices

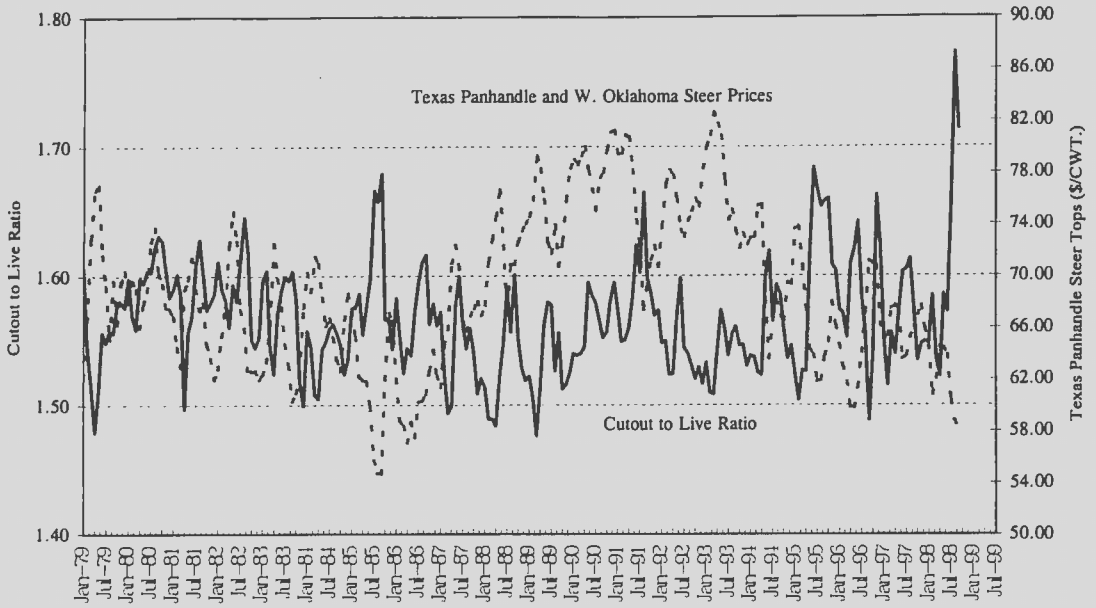

Figure 10. Monthly Cutout-to-Live Ratio and Texas Panhandle and W. Oklahoma Steer Prices

Once again, note that the primary source of price pressure from expanding margins comes from the retail sector. The ratios of boxed beef to live cattle prices (cutout to live in Figure 10) do not show the consistent expansion that is apparent in the retail-to-live ratio. There is an added important point, a clarification, to be made here about all this before moving on:

> **Even if the percentage increase is the same at the retail or the cutout level vs. the live animal level, the implicit spread is still increasing. The spread increases at the same percentage rate that the individual prices increase, and the size of the spreads in cents per pound or dollars per hundredweight will be increasing even if the ratios in Figure 9 were constant and were a flat line. When the ratios are increasing, the implicit spread is increasing very rapidly.**

To this point, we have found two important sources of downward price pressure on cattle prices, pressures that force producers to take lower prices. *The first is the pattern of decreasing prices at the retail level as the consumer refuses to take an often smaller per-capita offering at anything other than lower prices.* Indeed, we note that since the late 1970s, inflation-adjusted prices have been plunging to lower levels even as the per-capita offerings to consumers declined from near 95 lb (retail weight) in 1976 to a projected 64-65 lb in 1999. Intuitively, this is very important, and any proposal for progressive actions to turn us back toward a viable growth industry again will have to deal with this issue. And we will come back to it. *The other source of pressure is the expanding price spreads, especially at the retailer level.* Any "solution" will have to deal with this issue as well. But we need to look initially at the evidence with regard to the beef sector's ability to cope with the lower prices being pushed down toward them, a price pressure that will be accentuated if processor and/or retailer margins are expanding.

There is a tautology here that is important:

If the impact of lower selling prices, whether direct or as presented by expanded middlemen margins, can be offset by efficiencies, new cost reducing technology, economies of size and better management, then resources can be held in production and the sector need not downsize.

There is an extension to this "economic rule." If the cost reducing ability at the producer level is big enough and can be sustained, even more resources can be employed and market share can be increased even though selling prices are coming down. There are a number of examples in agriculture where we have seen just this pattern occur. Poultry is a primary example, and most major field crops like corn also fit this pattern. Outside of agriculture, the PC computer sector constitutes a highly visible example of prices declining as technology brings costs down.

Obviously, the beef sector has not been able to grow in the face of declining prices. How much beef is available to be offered to consumer is tied directly to the herd size and to the productivity of that herd. Total beef production in 1998 was close to the record high level of 1976, but on a per-capita basis the huge loss of market share has been widely documented. That increased efficiencies have been garnered are apparent from the facts. If total production in 1998, from a herd near 103 million (but a higher percentage is beef animals versus earlier years), can approach the 1976 record when the herd size was above 130 million and was being aggressively liquidated in a cyclical sweep, then much progress has been made in production efficiency. Progress has been made in genetics, animal health, calving rates, cattle management, nutrition, and a host of other dimensions, virtually all of which add to total beef tonnage. *But all the progress has not been enough to keep per-capita offerings from plummeting as the lack of profitability forced resources out of production, especially in the years since 1986. This hard fact suggests costs have not come down enough to offset lower selling prices and the industry has been forced into downsizing and disinvestment.*

Figure 11 shows what has happened in chicken with an inflation-adjusted price and per-capita consumption plot similar to the graph offered earlier for beef. Prior to 1980, price was trending lower but per-capita offerings continued to trend higher. Resources being employed in chicken production were clearly profitable or they would have been pulled out and committed to something else where the profit possibilities were better. And for the continued growth in offerings to occur, there had to be new investments coming into the sector. Investments flow to profits and profit potential and the new moneys would not have come to the poultry sector without the chance for profits. Up to 1980, the sector was maintaining profits and expanding primarily on the basis of cost-reducing efforts. Since about 1980, the situation has been more attractive. The strong increases in per-capita offerings in the late 1980s and into and through the 1990s have come in the presence of roughly stable or constant inflation-adjusted prices--*which means nominal selling prices have increased with increased quantity offered.*

If this pattern of continued technology, increased efficiency, and cost reductions could have been repeated in beef, the situation today would be radically different. But it did not happen, and it would be easy to point to all the ways in which beef and poultry production are different. The 2:1 or better feed-to-gain conversions broilers will accomplish are not possible in beef, and anyone who understands the industry--the geneticist, the nutritionist, the animal husbandry expert, the DVM, even the serious lay observer--knows that the beef animal is different, and that beef cannot be produced as cheaply as a whole bird can be produced and sold in the poultry industry. Tremendous improvements have been made as shown by the output per cow measures in Figure 12, but the improvement tailed off

after 1986. Cattle will gain over 5 lb per day for part of a feedyard stay in 1999, levels unheard of 20 years ago. An entire pen of the most efficient cattle will move to slaughter weights in the better feedyards on conversions that average less than 6:1, but that is still a long way from the 2:1 in poultry and the below 3:1 that hogs are now realizing on the finishing floors.

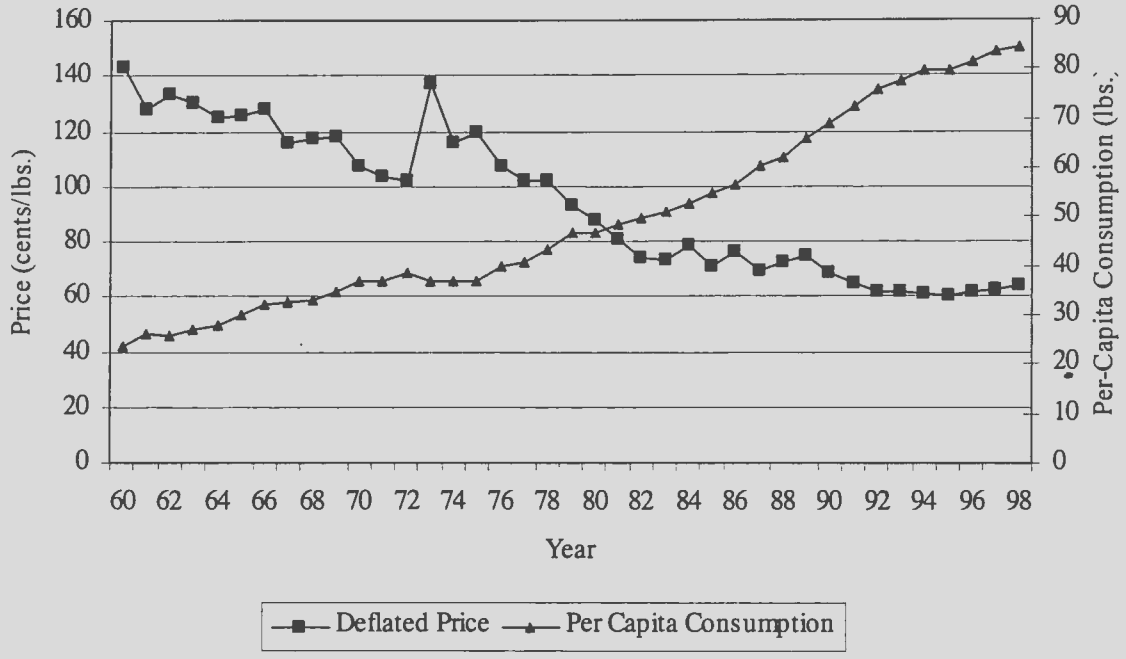

Figure 11. Per-Capita Consumption and Inflation-Adjusted Prices for Broilers (CPI, 1982-84=100), 1960-98

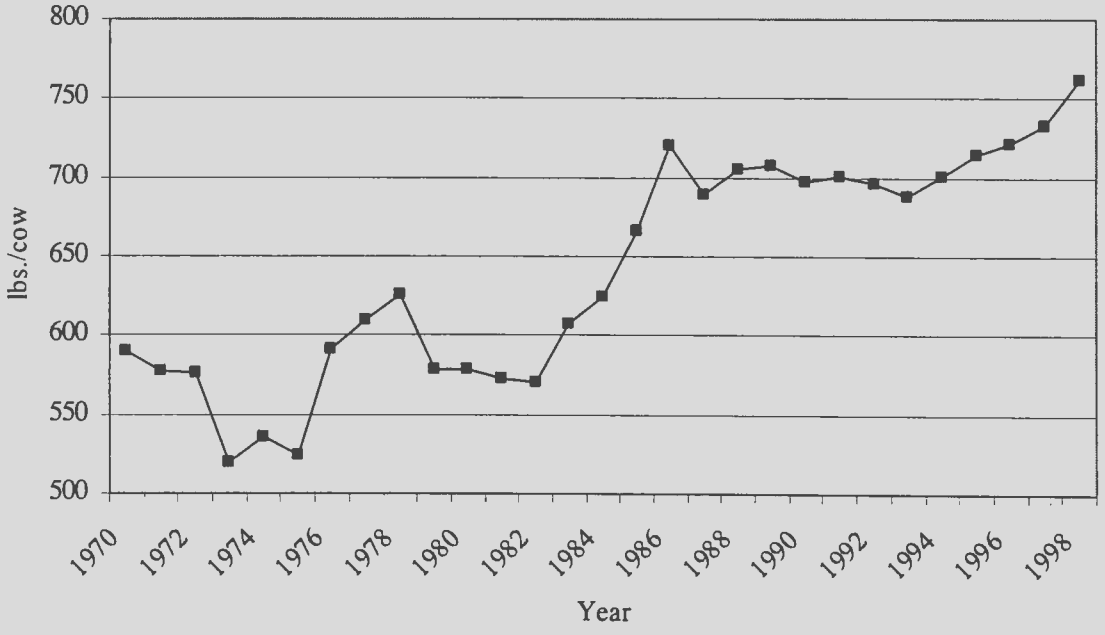

Figure 12. Beef Production Per Cow, 1970-98

Obviously, being cost effective and efficient is important. The manager of any for-profit firm, from the cow-calf operator to the meat department in a food store, knows this all too well. *For a given selling price, any reduction in costs that can be accomplished goes directly to the bottom line in terms of better profits.* And there are in fact huge differences in costs of producing a weaned 500-lb steer calf in different sections of the country and across farms and ranches within any one section. The NCBA monitors data on costs and at the producer level, it is not a "big versus small" issue. There are some economies of size in calf production, but there are low-cost producers in some of the smaller size categories. Management effectiveness seems to be the key, and it may be that the lower echelon of producers will be out of business as cost-price squeezes intensify unless the cattle business is subsidized by off-farm income. But recognizing there is a lot of room for improvement, cutting costs has not been enough in the past, has not been the "sufficient" answer for the beef sector, and it is not likely to be a sufficient answer in the future.

Attention, energy, and money have been used in pursuit of a "cheap product solution." A mid-1980s panel of "outside expert" economists engaged by the National Cattlemen's Association contributed to the emphasis on being cost competitive with competing meats. The group concluded that there were no major problems on the demand side of the price equation, that advertising and product/market development work was largely without merit, and that the only way the industry would be competitive and stop losing market share was to get costs down and sell the product to consumers at lower and more competitive prices. I will come back to this mid-1980s study and look at it in more detail later.

The emphasis on production efficiency was continued by the "beef quality audit of 1990." Some $280 of excess costs per head were identified in the report with the implicit idea that gains of this magnitude were possible if the industry could just get more efficient and more cost effective.

The 1995 "quality audit" downplayed the notion that huge cost savings could reasonably be accomplished and reported that quality was moving to or near the top of the list of needs in virtually every sector of the industry. *Quality, consistency, and convenience in meal preparation started to emerge as important needs in a much more visible way.* In the initial presenting of the 1995 study in Denver in early 1996, an important purveyor was lamenting the problems they faced not only in quality variation but in simple things like consistent portion size. Recounting experiences where they found a 20-lb ribeye in a box of 12-14s, the purveyor asked what they were supposed to do with the 20-lb cut that apparently had gotten into the box to fill out a per-box weight limit. Indicating that they had to essentially start a new and undesired merchandising program to handle such outliers, the purveyor was clearly upset by the lack of quality control. The representative of a large packing firm in attendance responded, also with some degree of upset:

"If you would pay us better, we would sort them better."

We need to store this in our recollection, but the intent here is not to pursue building of awareness of quality control problems. Rather, the intent is to expand recognition that "low-cost offerings" are not a *sufficient* solution to the problem facing beef producers and to recognize that by the time the 1995 audit was being finalized, the scientists involved in that important study were seeing concerns over quality and consistency come to the top in importance throughout the industry. Gary Smith from Colorado State University and his colleagues at Oklahoma State, Kansas State, and Texas A&M are saying in industry presentations that 1 of 5 or even 1 of 4 steaks from the Choice grade, especially low Choice, are too tough to provide an enjoyable eating experience.

At this point, it is useful to pause and reflect. In laying out this background statement for the industry, I have looked for sources of the downward pressure on producer prices. Recognizing that the price for live cattle is a derived price tied ultimately to what consumers are will pay for the product offering, two sources of pressure have been identified:

1. *After removing overall price inflation, the prices that consumers will pay for the offering of fresh beef have been coming down in recent years.* This has happened even though per-capita supplies of beef have been decreasing, and decreasing supplies of any product will normally tend to *increase* price--unless demand is decreasing. The dollars consumers will pay for beef in all its forms set the maximum dollars available to be divided across and among all the contributors to that final product offering. All middlemen in the beef system are margin operators, and when the consumer-level price comes down, the producer is a residual claimant and is a price taker, and in selling a generic product, the producer gets a lower price.

2. *Price spreads being extracted by middlemen are increasing, with the increases coming predominantly at the retailer level.* This widening of price spreads or margins exacerbates the producer-level pain associated with decreasing consumer-level prices and pushes the price for live cattle at the producer level even lower.

If the situation facing producers is to improve, either these "price pressures" must be eliminated or mitigated or costs must be reduced to ease the cost-price pressure and allow producers to stay in business. Still further progress on cost reductions could be made, but it is becoming clear that a lasting solution will have to be based at least partly on actions, programs, or policy moves that ease the pain of downward trending prices at the consumer level. The demand problems have to be solved.

In reflecting on the current situation and on the proposals for action that are being voiced, it will be productive to divide considerations into two subsets: (1) those that would help the long run and structural issues that are prompting the price pressures, and (2) those that are more nearly peripheral in nature and often deal with the symptoms of economic problems rather that the causes.

Among the attention-getting but possibly peripheral and short-run issues in early 1999 are the following:

- Imports of live cattle from Canada
- Captive supplies as the cause of low producer level prices
- The idea that all sales must be negotiated for prices to be properly discovered
- Packer concentration as the cause of low cattle prices

The longer term and more nearly structural issues being discussed in early 1999:

- Price discovery as distinguished from price determination

- Pricing to value as a necessary condition to long term quality control
- Impacts of alternative captive supply arrangements on price discovery
- Cost and price implications of variable slaughter and fabrication rates
- Impact of "sticky" and non-responsive prices at retail on producer level prices
- Reversing the long term decline in beef demand

Some or all of these issues will receive detailed attention below, often by the researcher or educator in our land-grant universities in the best position to deal with that particular issue. In their response, they will often be drawing on past or current research they have conducted that was financed partly by the Research Institute on Livestock Pricing. The Institute, started in the late 1980s, has attempted to provide good science and objective information on just these types of issues. That information has been made widely available through mailed distribution, national conferences, and is now on the Internet at

www.aaec.vt.edu/rilp

The need and the intent here in this paper is to help defuse the issues that have little or no chance to offer help in terms of plans, programs, or policy changes to improve the economic position of the beef industry and to accentuate the importance of those more nearly substantive possibilities that could and would help us out of the current dilemma.

Imports of live cattle from Canada increase the supply of beef and will have a price impact just as increased weights of feedlot cattle, slaughter of cows off dry pastures, or anything else that increases beef supplies. But to argue that imports of cattle from Canada are the cause of low fed cattle and calf prices in the U.S. is not an economically sound argument unless there is something illegal about the shipments. *Cattle Fax* reported in early October that imports of cattle from Canada would be down slightly in 1998 from 1997 levels. Intuitively, since there has been no surge in import volume across the past year, the imports are not a primary cause of the miserable prices and profit picture seen by cattle feeders and cow-calf operators in 1998. But the situation needs to be evaluated in much broader terms.

During the 1990s, exports of beef from the U. S. periodically exceeded imports of beef in both value terms (where exports have been ahead for years) and in quantity terms, where a net positive trade balance occurred during the 1990s for the first time. Imports tend to be processing beef, but exports include high-value middle meats. *There can be little doubt that export demand for beef helped support and hold beef prices high in recent years as the demand side of the price equation in the domestic market continued to slip lower.* We cannot have it both ways--keep export markets to help boost overall demand for our beef and then impose embargoes or restrictions on imports to keep out competition from other countries.

It is not the imports of live cattle that we need to look to in finding solutions and moving us back toward growth and profitability. The Canadian situation will be given more detailed examination by Jim Mintert of Kansas State University in later sections, but blocking imports out of frustration has the potential to backfire in terms of reactions in Canada and in the world market. In the short run,

meaning the past year, exports have not grown at the same robust pace of recent years due to economic problems in Asia. But 1998 export volume was still above 1997 levels even though the value of 1998 exports ran slightly behind 1997, primarily because of the low prices of cattle and beef in the U.S. Trade would appear to be net positive for the U.S. industry. More detail on this important issue is provided later, and I urge careful consideration of the coverage of this topic.

Captive supplies are one of the most controversial issues to emerge in the cattle business in many years. There are essentially two negative lines of thought on this issue: (1) the use of captive supplies by large packers allows them to control the market and force down the prices of all fed cattle, both those in and outside of the captive supply arrangements, and (2) captive supplies, at least for some of the contractual arrangements employed, interfere with price discovery processes and cause prices to be "discovered" at levels lower than they would be in a more nearly open and competitive market.

There is a huge amount of research in this area, but it has not been accepted as an "answer" and the emotional allegations surrounding captive supplies continue to be pressed. This issue will receive much more detailed consideration later (including research citations) by Ted Schroeder and Rodney Jones at Kansas State University, but it is important to treat the basic issues here and to try to start to move the dialogue in a direction that will be more productive.

First, it is important to understand that we have in the industry a decided difference of opinion on why captive supplies have existed across the past few decades. Related and secondly, we need to discuss the very real possibility that different arrangements that are used to schedule cattle into packing and processing facilities could have both different motivations and different impacts on the price discovery process.

In general, packers indicate that they have moved to contractual arrangements, business arrangements, the feeding of cattle, and similar arrangements to give them some control over the flow of cattle into the plants. If a kill line is set up to handle 350 head per hour, there are very few costs that decrease or can be eliminated if only 300 head of cattle are coming through the plant. Most union and non-union agreements call for a guaranteed workweek when workers show up on Monday morning. Only some of the larger packers have even limited flexibility to cut the workweek back once it has started. With contracts for product delivery that have to be met, the packers have little choice but to have something close to the desired number of cattle moving though the plant each hour. If they do not have the cattle when they need them, offering a quality that at least approaches what they need given their product sales and commitments, their costs can go up tremendously. *This perspective suggests that the primary motive for contracting cattle and scheduling them into the facility is one of cost control.* It is the same approach that is used in virtually every agricultural commodity from chicken to pork to tomatoes to peanuts.

To illustrate, if it costs $17,500 per hour to run a slaughter and fabrication plant set up to kill 350 head per hour, the combined slaughter and fab costs are $50 per head. If the flow is 325 head, the costs of running the plants will come down very little if any. Virtually all the costs are "fixed" within the week, and only relatively minor costs that are on a per-head basis such as shrouding, washing or otherwise meeting modern HAACP requirements will be eliminated if the plant rate declines. If we keep the number at $17,500 for illustrative purposes, the cost per head goes up to $53.85 at 325 head per hour. If the hourly flow drops to 300 head, then the cost goes up to $58.33—a huge 16.7-percent cost increase that the packer/processor cannot avoid. Granting that this is the upper extreme since the hourly operating costs have been kept constant at $17,500, having to cut operating levels clearly has major implications to the packer's margins.

There is another side to this issue. A packer could afford to pay (based on the arithmetic above) an added $8.33 per head to ensure they have 350 head versus 300 head per hour. If the rate drops below 300 head, the results get dramatic if we remember that within the week, all costs—even labor—are essentially fixed. Without captive or contracted supplies to draw on, the packer would be forced, at least periodically, to go into the market and bid up the price of cattle to keep the lines running. And this is exactly what many observers from the feeding and producing side want to see—the packer over the proverbial barrel and having to bid up cattle prices. Indeed, the minority report in *Concentration in Agriculture: Report of the USDA Advisory Committee on Agricultural Concentration*, June 1996, made just this point. The minority statement, authored primarily by producer representation, argued that the industry *needs* that type of leveraged buying from packers to be able to be profitable and survive over time. This is, in my opinion, an incredibly naïve position on an emotional and important issue. Is there no recognition that later when the showlists are heavy the packers just push prices down as much as possible to make up for the "peak prices" they were forced to pay in earlier weeks? It *is* the case that the packer or any agricultural processor will earn an acceptable margin over time or they will get out of the business. Variable flows of cattle are a source of risk and added costs to the packer, and there is a huge research literature that shows that exposure to the risk associated with variable flows of raw materials into processing plants carries a cost and that someone has to pay for those costs. *In the cattle markets, there is little doubt as to who pays. It is the cattle feeder and cattle producer in the short run in the form of lower, on average, derived prices for live cattle because of the added costs associated with variation in processors' operating levels. In the long run, it will be consumers who pay a higher-than-could-be cost for a smaller supply of product—and the industry has a smaller market share than might be possible.*

Captive supplies thus can cut the peaks off the price surges that would be there if packers could not contract and had to bid for cattle from a highly leveraged position since so many costs are fixed. But we have seen that this raises their costs, so there is another possible reaction to the longer run impact of captive supplies. *If scheduling flows via contractual arrangements does in fact cut packer costs, and there is little doubt of this, then the average price paid for fed cattle will be higher over time unless the packers just absorb all of the cost reduction in the form of large margins.* The inference of a *positive* impact on price levels is thus possible and that inference has been drawn (*Structural Change in Livestock: Causes, Implications, Alternatives,* Wayne Purcell, ed., Research Institute on Livestock Pricing, February 1990). All of the researchers who have examined the captive supply issue admit that they are not able to incorporate any measure of the price boosting influence of reduced operating costs over time into their analytical models. This, to date unmeasured, potential benefit could more than offset the typically small per-head negative price impact that some researchers have found associated with captive supplies in some, but not all, of their alternative analytical approaches.

Research conducted at Oklahoma State by Jim Trapp is part of the Institute's efforts to "put some numbers on it" with regard to this issue. Dr. Trapp looked at the implications to slaughtering and fabricating costs of variable flows of cattle through a processing facility. This research, covered in more detail later, gives a measure of just how important the opportunity to schedule cattle can be in terms of costs and, in the process, will give a basis for estimating the possible hidden costs of any legislative or regulatory moves that prohibit all contracts or other means of scheduling slaughter and fabricating flows.

The Trapp report (by John Anderson and James Trapp) in some detail is on the Internet at www.aaec.vt.edu/rilp.

The critic of captive supplies, and there are many, will point to a negative price impact on price levels and the interference of captive supplies in what they see as efficient and competitive price discovery. Here, it is important to differentiate between and among the various approaches to "capturing" supplies.

Packer feeding and business arrangements take cattle out of the market mix and they are not priced in any negotiated sense. But surveys indicate that these are not the growing or the most controversial of all the possible approaches. Here, it is useful to deal with cash forward price contracts, basis contracts, and formula priced contracts. To me, they are decidedly different in that they have a direct bearing on the opportunity the cattle feeder has to manage exposure to price risk and to contribute to the price discovery process.

Cash forward contracts, not widely used, are tied directly to the live cattle futures or options and represent a willingness by the packer to handle futures or options trades and extend either a specific cash price or a price floor contract to the feeder. A way of scheduling future deliveries that meet the stabilizing needs of the packer, feeders may still have autonomy and control over *when* they price—a right that I consider very important and very valuable. A modification of this procedure would involve scheduling the cattle, perhaps with a price grid for premiums and discounts (vs. some base price—more on this later) and allowing cattle feeders themselves to forward price directly in futures or options. *The pricing decision is in the hands of the feeder* and the base price issue is handled in a competitive and open price discovery process in the futures and options complex.

Another approach that leaves the pricing authority with the feeder is the basis contract where price is tied formally to the futures. The feeder will need to be well informed on basis patterns and distributions, but this information is available. The scheduling needs of the buying packer can be met and *the pricing decision in terms of timing and the opportunity to do something about price level is in the hands of the feeder*. I like this approach and see nothing but a positive contribution to price discovery. When the cattle feeder who holds a basis contract calls the buyer and picks a day to settle the price, the packer will usually sell futures. Futures get sold on or near the highs if the feeder is a good market analyst, and selling futures is avoided when they are trading near the price lows. The result is a stabilizing influence and an orderly moving of the discovered price in futures toward its underlying equilibrium and market-clearing price.

The formula price contract is widely used and, I think, brings the biggest and arguably most negative impact on price and price discovery. My big problem with this approach is that the incentives are wrong. Thus, even though it is the approach that often has a pricing grid associated with it and does some "pricing to value," it needs to be examined critically to see whether the industry as a whole would be better off without this type of scheduling arrangement. *The important issue is how the base price is established*, even when a price grid specifies premiums and discounts and attempts to "price to value."

A typical formula price contract attaches the final price to some observable cash price series or to a price being paid to others by the buyer. A Kansas cattle feeder might agree to deliver cattle and get paid in accordance with the USDA report of direct trade for that day, get paid the "Kansas top" with some indication of how that "top" will be determined, or get paid the average (or top) price paid by the packer during the prior week, etc. Often, this will be the way the base price is set and, as suggested, a price grid sometimes then pays premiums and imposes discounts relative to that base price.

The incentive problem is obvious—the buyer has an incentive to push down or lower prices or to selectively report transactions to keep the base price down. *I am not suggesting that this is done, but the incentive is clearly in place, cannot be logically denied, and the formula price contract will and should be criticized for this reason.* And that is not the only or even the most important concern I have with this approach.

The formula price arrangement can deny the seller the important right to determine when price will be established, and this is an important loss to cattle feeders, producers, and to the price discovery process. (It *is* the case that the cattle feeder could pick the right time and hedge the cattle in futures, but this is seldom done.) The basis contract, conversely, sets a cash-futures basis and allows the feeder to monitor the market and *select the day price will be set.* In late 1997, in the conditions described earlier, the cattle feeder holding a basis contract could have watched the April 1998 contract trade up to its highs in the mid-$70s and fail—and set the price in that mid-$70s market. The formula price arrangement would have been tied in various ways to the disastrous and sharply lower cash market in February through April of 1998. It is hard to find anything good to say about formula pricing except that it is cheap, the seller does not have to be well informed, and that it may have a pricing to value dimension. But these advantages are there for other approaches that meet the needs of both buyer and seller, approaches that leave the feeder in a position to manage exposure to price risk—something that has to be done in these volatile markets and something that is not impossibly difficult either by developing skills at the feedyard level or by hiring consultant help. *I support a policy to avoid formula pricing where the base price is tied to a price series the packer could influence as a win-win for seller, buyer, and for the price discovery process.* This issue will be discussed in more detail later when looking at some of the research on captive supplies.

The *negotiation issue* has received much attention. *Having every pen of cattle sell only when there has been some negotiation between buyer and seller* could be a burdensome requirement that accomplishes little or nothing. Smaller feedyards and producers may opt not to worry about being extremely well informed about the market and just prefer to use a basis contact, let price get discovered in the futures market, or decide when to use a cash forward delivery contact, which means the buyer is handling the futures trades. In the current marketplace, fed cattle are selling in a small time window each week, and sellers are afraid they will miss the market if they do not sell quickly. Having some negotiation on each set of cattle that gets sold this way could be trivial and do nothing to mitigate the obvious problems associated with selling everything at or near a single average price for the week. *Effective price discovery, at a minimum, needs to approach pricing to value, and that is not happening in the current environment.* Policy or legislative moves to require negotiation on each and every set of cattle, a move that has been proposed, could be costly and inflexible. It would not contribute anything of significance to the price discovery process or to the wellbeing of the industry in general and producers in particular unless some other more important changes (e.g., carcass-based pricing or individual animal pricing) are also made.

Packer concentration, taken alone, is not the reason for the current crisis in beef cattle. The Justice Department, presumably, allowed the last round of mergers in the mid-1980s because they could see the possibility of economies of size. There is ample evidence of those economies in the research literature and earlier coverage of the price spreads at the packer level suggests that some of those efficiencies have been passed back to the producer level in fed cattle and calf prices. Some of the research will be cited in later sections. It is not concentration that has caused low cattle prices, but it is possible that some of the characteristics of a concentrated market *are* causal factors, at least indirectly.

One of the long-standing concerns about a concentrated industry or economic sector is whether the firms in a concentrated industry will be progressive. Later, there will be detailed coverage of the beef sector demand problems associated with the lack of investments in product and market development, and these investments are one thing analysts have in mind when they speak of being "progressive." But then an immediate and important question comes up: Have the large packers been progressive in other important dimensions of what they do and would it be any different if the 4-firm concentration ratio were much lower than the current 80 percent--which means the 4 largest packers do 80 percent of the fed cattle business?

The big 3 have certainly been progressive in their technology and efficiency enhancing efforts and investments. Remember, the packer spread is trending down slightly in inflation-adjusted terms, and this has happened across the past 10-12 years when packers have taken on larger responsibilities in terms of kill-floor close trim, handling low-value bone and fat to best advantage, meeting increased food safety requirements, etc. In producing a generic product with no brand differentiation, it may be that what we would and should ask of the packers is that they be efficient and cost effective in what they do.

What about the other issue? Would the investments in product and market development be bigger in total if we had 10-15 medium size firms vs. 3 very large ones? So long as it is a non-branded product, the answer probably has to be "no." There is little incentive, in for-profit firms of any size, to make investments in technology, in packaging, etc., to modernize a generic product line. *With no brand identification, there is no way for the individual firm to harness the benefits of any costly new technology that it does develop and introduce.* Obviously, producer interests would like to see these large packers be more progressive in the product development arena, but it did not happen during the 1980s and much of the 1990s; however, some positive developments appeared in the last few months. We will come back to this area later in terms of how checkoff dollars might be spent to better advantage.

> **The peripheral issues are not the source of solutions, but they keep time and energy--and money--from being spent on more substantive issues. Low prices are frustrating, and mounting losses are even more frustrating. In these conditions and in the setting of early 1999, it is especially important that the industry turn its attention to the more substantive dimensions of many of these same topics of discussion.**

In turning to the more nearly longer term and substantive issues, *I will deal first with the need for better understanding of price discovery, price determination, and the difference between the two.* Clement Ward at Oklahoma State University will spend more time on this issue in later supporting sections, but we need to deal with it in a broad context here as we build an information base for suggested programs and policies.

A price is determined by the interaction of supply and demand. For example, we might see in the electronic newswires that cattle sold for an average of $59 during the last week in Texas. Coming into the week, there was a demand for these cattle that represented what packers felt they could pay for the cattle given the offers by buyers of boxed beef. Boxed beef offers are, in turn, tied to the levels at which consumers have set the value of the fresh beef offering at retail. Values are also being set in the HRI trade and in export arenas. And within all this, there are given middlemen profits or operating margin objectives. There was a "showlist" of cattle that was ready for sale during this week. The early-week give and take and the possible use of captive supplies by packers as they presented bids to the feedyards is all part of the dynamics involved in the price discovery process for the week. The

price of $59 that eventually was "discovered" was a function of what the showlists will look like the next week, the weights of the cattle in term of whether the feedyards can wait into next week, the packer movement of boxes into consumption and at what prices—and what the beef market is likely to be like next week. This dynamic process can and does move the price about within the week, but it is not the price discovery process that is responsible for the eventual average price at $59 that may mean continued losses to the feedyards.

The $59, or something very close to it, is an output of *price determination*. If $59 is the price that is needed to balance what sellers are willing to offer and what buyers are willing to pay for and take, then the price discovery process will surely focus in on that price or something very close to it. If that does not happen, then either the packers do not get the cattle they need or the feedyards are left holding cattle they needed to sell and watching them get heavier. *It is, then, the level of supply and demand that will ultimately determine the price level around which transactions occur.* No amount of legislated change in how the price is discovered—outlawing contracts and captive supplies, mandating reporting of all prices, requiring negotiation of all prices in some sort of competitive arena—will change the fact that something close to $59 is going to be required to clear this market and move those showlists into consumption. If regulations on procedures and legislated requirements add costs to the transaction process, then that added cost has to get covered—and the price discovery process will then have to discover a *lower* cattle price over time as the expanded costs of the packer and other affected middlemen will get covered in expanding operating margins. *On the other hand, reducing the costs of price discovery and/or reducing the uncertainty associated with discovery (uncertainty is another form of cost) could have a positive impact on the price level that is eventually determined.*

The solution to low prices is clear and we have known what it is for centuries: *You have to either reduce supply, increase demand, or accomplish some combination of the two.* What was happening in beef in late 1998 is that we were in a downward spiral of decreasing demand that has been going on since 1979, and the marketplace was in the process of running less efficient producers out of business via low prices to reduce the supply so that the quantity demanded at current prices will match the quantity supplied. Unless we want to continue to see a market-enforced solution in the form of running producers out of business, the demand-side problems have to get fixed. Regulating how price is discovered will not change things in any significant way. (We need to remember that effective price discovery needs to be value based in its discovered prices, and there is value in moving price discovery toward pricing to value because that will eventually change what we produce—and help fix the demand-side problems. But the price being discovered today, which is low, is the result of supply and demand forces that dictate the need for a low price to clear the markets. Price discovery or perceived problems in price discovery are not the cause of the low prices.)

Pricing to value is a second long-term issue that is clearly important. Both price discovery and market information dimensions of this issue are important. Longer term, producers must receive clear market signals if they are to change the beef product in ways consistent with what the modern consumer wants. Historically, the beef industry has been characterized by a number of profit centers between the producer and the consumer. The economic functions that are performed by the various profit centers were supposedly to be coordinated by the open market pricing system as prices were negotiated at each level of exchange. Price signals, premiums or discounts, were to be sent by consumers via their buying behavior to producers and what is being produced would then be changed and kept in line with consumers demands and preferences as they change due to changing lifestyles, income levels, etc.

In practice, the pricing system has failed—perhaps at least partly because the industry is now heavily concentrated. Large firms that see their pricing actions influence pricing actions of competitors

(the expected in an oligopsonistic structure in fed cattle buying) start to recognize very clearly the value of information and there is the related incentive to influence that which is reported to better their market position. Clem Ward deals with this issue in more detail in later sections as he writes about price discovery and price determination, but the ramification are clear along two important dimensions.

First, there is the issue of "alliances" that is a rapidly growing issue in the beef system. *There can be little doubt that one motivation for alliances is to distance the participants from the failure of the pricing mechanism.* Producers in particular are interested because they see a way, through internal accounting and record keeping processes, to get more nearly correct value for their cattle and be rewarded for excellence in ways the pricing mechanism has not been able to accomplish.

Second, the recognition that the current system does not price to value joins with captive supplies in prompting increasingly strident calls for mandatory price reporting. The Secretary's Commission on Concentrated Markets, referred to earlier, adopted a strong posture with regard to the need for "transparency" and open disclosure where pricing and price information by large processors is concerned. It appears that the Commission was saying that it recognizes the benefits of economies of size that came with the last round of mergers and acquisitions in the mid-1980s, but that is also recognizes the sometimes perverse incentives and the value of information that comes with the concentrated marketplace. To keep the benefits and not have them offset by poor price discovery that does not price to value and/or by any exercise of market power that is present with the large processors, some form of mandatory reporting of pricing is likely to be needed. For those of us who have preferred not to see legislated regulation of the marketplace, this may be the lesser of several evils. *Better price discovery that involves pricing to value is essential for the long-term wellbeing of the industry*. If requiring reporting of pricing is needed for better price discovery and the requirements can be reasonably enforced, then mandatory price reporting at some level of the system is surely on the horizon for this sector. In early 1999, it appears that "horizon" is very close. I would liked to have seen efforts to improve market information in the voluntary reporting system first, and this topic will surface again later in the paper.

With regard to the controversial captive supplies, we need to look in more detail at why they have evolved and emphasize the impact on price discovery of various possible arrangements. Both of these issues will be dealt with in more detail in later sections.

The work by Jim Trapp at Oklahoma State was referenced earlier in the background statement. Whatever the form of scheduling, his work shows that slaughtering and fabricating costs are influenced significantly by variability in daily volume compared to plant capacity. The same result was clear from the GIPSA round of research in the mid-1990s, and that research showed clear price implications: plants operating at or near capacity paid higher prices for fed cattle, other things equal. Further, larger plants tended to more nearly operate at or near capacity. The inference is clear: To the extent that captive supplies are a factor in "smoothing" the flow of cattle through processing facilities, then captive supplies are associated with an ability (cost based) and a willingness (cost control) to pay higher prices for cattle. *This conceptually sound and empirically verified finding needs to be brought into the middle of the dialogue and discussion about captive supplies*. The USDA's response to the petition for rulemakng by the Western Organization of Resource Councils, a request that would have made illegal virtually all of the presently used means of contracting for cattle, highlighted these same impacts of plant operating levels on packers' costs. *There is significant evidence to suggest that banning captive supplies would either create the need for packers to find some other means of scheduling and stabilizing fed cattle movements through plants or the prices they pay for fed cattle would have to go down, other things equal, to cover the added costs and added risk exposures they would incur. Packers' margins*

are variable, and it is not at all clear that they have room, even if they could be forced to do so, to absorb the increased costs via lower margins and keep capacity in the industry at levels sufficient to handle periodic slaughter surges.

Having said this, I recognize there are many astute observers of, and participants in, the daily cattle markets in the U.S. that firmly believe the use of captive supplies has the opposite impact and exerts a negative influence on fed cattle price levels—an impact larger than the relatively small impact that research studies have found. The issue may be one of type of captive supply arrangement vs. overall impact on prices. The different approaches can have a differential impact on price discovery.

Price discovery works best in a marketplace that is open and competitive with access to all pertinent information. In particular, effective price discovery needs all the legitimate participants who can and will bring information on supply and/or demand to the discovery process to be involved.

In the fed cattle market, one important set of participants is the cattle feeders. Even after recognizing that some feeders will opt to specialize in being efficient producers of beef and let someone else worry about price discovery (a possible rational decision for some feeders), it is nonetheless important that cattle feeders be involved in the price discovery process and bring their insight into that process. Not all forms of captive supply or supply scheduling arrangements allow or encourage that type of participation. This point was discussed earlier, but a bit of redundancy on this issue may well be needed.

Having control of the timing of price is the key. Basis contracts, cash forward contracts that allow the feeder to control timing of the pricing decision, quantity-only scheduled commitments to packers with the feeder looking to hedge or forward price in the futures, and minimum price contracts where the buyer bases the minimum price on a put option but allows the feeder to determine the "when" of pricing—these and a host of other possibilities allow or even require that the feeder get involved in pricing. *Having to pick the day that price will be set or picking when you do or do not want to get involved in a cash forward contract requires feeders to reflect their analysis of the market in the pricing process.* Price discovery will be more effective when this is happening. This is especially true when the instrument used has a "pricing to value" component in terms of a price grid. A price grid with premiums and discounts tied to true and final value of the beef carcass is always an important and positive contribution to price discovery. What is at issue here, in this discussion, is whether the cattle feeder is actively involved in setting the *base price* that is used to determine final price.

Any type of formula price arrangement, including proprietary business arrangements, that ties the final price to some observable cash market indicator or plant-paid prices at or near the time of delivery does not get the cattle feeder involved in price discovery. Even when a price gird is used, a possibility that is often found with formula pricing, the effectiveness with which the base price is discovered is suspect. As I noted earlier, the incentive is wrong when the final price and the final cost to the buyer is tied to a cash market in which the buyer is already involved. *There is an incentive to influence the cash price series that the final price is tied to either by buying and selling activities in that market or by selectively reporting information on those cash market activities.* Many critics see this latter possibility as the key—price paid for part of the volume bought is allegedly higher than the reported price, for example. Interestingly, a USDA and GIPSA study of fed cattle transactions in Texas apparently found that feeders were more likely to not report than packers and that more prices below reported levels were left unreported than prices above. But it is all a nebulous process that has inherent weaknesses associated with it, and formula pricing that ties to a cash price or cash series damages the integrity of the pricing process. The same scheduling of quantity can be accomplished by

using a basis contract where the base price is determined in the futures market and is not vulnerable to selective reporting or failure to report—and the timing of the pricing decision can be left open and under the control of the cattle feeder. I am opposed to captive supply arrangements which have a perverse set of incentives with price tied to a cash market the market is active in and feel the industry would be better off without such arrangements.

The issue of an unresponsive retail sector, where prices are slow to respond to changes at the live animal and boxed meat levels, is an important issue and is one that may be amendable to policy decisions on what information to report from the USDA and how often. The basic problem is widely recognized. Fed cattle prices plummet under the weight of increased marketings from the feedyards, drought induced slaughter of cows and non-fed cattle, and/or excessive average weights on feedlot cattle. In the very short run—a matter of weeks—demand at the consumer level is not likely to shift in any significant way. The stationary demand curve slopes down, which means that increased quantities will be absorbed by buyers only at lower prices. And when the tonnage produced surges, that is exactly what is needed—lower prices. Consumers will take the increased tonnage when prices decline and the pipelines and the marketplace "clear." But if it is months before the retail price respond significantly, the system stagnates. The pipelines do not clear, and packers reduce the box prices trying to move inventory. Fed cattle prices come down, and the losses that often show up at the feedlot levels drag out until reduced placements and lower prices for feeder cattle eventually restore positive feedlot margins.

Policy changes can help in this area. There is more detail and the reporting of Institute financed research by Barry Goodwin and Matthew Holt at North Carolina State University in later sections. This is an area in which policy help appears to be not only possible but advisable and could be a win-win situation for all concerned. One possibility would be more frequent reporting of retail prices by the USDA. This would facilitate observation of what is or is not happening in the retail sector as live cattle prices move up or down. Response at the retail sector might be quicker if it were easier to publicize the situation and to monitor price spreads weekly instead of monthly, and the added visibility could encourage retailers to be more efficient in what they do, to keep costs down, and to constrain the growth in the margins they are extracting over time.

The final long run and basic consideration, the one that I believe has been the most important determinant of the current negative economic picture in the beef business, is the long running and persistent declines in consumer level demand for beef. Discussed in some detail in the background statement earlier, decreases in demand (along with expanding retailer margins) were identified as primary sources of the pressure on livestock prices that is prompting cost-price squeezes at the producer level. In this section, additional empirical verification of the demand problems will be presented.

Figure 13 shows the per-capita consumption and inflation-adjusted retail prices for Choice beef, presented earlier in Figure 6 as a line graph, in a different and revealing format. The scatter plot shows price-quantity coordinates identified by years. Each coordinate was on a demand surface that prevailed in that particular year, and the price shown is the average price determined by the marketplace for the quantities being made available during the year. Every business day during that year, market processes were seeking to discover the price that would balance the quantity that producers were offering to the market with the quantity buyers were willing to take away from the market. *The price discovery process, no matter how volatile it might appear as the dynamics within the year play themselves out, will always focus in on the price that must be determined to clear the market.* Demand curves slope down and to the right at any particular level or strength of demand and show all the quantities that consumers will take at alternative prices. When the price is low, the quantity taken will be greater than

when the prices are higher. There are varying price-quantity combination on the same demand curve, which is but a plot of the demand schedule that shows quantities that will be taken at different prices.

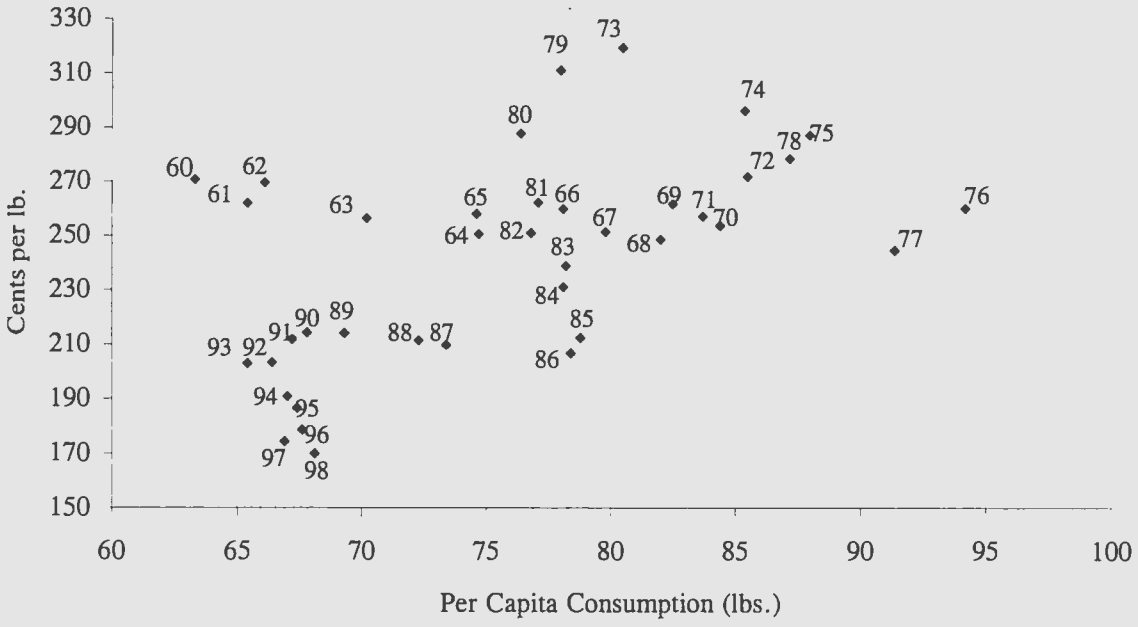

Figure 13. Per-Capita Consumption and Inflation-Adjusted Prices for Beef (CPI, 82-84=100), 1960-98

When the price-quantity coordinates that are determined by this interaction of supply and demand for any particular year lie up and to the right of the prior year, then demand is increasing. This was happening in the 1960s and early 1970s as the American consumer discovered a taste for marbled beef and bid up the price seeking to get it into their consumption patterns. Compare 1965 and 1975, to illustrate. Almost 15 added pounds were sold at significantly higher inflation-adjusted prices, which means nominal prices were increasing rapidly across the period. After 1979, however, it would appear that the changes started to go in the opposite direction.

Reflecting the growing concern about cholesterol and fat in the diets, the trend toward two wage earners in the same household, the resulting reduction in the time spend in food preparation and cooking, and augmented by the developing dissatisfaction with the quality and consistency of the eating experiences associated with the better cuts of beef, the movement after 1979 has been consistently down, to the left on the graph, or down and to the left. Any such moves that indicate willingness to take the same quantity only at lower prices (1979 through 1986), a lesser quantity at largely constant prices (1987 through 1991) and/or lower prices for reduced per-capita offerings (1991 to 1992 and 1996 to 1997) indicate--without any doubt--decreases in demand. Visualize the negative sloping curve coming through the price-quantity coordinates for each year at a slope of roughly 35 to 40 degrees (reflecting demand elasticity around -.67) and it appears that the demand surface shifted down and to the left virtually each year.

Economists talk about an issue called "identification" which deals with identifying the why of price moves. Was it due to shifts in demand, or due to shifts in supply? Which—demand shifts or supply shifts—do we "identify" as the causal factor in price moves over time?

It is possible that one of the reasons that per-capita consumption (which is per-capita production and net import/export availability since inventory changes are relatively small) has declined from nearly 95 lb in 1976 to about 68 lb for 1998 (and down again to a projected 64-65 lb for 1999) is because resources and investments have been taken away from beef production and diverted to some other application. That suggests that some of the price move over time can be coming from supply shifts—but it really doesn't matter much to the industry how we got to where we are in early 1999. Identification is an interesting academic issue, but one that is not of particular interest to the producer caught in a cost-price squeeze. *It is a tautology that the demand curve along which the industry was operating in recent years was much lower than that of 1979 or 1980 or even 1987 or 1988.* The economic havoc that is being prompted by this low level of demand is the same no matter whether we go there by demand shifts, supply shifts, or both across the past 18 years.

Consumer demand is complex but the essence of the problem is that the fresh beef product offering has diverged from what the modern consumer wants. References at the Internet site of the Research Institute on Livestock Pricing www.aaec.vt.edu/rilp, starting with the *Primer on Beef Demand* publication, and the more recent *Measures of Changes in Demand for Beef, Pork, and Chicken, 1975-1998* document the problems. Quality problems, inconsistent eating experiences, lack of convenience in preparation—all these appear to be more important than price in changing some consumers' buying behavior. A recent addition to the RILP website, *Will Consumers Pay for Guaranteed Tender Steak?,* adds evidence that price is often not the important issue. The 1995 Beef Quality Audit, conducted by the leading meat scientists around the country, clearly showed the magnitude of the problem when it indicates that as many as 1 in 4 steaks from the low Choice grade may be inferior products because they are too tough to chew. But we did not suddenly realize we had problems in 1995. A demand index prepared for NCBA (and included in the "Measures of Changes in Demand for Beef, Pork, and Chicken, 1975-1998" publication) and examination of the scatter plot in Figure 13 clearly indicate huge and mounting problems in the early 1980s. In the presence of largely constant per-capita offerings, inflation-adjusted price in 1986 dropped over 30 percent from the high of 1979 as the price discovery process sought a price sufficiently low that consumers would take some 78 lb per capita. Why have the long obvious problems not been fixed?

There are two primary reasons, both of which need further discussion. First, *there has been the barrier to progressive action that has emerged from the way the industry is organized and the related profit-center mentality.* And second, *there have been several well intended but misguided efforts that diverted attention from the mounting demand problems via a focus on reducing costs as the sole answer to the industry's needs.*

There are a number of economic functions that have to be performed to bridge the gap between the producer and the consumer. We talked earlier about the failure of the price-based systems to coordinate these functions, and the alliances that are starting to evolve to provide the needed coordination. For-profit firms at each level have their own agendas and goals, most built around the desire to maximize profits or market share over time. This profit-center mentality prompts a myriad of behaviors, none of which necessarily conform to what is needed to protect and enhance the wellbeing of the entire beef system. And where the need for enhancing consumer demand is concerned, the result has been devastating. *The investments in technology, in research and development, in capital equipment, and especially in new product and new market research has been far short of what has been*

needed to keep this important sector viable and growing. And the result is predictable. New capital expenditures lag behind the pace in a growing sector like poultry and the number of new products offered each year in chicken runs roughly twice the number introduced in beef. Since it is unlikely that the structure of the industry will change quickly and given the urgency of the need, it is imperative that the producer sector become the catalyst that makes sure the needed investments happen.

Among the well-intended but arguably misguided efforts, the "outside expert" study referred to earlier was surely the most important. Contracted by the National Cattlemen's Association, the study was published by the Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota in 1989. The study adopted a posture, on page 25 of the report, which appeared contradictory to what the price-quantity data were showing:

> "....nearly all, if not all, of the changes in per-capita consumption in recent years can be explained by traditional demand analysis that relies upon estimating the effects of changes in the prices of meats and related products and real income without including any presumed effects of change in tastes and preferences."

The report went on to conclude that what was needed were pervasive efforts to increase efficiency of production and decrease costs, thereby allowing beef to be more price-competitive in the store. There was no need, the consultants asserted, to worry about trying to influence the consumer with advertising or eduation programs because there has been no change in preferences at consumer levels. In their concluding comments (p. 40), they again emphasized their findings that any changes in consumer demand for beef can be explained by changes in relative prices (which supported their emphasis on getting costs down as the primary strategy) and changes in consumer incomes.

Table I presents the findings from a statistical effort to explain changes in quarterly beef prices since 1960. Initially, Choice beef price was modeled as a function of per-capita consumption of beef as a measure of beef quantity, per-capita consumption of pork and chicken to capture the impact of changes in the price/quantity relationships among the competing meats, consumers incomes, and quarterly 0-1 shift variables to capture any seasonal pattern in beef price not explained by the economic factors in the model.

If this set of explanatory factors were sufficient and adequate to explain what is happening to beef over time, then the residuals (model predicted prices less actual prices) would be random and independent of each other. If there is a consistent trend or pattern in the residuals across any time period within the analysis period, then we have evidence of model misspecification. Some other and important explanatory variable has been left out and this is not an acceptable modeling effort.

Figure 14 shows a plot of the residuals from the specification:

> *Pbeef = f(per-capita consumption for beef, per-capita consumption pork, per-capita consumption chicken, real disposable personal incomes per capita, seasonal dummy or 0-1 variable for quarters 2, 3 and 4)*

Since this is a price-dependant model, per-capita consumption of beef goes in first as an "explanatory factor." Quantity changes in beef will always be the biggest influence in explaining changes in beef prices. Then, the per-capita measures of pork and chicken are entered to pick up the demand shifting influence of changes in pork and chicken. Increased per-capita supplies of pork and chicken would decrease their prices, which decreases beef demand. Thus, the "relative price" issue

involving the meat substitutes is in the model. For statistical estimation reasons, only 3 of the 4 quarterly shift variables can be used. Quarter 1 is omitted and its impact is effectively in the intercept term.

The typical economic measures of substitute meats and incomes do not, as the "outside experts" had argued, explain what is going on in beef. The residual plot clearly shows non-random and non-independent residuals, especially in the 1979 to 1986 period which has already been identified as the first and prolonged period of major demand problems for beef. By inference, preferences—the other widely recognized demand shifter after incomes and the impact of substitute meats are accounted for—was shifting the demand surface for beef consistently downward during the late 1970s into 1998.

Table I. Statistical Properties of the Preliminary Beef Price Model, 1960-98

Ordinary Least Squares			
Dependent Variable	BEEFDEF	Number of Observations	153
Mean of Dep. Variable	243.0289	Std. Dev. Of Dep. Var.	35.614173
Durbin-Watson Statistic	.3160	Estimated Autocorrelation	.84198
Std. Error of Regr.	18.8271	Sum of Squared Residuals	51396.6
Total Variation	.19279E+06	Regression Variation	.14140E+06
Regression degrees of freedom	7	Residual degrees of freedom	145
R squared	.73341	Adjusted R squared	.72054
F (7, 145)	56.9863	Prob. Value of F	.00000

Variable	Coefficient	Std. Error	t-ratio	Prob |t| >x	Mean of X	Std. Dev. of X
Constant	260.046	38.34	6.782	.00000		
BEEFCON	-3.44178	1.502	-2.292	.02334	19.00196	2.05226
PORKCON	-.659447	1.619	-.407	.68435	13.05020	1.31933
BRCON	-17.0613	2.193	-7.779	.00000	12.22288	4.61912
DEFINC	.251737E-01	.4867E-02	5.173	.00000	10260.91209	1928.26195
QDUM2	16.7972	4.819	3.486	.00065	.24837	.43348
QDUM3	14.9225	5.044	2.959	.00361	.24837	.43348
QDUM4	-2.63978	4.500	-.587	.55842	.24837	.43348

Where:
BEEFDEF = deflated (CPI, 1982-84=100) retail Choice beef price (cents/lb)
BEEFCON = per-capita beef consumption, retail weight (lb)
PORKCON = per-capita pork consumption, retail weight (lb)
BRCON = per-capita chicken consumption, carcass weight (lb)
DEFINC = deflated per-capita disposable income ($)
QDUM2 = seasonal shift variable, quarter 2
QDUM3 = seasonal shift variable, quarter 3
QDUM4 = seasonal shift variable, quarter 4

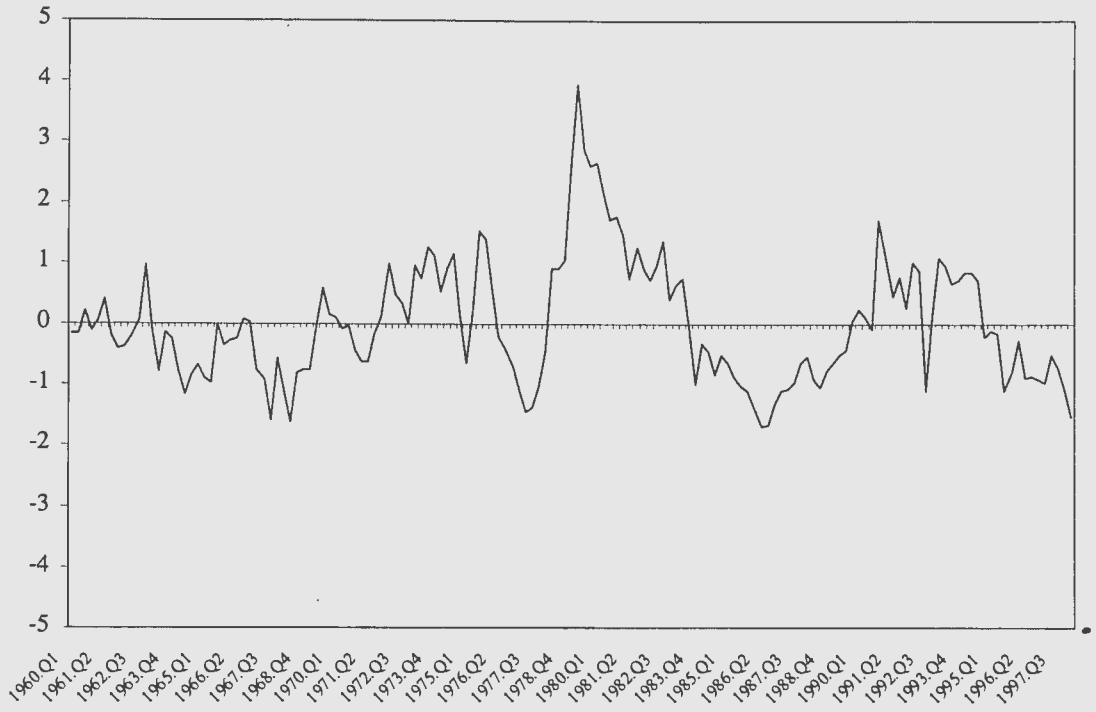

Figure 14. Residuals for the Preliminary Beef Price Model, 1960-98

Preferences have no numerical measurement that can be entered into the model. Some analysts have created "health" measures by, for example, counting the number of articles on cholesterol that were in selected science-type magazines. *How the missing impact is captured is arguably of less importance than recognizing that beef prices are moving in systematic and sustained ways that are not explained by the interaction among the competing meats and/or by consumers incomes. There has been a major preference shift.* Once there is recognition that something else is happening, with the "something" likely to be based in preference shifts, there is an issue of immediate interest: *How much shifting has occurred after the traditional economic forces that influence demand are accounted for?*

Adding 0-1 or shift variables, starting in and before the years in which the residuals are clearly not random, is a convenient way to measure the changes in price that have occurred over and above the changes related to the competing meats and incomes. Table II shows the model results and Figure 15 shows the random set of residuals that emerge from this model specification. The parameter on the 1998 year, shown as DUM98, measures the shift in the model intercept associated with influences not entered in the form of specific explanatory variables in the model. This parameter shows beef demand, in price terms, had shifted down $2.32 by 1998.

This finding is very important. After accounting for changes in beef quantity, for the substitute meats, and for consumers' incomes, prices of beef still decreased dramatically for other reasons. The "other reason" was a preference issue as consumers were increasingly not satisfied with the quality, consistency, and convenience of the fresh beef offering.

Table II. Statistical Properties for a More Extensive Beef Price Model, 1960-98

Ordinary Least Squares			
Dependent Variable	BEEFDEF	Number of Observations	156
Mean of Dep. Variable	241.6312	Std. Dev. Of Dep. Var.	36.661909
Durbin-Watson Statistic	1.5902	Estimated Autocorrelation	.20491
Std. Error of Regr.	7.7410	Sum of Squared Residuals	7430.49
Total Variation	.20833E+06	Regression Variation	.20090E+06
Regression degrees of freedom	31	Residual degrees of freedom	124
R squared	.96433	Adjusted R squared	.95542
F (31, 124)	108.1513	Prob. Value of F	.0000

Variable	Coefficient	Std. Error	t-ratio	Prob |t| > x	Mean of X	Std. Dev. of X
Constant	322.160	17.59	18.315	.00000		
BEEFCON	-10.9135	1.066	-10.239	.00000	18.96410	2.05115
PORKCON	-2.44937	.8778	-2.790	.00610	13.05372	1.31253
BRCON	-.954340	1.836	-.520	.60410	12.39872	4.74474
DEFINC	.231842E-01	.2439E-02	9.505	.00000	10324.73622	1963.33161
QDUM2	1.10365	2.392	.461	.64532	.25000	.43441
QDUM3	4.91496	2.298	2.139	.03442	.25000	.43441
QDUM4	-3.17413	1.919	-1.654	.10063	.25000	.43441
DUM75	11.3498	4.937	2.299	.02319	.02564	.15857
DUM76	-2.09236	4.949	-.423	.67318	.02564	.15857
DUM77	-29.9464	4.625	-6.475	.00000	.02564	.15857
DUM78	-15.3761	4.964	-3.097	.00242	.02564	.15857
DUM79	.156345	6.802	.023	.98170	.02564	.15857
DUM80	-16.8742	6.944	-2.430	.01652	.02564	.15857
DUM81	-41.4231	7.230	-5.729	.00000	.02564	.15857
DUM82	-54.3134	7.640	-7.109	.00000	.02564	.15857
DUM83	-67.9180	7.664	-8.862	.00000	.02564	.15857
DUM84	-87.2097	8.297	-10.511	.00000	.02564	.15857
DUM85	-102.533	9.002	-11.391	.00000	.02564	.15857
DUM86	-120.026	9.429	-12.729	.00000	.02564	.15857
DUM87	-134.053	11.59	-11.563	.00000	.02564	.15857
DUM88	-140.496	12.67	-11.091	.00000	.02564	.15857
DUM89	-155.875	14.81	-10.524	.00000	.02564	.15857
DUM90	-156.010	16.09	-9.699	.00000	.02564	.15857
DUM91	-163.859	17.11	-9.578	.00000	.02564	.15857
DUM92	-176.413	17.84	-9.890	.00000	.02564	.15857
DUM93	-183.299	19.47	-9.416	.00000	.02564	.15857
DUM94	-192.469	19.83	-9.707	.00000	.02564	.15857
DUM95	-207.979	19.41	-10.715	.00000	.02564	.15857
DUM96	-221.887	20.09	-11.045	.00000	.02564	.15857
DUM97	-233.057	20.93	-11.136	.00000	.02564	.15857
DUM98	-232.153	21.25	-10.927	.00000	.02564	.15857

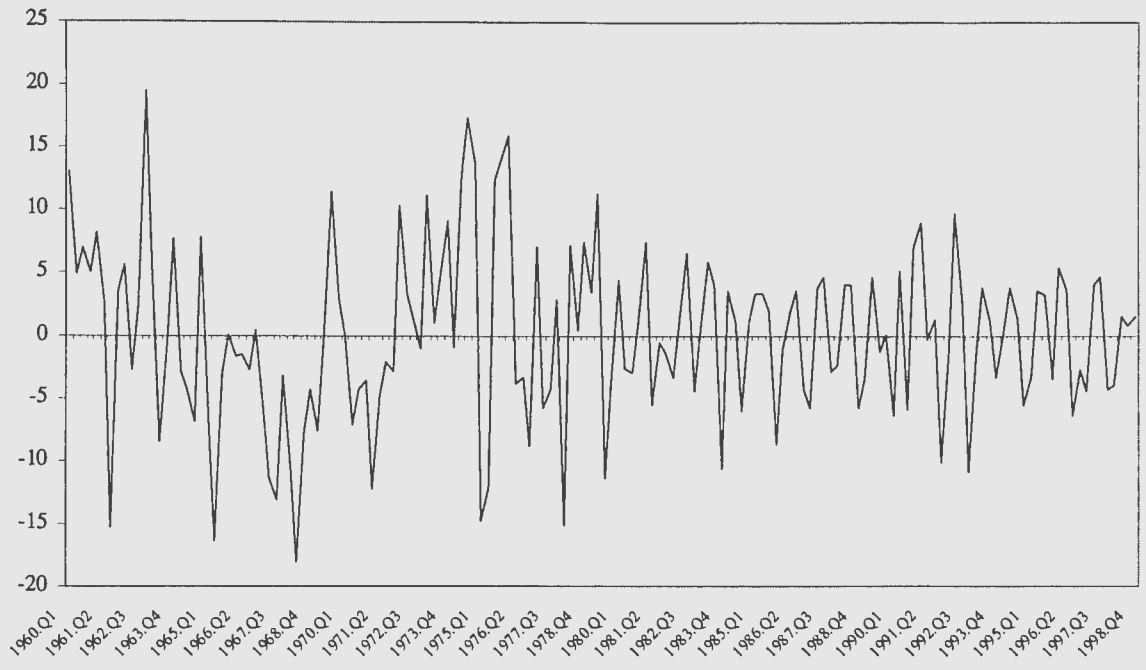

Figure 15. Residuals for a More Extensive Beef Price Model, 1960-98

Some academic purists would argue with this conclusion since there is no specific variable to capture the declines included in the model, but these coefficients on the yearly shift dummies measure the changes in price coming from the quality problems, the lack of convenience, and the other attributes that have prompted dissatisfaction with the fresh beef offering that shows up repeatedly in surveys and focus group work. An example of this is found in the recently released Tends in the United States: Consumer Attitudes and the Supermarket, 1998, by the Food Marketing Institute. Excerpts show

> "....9 in 10 shoppers express at least some concern about the nutritional content of the food they eat....Topping their concerns are fat content, salt, and cholesterol....One-third say they are eating less meat."

The failure of the "outside expert" consultants (referred to earlier) to pick this up was, it would appear, a major setback for the industry. In their publication, they indicated that their model (which was a quantity-dependent approach) generally had errors in per-capita estimations (i.e., their residuals) of less than 4 percent which they labeled as "small." On page 17 of their report, we find:

> The fact that predicted consumption of beef exceeds actual consumption for each year from 1978 through 1983 as well as for the period beyond the original date set (1984 through 1987) lends some support to the often-held position that the structure of beef demand has changed somewhat in recent years in a way that is unfavorable to the beef sector. From 1978 through 1983, the predicted consumption averages 2 lb, or about 2.5 percent, more than actual consumption. Almost exactly the same difference prevailed from 1984 through 1987. Consequently, if the structure of demand did change in the mid-1970s, the shift does not seem to have become more adverse over time.

There are factual and conceptual errors in this conclusion. Predicted per-capita consumption did *not* exceed actual in 1978 and 1979, a fact documented in their Table 3.1 on the next page of the report. The predictions did *not* average 2 lb over actual for 1978 through 1983—the difference was only 1.1 lb using the data in their Table 3.1. They used all this, recognizing that the predictions for 1984 through 1987 were an "out of sample" test of the model, to conclude there was no demand problem or that it certainly was not becoming "more adverse" over time.

Looking at the scatter plot data would have indicated the demand surface was shifting down, but we need to remember that what they were arguing was that all of the shifts can be explained by the impact of competing meats and consumers incomes—that there is nothing significant left to attribute to a "preference problem." The more recent analysis presented above clearly documents a huge shift due to something beyond the competing meats and consumers incomes. But there was clear evidence in their results as well that they were missing something, that their model was misspecified.

They used yearly data, starting in 1954 and running through 1983, for the model estimation and updating. The model was then used to predict per-capita consumption for 1984 through 1987 as an out of sample test of the model, a step that *is* important. If this model is not ignoring some important demand shifting influence, whatever it might be labeled, then the residuals need to be random. *Examination of their Table 3.1 shows that the last 8 residuals, 1980 through 1987, were all positive.* The actual per-capita consumption was *always* below the model predications, by a huge 3.8 and 3.1 pounds in 1980 and 1981 respectively, and again by a huge 3.4 lb in 1986. *This is clearly not a set of random residuals where each residual is independent of the prior residual.* The model is seriously misspecified and something very important was missing. The missing force was the preference shifts as consumers changed and found the unchanging product offering to be diverging from their needs in quality, consistency, and convenience.

There is not much point in debating how much time and energy has been lost to the industry and how many checkoff dollars have been spent in less effective ways than might have been the case due to the consultants' analysis of the demand picture. And there certainly is no intent here to minimize the importance of being efficient, keeping costs down at all levels of the system, and being as price competitive as possible at the consumer level. But we have to recognize that the big and sustained problem is on the demand side. It is this demand problem that is driving the inflation-adjusted retail prices down and keeping the nominal prices of beef stagnant and flat. Retail beef prices, before adjusting for inflation, are up only 15-16 percent since 1980, and they have trended down since late 1993. This is the primary source of the very difficult problems facing the cattle producer.

But we cannot undo what has been done in the past. The need is to redouble our efforts to get to programs and policies and to spending decisions on the checkoff funds that will give the industry a chance to get back to a growth status again and get back to the opportunity to make profits and attract investment dollars back into beef production, processing and value-added activities. The remainder of this paper deals directly with those needs.

REFLECTIONS ON CURRENT ISSUES IN THE BEEF INDUSTRY

Understanding Price Determination vs. Price Discovery
Clement E. Ward
Oklahoma State University

Captive Supplies in Fed Cattle Markets
Ted C. Schroeder and Rodney Jones
Kansas State University

International Beef and Cattle Trade Issues
James Mintert
Kansas State University

Stable Slaughter and Fabrication Levels: Implications to Costs and Cattle Prices
James N. Trapp
Oklahoma State University

Vertical Price Transmission Issues in the Beef Sector
Barry K. Goodwin and Matthew T. Holt
North Carolina State University

Brief reflections on several of the issues in the beef industry of early 1999 by researchers at land-grant universities are presented in this section. Most of these writings are based on research receiving financial support from the Research Institute on Livestock Pricing. More detailed reports of the research are on the Internet at www.aaec.vt.edu/rilp or hard copies can be obtained from

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Understanding Price Determination vs. Price Discovery

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Introduction

Cattle prices, including calves, feeder cattle, and fed cattle, have generally trended lower for most of the 1990s since the cyclical price peak in about 1991. There have been periods of severe price breaks, such as 1995-96 for calves. Cattle producers and feeders wonder how there can be $30/cwt. price swings, sometimes within just a several-month period. Producers have cited several causes: packer concentration, captive supplies, and beef imports, among others. But are these really the factors affecting large price swings or price trends over extended periods?

There is a critical need to understand that some pricing issues relate to price determination and some to price discovery. Understanding the nature of the issue is important in evaluating potential alternatives to pricing problems. For example, low "market" prices for cattle are related to price determination factors, *not* to price discovery factors. Low prices result from supplies which are large relative to existing beef demand. Widely varying prices above and below the market price level over short-run periods, such as any given day or week or from week-to-week, result from many factors directly affecting price discovery. These can include captive supplies, reported market information, and meatpacking concentration.

Price discovery is frequently confused with price determination. These are two *related* but *different* concepts which producers need to understand. In what follows, I will attempt to distinguish between the concepts, identify how they are interrelated, and provide an indication as to when price discovery concerns typically increase.

Price Determination

Price determination is the interaction of the broad forces of supply and demand which determine the market price level. You may ask, "What's the market for cattle today?" The reply could be, "About $90/cwt for calves, $75 for feeder cattle, and $65 for fed cattle." These prices constitute the market price level, the level resulting from the broad forces of supply and demand. These are the prices at which supplies brought to market are purchased by buyers demanding cattle and are prices at which the market "clears." Supply and demand determine the "general" or "market" price level for beef at retail. The wholesale price for boxed beef is derived from the market price for beef at retail. The fed cattle price is derived from the wholesale boxed beef price. The feeder cattle price is derived from the fed cattle price and the calf price is derived from the feeder cattle price.

What are the broad supply and demand forces? Factors affecting the quantity of beef produced, or supply, include:

- input prices (for replacement heifers, cows and bulls, forage and feed grains, interest rates),
- technology (breeding programs, nutrition management, animal health management),

- price of outputs produced from those inputs (ultimately beef products for retail and food service consumption and cattle byproducts), and
- imports (net of exports, depending on exchange rates and supply-demand conditions in exporting and importing countries).

Factors affecting the demand for beef include:

- prices of competing protein or main-dish products (pork, poultry, fish and seafood),
- consumer disposable income, and
- consumer tastes and preferences (including health and nutrition preferences, type and size of products, seasonings and flavorings, consistency, convenience in preparation).

The quantity of beef consumed largely mirrors the quantity produced, but these quantities will change over time with the level of profits at the producer level. And at any one point in time, the level of demand is constant and quantity bought will vary inversely with price. Market price levels can thus vary widely due to supply factors, demand factors, or both. Supplies change more rapidly than demand. Changing the number of cattle takes considerable time due to the biological breeding and growth of cattle. However, simply holding cattle on feed longer and putting extra weight on slaughter cattle increases production, or the supply of beef. In 1998, added weight on slaughter cattle by itself has added the equivalent of about 900,000 head of cattle to beef supplies. Thus, supplies can change rather quickly.

Beef demand has experienced considerable downward pressure for the past two decades. Demand changes are less evident than supply changes and more difficult to measure. We can see clearly how supplies of beef have periodically increased during the 1990s, due to increasing weights of fed cattle marketed, despite a substantial decline in beef cow numbers. Add to that the increasing supplies of pork and poultry, which translate into beef substitutes for consumers, and beef (and cattle) prices may drop sharply until conditions change. Demand changes can only be measured after taking into consideration the effects from those factors that affect it or shift it, the factors listed above.

Price Discovery

Price discovery involves buyers and sellers "discovering" or arriving at transaction prices for given qualities and quantities of cattle at a given time and place. Many factors affect price discovery. Price discovery involves several interrelated concepts, such as:

- market structure (number, size, location, and competitiveness of buyers and sellers);
- market behavior (buyer procurement and pricing methods);
- market information and price reporting (amount, timeliness, and reliability of information); and
- futures markets and risk management alternatives.

Price discovery begins with the market price level. Thus, the current or recent "general" or "market" price level resulting from supply and demand forces becomes the base or starting point for price discovery. Thus, "discovered" transaction prices fluctuate above and below the general or market price level. This fluctuation is attributable to the quantity and quality of the cattle brought to market, the time and place of the transaction, and the number of potential buyers and sellers present. Other important factors, for example, in the case of fed cattle prices, are the amount and type of public market information available, pre-purchased (captive) supplies, and packer concentration.

One type of price discovery research attempts to determine factors which explain variation in transaction prices. Several studies have been conducted to understand the variation in feeder cattle prices (Sartwelle et al.1995; Coatney, Menkhaus, and Schmitz 1996). Some of the relevant price discovery factors included:

- weight;
- lot size and uniformity;
- health (vaccinations, sick, bad eyes, lame, etc.);
- condition and fill;
- muscling and frame size;
- horns;
- breed and breed combinations;
- time of sale;
- location of sale;
- marketing method (auction, direct, satellite auction); and
- buying activity (number of buyers or number of bids).

Similar research has been conducted for fed cattle (Jones et al. 1992; Ward, Koontz, and Schroeder 1998). Factors affecting variation in discovered transaction prices for fed cattle included

- boxed beef cutout values;
- live cattle futures market prices;
- cattle quality (including sex, weight, quality grade, yield grade, and breed);
- sale lot size;
- number of days between purchase and delivery of cattle;
- number of packers bidding on cattle;
- individual packing plants or firms;
- individual feedlots;
- day of the week;
- time of year;
- region of the country; and
- extent and type of captive supplies.

Thus, several factors affect individually "discovered" transaction prices. All prices, though, are derived from and tied to the general level of "determined" prices that reflect the broad forces of supply and demand.

Price Discovery Interactions with Price Determination

Price determination and price discovery are clearly interrelated, but are not as clearly distinguished. Price determination finds the market price level. Clearly, market prices or the general level of prices may be high or low from a producer's or cattle feeder's perspective. However, when market prices are low or are falling, questions and concerns about price discovery regularly increase. Figure 1 is a matrix showing potential price discovery problems or concerns under given supply and demand scenarios. When demand is strong or expanding and when supplies relative to processing capacity are small or declining, price discovery problems are generally not a major concern. Under these conditions, competition is generally keen, thus ensuring what sellers tend to believe is efficient price discovery.

For some recent years, the opposite conditions have existed. Beef demand studies indicate consumer beef demand has been weak or declining. Thus, during most of the past two decades we have been in one of the two far right cells of the matrix in Figure 1. During the part of the cattle cycle when inventory numbers increase, as they did during the early 1990s, and when increased weights of slaughter cattle increase as they have in 1998, beef supplies are large or increasing. Under these conditions, large supplies of cattle and beef occur simultaneously with weak or declining consumer demand. This causes low cattle and calf prices and heightens producers' price discovery concerns.

	Demand for Beef	
	Strong or Expanding	Weak or Declining
Relative Supply of Beef		
Large or Expanding	Potential Concerns	Probable Concerns
Small or Declining	Unlikely Concerns	Potential Concerns

Figure 1. Price Discovery Concerns Under Alternative Price Determination Conditions.

Compounding the problem frequently, as in 1998, are large supplies of competing meats such as pork and poultry. Large supplies of pork, for example, decrease pork and slaughter hog prices and a decrease in pork price relative to beef will decrease the demand for beef. The combined result tends to be increased producer concerns about price discovery and accusations about captive supplies, packer concentration, beef imports, and other factors.

Net cattle and beef imports affect the supply of beef in the U.S. and thus have a bearing on the market price level. However, captive supplies and packer concentration primarily affect price discovery, short-period price changes and price variation. Therefore, the market price level is not directly a result of packer concentration or captive supplies. There is, however, an effect in a longer run sense. Research has shown that larger packing plants and those plants which procure fed cattle via captive supply methods are more cost efficient and this affects the price they can pay for fed cattle (Ward 1993; Barkley and Schroeder 1996). Research also has shown larger plants do, in fact, pay higher prices for fed cattle than smaller plants (Slaughter Cattle Procurement and Pricing Team 1996), and that on balance efficiency gains have offset market power inefficiencies as packer concentration has increased (Azzam and Schroeter 1995). These positive impacts work to offset any short run or local price pressures that might accrue from fewer bids, longer hauls to the now-fewer processing facilities, etc.

Conclusion

The general level of prices reflects supply and demand factors. Individual transaction prices fluctuate around the general market price, whether that market level price is high or low. Variation in transaction prices and day-to-day or week-to-week changes in prices are related to many factors, including quantity and quality of cattle, and the timing and location of cattle sales/purchases.

To paraphrase the above in terms of cattle prices during most of the 1990s, low prices are related to price determination factors, *not* price discovery factors. *Low prices result from beef supplies which are large relative to existing beef demand conditions*. Note this does *not* mean beef supplies are necessarily high in a historic context. In 1998, per-capita supplies of beef generated per-capita consumption measures of 68.1 lb. This 68.1 lb was up over 4 percent from, for example, the 65.4 lb of 1993 when fed cattle prices surged to the $80 level. But the 68.1 is far below the nearly 95 lb of 1976, providing clear evidence of the problems of declining demand and suggesting (correctly) that "big supplies" are always relative to some base for comparison purposes. Widely varying prices, both above and below the market price level, result from many factors directly affecting price discovery. Captive supplies, market information (or lack thereof), pricing on averages, and meatpacking concentration are likely contributing causes.

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Captive Supplies in Fed Cattle Markets

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Vertical coordination by beef packers into fed cattle markets, commonly referred to as captive supplies, has been a concern in the beef industry for more than a decade. Cyclical declines in cattle prices together with reduced public price information fuel producer concerns regarding contract buying and/or owning cattle on feed (vertical integration) and their impacts on the fed cattle market. Many of the concerns that have been raised regarding captive supplies relate to availability of market information necessary for efficient price discovery. Reliable, representative, balanced, and readily available market information is essential for price discovery in a market like fed cattle where price is the most important signal coordinating production and marketing activities. In an industry like beef with high packer concentration, symmetry of market information between cattle feeders and beef packers is even more important for efficient and fair price discovery.

Despite concerns regarding captive supply, use of captive supply marketing methods also benefit the industry. These benefits need to be weighed against possible negatives of captive supplies in any policy deliberations. The purpose of this paper is to outline benefits, concerns, and implications of captive supplies in the fed cattle market. Much of this discussion is adapted from Schroeder *et al.* (1998). For ease of presentation, we use "vertical integration" to refer to the various ways that buyers schedule cattle, in advance, into the packing plants.

This report:

(1) Outlines motivations and benefits associated with vertical integration,

(2) Reviews economic concerns associated with vertical integration in fed cattle markets and summarizes research results investigating the impacts of this integration, and

(3) Identifies and assesses potential policies to address impacts associated with beef packer vertical integration.

Background

One approach to vertical integration in fed cattle markets has been packer and feeder use of captive supplies. Vertical integration in fed cattle markets has been referred to as *captive supplies*. Captive supply, as defined by the Grain Inspection, Packers and Stockyards Administration (GIPSA), includes any livestock owned or otherwise contractually controlled by packers two or more weeks prior to slaughter. This includes:

(1) Cattle sold by feedlots to packers using forward contracts, generally basis contracts or cash price contracts.

(2) Cattle sold by feedlots to packers via marketing agreements with price typically established using a negotiated formula, typically consisting of a base price and perhaps stipulated premiums or discounts (around the base price) for quality differences.

(3) Cattle that were owned and controlled by packers during feeding.

Some livestock associations have requested that the definition of captive supply be expanded to include any cattle purchased using formula pricing, regardless of when the commitment to deliver cattle may have been established. This expanded definition of captive supply has not been adopted by GIPSA. However, with alliances and other forms of non-cash fed cattle transactions becoming more common, the GIPSA definition of captive supplies used for reporting may be modified in the near future to reflect this type of cattle trade. One aspect of many alliances that markedly differentiate them from traditional captive supplies is that they often originate and are controlled by cattle producers and not necessarily by beef packers. Thus, the mix and definition of captive supplies will likely continue to evolve with changing industry structure and practices.

The percentage of cattle procured via captive supply arrangements by the four largest beef packing firms in the U.S. from 1990-97 is summarized in Figure 2. The percentage of packer-owned fed cattle remained relatively steady over the period, representing about 3-5 percent of annual slaughter. Contract and marketing agreement cattle procurement varied from a minimum of about 13 percent in 1993 to a maximum of nearly 19 percent of slaughter in 1996. Combined, cattle procured under packer-owned, forward contract, and marketing agreement methods represent roughly 20-25 percent of annual commercial fed cattle slaughter. Over the past eight years, annual average levels of captive supplies have essentially remained unchanged. On a weekly basis, captive supply levels are more variable ranging from less than 10 percent to 50 percent or more of local slaughter. The percentage of cattle marketed using captive supply arrangements typically increases during April-May, declines during the summer, and increases in December.

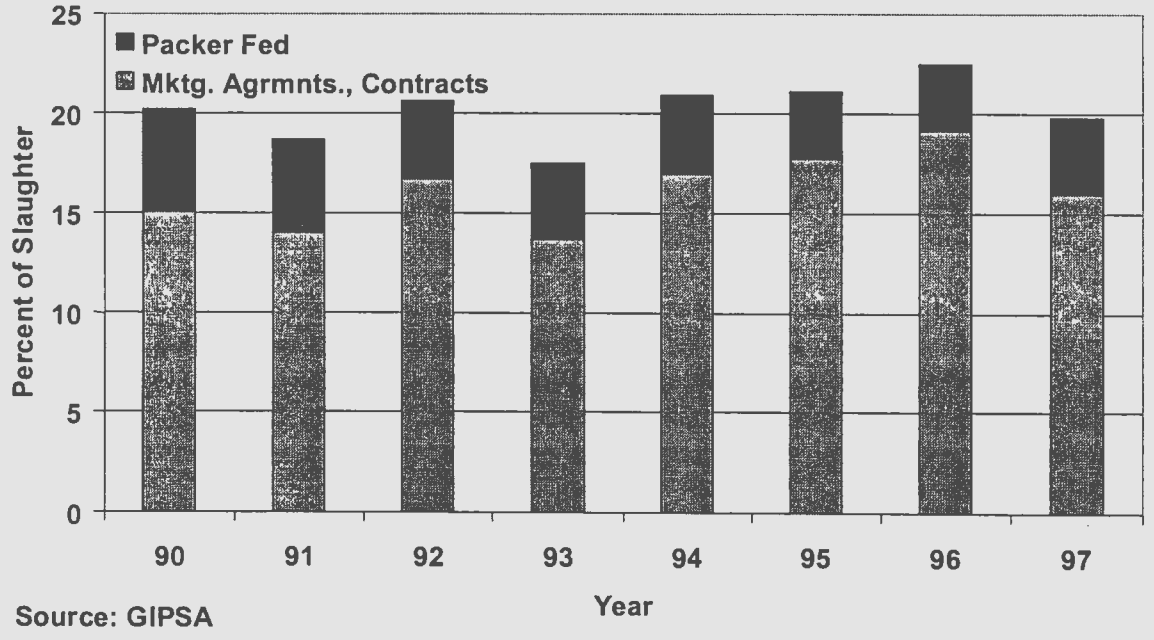

Figure 2. Captive Supplies as a Percent of Slaughter, 4 Largest Packers

Incentives to Enter Captive Supply Agreements

Cattle producers and beef packers both potentially benefit from entering into captive supply agreements. Table I summarizes potential incentives of cattle feeders and beef packers to enter into particular captive supply agreements. Primary benefits to cattle feeders may include *improved price risk management, access to more financing options, a guaranteed buyer for the cattle, improved opportunity for carcass quality premiums, and reduced marketing costs. Packers' primary benefits include securing cattle slaughter needs so they can operate large packing plants near capacity, having more control over the type and quality of cattle to fill their plants, and reducing procurement costs.*

Table I. Summary of Potential Incentives to Enter into Captive Supply Agreements

Method of Captive Supply	Cattle Feeder/Feedlot Benefits	Beef Packer Benefits
Forward Contracts	1. Reduce price risk if cattle are hedged or flat priced 2. Obtain favorable financing 3. Ensure a buyer for cattle 4. Reduce marketing cost	1. Secure slaughter needs 2. Secure quality supply 3. Reduce procurement costs 4. Reduce price risk
Marketing Agreements	1. Premiums for some cattle quality characteristics 2. Obtain carcass information 3. Ensure a buyer for cattle 4. Reduce marketing costs	1. Increase cattle quality control 2. Secure slaughter needs 3. Reduce procurement costs
Packer-Owned Feeding	1. Increase feedlot utilization 2. Improve packer to feedlot relationship	1. Secure slaughter needs 2. Increase cattle/beef quality control

Captive cattle supply can also contribute to overall efficiency in the beef marketing system. Reducing risks (of quality and quantity variation) faced by cattle feeders and beef packers allows both parties to perform their economic activities of production and processing, respectively, at lower cost. Beef packers must operate near capacity to fully capture cost efficiencies of their large slaughter plants (Ward 1988). When packers operate close to capacity, producers benefit with higher fed cattle prices and consumers benefit with lower beef prices. Captive supplies enable beef packers to improve the timing of cattle deliveries to operate slaughter plants near capacity. However, research to date has not quantified beef packer efficiency gains associated with the use of captive supplies. (The research by Jim Trapp at Oklahoma State, reported on pages 19 to 21 in this writing and in detail at www.aaec.vt.edu/rilp indicates the implications, on a per-head basis, are indeed significant.)

Cattle producers can use forward contracts to reduce their exposure to price risk. By pricing cattle in advance of delivery, cattle feeders eliminate market risk thereby allowing them to obtain

favorable financing (Ward and Bliss 1989). Forward contracting shifts fed cattle price (or basis) risk from the cattle feeder to the beef packer.

Some captive supply agreements can facilitate value-based marketing of live cattle. Captive supply agreements that contain price adjustments for varying carcass quality attributes provide cattle feeders increased incentives to produce cattle possessing desired quality characteristics. Most marketing agreement and/or formula-priced cattle are priced based on carcass grade and yield or other quality specifications (see Pricing to Value section). Fed cattle sold in the spot market are largely sold on a live basis. Schroeder *et al.* (1993), Jones *et al.* (1992), and others have determined that price differentials for fed cattle do not fully reflect wholesale meat value differentials associated with differences in carcass quality. This has been referred to in the industry as cattle being "bought on the average," with little difference in prices related to quality differences. *Beef carcass value-based marketing ultimately contributes to improved meat product quality and consistency and may strengthen retail consumer beef demand helping beef compete more effectively with other meat products.*

Captive Supply Concerns

Packer concentration in the beef industry has received considerable attention from cattle producers. The four largest packers represented 36 percent of steer and heifer slaughter in 1980, and by 1994 this share increased to 81 percent. In contrast, during this same time period hog slaughter four-firm packer concentration increased from 34 percent to 46 percent. In some local regions, the four-firm beef packer market share is 100 percent causing increased concerns in local areas. One of the recent GIPSA packer concentration studies (Hayenga, Koontz, and Schroeder 1996) revealed that, although 95 percent of cattle in average plants are purchased within a 270-mile radius of the plant, beef packers compete in more nearly a national market for cattle, especially in the primary cattle feeding regions of the country. This indicates that national, rather than local four-firm concentration measures are most reflective of beef packer market structure.

Beef packer concentration of this magnitude raises concerns that these large firms could exert market power and reduce fed cattle prices, either by themselves or in collusion with other beef packers. Research to date has been mixed regarding whether beef packers exert market power. A comprehensive review of past research contained in the GIPSA packer concentration study (Azzam and Anderson 1996) revealed that the body of evidence was insufficient to support a finding of noncompetitive behavior, but it also could not conclude that the industry was competitive. Beef packing firms have increased in size to take advantage of economies of size. These include spreading fixed assets and management over more output and the ability to provide cost efficient processing services to specific markets such as the food service and export sectors. Packers' efficiency gains reduce their costs and may lead to higher prices for fed cattle and lower consumer beef prices. Therefore, possible market power that could depress live cattle prices could be offset by cost efficiencies that would be expected to increase live cattle prices. *Recent published research by Azzam and Schroeter (1995) concluded that increased beef packer concentration resulted in about 1.7 times greater savings in costs associated with size efficiencies than market power costs.* They concluded that, on balance, increased concentration has enhanced fed cattle prices. The GIPSA study results lend support to this by revealing that larger plants and firms paid higher prices for fed cattle than did smaller firms.

Concerns regarding fed cattle procurement via contracts, marketing agreements, and packer-owned feeding are related to packer concentration. Without packer concentration, many of the concerns would not be as pungent. These concerns are summarized in Table II. When packers obtain a

large percentage of their slaughter requirements from various captive supply arrangements, they may withdraw from the cash market for short time periods and rely on their captive supply to fill their slaughter needs. This elimination of a market outlet may create temporary, but at times dramatic, loss of market access for some producers (usually, though not always, smaller feedyards who have difficulty getting more than one packer-buyer to regularly bid on cattle). *If* this behavior caused by increased concentration has a negative impact on cash prices, then cattle feeders may face reduced cash price bids. Empirical research to date suggests that this has taken place, to some extent, in cattle markets. For example, Schroeder *et al.* (1993) found cash market fed cattle transaction prices in western Kansas were reduced by $0.22/cwt when 10 percent of cattle slaughtered in the region were from captive supplies.

Elam (1988) concluded that aggregate fed cattle market prices in Kansas and Colorado declined by $0.02-0.05/cwt for each 1,000 head of contract fed cattle shipments. However, he found no significant price impacts arising from contract shipments in Texas or Nebraska. In the GIPSA packer concentration study, Ward, Koontz, and Schroeder (1996) found that a 1 percent increase in captive supplies was associated with less than a 0.003 percent decrease in cash fed cattle price. Thus, the balance of research on the short-run impacts of captive supply on fed cattle cash market prices indicates that price impacts are negative, but very small.

Table II. Concerns Regarding Captive Supplies

Concern:	Cause:
1. Lack of and reduced public market information	1. Captive supply arrangements are private negotiations between packers and participating cattle feeders. No mechanism exists to report prices or other conditions of trade.
2. Reduced competition for fed cattle	2. When packers have large percentages of slaughter secured by captive supply they may bid less aggressively for cattle in the cash market.
3. Increased market power of packers holding captive supply cattle	3. Packers may maintain complete rights on timing of cattle delivery under captive supply.

Captive supplies *could* lead to more fed cattle cash price variability if information regarding the number of captive supply cattle being delivered is largely unknown by market participants. *This can increase price variability because, in the process of discovering price, cattle producers and packers negotiate on the basis of expectations regarding current unknown market demand and supply conditions*. The less information packers and/or producers have regarding current market fundamentals, the more variable discovered prices are likely to be relative to the true market equilibrium.

Terms of contracts and prices paid under marketing agreements with formula prices, forward contracts, or production contracts are not public information. *During times when large quantities of cattle are being delivered under various captive supply arrangements, publicly reported price information, which reflects only cash market transactions, is not representative of all fed cattle traded.* This creates two potential problems: (1) the cash market may not be representative of market conditions, and (2) producers may not know whether contract terms offered to them are representative of current market conditions. *Considerable information asymmetry exists between packers and cattle*

feeders regarding prices and quantities under captive supply arrangements. This can increase price or basis variability and also contribute to variability in other contract terms across different producers. Filling this information void is essential to allow cattle feeders to negotiate fair contract terms and better negotiate fed cattle sale prices.

Finally, *packer market power may increase in the short-run in the presence of captive supply*. The increase in market power stems from packers having flexibility regarding the timing of delivery on forward contracts, thereby increasing their flexibility in both the contract and spot markets. The ability to determine precise timing of contract delivery allows packers to substitute contracted cattle for cash market cattle if local cash prices are strong relative to expected cash prices in the near future. This market power argument is less apparent, however, with many formula cattle purchasing arrangements in which the cattle feeder determines timing of cattle delivery.

Schroeder *et al.* (1998) reported that in interviews with cattle feeders, a lot of varied opinions about captive supplies and their impact on cash fed cattle trade surfaced. However, one significant concern was lack of market information. *In discovery of fed cattle price each week, an important component of information is the current supply of and demand for fed cattle on the market. This supply includes cash cattle on showlists as well as forward contract cattle and formula agreement cattle scheduled for delivery*. In general, asymmetric information exists in this regard. *Because of their size, large packers know how much of each type of cattle are available each week whereas, cattle feeders only have an idea of cash market cattle available*. This contributes to what some have termed psychological markets or panic selling by cattle feeders in part because they lack sufficient information to make market timing decisions. This psychology may be especially apparent during periods of large cattle numbers and declining or low fed cattle prices, such as occurred in recent years.

Over the past couple of years, daily fed cattle marketings have been sporadic, varying from nearly 200,000 head to less than 5,000 head marketed on any particular day in the five largest cattle feeding regions. Exactly what causes this marketing variability is not apparent. Some cattle feeders and packers have indicated this has been a result of producers panic selling cattle all at once when a price break is perceived. A regression of the change in daily marketings as a function of the change in daily fed cattle price over the 1990-August 1996 period had a positive and statistically significant parameter, indicating that when price increases from one day to the next, cattle feeders market more cattle. This is essentially a normal, expected supply response; when price increases, more cattle are supplied. This may be especially apparent when prices are in long-term downtrends as during 1995-96.

Lingering Questions

Two questions that surfaced recently relative to packer concentration and captive supplies are: (1) whether recent declines in fed cattle prices have been created by packer captive supply? and (2) whether recent high margins of beef packers are related to captive supply levels? The answer to each is "no." Recent fed cattle price declines are a result of record per-capita meat supplies in general, and increases in beef supplies in particular. Figure 3 illustrates how the single most important determinant of fed cattle price, beef production, has induced prices to fluctuate over time.

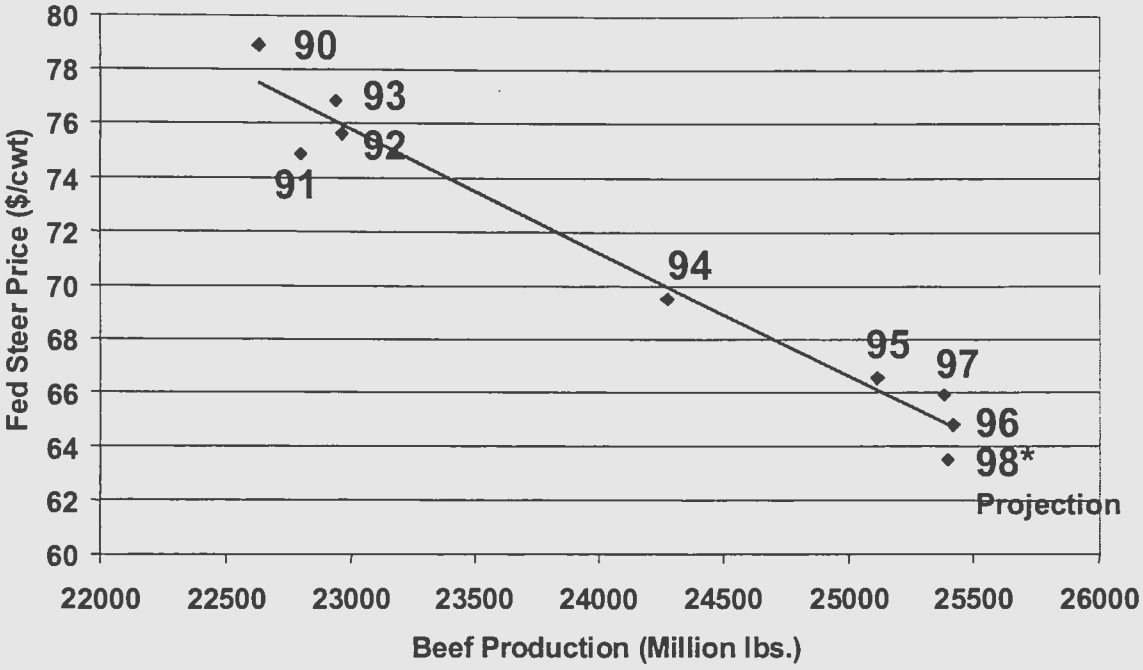

Figure 3. Western Kansas Fed Steer Price vs. Beef Production

Questions have also surfaced regarding recent packer margins. Margins (wholesale boxed beef price plus by-product value less live cattle price) and operating profits in beef packing were large in 1995 compared with recent years. During 1992 and 1993 estimates suggest beef packer margins were, on average, negative. However, packer margins follow beef production. *When beef production is high, farm-to-wholesale price spreads are higher, and when production is low, margins tend to be lower.* Approximately 90 percent (or more) of beef packer variable cost is the cost of fed cattle. Thus, when production is high and prices low, packers' major input costs are reduced. In addition, plant capacity utilization is a critical determinant of packer profits. When production is high, plant utilization is high, and packer profits tend to be high. Therefore, beef price spreads are, essentially, an indicator of beef production and provide limited information regarding impacts of captive supply on market performance.

Future Prospects

Most industry participants indicate captive supplies will not change much over the next five to ten years, much as they have remained relatively constant over the last five years (Schroeder *et al.* 1998). However, various forms of alliances are likely to continue to increase in the future. Increased development of alliances over time could lead to different forms of contractual arrangements than the beef industry has been accustomed to. How alliances might affect fed cattle markets and price discovery is difficult to project since so many different types of alliances with different objectives, structures, make-ups, and administrations are being explored. However, most alliances by-pass live cattle cash market trade as we know it today. Therefore, if alliances grow, progressively fewer fed cattle will be traded in cash markets. In addition, alliances could be considered a portion of captive supplies in the future, although the owners and benefactors of the captive supplies may be less apparent than under current contractual arrangements.

Policy Implications and Options

Some industry groups have called for legislated elimination of all captive supply arrangements between packers and livestock producers. Others proposed imposing limits on the level of captive supply arrangements allowed. Clearly such policies have costs and benefits. *Benefits of such policies include placing cattle that might be removed from cash market trade back into the cash market.* This would improve cash market liquidity, and if marketings and prices of these cattle were publicly reported when the cattle were sold, it would likely increase market information. In addition, this would force beef packers to compete head-to-head in the cash market for all fed cattle slaughter needs which may increase the number of bidders at particular feedlots on any particular day. The total number of buyers and level of long term market concentration would remain unchanged, however.

However, restricting the use of captive supply arrangements would also come with significant economic costs. First, *banning forward contracts eliminates a risk reduction tool for both cattle feeders and beef packers.* Not allowing cattle feeders to lock-in either a flat price or a cash-to-futures basis with a beef packer eliminates a price risk management option. Cattle feeders could still hedge cattle in the futures market independently, but they could not secure a basis and they would need to manage futures trading margin accounts themselves. Currently, when a feeder contracts cattle with a packer the packer generally sells cattle in the futures market at the time price is established to cover the packer's price risk. *Suspending forward contracts would also eliminate an important tool for packers to use to assure slaughter needs. This would increase packers' risk of not being able to operate plants at capacity and likely result in some long run reductions in fed cattle prices and/or increases in wholesale beef prices.*

Precluding use of marketing agreements could also reduce the percentage of cattle sold on a value-based pricing system. Unless cattle that would have previously been sold under marketing agreements were still sold on a grade and yield basis, pricing on a live basis would tend to eliminate most of the price premiums or discounts cattle feeders would otherwise have received for cattle quality differentials. *This penalizes producers who produce high quality cattle and rewards those with animals having less desirable traits.* Of course, this would not have to be the result if cattle feeders and beef packers could figure out ways to market more cattle on a grade and yield basis, or if technology would allow us to better predict these characteristics when evaluating live cattle.

Importantly, both cattle feeders and beef packers voluntarily developed and regularly pursue forward contract and marketing agreement fed cattle trade. This indicates that both benefit individually from the transaction methods. Precluding this marketing activity eliminates the benefits accrued to each party from the use of captive supplies.

Are there alternative policies to consider instead of regulating livestock markets? *One possibility is to provide better market information.* Market information asymmetry is an important determinant of livestock producers' competitive marketing positions relative to beef packers. For example, if formula bids, flat price contract bids, basis bid offers, quality premium offers, and other cattle pricing and quantity information were publicly available, concentrated buyers (packers) would have less of a competitive advantage over dispersed sellers (feedlots). Under current marketing practices, livestock producers have virtually no market information regarding pricing arrangements for cattle marketed under captive supply arrangements. The result of this information void is that when cattle feeders enter contract or marketing agreement negotiations with packers, they have little market information to determine the competitiveness of the packer's offer. For example, they do not have information regarding where the market is trading on forward contract basis levels. Packers, on the

other hand, have considerably more knowledge in this regard because they represent such a large share of the market. Likewise, information regarding numbers of cattle being delivered under captive supply arrangements during any week is limited. This information void makes it more difficult for feedyards to know current and likely spot market demand for cattle by beef packers in the near future.

Improved market information is also important for producers selling cattle in the cash market. Part of the short marketing period ("45 minute market") and sporadic daily fed cattle marketings could be related to complete lack of information on the part of cattle feeders regarding that particular week's available cattle supply and packer demand. The fear of missing the market in absence of better knowledge about formula agreement and other non-cash cattle trade for that week makes cattle feeders anxious and may contribute to the concentrated marketings.

Methods to develop such price and information reporting need to be carefully explored if this alternative is pursued. Livestock producers could potentially benefit through better access to improved market information without having to resort to additional regulation of marketing practices.

New issues surrounding market information in the beef industry are on the horizon and deserve consideration. Alliances that integrate cow calf producers, cattle feeders, beef packers, processors, retailers, and food service establishments will probably bypass many of the traditional markets. The industry would benefit from consideration now of how to collect and report information on these transactions that will not generally be part of public trade.

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International Beef and Cattle Trade Issues

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Overview

Exports have become an important component of beef demand in recent years. Prior to the early 1980s, beef exports averaged less than 1 percent of domestic U.S. beef production and had relatively little impact on domestic beef or cattle prices. Beef exports increased modestly through the mid-1980s and then accelerated sharply in the late 1980s and 1990s. By 1990 beef exports totaled 4.4 percent of U.S. beef production, and exports exceeded 8 percent in 1997. USDA data from January through October suggests that beef exports again exceeded 8 percent of U.S. production in 1998. In a marked contrast to the pre-1980 period, *beef exports are now a sufficiently large component of total beef demand to have a significant impact on beef and cattle prices.*

The U.S. exports beef to several locations, but the four largest customers accounted for 89 percent of U.S. beef exports (measured on a quantity basis) during 1997. Japan was the largest U.S. beef export customer in 1997 (49 percent share) and Mexico was the second largest customer (14.6 percent share). Canada, which along with Mexico is the third partner in the North American Free Trade Agreement (NAFTA), was the third largest U.S. beef customer in 1997, consuming 13.2 percent of U.S. beef exports followed by South Korea (12.3 percent). The situation changed in 1998 as declining economic conditions led to a 55 percent decline in U.S. beef exports to South Korea at the same time beef exports to Mexico were booming. As a result, total beef exports from the U.S. to all countries increased just 1.2 percent compared to the previous year and South Korea's share of 1998 U.S. beef exports declined to 6.2 percent while Mexico's share increased to 18.6 percent (through October).

At the same time the U.S. exports boxed beef, it also imports beef. Most of the imported beef is of substantially lower quality than U.S. beef produced for export markets. This occurs because the U.S. has a comparative advantage in the production of high quality grain-fed beef whereas other countries around the world are very competitive in the production of lower quality beef where cattle are not fed a concentrated grain ration prior to slaughter. Total boxed beef imports fluctuate from year-to-year, but over the last decade ranged from approximately 8 to 11 percent of domestic U.S. beef production. For example, in 1997 boxed beef imports totaled 9.2 percent of U.S. beef production.

Live cattle trade also has an important impact on total U.S. cattle and beef supplies. The U.S. has a comparative advantage in boxed beef production and, as a result, most "cattle" exports from the U.S. are actually in the form of boxed beef. The U.S. does export modest quantities of live cattle to Canada and Mexico, but they have relatively little impact on U.S. prices. Principally because of its comparative advantage in cattle feeding and boxed beef production, the U.S. imports feeder and fed cattle from two sources, Mexico and Canada. Imports from Mexico are primarily light weight feeder cattle exported to the U.S. to be raised to slaughter weight and subsequently shipped to U.S. slaughter plants. In contrast, the U.S. imports both feeder cattle, which will be placed on feed in U.S. feedyards prior to slaughter, and finished cattle suitable for immediate slaughter in a U.S. slaughter facility from Canada. Since 1990 total cattle imports into the U.S. have fluctuated between 1.9 and 2.1 million head. During 1997 cattle imports into the U.S. from Mexico and Canada totaled 2 million head.

Thirty-three percent of the 1997 total came from Mexico and the remainder came from Canada. During 1997, 87 percent of the 1.38 million head of cattle imported from Canada weighed over 700 pounds when they crossed the U.S.- Canadian border. The remainder of 1997 cattle imports from Canada were primarily light weight feeders (7.8 percent), breeding stock or cattle that were later exported from the U.S.

Cattle Trade With Canada and Mexico in 1998

The benefits to U.S. cattle producers of increases in boxed beef exports are transparent. Growing demand for high quality boxed beef in export markets reduces beef supplies on domestic U.S. markets and, hence, has a positive effect on U.S. boxed beef, fed cattle and feeder cattle prices. Perhaps because of the success the U.S. has had in reducing domestic beef supplies by increasing exports, cattle price weakness during 1998 encouraged some industry participants to search for ways to further increase domestic prices by restricting cattle imports into the U.S. Claims that imports of cattle from Canada and Mexico were the source of price weakness in the beef sector continue to be voiced by groups that want to limit imports of cattle to the U.S.

An examination of cattle trade with Canada and Mexico in 1998 compared to 1997 clearly indicates that imports were not a primary reason for price weakness in 1998. Through October, 1.157 million head of cattle were imported from Canada. This compares to 1.195 million head of cattle imported from Canada during the same 10-month period in 1997. Thus, 1998 imports of cattle from Canada were actually 3 percent smaller than in 1997. When imports of cattle from Canada and Mexico are combined, the 1998 total (through October) was still 1.2 percent smaller than during the same 10-month period in 1997. Clearly, changes in cattle imports from Canada and Mexico do not explain the abrupt decline in U.S. cattle prices that took place in 1998 compared to 1997.

Proponents of a ban on cattle imports from Canada are not often swayed by arguments documenting that cattle imports are not responsible for the cattle price decline in 1998 vs. 1997. Instead, they argue that U.S. cattle prices would be higher if the million plus head of Canadian cattle imports were prohibited from crossing the border into the U.S. From their viewpoint, restricting cattle imports is tantamount to reducing slaughter cattle numbers and, ultimately, reducing beef supplies. But that position is too simplistic.

What would happen in the extreme case that the U.S. simply banned imports of cattle from Canada? Unfortunately for those advocating a trade ban, it would have little effect on U.S. cattle prices. Why? Because the cattle still exist. In the event of a trade ban, the cattle would still be fed to slaughter weight. The cattle would still be slaughtered and used to produce boxed beef. And, most importantly, the resulting increase in boxed beef production would likely be exported from Canada. Where would the boxed beef be exported to? An examination of Canada's beef export customers reveals that their three largest export customers are the U.S., Japan and Mexico. If the increase in Canadian boxed beef production is not exported directly to the U.S., it likely would supplant some of U.S. beef exports to countries such as Mexico and Japan. *The net effect is that trade flows would be affected, markets would be disrupted, and total industry costs would rise, but the impact on cattle prices in the U.S. would be negligible since the total supply of cattle and beef in North America and the world would be unaffected.*

Summary

Several factors explain the dramatic growth in U.S. beef exports which took place from the mid-1980s to the mid-1990s. Depreciation in the value of the U.S. dollar relative to other countries' currencies made U.S. meat exports relatively less expensive than those of other exporters and stimulated U.S. exports. Improvements in technology made it feasible to ship fresh meat, which most consumes prefer, instead of frozen meat at prices similar to what consumers had been accustomed to paying for frozen meat. Given their preference for fresh meat, consumers in importing countries increased their consumption of imported fresh meat. Reductions in trade restrictions in the Pacific Rim, the Gatt/Uruguay Round trade negotiations, and the NAFTA agreement all encouraged growth in world meat trade which benefited the U.S. beef sector. Finally, per-capita income increases in importing countries boosted fresh meat demand which led to larger U.S. beef exports. The long term beef export picture is bright, but, in the short run, economic problems in several importing countries mean growth in boxed beef exports will be sluggish at best.

The U.S. has a comparative advantage in production of high quality, grain fed boxed beef. Partly as a result of this comparative advantage, the U.S. imports live cattle from Canada and Mexico to produce finished cattle suitable for boxed beef production. Since 1990, total cattle imports into the U.S. from Canada and Mexico have ranged from 1.9 to 2.1 million head. Advocates of restrictions on cattle imports into the U.S. believe that reducing cattle imports will raise U.S. prices. *In reality, restricting imports is not likely to have a significant impact on prices since the total supply of cattle and beef in North America and the world would be unaffected, and restrictions on imports could have a negative impact on access to export markets.*

Stable Slaughter and Fabrication Levels: Implications to Processor Costs and Cattle Prices

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Economic gains appear to be possible for both cattle feeders and packers with improved coordination of the flow of cattle from feedlots to packing plants. From the packer's viewpoint, analysis indicates that a steady daily flow of cattle into their plant, a flow that is near their optimal processing capacity, will allow them to process cattle $2 to $5/head cheaper than is cur ently the norm for the industry. Packers could also save about $1/head if they could remove the fluctuations they experience in current day-to-day slaughter rates. USDA data show that daily slaughter rates typically vary in beef processing plants by about 15 percent from day to day. In addition, it is estimated that packers can cut costs significantly by running within 5 percent of their optimal capacity rate. Five percent under-utilization of a plant costs the packer about $1/head. Ten percent under-utilization costs about $2.00/head and 20 percent under-utilization costs over $9.00/head more. The table shows dramatic increases in costs at still lower levels of operation.

Combined Killing and Fabrication Costs/Head for Alternative Slaughter Rates

Slaughter Rate as a Percent of Physical Plant Capacity	Killing and Fabrication Costs/Head
40	$169.69
50	$138.13
60	$117.81
70	$105.79
80	$ 96.61
90	$ 89.59
100	$ 87.50
110	$ 87.61
120	$ 87.74

From the feedlot's perspective, being able to market cattle when they are ready has value. Growth/cost of gain simulators and serial slaughter data (used to determine how yield grades and quality grades change with slaughter weight and days on feed) indicate that the ability to sell cattle within one week of their optimal sales date can be worth $2 to $12/head. The analysis indicates that feedlots have about a two-week window to market cattle effectively. Within this window, profits do not change by more than about $1/head given a stable cash market. Avoiding the marketing of overweight cattle avoids heavy discounts for over-done cattle and the feed conversion inefficiency that is suffered when cattle are held too long. Typically, holding cattle about one week beyond the window reduces potential profit by about $2/head, and holding them two weeks beyond the window reduces the maximum potential profit by over $5/head. Selling cattle a week ahead of the window (i.e., "green") typically results in about a $6/head loss. Selling them two weeks before the start of the window nets nearly a $12/head reduction in potential profit. It should be noted that these estimated costs of non-

optimal slaughter dates depend partially upon the market-determined discounts for undesirable carcass characteristics. Therefore, they will vary somewhat over time.

The magnitude of profit potential estimated to arise from the timely exchange of cattle between feedlots and packers appears to provide strong incentives for packers and feedlots to coordinate the timing of the flow of cattle to their mutual benefit. However, study with a fed cattle market simulator shows that there are some natural conflicts in doing this that call for more than simple contracting arrangements between packers and feeders. The simulator used to analyze these conflicts is designed such that it can be operated by actual participants assuming management roles in eight simulated feedlots and four simulated packing plants, or it can be run totally by computerized/formula-controlled marketing arrangements. The simulator, by necessity, simplifies the fed cattle market to some degree, but the results are believed to be useful in analyzing the types of vertical coordination strategies needed to improve industry-wide profits and in determining the magnitude of potential profit improvements associated with such strategies.

Five industry-wide vertical coordination strategies were tested in the simulator. In general, the simulator showed that feedlots should and do prefer strategies that sell cattle light (i.e., early in the marketing window). Such strategies keep feed efficiency high and the volume of beef on the market in terms of total pounds relatively low. On the other hand, the simulator showed that strategies that generate a steady volume of relatively heavy cattle—that is, cattle at weights above the optimal weight sought by feedlots—favor packers. By keeping feedlots "backed-up," packers assure themselves of a large potential volume of cattle and thus an enhanced ability to operate at their optimal volume. These results are not surprising. They mirror the common belief in industry that there is an incentive for packers to "back cattle up," while there is an incentive for feedlots to "keep their showlist current" (if indeed not a bit beyond current).

The power of the simulator is its ability to look at the cost implications of these conflicting vertical coordination strategies. In comparing the strategy that was most favorable to packers versus cattle feeders, the packer-favoring strategy resulted in the lowest processing cost/head. However, this strategy raised the cost of gain to feedlots by $25/ head or about $.037/pound, and it increased the price discounts received/head (mostly due to more yield grade 4 discounts) by about $9/head, which translates to about $.008/pound. On the other hand, the strategy that favored cattle feeders resulted in the lowest cost of gain and least quality discounts for feedlots but raised packer processing costs by $2/head. The strategy favoring feeders also cut the volume of meat processed by nearly 6 percent and thus increased beef prices by about 4 percent relative to the strategy favored by packers. However, neither of these extreme strategies resulted in the highest total industry profit, (i.e., feedlot plus packer profit per head). The strategy that favored packers actually lost money for the total industry. The strategy that favored feedlots made approximately $22/head. If allocated equally, this would permit an added $11/head of profit for both packers and feeders.

A third strategy that neither minimized processing cost nor cost of gain and quality discounts generated the highest total industry profit. *It resulted in nearly $37/head of added profit under the same supply and demand conditions facing the previously discussed strategies that favored either feeders or packers.* This strategy called for packers to receive their optimal volume of cattle when possible, but the strategy never sold cattle above the feedlot's optimal selling weight. The strategy required the anticipation of "gluts" of cattle (i.e., numbers in excess of the combined industry-wide optimal packer volume). The response to such anticipated gluts was to sell cattle early at somewhat lighter than optimal weights in order to avoid selling overweight cattle and volumes of cattle in excess of the packers' needs at a later date.

Allowing people to operate the simulator confirmed that natural conflicting interests do not lead to optimal industry vertical coordination strategies. Profits achieved when participants operated the simulator in an open market environment averaged only about $12/head compared to the $37/head of profit achieved with the best simulated vertical coordination strategy. In reality, profits can likely not be increased through improved vertical coordination by $37/head because of the added cost of negotiating and administering vertical coordination strategies and the need for a large percentage of the industry to use similar contracting arrangements. Likewise, what can be done in the controlled environment of a simulator cannot be perfectly duplicated in a more complex real industry setting. However, the cost savings estimates made here, as well as the simulations, suggest that improved vertical coordination through various contracting methods has the potential to add $5 to $15/head of industry-wide profit. Exactly how these enhanced profits would be shared between feeders and packers is dependent upon the terms of the vertical coordination/contracting agreement used, but there appears to be ample potential for both feeders and packers to benefit. *What is clear from this study is that non-price vertical coordination of the flow of cattle from feedlots to packers through contracting and other forms of agreement has the potential to be a positive activity for both feeders and packers*, rather than a strictly negative activity as is currently feared by some cattle feeders.

Analysis did not progress to the point that it could recommend specific vertical coordination strategies that would benefit both feeders and packers. However, it defined several basic attributes that appear to be essential for successful strategies. The vertical coordination strategies with the best potential, based on the strategies simulated here, appear to be those that utilize the day-to-day marketing flexibility that feedlots have (due to their approximately two-week marketing window) to stabilize the short-run flow of cattle into packing plants. In return, packers must make concessions to feedlots over a longer run to avoid extreme gluts of cattle and to keep slaughter weights down. In an ideal world, this would require industry-wide knowledge of current showlist sizes as well as knowledge of the approximate number of cattle coming onto the showlist over the next several weeks. This knowledge would then need to be utilized to make advanced commitments/plans for purchase/slaughter rates nearly a month in advance. In a less than ideal world, it would seem to imply some type of commitment from packers to assist feedlots in remaining "current."

The economic incentives for coordinated flows of cattle through the feedlot and processing phases are very strong. Non-price means of achieving stable flows of cattle are likely to persist and they may grow and expand over time. The cost-reducing benefits of stable flows prompt contractual buying and business arrangements that cause transactions to focus on price and non-price measures. There is a continuum of possibilities in terms of when cattle are sold, coordinating flows through slaughtering and fabricating, price premiums and discounts, and other terms of trade that range from the best (most profitable) scenario for cattle feeders to the best (most profitable) scenario for packers. What scenario actually exists in today's markets is likely a function of beef demand, cattle numbers and where the industry is in terms of the cycle, and the relative bargaining position of sellers and buyers in a fed cattle marketplace where the buying side is highly concentrated and much more concentrated than is the selling side, the cattle feeding sector.

This section is adapted from the Executive Summary of "Estimated Value of Non-Price Vertical Coordination in the Fed Cattle Market" by John D. Anderson and James N. Trapp. This report of extensive analysis is available on the Internet at www.aaec.vt.edu/rilp or can be requested from the Research Institute on Livestock Pricing.

Vertical Price Transmission Issues in the U.S. Beef Sector*

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The U.S. livestock sector has experienced numerous structural changes in recent years. For example, the meatpacking industry has experienced many mergers and acquisitions leading to significant increases in industry concentration. In particular, the four-firm concentration ratio for steer and heifer slaughter, a frequently cited statistic and an important indicator of industry concentration, increased from 35.7 percent in 1980 to 79.8 percent in 1997 (US Packers and Stockyard Administration 1998). This increased concentration has led to significant concerns regarding the potential exercise of market power by large livestock buyers. There have also been significant regional shifts in livestock production and changes in marketing practices, with decreased use of public markets in many areas. For some products, traditional auction markets have been largely replaced by contract production and sales. Markets that were formerly of central importance to the price discovery process (e.g., Omaha) are now of limited significance. Terminal markets have been largely supplanted by direct buyer-to-producer marketing. Cattle inventories have also trended downward over the last two decades. This has been accompanied by decreases in the number of producers and, in some cases, by significant increases in the scale of operations.

Recent years have also been a rather static period for nominal farm-level prices. *Although retail prices have followed an increasing trend (coincidental to movements in aggregate economy-wide prices), wholesale and farm-level prices have remained relatively constant.* Figure 1 illustrates beef price movements between 1981 and 1998. *The differential between retail and farm level beef prices has widened considerably in recent years.*

Structural changes in the industry and concerns regarding the potential for the exercise of market power have led many to question the competitiveness of pricing practices in livestock markets. These concerns have been driven, in part, by the behavior of prices, as reflected in Figure 4. The fact that farm level prices have not kept pace with prices at the retail level has led observers to question the extent to which retail-level shocks are realized at the farm level. A considerable volume of research has evaluated vertical price transmission and discovery issues. This research has established that *the vertical price adjustment process is characterized by significant lags in adjustment, such that shocks at one level may bring about adjustments in other levels that persist for several weeks.* While this large volume of research is difficult to generalize, *most studies have determined that farm prices are not responsive to market changes occurring at the retail level, although retail prices do eventually reflect shocks at the farm level.* These lags are generally attributed to adjustment costs which delay or otherwise inhibit market price adjustments.

*A detailed report of this work is available from the Research Institute on Livestock Pricing. The work is, or soon will be, available on the Internet at www.aaec.vt.edu/rilp.

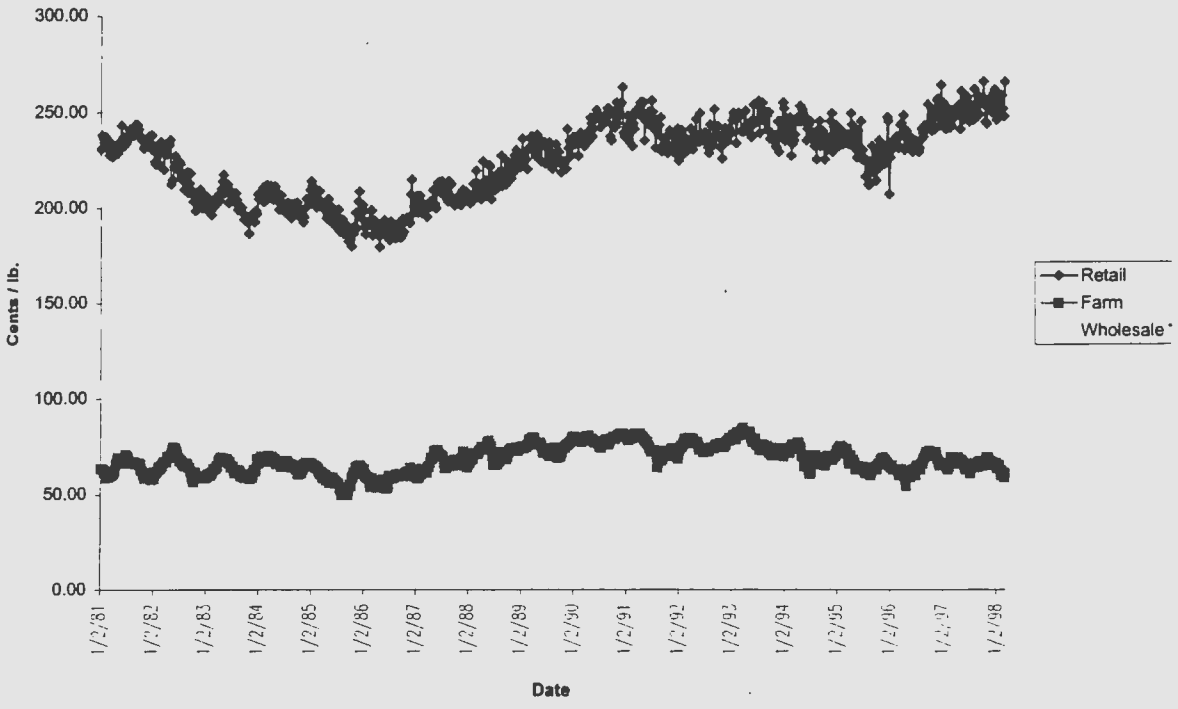

Figure 4. Beef Prices

The vertical transmission of shocks among various levels of the market is an important characteristic describing the overall operation of the market. Of course, price is the primary mechanism by which various levels of the market are linked. The extent of adjustment and speed with which shocks are transmitted among producer, wholesale, and retail market prices is an important factor reflecting the actions of market participants at alternative market levels. The nature, speed, and extent of adjustments to market shocks may also have important implications for marketing margins, spreads, and mark-up pricing practices.

Recent research in this area has concentrated on the potential for asymmetric adjustments in prices at various market levels. Conventional wisdom suggests that responses to price increases may differ from responses to price decreases. The particular concern has been that retail price decreases may be passed back to the farm level while retail price increases are not. Again, although a sweeping generalization of the results is somewhat difficult to make, most research has revealed the presence of asymmetries in price adjustments at the various market levels though the extent of asymmetry is generally small. In addition, existing research has found that farm prices are relatively less responsive to shocks in wholesale and retail markets than is the case for wholesale and retail markets.

A number of institutional and theoretical reasons for asymmetries in price adjustments have been offered. Imperfectly competitive markets characterized by price leadership roles by major buyers or sellers are often suspected to underlie asymmetric price adjustments. Other explanations are possible, however. Ward (1982) noted that agents in possession of perishable goods may resist the temptation to increase prices for fear of being left with spoiled product. Bailey and Brorsen (1989) noted that asymmetries in adjustment costs may underlie asymmetric price adjustments.

With few exceptions, the existing research is significantly flawed in that it ignores important statistical properties of the price data. Our recent research (Goodwin and Holt, 1999) has attempted to update the existing research by incorporating new developments in time series analysis techniques. In particular, we considered asymmetric price transmission issues among producer, wholesale, and retail beef markets. In the following section, we present a summary of this analysis and its conclusions.

An Investigation of Asymmetric Price Transmission

As noted above, concerns about noncompetitive pricing practices and increasing margins between retail and farm prices have led many to question whether retail price increases provoke less of a response at the farm level than do retail price decreases. Such asymmetry in price adjustment has been the focus of numerous modeling efforts and was the cornerstone of our investigation. Our analysis utilized error-correction models—a particular econometric model that gives attention to the dynamic properties of adjustments toward new equilibria following external shocks.[1] *An objective of our research was to identify any asymmetries that existed in price transmission*. We did this in two ways. First, formal statistical tests were used to evaluate models of price transmission for asymmetric behavior. Second, the nature of any asymmetries was investigated by performing simulated positive and negative shocks and considering how the models' predicted prices reacted. Our model identified three different regimes, corresponding to small (close to zero) shocks, large negative, and large positive shocks.

Our empirical analysis used three series of weekly beef prices observed from January 1981 through the first week of March 1998. Producer prices were taken from the Bridge database of live cattle prices. Wholesale prices for boxed beef cutouts (550-700 lbs.) were collected from unpublished Agricultural Market Service and Economic Research Service databases. Retail prices were represented by the Bridge composite retail beef price series.

Our formal tests of asymmetry were statistically significant, indicating that positive shocks to prices do indeed elicit different responses than do negative shocks, at least during some time periods. Our evaluation of simulated shocks to prices leads to a somewhat different conclusion, however. The results indicated that, although the asymmetries were rather apparent when one examined a graph of simulated responses to positive and negative shocks, the extent of asymmetry was modest.

The findings of our research are consistent with conventional wisdom regarding price transmission in the beef marketing channel and, as well, with the conclusions of a large body of research addressing this topic. We found that the price transmission is, for the most part, uni-directional, proceeding from the farm, to wholesale markets, to the retail level. Shocks do not appear to move in the opposite direction. This is a standard result in the literature on this topic, suggesting that the inappropriate statistical models used in previous research did not lead to invalid conclusions regarding patterns of dynamic adjustments. An important characteristic of our modeling approach is that it allows us to identify alternative regimes that may suggest differences in price adjustment in alternative periods. Our analysis identified three regimes, with switches between Regimes I and II dominating price behavior early in the period of study (i.e., the early 1980s) and switches between Regime I and III dominating the late 1990s. There is little feedback to farm and wholesale markets from shocks at the retail level regardless of the period being analyzed. Although retail price shocks bring about responses in future retail prices, no response is realized by wholesale and farm market prices.

[1] Existing research is flawed by its omission of "error-correction" terms. Technical details are provided in Goodwin and Holt (1999).

Wholesale market price shocks elicit responses in wholesale and retail markets. These responses are considerably larger during the mid and late 1990s, suggesting greater interaction between wholesale markets and retail and farm markets during this period. *Farm price shocks elicit responses in all three markets. The response to farm price shocks appears to be somewhat damped as one moves up the marketing chain—farm prices exhibit the largest response, followed by wholesale prices, and finally by modest retail price adjustments.*

Overall, our results largely confirm the findings of previous research on this topic. In particular, the transmission of shocks appears to be largely unidirectional with information flowing up the marketing channel from farm to wholesale to retail markets but not in the opposite direction. *Farm markets do adjust to wholesale market shocks. Thus, those maintaining that margins are being inflated by unfair pricing practices on the part of packers and wholesalers should perhaps look farther up the marketing chain. As Figure 1 made apparent, the linkages between wholesale and farm prices appear to have been much more stable than linkages between farm (or wholesale) and retail markets.* Farm prices are responsive to events in wholesale markets and the responses to positive and negative shocks are reasonably symmetric. The effects of retail market shocks, however, are largely confined to retail markets. Finally, the results suggest that the responsiveness to price shocks has increased in recent years. This result may suggest that markets have become relatively more efficient in transmitting information through vertical marketing channels.

Implications for Price Transmission

Sophisticated econometric research has confirmed what is quite apparent to the untrained eye—*linkages between retail markets and farm and wholesale markets are weak and may have become even weaker in recent years.* Although retail markets appear to quickly reflect price shocks occurring at the farm level, the converse is not true. In contrast, wholesale and retail markets are linked. Of course, the nebulous concept of "value-added" is what separates alternative vertical levels of the market. The extent to which the final value of a product at the retail level reflects the values of raw materials and intermediate inputs is critically tied to the prominence of such inputs in terms of making up the overall product. As Figure 1 illustrates, the value of beef at the farm level is only about 25 percent of the value of retail products. Also important though often not considered is the extent to which processors are able to substitute away from raw materials to other inputs throughout the processing and manufacturing process. Conventional wisdom has long held that other inputs such as capital and labor could not be substituted for raw materials in food processing sectors. More recent research, including papers by Wohlgenant (1989) and Goodwin and Brester (1995) have suggested that, at least for a highly aggregated product category, substantial substitution among raw materials and other inputs is possible.[2]

Experiences with pork prices over the last six months have especially heightened concerns about the transmission of retail price movements back to the farm level. The margin has become extreme with farm prices in some places falling to below $0.10 per pound. At the same time, retail prices have maintained roughly the same levels. Although the institutional setting and experiences of pork are clearly different from that of beef, it is likely that many of the same forces are at work. Our current research will include expanding our beef price transmission project to also include pork price behavior.

[2] In economic parlance, this concept is expressed as the "elasticity of substitution. " Product aggregation is important here. Substitution may involve altering the mix of products at the retail level. For example, cheaper labor may provide an incentive to provide more highly processed products.

Price Volatility Transmission

A somewhat related question to that of asymmetric price transmission among various levels of the marketing chain, as summarized in previous sections, is the extent to which volatility spillovers occur among related sets of farm, wholesale, and retail prices. That is, does a positive shock in the retail beef price induce positive or negative shocks in the volatility (variance) of, say, farm prices? Moreover, are positive price shocks associated with the same general effect on price variability as negative shocks, or might price *variances* also respond in an asymmetric manner depending on whether the source of the underlying price movements are positive or negative? Questions of this sort have been examined extensively in the general economics literature in recent years, where much interest has focused on volatility li ıkages among major global stock and foreign exchange markets. To date, however, similar anılyses have not been performed with respect to vertically linked agricultural markets.

The analysis of asymmetries in volatility spillovers in farm, wholesale, and retail markets for beef is conducted using the same weekly data described previously. In addition, the statistical model of prices employs the same basic error correction described in previous sections. The major difference is that dynamics in conditional variances are modeled by using a multivariate generalized autoregressive conditional variance (GARCH) process that allows for changes in lagged price variances (and shocks) in one market to have asymmetric impacts on the variances (volatility's) of other market prices. The basic setup is similar to that employed by Koutmos and Booth (1995) in their investigation of asymmetric volatility transmission in international stock markets.

Overall, the results of the asymmetric volatility transmission analysis with the beef market data only further confirm the results obtained for the asymmetric price transmission model described in previous sections. Specifically, we find no evidence of asymmetric volatility response in retail beef prices, limited evidence of asymmetric volatility response in wholesale prices, and strong evidence of asymmetric volatility response in farm level prices. The results show, for example, that a negative innovation at the farm level increases the volatility of farm prices by 2.3 percent more than an equivalent positive innovation. There also appear to be a number of statistically significant volatility spillovers among the various levels of the beef marketing chain. The results show, for example, that shocks at the farm and wholesale level have significant (negative) impacts on retail price volatility, but that retail and wholesale price shocks do not have a significant impact on the volatility of farm-level beef prices. Of interest is that retail price shocks actually have a dampening effect on farm price volatility, although the impacts occur in an asymmetric fashion, depending on whether the retail price shock is positive or negative.

This work, while still in its preliminary stages, should further highlight the interdependencies among first *and* second moments of farm, wholesale, and retail prices for beef. Prior research has exclusively focused on interdependencies among first moments only. The results of this research show that interdependencies in second moments, at least in the beef-marketing channel, should not be ignored.

Concluding Remarks

We have investigated vertical price transmission issues in the U.S. beef sector. A large volume of economic research has determined that, although significant lags exist in the adjustment of prices to new information, the extent of asymmetries in adjustments is rather modest. Likewise, existing research has consistently concluded that the price discovery process is characterized by a unidirectional

flow of information from the farm level to retail markets. Shocks at the farm level affect prices at the farm, wholesale, and retail levels. Retail market shocks, however, do not elicit significant responses at the farm level. Our research addresses several shortcomings in the existing literature on this topic. In the end, our results are, for the most part, consistent with this existing literature—suggesting that deficiencies in existing models do not appear to have led to significant errors in their conclusions.

Recent events in the pork sector, including a downward spiral of farm prices, have led many to question the industry's competitiveness as well as the efficiency of the price discovery process. Our current research is extending the analysis to consider price transmission issues in the pork sector. Asymmetric transmission of market shocks is a focus of our current analysis. Forthcoming research results will, hopefully, illuminate p icing issues in the pork sector and provide a firmer understanding of price transmission issues.

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Recommendations to Nat'onal Cattlemen's Beef Association

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Recommendations to NCBA on policies and programs to help revitalize the beef business are presented and justified in this section. In general, these recommendations reflect recognition of the loss of market share in beef, the related disinvestment and downsizing that has been occurring since the 1970s, concerns about performance of a highly concentrated beef processing sector, and the long standing loss of respect and credibility afforded the price system and price discovery in the beef sector as we move toward the year 2000 and beyond. The information base for these recommendations is comprised of research financed and/or coordinated by the Research Institute on Livestock Pricing (RILP) along with the broad array of research efforts conducted by the land-grant universities in each state, other research universities, private firms and consultants, plus the Economic Research Service, Agricultural Marketing Service, Grain Inspection and Packers and Stockyards Administration, all in the U. S. Department of Agriculture. The RILP research studies are available at http://www.aaec.vt.edu/rilp on the Internet or can be attained by contacting the Institute director, Wayne D. Purcell, at (540) 231-7725, fax (540) 231-7622 or by e-mail to purcell@vt.edu at Virginia Tech. Citations of these and other research efforts occur throughout the "white paper," an effort to examine important issues in beef, that accompanies these recommendations and involves a number of leading land-grant university researchers and extension educators.

Recommendations:

1. **Continue to change the emphasis in use of checkoff funds from support of generic advertising of beef to support of programs designed to develop, introduce and promote new consumer-oriented product offerings that feature quality, consistency, and convenience in preparation.**

   Analysis suggests that the demand for beef has decreased each year since 1979 or 1980 with the cumulative decline in excess of 50 percent. Advertising of beef as a generic commodity may have mitigated the declines, but has not solved the problem. Surveys, focus groups, and the 1995 Beef Quality Audit indicate level and consistency of quality, nutrition/health concerns, and convenience in meal preparation are increasingly important to modern consumers, often more important than price level or price level relative to competing meats. Modernizing the product offering, therefore, may be a necessary condition to reversing the long slide in demand and creating an environment in which advertising of branded or value added products might be more effective.

   This recommendation is related directly to an issue in the background statement. One important source of price pressure at the producer level was the declining inflation-adjusted prices at the consumer level. The long-standing decreases in demand must be reversed, and this recommendation suggests how that might be done by how checkoff dollars are spent. Progress here is of paramount importance.

2. **Prompt more frequent dissemination of retail beef prices and price spreads for live to boxed beef and boxed beef to retail. Volumes of boxed beef and fresh product at retail should be reported, and the retail prices for fresh beef should be volume or weighted averages vs. the current simple averages.**

   One of the continuing characteristics of a highly concentrated retail sector is reluctance to lower retail beef prices when live prices and boxed beef levels decline. A lengthy time delay is often involved. On a month-to-month basis, beef demand does not change a great deal, and at any point in time, the demand surface that prevails is downward sloping. For a given strength or level of demand, more product will be taken by consumers only at lower prices. When live cattle prices and boxed beef values decline due to a surge in fed marketings or an increase in average slaughter weights (the big problem of 1998), the increased tonnage does not move through the pipelines when the retail prices stay up. Product has to move into storage or be moved through export channels or new domestic channels such as school lunch and food aid programs, but these programs are often not adequate to absorb the "surplus." With no progressive adjustment of prices at retail to pass the short term benefits on to retail customers, the price problems at the live animal level persist and are accentuated before they are eventually resolved by reduced placements of cattle and related reductions in beef supplies. If the NCBA or the USDA were to collect and disseminate weekly prices from an adequate sampling of retail sales, price spreads could be disseminated more frequently and public awareness of the speed and accuracy of price transmissions from live to wholesale to retail (and from retail to wholesale to live) could be significantly increased. The price data at all levels of collection should be volume weighted.

   In highly concentrated sectors, where mergers and/or acquisitions have been allowed or approved by federal regulatory agencies to achieve the benefits of economies of size, public scrutiny and awareness may be the only non-mandatory way to reduce the time lags, the magnitudes of differences in inter-sector prices or values, and improve the price transmission performance of the processing and/or retail sectors.

This recommendation is tied directly to a second source of pressure on producer prices identified in the background statement--expanding retailer margins. Making the spreads more visible could help the time lags *and* the progressiveness of retailers in trying to be efficient and keep costs down.

3. **Support expanded reporting of boxed beef values by packers, retailers and other buyers.**

In highly concentrated markets, firm behavior tends to follow the behavior expected of oligopolistic and/or oligopsonistic structures where the value of information is recognized and firms tend to protect access to information that they feel gives them an advantage. Research shows that boxed beef values tend to move with fed cattle prices and, while there is interest in some quarters in requiring reporting of boxed beef trades and/or cash transactions in fed cattle, the logistical issues associated with broader and more nearly complete voluntary reporting of boxed beef activity may be far less imposing and far less costly than reporting of fed cattle transactions. One of the dimensions of the loss in credibility in the price system and price discovery is the alleged tendency for "selective reporting" cattle transactions and/or boxed beef transactions in an attempt to improve the profit position of the firm(s) involved. Removing this shroud of doubt and skepticism may be a necessary condition to improving the attitude towards our pricing system and the price discovery process.

4. **Support the extending of reporting of fed cattle sales activity to include contracts for future delivery with reporting of an expected 10-day (or other more appropriate length of time such as a week) period of delivery and method of determining base price, with such information and the quantity of cattle involved to be reported on the date the contract is established.**

The captive supply controversy continues and perhaps strengthens, diverting time and energy from more substantive issues in the industry. If contractual activities that are being established were known in terms of delivery period and related details when the contracts are established, the price discovery process in the cash and futures markets could incorporate and reflect that information. Such information would be most valuable to the cattle feeder who could then make well-informed decisions on needs for contract protection and/or forward price protection for later time periods. Extended reporting of contract arrangements would help to eliminate the imbalance in information available to cattle feeders as compared to packers

5. **Continue improving price reporting of fed cattle and recognize the time differences in establishing prices which contribute to increased price dispersion.**

Accurate reported prices are essential for efficient price discovery. Reported prices must accurately reflect supply and demand conditions to be useful in the pricing process. Recent evidence in hogs suggests while prices were reported at some levels ($10-15/cwt.), many hogs were priced much higher ($30/cwt.?) under various contractual arrangements. Research by and for the Grain Inspection, Packers and Stockyards Administration suggests this is a problem both for hogs and cattle. On any given day, cash-market cattle could have been priced over a 14-day period. Forward contracted cattle could have been priced over a three-month or more time period. Cattle sold on grids have many alternative base prices, computed in several ways and covering several time periods. Thus, on any given day, several prices can be observed in the market. It is believed price dispersion on any single day has widened considerably. It is not clear that the most visible of prices (cash market prices), and those most useful for price discovery, accurately reflect the quality

or quantity of cattle sold at that time. We encourage the industry to work with Agricultural Marketing Service, USDA to continue improving its price reporting methodologies and reports.

6. **Adopt a policy position opposed to contractual arrangements between cattle feeder/producer and packer when the base price is tied to a cash market in which the buying packer is active in buying fed cattle and/or when the base price is tied to plant or firm prices paid or cattle costs into the plant(s) for some time period prior to the date of delivery with the reasons for the policy position coming from the inappropriate incentives of this approach and from the need to restore integrity to the pricing system.**

   The incentives facing buyers when price is tied to markets in which they are large buyers are not consistent with confidence and integrity of the pricing process. If there are benefits of scheduling cattle into packing and processing facilities, and the research clearly shows such benefits directly to the packer and indirectly to the cattle feeder and to the producer, the scheduling can be accomplished in a number of ways. Resorting to an arrangement that has the perverse economic incentives that attach to a contract with the base price tied to a cash market in which the packer is active or to some measure of prices paid by the firm or plant is not essential or necessary. The effective removal of this approach to contracting or formula pricing would mitigate many of the negatives associated with captive supplies while leaving open the possibilities of realizing the cost-reducing benefits of even flow of cattle into a slaughtering and fabricating facility via basis contracts with price tied to the live cattle futures, hedged contracts specifying time of delivery, (flat price) cash forward contracts with a cash price established at the time of contracting, or other and similar arrangements.

7. **Support increased flow of information in the beef industry from consumer to producer. In particular, support moves toward value-based pricing of fed cattle on a per-head basis using technology to objectively measure beef quality and food safety and to track this information back to the feeder cattle market and to the cow-calf sector.**

   The evidence on this issue is clear: Pricing to value and the related capacity of the pricing system in an open-market industry structure to prompt changes in production to match the modern consumer's needs and preferences will not happen in a pricing system based on live sales and on estimates of carcass characteristics. Moving to value-based pricing of individual animals would eliminate the problems associated with "selling on average" and reward (penalize) the producer of high-value (low-value) cattle. Objective measures of value identified back to individual producers would facilitate pricing to value and enhance the capacity to ensure safety of the beef supply. The current grid pricing system is a step in the right direction, but it still has some distance to go. First, current magnitude of grid price premiums and discounts as reported by the USDA appear to be only minimally adequate to provide the incentives needed to cause producers to produce a better quality animal. Second, the base price in the grid must be determined by open negotiation--use of plant averages and formula's to determine the base price distort the ability of the system to communicate the existing demand for quality (see recommendation 6 above). Third, sorting systems that likely commingle cattle of different ownership's at the feedlot level appear necessary for grid pricing to be fully effective. (For a detailed report on analysis of cattle price grids, see the publication by Ward, Feuz, and Schroeder on the Internet at www.aaec.vt.edu/rilp or contact the Research Institute on Livestock Pricing.)

8. **Support continued unobstructed trade where that trade is in accord with existing international or country-to-country trade accords and is, therefore, legal and proper.**

The research on trade is abundant and clear: trade has the capacity to boost economic well-being in both countries involved. The growth in beef exports in the 1990s has been widely documented and has served to augment the overall demand for beef, for hides, and for other byproducts. Imports of largely processing beef into the U.S. at significant levels have been present for decades. The 1998 controversy over imports of live cattle from Canada and Mexico appears to be a reflection of the legitimate frustration over low selling prices and the related and recurring operating losses at the producer and cattle feeder level. Longer term, assuming shipments are legal in the context of NAFTA and other relevant trade accords, the economic well-being of the U.S. beef industry in its entirety will be boosted by unobstructed trade and by allowing the U.S. cattle producer access to the markets in developed and developing countries around the world.

9. **Continue to encourage and facilitate research and educational efforts to lower per unit costs of production and improve economic efficiency at all levels of the beef industry.**

The empirical evidence clearly indicates that there is room for efficiency improvement in beef production. Per pound cost reductions would ultimately lower prices at the retail level, improving beef's competitive position in the struggle for the consumer meat dollar. At the cow-calf level, for example, Standardized Performance Analysis NCBA data reveal that producers in the highest profitability quartile can produce a pound of weaned calf for about $0.55, while those in the lowest profitability quartile have an average cost of production of $1.23 per pound of weaned calf. In addition, recent empirical work reveals that the average Kansas cow-calf producer is about 73 percent efficient in converting costly inputs to pounds of weaned calf. If the average producer were using the best available technology, using the most efficient input mix, and producing at the optimal size, the same level of production could be achieved at 27 percent less cost. Research has shown that productivity improvements in beef over time are lagging behind other agricultural sectors.