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# **PRICE DISCOVERY IN CONCENTRATED LIVESTOCK MARKETS: ISSUES, ANSWERS, FUTURE DIRECTIONS**

**Wayne Purcell, Editor**

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**Wayne Purcell, Editor**

- **Steven Koontz and Wayne Purcell**
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February 1997**



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## CHAPTER 1

# *Price Discovery and the Future of the Livestock Sector*

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### Introduction

Price discovery in the livestock production and marketing systems has been the subject of significant attention, scrutiny, and criticism during the 1990s. Cattle industry meetings at the state and national levels have been charged with excitement, sometimes distrust, as livestock producers debate the pros and cons of alternative ways to sell livestock. Arrangements between producers and processors that allow the buyers to schedule forward delivery of livestock have been dubbed "captive supplies," and have been attacked by some producers and producer groups as blocking equitable and effective price discovery and driving cattle prices down. During 1996, congressional hearings probed the relationship between industry structure, procurement arrangements, and the disastrously low calf prices being received by producers.

Other livestock industries are not immune from discussions related to price discovery. Popular press outlets for the hog and pork industry often discuss the production and marketing contract relationships which are the source of growth in that industry. Industrialization of the hog and pork industry is changing the nature of the markets in which producers participate. Grid-based pricing and the selling of hogs on a carcass merit basis are becoming common practices. Concerns over price discovery are further up the market channel with dairy products. With the lessening role of government controlled and influenced price discovery, dairy product processors and marketers are struggling to construct institutions within which to trade these products. It is clear the dairy industry is having trouble conceptualizing the best set of marketing institutions, and that the beef and pork sector participants do not like some of the institutions that have evolved across the past 10 years.

The intensity of interest, the concerns, and the calls for action continue to grow in the cattle and beef industry. In an October 12, 1996 statement, the Secretary of Agriculture acknowledged receipt of a petition from the Western Organization of Resource Councils (WORC) and announced the petition would be published in the Federal Register to seek public input on the issues it raises. The WORC, self described as a federation of grassroots organizations, indicated that its 6,000 members includes farmers, ranchers, small businesses, and consumers.

Specifically, the WORC petition requested the Secretary to issue rules that:

- prohibit packers from procuring cattle for slaughter through the use of a forward contract, unless the contract contains a firm base price that can be equated to a fixed dollar amount



on the day the contract is signed, and the forward contract is offered or bid in an open, public manner; and

- prohibit packers from owning and feeding cattle, unless the cattle are sold for slaughter in an open, public market.

The petition further asked that packers be prohibited from using “formula” or “basis” pricing on forward contracts. This would preclude the relating of price at delivery to an observable cash price series (the formula-pricing approach) or to a futures contract price (the basis approach). The procedures for pricing and price discovery in the petition would allow forward cash contracting, but only if the contract provides for a firm and specific base price when the contract is signed. All contracts would have to be offered on bid in an open, public manner and the WORC indicated that such an approach would meet the entire industry’s need for timely, accurate, value-based, and competitive price discovery.

The WORC petition came subsequent to, and used in support parts of, the report from a USDA advisory committee formed by the Secretary of Agriculture to look at the economic impacts of concentration in agriculture. That committee discussed problems members felt were indicative of increasingly concentrated and industrialized agricultural industries. One specific problem was attributed to the increased use of formula pricing arrangements. Their concern, and the concern echoed by the WORC, was that the base price being used in the formula arrangements could be manipulated by packers in a highly concentrated marketplace.

It is interesting and useful to reflect on why there has been a surge in interest in price discovery in the 1990s. One possibility is the long-standing tendency to attack the messenger of bad news and to dismiss the recent and current focus on price discovery as predictable and short run in nature. The low calf prices of 1995 and 1996 can be explained in economic terms by the continued weakness in beef demand that began in and around 1979 and 1980, the large cyclical increase in beef production during 1995 and 1996, and the surge in corn prices to record levels after a short corn crop in 1995.<sup>1</sup> If supply and demand forces are dictating a low price to clear the market, then *any system of price discovery* must discover that low price.

A second possibility is that not all observers, including the strident critics, fully understand or have a common perception of price discovery. Price discovery is a dynamic process of buyers and sellers searching for the market-clearing price in a particular marketplace at a particular point in time. *The price discovery process cannot, as suggested above, be blamed for low prices that evolve because of the price determination that has come from a supply-demand balance that dictates a low price is needed to clear the market.* The solution to low prices is to increase the quantity demanded if weak demand is a problem and reduce the quantity supplied if there are unusually high levels of production. Over time, the price that gets discovered will always be a price that corrects the market imbalance characterized by excessive supply versus demand, if an imbalance exists, via prices low enough that some producers will reduce production or be forced out of business. As market analysts look toward

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<sup>1</sup> About 50 bushels of corn-equivalent feed are needed to finish a beef animal for slaughter. A \$2/bu. increase in corn costs, and increases were greater than \$2/bu. in some locations, will reduce the price cattle feeders can pay for a 700-pound animal by roughly \$15/cwt., and by \$20/cwt. for a 500-pound calf.



the liquidation phase of the current cattle cycle, starting in late 1995 and continuing through 1997, this process of reducing the potential for large future supplies will feature low prices.

While it might be convenient to dismiss much of the concern over price discovery as being somewhat misguided, that would be a mistake. Policy changes are being considered, and new regulations on how livestock supplies can be procured are being proposed. Of particular concern is the possibility the political arena, reacting to legitimate constituent concerns over cattle prices that are at record lows in inflation adjusted terms, will try to legislate solutions to economic problems. Once enacted, new regulations will have a potentially large impact on the future of the cattle and beef industry and, if they turn out to be inappropriate, will be hard to remove. With that concern in mind, we want to look at some of the history surrounding price discovery and develop a set of legitimate concerns, and related policy issues, that will surround price discovery as we move toward the next century.

### Historical Perspective

A useful question to ask is why price discovery? There are many issues facing the livestock sectors in early 1997. Why all the energy attached to price discovery as an issue? Is there a public good dimension to this issue that suggests any problems will be solved only if the public sector, as contrasted to private for-profit firms, gets involved and plays either a facilitating or regulatory role? Are issues surrounding price discovery for livestock such that any problems will not be self-correcting, and new regulations will therefore be needed?

In general, the pricing mechanism or the pricing element of markets has always been asked to make two economic contributions:

- Guide the allocation of resources across alternative uses for those resources, and
- Provide for coordination of production and marketing activities such that what is being produced is consistent with consumer preferences and needs.

Price levels across different products, especially *relative* prices, guide resource allocation. This perspective suggests price determination, not price discovery, meets the need to guide resource allocation, but that conclusion may be overly simplistic.

To illustrate, assume an available set of resources can be used to produce two separate classes of livestock, enterprise 1 and enterprise 2. If production costs are known and fixed, then resources should flow to enterprise 1 if the profit is greater than the profit from enterprise 2 and vice versa. This inference implicitly assumes something about the variability in the profit stream, however, profit variability brought on by volatile selling prices for one or both of the enterprises. In fact, then, the profit from enterprise 1 may have to exceed that from enterprise 2 by at least some positive amount if there is significantly more variability in profits from enterprise 1. Most livestock producers are risk averse to some degree and will discount profits from the first enterprise if that profit stream is highly variable.

If the variability surrounding enterprise 1 is temporal in nature and prices are highly variable within the year at least partly because of ineffective price discovery processes, then price discovery is an issue in resource allocation. Price discovery might be ineffective because

available market news is limited or sporadic, because there is a marked imbalance in the knowledge or bargaining power of buyer and seller, or for a number of other reasons. But if there is an underlying but unobservable pattern of prices across weeks or months that the price discovery process reflects poorly, then resource allocation decisions are not as efficient as they could be.<sup>2</sup> Producers are responding to the wrong price signals or to price signals that turn out to be substantially incorrect in an *ex post* context.

Without disparaging the importance of price discovery in the resource allocation arena, it appears that it is the second function expected of price discovery that is attracting the intense attention. *If the market-price system cannot or does not coordinate the vertically related stages of production and marketing so that what is produced is responsive to consumer preferences, then the economic viability of the entire system is threatened.* If that threat is not mitigated by improved pricing and price discovery processes, then the market-price system will tend to be replaced with some other means of achieving the needed vertical coordination. And this will occur in an industry (cattle and sheep in particular) which is shrinking in size because the needed levels of coordination have not been achieved and the industry has not, across recent years or even recent decades, been responsive to changing consumer needs.

It appears recognition of this economic dictate, as that recognition spreads across producers and they come to realize their traditional marketplaces are at risk, is substantially responsible for the growing interest in price discovery. *Producers and producer groups often do not like the emerging alternatives to the traditional price-based marketplace.* The close scrutiny on price discovery and the emerging desire to legislate against the procedures that change or bypass traditional pricing processes may be reflecting legitimate concerns about the future of the independent producer.

The interest and concern may be growing, but it is not new. Much of today's agenda has root in developments of the 1950s, 1960s, and 1970s.

Mighell and Jones documented these same issues in the early 1960s. In what has come to be called a landmark effort, the USDA researchers attempted to organize the thinking to that date on vertical coordination in agriculture. They defined vertical coordination as a general concept that includes all the ways of "harmonizing" the vertical stages of economic activity in production and marketing. The alternatives included (1) the market-price system, (2) vertical integration, (3) contracting, and (4) cooperation. The authors thus restricted vertical integration to the subset of vertical coordination approaches that involve ownership at technically related states.

In early 1997, both the vertical integration and contracting alternatives identified by Mighell and Jones are controversial. The petition submitted by the WORC group dealt with both. The attention being given threats or perceived threats to price discovery clearly, then, is

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<sup>2</sup> One way to conceptualize ineffective price discovery processes is to look at the variance of the differences between transaction prices and the *ex-post* price for a time period such as a day, week, or month. In this context, price discovery is more effective if the variance around the final price is smaller. This assumes the *ex-post* price that is observed is the correct market clearing or equilibrium price for that time period, and transaction prices not equal that level can therefore be due at least partly to ineffective price discovery processes.

rooted in the moves away from a market-price system to other means of coordination. Given these trends, it is instructive to look at why the market-price system with its inherent reliance on price discovery is being threatened and even abandoned and to reflect on whether the changes that are garnering so much attention today were anticipated. Did we have any warning of this "storm" of change?

It is important to recognize that there is a set of strong economic reasons for coordination of the various stages. There is a technological complementarity that spans the various stages of economic activity. In fact, the production and marketing functions are often seen as a joint process which suggest joint decision making. If the pricing system does not achieve coordination, combined costs of all the functions increase. Stigler discussed the advantages of specialization and recognized those advantages would be forthcoming only if the technically related stages of economic activity are coordinated.

Paul expanded Stigler's thinking. He showed that technological advancement is a strong motivating force for change, and discussed how the risk-sharing distribution across participants along the production-marketing chain might change with technology changes. Paul showed that a firm might integrate vertically with an adjacent stage even if no cost reductions are accomplished so long as the variability of costs, and therefore variability of revenues, is reduced.

Suppose, to illustrate Paul's point, that advances in technology allow a packer to increase line speed, slaughter more livestock, and reduce costs. Assume this new technology demands a more stable flow of slaughter livestock into the facility in order to accomplish the reduction in costs. If the price-based system cannot provide a stable flow, then there is a powerful cost or efficiency-driven reason to integrate or to coordinate by contracts and other means. In the context of price discovery, the exchange-based system would have to identify and discover a price, such as a price premium or essentially an "option premium," for producers who accommodate the stable quantity flow needs of the packer. *If lack of information, inconsistent goals, non-equal bargaining positions or any other barrier keeps this from happening, then the price discovery process has failed in an important way and system participants will inevitably look to some other means of achieving the needed coordination.* It is useful here to recognize that achieving the reduced costs is important to the producer and to other system participants because it contributes to lower consumer-level prices, provides for a more competitive sector, maintains a larger market share, and keeps more producers in business in the long run.

Reducing transaction costs can be another reason to change systems. The widespread move away from price discovery in terminal markets in the U.S. and toward direct sales of livestock is clearly an example of this force. Costs of the transactions between seller and buyer were reduced, ultimately raising prices to producers.

Walsh, Parker, and Breimyer all pointed to market imperfections as yet another reason to abandon price-based systems. A firm buying from, or selling to, a much larger firm with more bargaining power might integrate or go into contract arrangements to improve its competitive position. The unequal bargaining power, a characteristic of an imperfect market, prompts the change. This type of market imperfection is clearly present in the beef and pork sectors today. One of the reasons cattle and hog producers get involved in contracting with packers is to guarantee access to a market that has fewer buyers each year.

Sporadically during the early development of non-price means of coordination, empirical research findings confirmed the motivations. Holtman, Sullivan, and Barreto, for example, estimated that slaughter plants could realize cost savings of over 10 percent if control over hog numbers could be attained and flows into the plant stabilized. Other examples can be gleaned from the literature, but as the research in the 1960s and 1970s started to be more focused, a consensus on the “why” of moving to non-price means of coordination started to emerge. A key issue that started to claim more attention was the importance of the pricing processes as a communication medium and its effectiveness in accomplishing vertical coordination and an alignment between what was produced and the demands of consumers.

Kohls and Wiley had made the arguments for vertical and systematic coordination in the 1950s. To be viable and to grow over time, the production-marketing system must achieve coordination between consumers demands and what is produced and offered. Shaffer (1968) continued the theme in the 1960s, calling on researchers to recognize the importance of study of the entire system versus focusing on any one function. Other researchers picked up the theme, and Purcell argued in the early 1970s that if the price-based system did not improve as a coordinating mechanism for the livestock marketing system, it would surely be replaced by non-price means of coordination.

In the 1980s and 1990s, the earlier predictions by researchers started to come true. Slowly at first, now rapidly in hogs, the price-based systems are being replaced. In 1997, the pace of change in hogs is so rapid that some fear for the future of the swine-producing entrepreneur who makes his own management decisions and manages his own price and price risk decisions. In cattle, the pace is slower for a host of reasons, but the emergence and survival of the controversial captive supply arrangements attest to the strength of the economic pressures for change. *There are huge economic incentives for processors to reduce costs by stabilizing flows of hogs or cattle*, and many producers feel pressure to accommodate the wishes of the large and often single buyer in their region or area.

There are economic incentives for processors to have consistent quality if they are to become consumer-driven merchandisers, incentives of monumental importance. The continued lack of refinement in systems that price on a live animal basis and pay average prices for everything, especially in cattle, means we are not pricing to value and the consistent quality is not being achieved. The beef sector in particular is not coordinated and is not consumer driven. It is true that there is a market, at some price, for all of the different qualities we produce, but that is not good enough and this often advanced argument (that there *is* a market for everything) misses the point. To move ahead, the beef sector must move to a consumer-driven status and that, in turn, will require a capacity to realize effective quality control and target specific product offerings to specific classes of customers. *The processor must be able to focus on a particular final use and accomplish total quality control in meeting the needs of that sector of the market.*

In the current setting, then, it is important that the research and education community, policy makers, and well-meaning authors of proposed legislation, i.e., regulations, ask the correct question. Is the problem (1) that we do not want to lose negotiated prices and transactions because that will mean less effective price discovery, or is it (2) that we do not like the way our livestock sectors are being structured and operated as we go to non-price means of coordination?

The answer is surely partly number (2), and concerns about price discovery are becoming the proverbial straw man that allows us to ignore the real economic issues. Even if every transaction on fed cattle in the U.S. were negotiated by buyer and seller or discovered in some type of public auction or arena where all prices are visible, virtually all of the motivations delineated above (consistent quality, stable quantity flows, etc.) for moving to non-price means of coordination would still be present. *The pricing system in livestock has failed in its assigned task of ensuring the vertically related stages of economic activity along the production-marketing chain from producer to consumer will be well coordinated.*

Failure to achieve coordination of those activities means lower prices to producers in the short run as processors cover margins inflated by costs that are higher than they could be. In the long run, resources are forced out at all levels of the system for that industry because the product offering is not matched to consumer demands and the sector is not consumer driven. The result is loss of market share for beef or for pork, and smaller supplies and higher prices to consumers than would be the case if a production and consumption "match" were to be achieved. Per-capita offerings of beef have plunged from near 95 pounds in 1976 to near 65 pounds in the 1990s. This failure of price discovery at several interchanges between separate and often adversarial profit centers is the real issue, and we need to look at price discovery in that context. *The important policy issue is market failure, an abject failure of the traditional price-based marketplace to even come close to the level of vertical coordination that economic forces are dictating must be achieved if the livestock/meats sectors are to grow.*

### **Market Failures in the Livestock Pricing System**

Competitive markets--often referred to in producer circles as free markets--have the attractive quality that they are efficient in allocation of resources. The pursuit of profit has long resulted in increased investment in poultry and investment is starting to seriously expand in pork production. Investments in beef production have not kept pace and beef has lost market share. This allocation, or re-allocation, of resources is dictated and driven by consumer dollars. However, there is no longer any guarantee that these free markets will or can exist for a number of reasons.

First, the markets may be defunct as an institution. Producers frequently demand access to markets. Demanding access to a centralized marketplace is reasonable. However, in a time period where direct trade is the norm and where there are a small and decreasing number of processing firms, demanding access to markets is equivalent to demanding access to a purchasing firm. It is equivalent to demanding that purchasers buy at the centralized marketplace. This demand cannot be enforced in any competitive marketplace. Buyers cannot be made to buy nor can sellers be made to sell--not in a free market. The institutional arrangements used can be regulated but transactions and use cannot be mandated. Second, there can be market failures in competitive marketplaces. Market failures will cause the markets to break down or at least function poorly. More on the first point will be discussed later, but as has already been implied, the second point is arguably more important.

One of the main reasons competitive markets fail is because the good in question is a public good. Public goods have high exclusion costs, which basically means that use by one person does not affect the ability of others to use the good. Because of this, the first person or



firm to invest in a public good pays the majority of the investment costs while the other people or firms in the market pay little or none of the costs. All people and/or all firms benefit from the public good, and there is a "free rider" problem. The net benefit to the innovator who makes the investment and initial effort is smaller than to all who wait and follow. Consequently, everyone waits for someone else to go first, so there is not enough of the public good provided.

One of the better solutions to this problem is for society to decide collectively what and how much of each public good it desires through government entities or institutions and then charge the government with providing those goods. This is the case for national defense and public parks. This is part of the justification for investments in research and education. *We think the livestock industry should start to think about price information and the price discovery system as approaching the status of a public good.*

The idea of pricing systems and price discovery as a public good is not a new one (Grossman; Tomek; Grossman and Stiglitz). However, the idea has not generated much research or any action by livestock industry economists or leaders. Further, the real ramifications of this idea have not been explored. The impact of price information being seen as a public good by the private sector is becoming obvious, but the industry has not used the idea to develop any solutions to the problems it faces.

The voluntary and direct trade nature of the current system is efficient from the standpoint of livestock procurement costs. Direct trade is efficient in terms of animal collection and delivery cost, physical and personnel costs in negotiation, and it gives the packer the opportunity to buy from the lowest price seller and animal producers the opportunity to sell to the highest price buyer. However, this type of trade can still be inefficient in the contribution to price discovery.

We are thinking here of the pricing process--the amount and quality of the price discovery process--as a good that is provided in the economy. Price discovery consumes resources. It is performed through institutions that are not costless to operate and in that sense, markets are not free. *The price discovery process is a public good because market participants that contribute to the price discovery process, through price reporting or establishing a true value-based marketing plan, may receive a smaller net benefit from doing so than those users who do not make comparable contributions.* With consolidation of the livestock industries, there are growing incentives to withhold pricing information. A large firm benefits from withholding pricing information and seeking the price-related information of others. Pricing information is not excludable and its use by one firm does not preclude its use by other firms. And it is not costless to provide this information to the market in terms of its strategic value. *The firm or alliance developing a valued-based system will incur costs such that the net benefit to innovators may not be as large as the net benefits to firms that wait for the correct model to be built and tested and then use its information and pricing-to-value contributions.*

The analogy is similar to economic forces behind technology adoption in most food processing industries. In the pursuit of reduced processing costs, firms often adopt large-scale processing technology, hire labor to do specific desired tasks, and consolidate management, procurement and sales. The firms that adopted these large-scale systems achieved economies of size, realized lower costs, and pushed smaller producers and processors out of business. The economic incentive to reduce costs has resulted in more concentrated processing industries

where the level of competitiveness in the now-consolidated markets is in question. We are left in the world of second best alternatives. There are simply not enough buyers and sellers to guarantee a competitive market. However, this result was achieved through reducing processing costs. Do the cost savings outweigh any market power abuses? Recent research suggests the answer is "yes" for the beef industry, at least up to the mid-1990s (Azzam and Schroeder). The same type of change has happened in the price discovery system. Direct trade is efficient from the standpoint of physical delivery of product and it reduces costs, but the price discovery system suffers from the lack of information. *Do the advantages of reduced marketing costs outweigh the disadvantages of less information and a less visible price discovery process?*

Lack of information, or high levels of risk and uncertainty, can also cause markets to fail. Producers and even managers of well diversified firms tend to be risk averse. In the presence of high levels of risk, these economic agents tend to make cautious decisions. In such an environment, the economic resources devoted to production will be smaller than if future economic conditions were anticipated correctly or if there were futures or contracting markets to allow management of and reducing exposure to risk. The high fixed costs that are present in agricultural and the related processing industries exacerbate this failure. Both investment and disinvestment are slow to be made in such industries. Thus, there can be a misallocation of economic resources that persists for a long period of time.

Further, even if the industry had more complete information on all livestock transactions, this information may not improve the price discovery system. This is likely the case because there is insufficient information about the products that are being trading. It is both a quantity and quality issue where price information is concerned. We tend to be critical of the formal grading system and other components of the current system where prices are discovered for quality differences and product designations. We also hear criticisms of grid-based pricing systems, value-based marketing systems, and alliances as they are now being planned and implemented. There are characteristics that consumers desire in animal system products, but these characteristics are not being reflected in current pricing systems. This reduces overall demand for meat products to the extent that product characteristics are not discovered by anyone except the consumer only after the eating experience, or to the extent processors pass poor quality on to the consumer deliberately or through inappropriate marketing procedures. This also increases marketing costs to the extent that processors find quality problems after purchase of the live animal and must sort meat products into the correct marketing channel. Processors build a risk premium, i.e., a discount, into bid prices as insurance to cover such surprises. This is again a market failure due to risk and uncertainty, and the industry falters. Will regulating how processors can buy livestock solve these and similar problems? The answer is clearly "no."

Alliances and privately developed grading systems address the quality and related price discovery issue, but the benefits of the knowledge and the practice are not spread through the marketing system. Not all market participants have direct information about profit opportunities. A strong case can be made for improving the formal grading system and implementing all alliances or private systems on top of the base USDA system, or at least giving alliances and packers the option of participating by building on the USDA grades. *Improving the ability of the grading system to identify meat quality characteristics sought by consumers, and then pricing based on those characteristics, will improve the price discovery process for the whole system and will improve industry performance.* Simply replacing a



USDA system with alliances and private “grading” systems would not necessarily be a good idea. The current system may be insufficient, but there is no guarantee that the private systems which replace the current system will be an improvement or generate pricing and value information that is accessible to producers. Large packers have strong incentives to purchase in volume and perform cost accounting on a per head basis. These incentives are serious impediments to value-based marketing--a desirable and even essential characteristic of future price discovery systems. And there are strong incentives for the developers of private systems to use those systems for their exclusive benefit. This will benefit the adapters but will not necessarily benefit the entire industry.

Our involvement in the P&SP concentration study revealed to us that packers either cannot or have extreme difficulty linking meat revenues from different product lines directly to purchase costs of specific pens of animals. Animals lose identity once the carcass hits the breaking table. Thus, packers have an incentive to allocate cost on a per-head basis. This is a barrier to information flows that are critically important if the market is to solve the problem of pricing to value. Price discovery is ineffective. Some livestock are worth more than others, but the technology and adopted cost structure of processors prevents them from transmitting that information back to producers through differential bid prices for individual animals.

Changes in the grading system will not necessarily address this problem. Rather, new technology must be adopted that better enables the packer to link meat revenues with animal purchase prices and overall costs. The pork industry has addressed this problem through narrowing the commercial herd genetics, improving feeding programs, and using production and marketing contracts. Much less flexible feeding programs and a smaller number of products--compared to cattle--also provide a natural advantage. The wide genetic pool, flexible feeding programs, and variety of meat products associated with cattle and beef production will likely necessitate the use of new and usually costly technology in beef packing plants to generate the types of information needed for effective price discovery. This will be the case even if an electronic marketing system comes into widespread use. Changes will be required at the packer level to accommodate the richer information needs, and packers will not be anxious to make those changes.

The overall cost structure of the packing industry is another potential barrier to the solution of the information problem. Packers have a high proportion of fixed to variable costs so that the average total processing costs decline over a large range of plant output (Ward). Packers that have strong incentives to use plants to capacity and operate at high line-speeds. Thus, any new technology that slows the line-speed and decreases plant capacity will not be readily adopted. Further, with the economies of size and high industry concentration, it is unlikely that any new player will enter the market and introduce the new technology. Declining beef demand and low-cost large-scale technology may stifle the very innovation process that could improve communication, price discovery, coordination, and demand.

Beyond the obvious objections to industrialization, such a process privatizes the previously public information base. If the poultry system was broke, would we know? How would we know? This is a cost of lack of access to price information that is often not considered.

As a final note, the willingness of private companies to provide market pricing information, grading systems, or an electronic aid to price discovery, even if that willingness

exists, does not change the public good characteristic of pricing and public grading systems. The fundamental characteristics of these goods do not change because private firms will provide them, and it is likely investment in these goods will be insufficient if they are provided by for-profit private firms that discount for uncertainty and then seek some, likely high, return on their investment. Because of this, it is likely that paying for price discovery directly, or indirectly through participation, will not succeed if it is strictly voluntary. The market itself may fail if it is completely voluntary.

### **Suggestions and Alternatives**

The purpose of this section is to suggest courses of action and changes to market institutions that will address the market failures outlined in the previous section. Some of our suggestions will be controversial. But we think innovative and even controversial ideas are needed. If current trends continue, industrialized, heavily concentrated, and likely smaller industries will be the result. The economic incentives for control and coordination are that strong. The control will likely be exercised by an even smaller number of players or participants than is the case today.

Strategic alliances and private grading systems can be a step in the right direction. There will always be a place in commodity systems for firms to provide niche and specialized products that better accommodate consumer preferences. However, there is a strong need to improve the current commodity system. It is unlikely that all meat products can be successfully marketed through branded and niche products. If this is in fact the case, the resulting industries will be rather small compared to the system that could exist if pricing and pricing to quality information were widely available and publicly known. Strategic information and control of that information will prompt incentives to make investments in quality control and in consumer-driven products, but this will not solve the problems facing the broader commodity business.

How do we improve the commodity system? As parts of the volume slowly move to consumer-driven subsectors with private control, what can be done to help the still massive commodity-oriented part of the business?

*There must be technical progress in the pricing and grading systems.* There must be technical progress in the information transfer from consumer through processors to producers. New technologies must be adopted. Visual grading must be replaced with mechanical grading and the number of grades must be expanded or refined to identify more of the product attributes of importance to the final consumer. Science and engineering must be employed to identify gradable animal and meat traits that can be linked to consumer preferences, the technology adapted to or perhaps mandated in high-volume processing plants, and then prices must be discovered for this new array of grades that document tenderness, flavor, etc. This is where our concern is greatest about the impact of concentration on the meats industries. *If the large processors do not develop and adopt such technologies, then where are the firms that will adopt and force the system to be competitive and progressive?* It is possible that there now exist technologies that will improve meat grading, improve the quality of meat in front of the consumer, or at least effectively identify various qualities to the consumer. Yet, these technologies are not used because they slow the line speed. The known increases in plant operation costs associated with adopting the new technology are perceived to be greater than unknown increases in demand, especially when any increases in demand for beef may be of

only incidental interest to the processor who seeks to gain and protect operating margins. Today's large packer/processors do not worry about the industry 15 to 20 years from now. Their focus is on the earnings in the next quarterly statement.

This is known as "technology lock-in." This phenomenon has occurred in the computer industry. Significant changes to technology may result in much improved or more efficient markets--in terms of the use of computer and software products--but the change is perceived as too great and too costly to be feasible. The new technology requires changes which are substantially different from the current processing system and its technology. The same case may be argued to have occurred with respect to boxed beef processing technology and the large processing plants when the technology was available for years before it was introduced. Legislative or regulatory actions may be needed to achieve the necessary changes in technology to generate the needed changes in grading, pricing, and moving to consumer driven status. Direct payments may be required, as an alternative, by those that would eventually benefit from the change to those who incur the costs of the change, i.e., from producers to packers. Incentives to facilitate the adoption of new technology and modern quality control measures would be a good use of industry check-off funds. These expenditures would truly improve demand.

Further, with the adoption of new technology, information on pricing and marketing of different grades must become public knowledge. This point moves into the possible need for mandatory price reporting. *There is no publicly defensible economic justification for withholding of price information by private firms.* This is especially true when that price information is almost costless to report. The USDA, AMS provides the service of collecting and disseminating price information. *The only reason to withhold information would be to use that information for strategic benefit and that action, by definition, leads to inefficient price discovery.* There is simply no economic reason--from the perspective of the well-being of the marketplace--that can justify non-reporting of price data. And as long as firms volunteer to report this information, there is no need for mandatory reporting. *But if voluntary participation leads to the withholding of important information and this leads, predictably, to a failure in price discovery, then mandatory price reporting has to be considered.*

Through the 1970s and 1980s, a wealth of research communicated much promise for electronic markets. Electronic markets were relatively efficient, counteracted the effects of increased market concentration, and the prices from these markets regularly reflected competitive prices. But electronic markets are still basically a failure. A few are quite successful, Telcot for example, but electronic markets are used to transact only a small portion of food and agricultural products. The problem with electronic markets in the 1970s and 1980s was that cost of computer facilities was too great. Computers were expensive, computer expertise was lacking, and dedicated phone or communication lines were sometimes needed.

None of these problems are present in the late 1990s. The development and use of electronic markets should be pursued aggressively. However, these markets cannot be one-sided. Development should incorporate needs of both buyers and sellers. The development should be even handed and electronic systems should not be used by producer groups to specifically gain leverage on processors. It is true that the structure of the industry plays against the producer. It is our perception that packers are better informed than producers, or at least the packers can set up an inter-plant information system to be well informed about market conditions. But this is not the main point. It simply underscores the possibility that packers

will resist these changes. The main and important point is the need to get to a position of pricing to value and effective communication, via price signals, from consumers to producers. Electronic marketing can help in the process, but there are huge firm-based barriers to participation. Participation will likely need to be mandatory, and this will of course be controversial.

Suggesting mandatory participation in electronic markets is also not a new idea. Schaffer (1989) presented this as an alternative to farm programs. One of his underlying arguments was that it is not that producers are exploited in the market, but rather it is that the markets in agriculture do not perform well. The prices that we see at any point in time are not the problem. There will be times when low prices are justified. Rather, the challenge is to develop market institutions that will improve the performance of the agricultural economy. The argument definitely applies to the livestock industries.

Alliances and other niche arrangements may not need to participate directly in this electronic market. There will need to be arrangement for special cases. However, information on the alliance will need to be made available to the public. If the alliance has truly invested in new science or technology, the intellectual property rights of that development will need to be protected, but that can easily be done through patent or copyright procedures. Incentives to innovate need to be protected. However, the market for information on these innovations needs to be relatively open.

It is our perception that the livestock markets are learning what fruit, nut, vegetable, and fluid milk producers have know for a long time. Small numbers of buyers and sellers combined with inelastic consumer demand, limited processing capacity, and variable supplies can result in highly volatile market prices and financial problems to all players and especially to producers. *There is a huge value to building marketing institutions which effectively coordinate production and marketing functions through something other than the open market with its emphasis on negotiated prices if that price-based system fails.* The resulting market institution needs to be able to respond to economic incentives and forces, but there may be better ways to coordinate the technically related stages than to have each buyer and seller acting individually in what they perceive as in their own best interest. There are economic conditions when strictly individual firm profit-maximizing behavior is not the most efficient system, and today's beef sector with its adversarial attitudes between narrowly focused profit centers constitutes a clear example. The trick is to blend broad institutions or rules with individual incentives and still have access to information, pricing to value, and effective price discovery.

A central electronic exchange will very likely solve the perceived captive supply problem. Discussion with producers frequently reveal they are not concerned about contracting as much as they are concerned about knowing the number of cattle and the number of days ahead for which packers have secured cattle. This information can easily be captured and reported in an electronic system. Likewise, market participants are often interested in the size and currentness of the showlist. How many market-ready cattle are available and what is their finish condition? Both of these types of information are difficult to secure, dictate trading patterns, and have strong impacts on price and price changes. *Price discovery and the orderly marketing of cattle would be improved greatly if this information was known.* This information could be easily collected and recorded through a computerized trading system.



Mandatory price reporting is a non-issue in such an environment. Further, this system could be expanded beyond cash market trading. The system could be used to post and monitor contracting arrangements, and alliance data should be included in such a system. The types of contracts could be regulated for fairness. Contracting would *contribute* to price discovery in such an environment. Futures contracts and options on futures contracts could also be coupled with the system and the Chicago Mercantile Exchange could institute clearing services. A clearinghouse would guarantee performance on cash and contract payments, and contracts could be modified based on client needs. Market liquidity would be improved with this system. The current fed cattle market, which sometimes trades a week's worth of cattle in one hour, has serious liquidity and related access problems.

Many readers will likely be skeptical about the degree for intervention suggested in this section. We are cautious about considering and advocating intervention. It is not usually good to try to legislate solutions to economic problems. However, the problem is in the poor performance of the system, and there are market failures and other structural impediments that will likely continue to prevent the competitive process from finding a solution. We have waited for years for the beef industry to find a solution and one does not appear to be forthcoming. *Without intervention to fix the market institutions, the industries will continue to integrate, concentrate, and become more industrialized.* There is a real need for this industry to collectively act--and not simply through limiting contractual arrangements.

Further, we suggest an alternative reference point to use for perspective if you have developed a negative perspective about intervention. The model of unregulated agricultural markets involved in direct trade is the frame of reference with which we are all familiar. However, we suggest the reader contrast livestock and meat markets and the degree of intervention, not with other agricultural markets, but with financial markets. It is not controversial to suggest that these market perform very well and it is hard not to notice that the government is heavily involved in monitoring and setting the rules for financial markets. Further, there is an enormous amount of self-regulation of financial markets. These markets function quite well, even given the high concentration in some of them, because of the amount of information that is available. There is no product or commodity in the world which is harder to grade and price than a stock for a specific company.

The Securities Exchange Commission (SEC) is heavily involved in the regulation of financial markets. Most of the regulations have to do with standardized accounting and reporting procedures, and the reporting of accurate--or at least non-misleading--information for firms with publicly traded stocks and bonds. The SEC also plays an active role in policing fraud. However, one of the SEC's largest roles remains in facilitating the provision of market information. Markets function better with more information, and consumers or stock purchasers are better able to protect themselves when they are well informed. Imagine a cattle market where fraudulent representation of animal quality was prosecutable--not rewarded by pricing on averages.

In the financial community, industry associations play a strong role in education, testing, and certifying industry members and brokers that have contact with the public. This is not an issue for livestock markets. In the financial markets, the associations also facilitate communication between the larger industry players and there is an air of self-regulation which contributes to overall market performance. The industry members recognize that some types of collective action benefit all participants in the industry.

Stock exchanges play an important function in the trade of equities. Basically, they are a safe haven; participants have to meet certain standards and trade takes place following rules which specifically do not benefit the buyer or the seller. These rules facilitate efficient exchange and the discovery of stock equity prices. Exchanges police their members which do not meet the standards and which do not follow the rules. The over-the-counter market is large and expanding, but this market is generally for trade in specialized products and unique customers (most small), and the regulation of this market is increasing daily. More importantly, trade in this market is still well reported. *The quantity and quality of information is the key, and the livestock markets face major issues in both quantity and quality of information.*

### Summary

The beef industry has changed from perceiving that no problem exists--the only acknowledged problem in 1989 was the loss of market share and the desire to sell more product--to perceiving a crisis. Proposals from producer and other grassroots organizations can be negative and confrontational, and include suggestions of rigorous enforcement of antitrust laws, limiting marketing methods, and requiring divestiture by the large packers. Producer proposals have also been positive and shown industry leadership, including actions such as formation of alliances and producer investment in processing cooperatives. However, it may be that the industry is still missing the real issue.

Livestock and meats industries will, inevitably, make technological progress that results in reduced production and marketing costs. However, the structure of the resulting production and marketing system is ambiguous and unknown, and the structure that evolves can mean still further problems for the industry. *Individual firms have the incentive to innovate and capture the benefits of that innovation. Left to its own devices, the livestock industry will consolidate, industrialize, and move to non-price means of control and coordination in both pork and beef. The long anticipated replacing of failed and failing price-based marketplaces will have been completed.*

Progressive action taken in the public interest through state and national government, through producer organizations, and through making changes in the marketing system might achieve the same levels of efficiency without the continued consolidation and industrialization. The benefits are then captured not by the innovating firms but by all participants in the system. But the players in the system must be willing to change.

A real issue is the public pricing and grading system, and the resulting price discovery system. Innovative thinking and actions are needed. Producer groups must think beyond demanding rigorous and to-the-letter enforcement of the 1921 Packers and Stockyards Act. There are no easy solutions. Breaking up the big packers and regulating the way they buy livestock will not fix the problems facing the industry. Costs would likely go up at the processing level if legislation forces a reduced 4-firm concentration ratio, and the processor price spreads (producer-to-wholesale) that have decreased in inflation-adjusted terms since the mid-1980s will likely start to increase again. This will decrease cattle prices in the short run and cost market share in the long run in the form of reduced supplies and higher consumer-level prices. Just turning to a new marketing alternative will not fix the problem; it is not

enough to voluntarily participate in an alliance. *The industry must make the change necessary to get to better price discovery and all the advantages it brings--pricing to value, being consumer drive, achieving coordination--or there will continue to be change to the inevitable, a more concentrated, more regulated, and possibly less efficient system that pushes the producer into a pattern of forced actions and, eventually, forced disinvestments.*

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## CHAPTER 2

### ***Beef Industry Price Discovery: A Look Ahead***

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#### **Introduction**

Price discovery is the process of buyers and sellers arriving at a transaction price for a given quality and quantity of a product at a given time and place. Price discovery involves several interrelated concepts, among them:

- 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 is frequently confused with price determination. These are two *related* but *different* concepts which need to be understood when discussing prices and pricing issues.

Price determination is the interaction of the broad forces of supply and demand which determine the market price *level*. For fed cattle, supply determinants or factors affecting the quantity of beef produced include:

- Input prices (feeder cattle and grain);
- Technology (growth promotants, etc.); and
- Price of outputs produced from those inputs (fed cattle).

Demand determinants or the broad demand factors affecting the amount of beef consumed include:

- Price of products produced from fed cattle (beef);
- Prices of competing products (pork and poultry);
- Consumer income; and
- Consumer tastes and preferences.

Price determination and price discovery are interrelated. Price determination finds the market price level. That general level of prices may be high or low. However, when market prices are low or are falling, questions and concerns about price discovery increase.

Price discovery begins with the market price level. Because buyers and sellers discover prices on the basis of uncertain expectations, transaction prices fluctuate around that market price level. This fluctuation is attributable to the quantity and quality of the commodity brought to market, the time and place of the transaction, and the number of potential buyers and sellers present. Other factors are the amount and type of public market information available, captive supplies, and packer concentration in the case of fed cattle prices.

One type of price discovery research attempts to determine factors that explain variation in transaction prices. In the 1970s, most fed cattle were priced on a live weight, cash market basis. Factors affecting fed cattle prices included (Ward 1981):

- (1) carcass beef prices;
- (2) live cattle futures market prices;
- (3) cattle quality (including sex, weight, quality grade, and yield grade);
- (4) sale lot size;
- (5) number of days between purchase and delivery of cattle;
- (6) number of packers bidding on cattle;
- (7) individual packing plants or firms;
- (8) time of year; and
- (9) region of the country.

Many things have changed since the 1970s. Transaction prices for the same kind of price discovery research today would include more dressed beef (in the beef) prices and dressed weight and grade prices (formula prices) and more forward contract prices. Pricing models would include the following variables (Jones *et al.* 1992; Ward 1992; Schroeder *et al.* 1993; Ward, Koontz, and Schroeder 1996):

- (1) boxed beef cutout values (instead of carcass beef prices);
- (2) live cattle futures market prices;
- (3) cattle quality (including sex, weight, quality grade, and yield grade);
- (4) sale lot size;
- (5) number of days between purchase and delivery of cattle;
- (6) number of packers bidding on cattle;
- (7) individual packing plants or firms;
- (8) individual feedlots;
- (9) day of the week;
- (10) time of year;
- (11) region of the country; and
- (12) extent and type of captive supplies.

A multitude of factors has caused price discovery to become a major concern to cattle producers and others in the past few years. Cattle feeders tend to market and packers tend to purchase whole showlists of fed cattle at a single price. Thus, better and poorer cattle are priced the same, despite significant differences in quality. Cattle feeders and packers pit their supply and demand conditions and expectations on each other until someone makes a move. When a cattle feeder accepts a bid, there is a rush of transactions, everyone attempting to trade cattle at the same price. This results in what has been termed the “45-minute market” for fed cattle. Essentially, large

numbers of fed cattle are traded in a short time period each week, though not necessarily the same day each week. As packers attempt to move toward case ready and branded beef programs, more consistency is needed and there is a clearer reason to pay different prices for different quality cattle. However, this need may be offset by the sheer volume needs by packers in order to keep plant operating costs low and as competitive as possible. Volume needs have led to increased use of captive supply procurement methods (Barkley and Schroeder 1996). A final factor is the absolute amount of fed cattle handled by just three large packers and the question of packer concentration and market power in fed cattle procurement.

As a result of the above, this research was initiated to examine vertical coordination and price discovery issues in the beef industry. The overall objective was to determine how vertical coordination and price discovery in the beef industry will change over the next 10 years. Specific objectives were:

- (1) Determine the relative importance of factors influencing vertical coordination and price discovery at various levels in the beef industry;
- (2) Project probable changes in vertical coordination and price discovery by the year 2005; and
- (3) Assess the role of market information, technology, risk management tools, and market structure on vertical coordination and price discovery in the next decade.

Most information for this study came from two sources. First was a series of personal and telephone interviews with persons associated with selected cattle feeding, beef packing, and related industry firms and organizations. Second, the economics research literature was used to complement and contrast information obtained in personal interviews. Several topics were discussed in each interview and the outline of this chapter was based on the topics and issues which we heard repeatedly in the interview process. The authors wish to caution readers that there are, predictably and unavoidably, areas of overlap among sections.

## **Price Discovery: Industry Perspectives**

### **Interview Design**

To discern industry perspectives regarding cattle price discovery problems and future prospects, a series of in-person and telephone interviews were conducted. Individuals interviewed included upper-level management and/or principal owner-managers of selected cattle feeding firms, beef packing firms, beef product retailers, and related industry firms and organizations. Interview participants were selected based upon a desire to have representation from the major cattle feeding region, a diversity of firm sizes (but with emphasis on firms with large market shares), and representation from operations likely to be a significant force in the beef industry over the next decade. As such, the interviews do not represent a random, scientific sample. Instead, individuals interviewed are from a targeted group of specific operations located primarily in the major cattle feeding and packing regions of the central U.S.

Individuals interviewed will remain anonymous in accordance with agreements made prior to each interview. Each individual interviewed was provided the opportunity to review notes

detailing the essence of the interview and make corrections, clarifications, and/or elaborations. Firms interviewed included 5 of the largest beef packers representing an approximate annual kill capacity of 25.5 million head. Packers interviewed were among the largest multi-plant firms and single-plant firms. Also included in the interview sample were 8 of the 25 largest cattle feeding operations and a few smaller cattle feedlots representing a combined total of approximately 3.4 million head of annual fed cattle marketings. Feedlots represented were primarily located in Nebraska, Kansas, Colorado, Oklahoma, and Texas with some yards located in other surrounding states.

Several topics were covered in each interview and the specific major sections of this report highlight important issues that repeatedly surfaced in the interviews. The purpose of this section is to summarize industry sentiments about cattle price discovery issues and perspectives based on these interviews. In attempting to summarize industry perspectives it is apparent that many issues have a divergence of opinion. The divergence of opinions is associated with differences in firms' comparative advantages. Comparative advantages stem from the stage in the market system the firm primarily occupies (e.g., feeder, packer, or retailer), facility numbers and locations, firm and facility sizes, access to and ability to analyze market information, access to capital, legal structure, and management resources and philosophy. The ensuing discussion highlights opinions based on comparative advantages. However, generalizations are tenuous and should be taken as observations rather than rules because of the qualitative nature of information collected, the nonscientific sample interviewed, necessarily subjective judgements regarding perceived comparative advantages, and the multi-dimensional attributes of comparative advantages.

### **Fed Cattle Price Discovery: What are the Issues?**

The authors found interviews with packers, feeders, and others both interesting and revealing. Individuals interviewed were candid and displayed a sincere interest in the future of the beef industry. There was considerable agreement in some areas and wide differences of opinion in other areas. As many differences were identified *among* packers and *among* feeders as there were *between* packers and feeders.

Some packers and feeders thought price discovery was not really a problem or issue. Others thought it was a major problem. To some, trading large numbers of cattle in a short time period each week, i.e. the "45-minute" trading week was not a price discovery problem. To others, it exemplified the severity of the problem.

Three issues may have received more unanimity than others related to price discovery. One was the need to better identify quality, ideally by a more objective means. Quality often, but not always, referred to tenderness and the "eating experience" of consumers. Second was the need for greater pricing accuracy, moving from average pricing to more value-based pricing. Both packers and feeders mentioned this issue frequently. Third was an issue addressed more often by feeders than packers. That was the need for more complete and better market information. Much of the information mentioned related to short-term, week-to-week market supplies and packer demand positions, especially related to captive supply purchases. The other most-mentioned type of information related to more and better reporting of prices for boxed beef. Those interviewed did not use the term asymmetry, but the discrepancy in access to information between packers and feeders is a real concern.

Considerable variation surfaced regarding price discovery solutions and other solutions to related beef industry woes in recent years. Many solutions pertained to more and better market information, more objective measures of beef quality (as defined by tenderness or eating experience), and closer ties between feeders and packers to reduce the adversarial relationship that exists currently. Variation became especially apparent when questions were raised about who should lead in making appropriate changes. In some cases, feeders were mentioned as the obvious leaders for change. In other cases, packers were identified.

Some differences of opinion related to position in the industry (packer or feeder), some to geographic location (southern plains vs. northern plains), and some to size (smaller vs. larger firms, feeders or packers). However, nearly always, exceptions arose, thus highlighting perhaps the most notable difference among those interviewed, i.e., management and management philosophy. For example, large or small feeders might differ on the future of alliances, or large or small packers might differ on the need to privatize quality grading. How management viewed the problem influenced their potential solution and their role in reaching the solution.

One thread seemed to tie much of the discussions together. *Economics will dictate where the beef industry goes and how it gets there.* Economics will ultimately determine what beef's market share will be in 2005 and 2010. Economics will dictate how important public grades and grading will be and whether consumer brands for fresh beef become common. Economics will affect how much influence alliances will have and whether most cattle are marketed by some value-based pricing system. Economics will drive changes in market information and futures markets. Some of those interviewed explicitly mentioned the influence economics will have, others alluded to it.

Six price discovery issues which surfaced frequently are listed below. These issues are discussed in more detail in later sections.

(1) *More accurate, less subjective measurements of beef quality are needed.*

Most cattle feeders and packers alike felt that any movement to less subjective grading would be beneficial. Cattle producers located in the northern regions felt that regional biases in cattle quality grading increase the need to develop less subjective grading systems. Regional grading biases were echoed by several beef packers. Many participants generally agreed that third party quality grading was essential. However, larger packers felt that they could quickly adjust to elimination of federal quality grading. A consensus felt that mechanized, objective quality grading is preferable to current, subjective quality grading.

Several cattle feeders and packers indicated that there is a large market for lower-quality cheaper beef products and that the entire industry should not necessarily be encouraged to produce the same high-quality, high-priced products. These participants felt that having only high quality, high priced beef would price some consumers out of the market and reduce the overall demand for beef. The issue is that these lower quality beef products need to be accurately identified and targeted to the appropriate markets and lower prices paid for these animals at the time they are marketed. The problem was described as not so much one of excessively bad beef quality, but one of inaccurate and inconsistent identification and sorting of higher versus lower quality beef.



Many also voiced considerable concerns regarding predictability of red meat yields. Boxed beef yields from the same quality and yield grade of carcasses vary considerably and current technology does not accurately estimate boxed beef yields. Technological developments including video imaging and others seem to have the most promise in this regard in the near future.

- (2) *Price premiums and discounts for fed cattle do not adequately reflect cattle value differences.*

Cattle feeders with small operations located in areas with access to higher quality, more uniform cattle (e.g., Nebraska) had strong sentiments regarding this issue. They felt that the way to receive prices that reflect value was to sell cattle on a grade and yield, dressed weight basis. As a result, a large percentage of cattle in this area are sold on a dressed weight basis. However, in areas with less uniform cattle, large custom cattle feeders tend to be less concerned about their selling cattle on averages as they have significant incentives to do so. Large cattle feeding operations that feed large numbers of their own cattle varied in their opinion on this issue depending upon their management strategy. Cattle feeders striving to be low-cost cattle feeders tended to be less concerned about price differentials and more willing to sell cattle on averages than those attempting to target their cattle to specific markets.

Another way cattle feeders more closely tie cattle price to quality was through development of vertical alliances. Some cattle feeders felt that if they could develop vertical alliances with cattle of known genetic bases, they could brand market beef from these cattle to higher-value markets and secure part of the premium themselves. Longer-term alliances were viewed as a way to accomplish this. Here again, some larger feeding operations that tended to be volume-driven were less interested in developing such arrangements.

Most beef packers interviewed felt that buying cattle on averages was detrimental to the industry. All packers indicated a willingness to buy cattle based on quality. Buying cattle based on dressed weight seemed to be more prominent than grade and yield. Packers felt more cattle would move away from being bought on a live basis, i.e., on averages, over time but it would be slow to happen because of some cattle feeders' resistance to change.

- (3) *Inadequate market information inhibits efficient price discovery.*

Almost every cattle feeder interviewed, many of the beef packers, and even retailers indicated needs for increased and more reliable market information. Of course, different individuals and firms stressed different needs. Cattle feeders felt more information was needed on short-run week-to-week supply and demand conditions. In particular, they wanted more information regarding formula and contract cattle being delivered to packers.

Many of the industry participants across different sectors indicated a need for better price reporting of wholesale boxed beef products. They felt current price reports were not representative of boxed trade primarily because of insufficient volume of trade sampled, especially close-trim products. Recommendations included using less than carlot prices to increase the volume of trade and increased efforts on capturing more of the total boxed beef trade in price reports.

Inadequacy of public retail price reporting received even greater concerns by those who need this information. Concerns included the need for volume-weighting retail prices to reflect actual

trade rather than just published prices, and a desire that retail specials be better reflected in retail price reports.

(4) *Live cattle futures basis risk is excessive.*

Some cattle feeders felt live cattle futures basis risk has become excessive since contract specification changes were made starting with the June 1995 contract. They indicated problems with the delivery process for the live cattle contract, especially for cattle that do not meet contract specifications. Stipulated discounts for cattle not meeting specifications are not market determined which cause divergence of futures and cash prices at times. These participants advocated cash settlement of live cattle futures.

Concerns regarding live cattle futures tended to be regional. Cattle feeders in the northern states were generally less concerned than cattle feeders located in Texas and Kansas. This may be in part because of differences in quality distributions of cattle fed in northern states relative to the south. Many cattle fed in the north may fit futures contract quality specifications more closely.

(5) *Formula pricing arrangements adversely affect cash fed cattle markets.*

Cattle feeders who do not participate in formula marketing agreements had strong sentiments against such agreements. This was true regardless of feedlot operation size. These feeders voiced considerable concerns that existence of formula pricing arrangements made it difficult for them to discern fed cattle supply and demand on a week-to-week basis. As a result, they indicated that this contributes to panic selling of fed cattle by cattle feeders who have limited access to this information. Some of these cattle feeders called for a need for weekly information on how many cattle each packing plant had secured for delivery under formula. Some cattle feeders indicated that when formula cattle deliveries were at high levels, certain packing firms did not bid for cattle in the cash market and they felt this depressed live prices.

Cattle feeders involved in formula marketing agreements generally had much different perspectives than their counterparts who did not participate in such agreements. These cattle feeders marketing via formulas indicated that formula pricing taught them more about advantages of sorting cattle, including sorting several times prior to marketing. They indicated formula prices better reflect true value and eliminate pricing on averages. They felt that pricing fed cattle on formulas helped them improve their feeder cattle purchasing strategies. Some participants in formulas voiced concerns that if only better quality cattle are sold on formula, and the formula price is based on live cattle cash market trade, then poorer quality cattle are establishing the base price for better quality cattle.

(6) *Group marketing of fed cattle may offer solutions to some price discovery problems*

Cattle feeders who had smaller operations, especially those not located in strategic locations relative to several competing packing plants, felt that group marketing efforts could help reduce some of the problems associated with fed cattle price discovery. Some perceived countervailing the power of large packers as one potential benefit of joint cattle feeder marketing. Generally, large feeding operations had less enthusiasm regarding these arrangements. Many felt that group fed cattle marketing efforts would fail because nothing would bind participants to the group and actual benefits may not be as large as some organizers perceive.

Packers tended to be less excited about group marketing efforts. Several issues they felt important to consider included the fact that group marketing would not solve the problems associated with pricing on averages for the industry as a whole. They voiced concern that cattle producers need to be cautious about getting tied into group marketing efforts that promise big returns by branding beef products and owning them all the way to retail. They felt that considerable capital, infrastructure, and marketing expertise is needed to develop and sustain this kind of effort.

### **Consensus Opinion**

If there was a consensus opinion among those interviewed, it was that cattle prices need to be more closely tied to red meat yield and eating quality of the meat. The first step in improving these aspects of meat pricing is to find ways to more accurately predict these attributes. A number of technological developments are being explored to improve the accuracy of meat yield and quality prediction. As these are developed and become commercially feasible, it would appear that changes are imminent in cattle production management, marketing, and pricing, as well as beef processing, preparation, and merchandising.

### **Assessing Beef Quality**

Accurate determination of slaughter cattle value is essential to coordinate the beef marketing system. Price is the single most important signal to encourage production of beef products demanded by consumers. Price incentives must be present for producers and processors to react to and target production and marketing management decisions. In order for the pricing system to provide appropriate signals to producers, accurate measurements of desired beef quality attributes are necessary. Inadequate measures of beef quality and lack of pricing cattle according to their wholesale values have caused considerable consternation in the beef industry for a long time.

The top five ranked quality concerns regarding beef identified from surveys of beef purveyors, packers, restaurateurs, and retailers in the 1995 National Beef Quality Audit (Smith *et al.* 1995, p. 3), were:

- (1) low overall uniformity and consistency;
- (2) inadequate tenderness;
- (3) low overall palatability;
- (4) excessive external fat; and
- (5) beef's price is too high for the value received.

These are not new problems to the beef industry. In fact, most of these same problems were among the top 10 concerns determined from surveys conducted during the 1991 National Beef Quality Audit (Smith *et al.* 1992). These problems are all related to determining and paying for the value of fed cattle. This section examines problems regarding how value of fed cattle has been determined and explores probable changes in the future.

Solving problems related to beef quality and consistency first requires the ability to measure the magnitude of the particular problems and then distinguish among cattle possessing different

levels of the desired traits. Second, different prices reflecting value differences need to be paid for beef possessing varying levels of these traits.

This and the next sections address:

- (1) accurately measuring or determining beef quality, and
- (2) paying prices for fed cattle consistent with measured quality differences.

These are two of the most important issues facing the beef industry over the next decade. Progress in these areas is imperative for the beef industry to be competitive in the meat sector in the future.

### **Brief History of Grades**

Traditionally, federal quality grades have been used to categorize beef quality. Measuring fed cattle quality has been an important and often emotion-laden issue in the U.S. beef industry for more than a century. In 1878 the Illinois State Board of Agriculture instituted the first Fat Stock Show in which cattle were judged for their merit. The best steer was "...a grade Shorthorn, three years and seven months old, that weighed 2,185 pounds. The steer was nearly the model of perfection for a choice butcher's bullock, that of an oblong square" (Whitaker 1975, p. 103). At that time, official quality standards had not been developed and controversy surrounded these shows as owners and promoters of different cattle breeds jostled for the limelight. In 1918, although no official federal grades were published, the USDA adopted beef quality grades for market price reporting purposes (McCoy 1979).

Considerable concern was present during the 1920s that some retailers were deceptively misrepresenting beef quality to consumers and this was considered harmful to the industry. This and other concerns with regards to meat quality led to development of official voluntary federal quality grades in 1927, despite beef packer resistance to federal grades (Rhodes 1960). The use of grading started slowly and only the top two grades, Prime and Choice, were used much. Interestingly, government grading enticed Swift, the largest beef packer, to initiate private branding and within a year the four largest packers were private branding beef whereas smaller packers preferred USDA grades (Rhodes 1960).

The first published federal slaughter cattle grades in 1927 established quality grade nomenclature similar to that used today. The original federal quality grade standards were (highest to lowest quality): Prime, Choice, Good, Medium, Common, Cutter, and Low Cutter (McCoy 1979). This compares with today's beef carcass grades: Prime, Choice, Select, Standard, Commercial, Utility, and Cutter. Over the years, 14 official modifications have been made to the federal slaughter cattle quality grades (Smith, G.C. 1997). Sometimes, relatively small changes have had significant impacts. An example is the 1987 change in name of the Good quality grade category to Select. Following the name change, the percentage of beef graded Select increased from 9% in 1990 to approximately 25% in 1995. The most recent change in federal beef quality grades is the removal of B-maturity cattle having small or slight marbling from consideration in the Choice and Select quality grades beginning January 1997.

Some lessons can be learned from beef grading history. First, controversy has and likely will always surround subjectively determined quality grading. Generally, changes made to grading

standards have non-neutral impacts on market participants. Those negatively impacted by a grade change often drag their feet or launch strong lobbying efforts against proposed changes. This was apparent in the recent changes regarding B-maturity cattle. What could be considered a relatively minor change for the market as a whole generated considerable controversy among several factions of the beef industry. Second, changes in the grading system should not be taken lightly. Changes in grades may impact the market system in a number of ways. Such was the case with the introduction of grades in the 1920s where packers quickly developed their own brand grades following the introduction of federal grading standards. Likewise, simple name changes made in 1987 appear to have had significant impacts on quality grade usage, although other factors likely contributed to this surge in quality grading. Because different factions are affected differently, making changes to federal beef grades will continue to be a painstaking, expensive, and slow process.

### **Lingering Problems**

Since their inception, concern has existed about whether federal beef quality grades accurately measure quality and therefore, value. Beef quality grades are correlated with consumer meat palatability ratings. Smith *et al.* (1987) studied palatability of 1,005 loin steaks with several different quality grades and concluded that Prime, Choice, Select, and Standard steaks had 5.6%, 10.8%, 26.4%, and 59.1% respectively, undesirable overall palatability ratings. However, Wheeler *et al.* (1994, p. 3150) concluded that beef “.. marbling explained at most 5% of the variation in palatability traits.” They further suggested that “USDA quality grade does not sufficiently segregate carcasses for palatability differences, and thus a direct measure of meat tenderness is needed to supplement USDA quality grade.” The top five concerns identified in the 1995 National Beef Quality Audit suggest the current beef grading system inadequately identifies uniformity, consistency, tenderness, and palatability.

The problem of measuring beef tenderness and palatability is an on-going struggle. Aging of beef has long been recognized as one way to increase tenderness. However, this does not necessarily solve the tenderness problem because it only improves tenderness (a tough steak will still be tough after aging, just less tough than before) and does not separate steaks according to tenderness levels. In addition, aging may not be feasible for many reasons including requiring vacuum packing or other means to ensure freshness during the 14-day aging period as well as costs associated with storage.

In surveys of industry participants, the large majority of individuals or firms surveyed indicated that the current federal beef quality grading system is too subjective. Some packing firms indicated that they had split loads and sent them to different plants and observed significant differences (as much as 25%) in quality grades at two or more different plants. Several industry participants felt that USDA beef quality graders located at packing plants in the south had upward biased grades because of generally lower average quality cattle in the region. Others felt the problems of grading inaccuracy were more random in nature, but were subject to human judgement error. There was general agreement that the current system's subjectivity was a problem that needs to be addressed.

The evidence suggests that the USDA quality grade is not adequately performing its desired role. That is, although the grade is related to overall palatability, variance among eating experiences



is great enough within and across each quality grade to have significant probabilities of undesirable eating experiences. In addition, marbling has not been a good predictor of beef tenderness or palatability. Finally, the subjectiveness of the current beef quality grading system has raised serious concerns about its ability to accurately discern quality. Thus, it is time to examine what can be or even should be done to remedy this problem.

### Possible Solutions

Many cattle feeders indicated that they felt that their role in influencing beef quality was limited to sorting for weight and perhaps color or breed, finishing for projected Choice quality grade, and managing cattle so as not to induce dark cutters. Koohmaraie *et al.* (1996) agreed and indicated that to increase the probability of tenderness, the producer should obtain the best genetics and follow sound management during growth, slaughter, and processing of carcasses. However, Koohmaraie *et al.* cautioned that although breed is related to tenderness, breed alone does not ensure tenderness. In fact, variation of tenderness and palatability *within* breeds is greater than variability *across* breeds. This is important because some producer alliances with the goal of targeting beef to specific markets demanding particular quality attributes will likely find success elusive if they rely predominantly on current beef quality grades, cattle breeds, and genetics to ensure tenderness and consistency of their products. Producers may also need to employ some type of tenderness testing.

Koohmaraie *et al.* (1993 and 1996) have developed a beef processing system that could be used to ensure tenderness. Their system amounts to conducting a Warner-Bratzler shear force test on each carcass. They indicated (Koohmaraie *et al.* 1996 p. 4):

“Ideally we would like to be able to measure (predict) meat tenderness with a rapid, automated, tamper-proof, noninvasive, accurate instrument. None of ..[the current].. technologies have successfully predicted meat tenderness because these technologies are all based on indirect measurements that are not capable of sensing the subtle changes in raw meat that are responsible for variation in cooked meat tenderness.”

They further suggested that steaks found not to be tender could be chemically tenderized using Calcium-Activated Tenderization which consists of injection-marinating cuts of meat with calcium chloride. A similar process is already being used on some retail fresh pork products.

Assurance of beef tenderness would go a long way towards solving quality problems in the beef industry. Consumers have demonstrated a willingness to pay for tender steaks (Boleman *et al.* 1996). Therefore, if feasible quality identification processes can be developed, there is an opportunity to recover these costs.

In addition to problems in measuring beef quality, difficulty in predicting red meat yields from live cattle or even from carcasses presents a significant obstacle. Projecting primal weights using carcass information is essential if producers are going to be paid for value differences. If red meat yields cannot be accurately predicted on a carcass-by-carcass basis, packers face risks of primal yield variability which increases their costs and leads to lower prices for fed cattle. To solve this problem, meat yields either need to be projected from carcass traits by further development of technologies such as video imaging, or identity preserving technology needs to be developed that

can effectively track primal cuts from carcasses through fabrication. Improvement in projecting meat yields from carcasses would reduce packers' yield risks thereby increasing fed cattle prices. In addition, video imaging can be used to digitize marbling which would provide information that could help reduce grading subjectivity. Video imaging technology is scheduled to be employed in some commercial beef packing plants in Canada during the spring of 1997. This will provide a test for the commercial feasibility of this technology and provide a measure of its benefits relative to costs.

Tracking primal cuts through fabrication is superior to video imaging for yield projections since yield prediction errors are eliminated and additional information important for retail yield and perhaps food safety could be retained from each carcass. However, individual meat cut tracking technology is further from being commercially feasible than technology such as video imaging.

### **Merchandising Meat of Varying Quality**

Several packers and feedyards surveyed were leery about categorizing meat according to tenderness because they felt that no one would want to purchase steaks in the least tender categories. Obviously, consumers are not likely to be willing to pay much for steaks they know are tough. Koohmaraie *et al.* (1996) recommended using mechanical tenderization for the least tender steaks to ensure tenderness. More importantly, this suggests that processors need to better target steaks of particular quality to different markets. For example, the most tender steaks may be targeted specifically to more selective food service markets such as high-quality white tablecloth restaurants. Less tender and/or chemically-tenderized steaks may be targeted to lower-priced meat market outlets that are significant markets for lower-quality beef, such as lower-priced steakhouses.

Targeting meat products to specific consumer demands requires careful meat sorting and identification in beef packing plants. Increased costs of additional sorting would need to be offset by higher prices for higher quality meat products. "Guaranteed tender" beef cuts would probably be more expensive than current beef cuts. More research is needed on the willingness of consumers to pay for guaranteed tender steaks. The beef industry needs to move more toward producing products specifically targeted for segments of consumers with specific demands. Without better matching of beef products to consumer demands, the industry will continue to face a weakening demand for beef.

### **Future of Federal Grading**

In addition to discussion regarding whether current USDA quality grades adequately measure quality differences, there has also been discussion about whether to even have USDA federal beef quality grading. Cox *et al.* (1990), in a survey of 306 consumers who purchased beef, concluded that consumers were confused regarding the information provided by USDA and housebrand beef grades. Many consumers who thought they were purchasing lower-fat content beef actually purchased Choice and many who thought they bought Choice actually purchased ungraded housebrands (which were likely Select grade or lower). Thus, there is some question regarding the amount of information consumers discern from quality grades.

Some have advocated transferring government beef quality grading to the private sector. They believe the current grading system hinders development of branded beef products (Smith, R.



1996). Others contend that third-party unbiased quality beef grading is essential, citing numerous reasons in support of government grading (e.g., Ensminger 1996). In addition, the branded beef products that have been developed (e.g., Certified Angus Beef and others) use the USDA federal beef quality grade as one important part of their specifications which provides information describing the product.

Individuals visited with in our interviews were somewhat split on this issue. Many felt that despite problems with the current federal grading system, it is the best we have to monitor quality and should be maintained. They also argued that USDA quality grading is entirely voluntary and therefore could not be constraining the industry's movement to branding products. There was widespread agreement that the primary constraint is predictable consistency of eating quality of beef products. Proponents of federal grades felt that a third independent party involved in quality grading was essential to preserve grade integrity. Most of these individuals felt that less subjectivity in grading such as mechanical grading would be better than the current methods used if accurate, reliable, and economically feasible mechanical grading systems could be developed.

A minority of those interviewed favored discontinuing federal beef quality grading. They felt that federal grading was somewhat of a hindrance to development of branded beef products. Most of the proponents of quality grades felt that discontinuing grades could be harmful to segments of the beef sector, particularly the export market.

A surprising number of individuals/firms were somewhat complacent about keeping or discontinuing federal beef quality grades. Those holding this position indicated that their business would not be adversely affected appreciably if federal quality grades were discontinued. They felt that other means of describing quality would quickly replace the USDA system.

Interestingly, a majority of the feeders, packers, and retailers we interviewed, including both opponents and proponents of the current system, felt that federal beef grades would gradually be of less and less importance to the industry in the future. They believe that the federal beef quality grades will be replaced by branded beef products targeted to specific markets over the next 5 to 10 years. This general sense was consistent with expectations regarding increased vertical alliances over time to better control and ensure product quality and consistency. That is, alliances allow for more opportunity to control quality and therefore develop branded products which can substitute for federal quality grades. Of course, branded products generally use federal quality grades as one of their quality specification standards. Thus, federal quality grades can be complementary to the development of branded beef products, not hindrances.

A few of those interviewed felt that extensive beef product branding was far from being profitable because of difficulties associated with differentiating fresh beef products and a lack of capital necessary to establish a national brand name. They also cited a lack of networks to assist local retailers with product merchandising. In addition, some felt that if fresh beef products could be differentiated, this would have to occur through supply sourcing and alliances which could only differentiate part of the product and would have to compete in the large volume commodity trade (e.g., roasts, hamburger, etc.) with the rest of their product. The concern was whether such strategies could be accomplished at a low enough cost relative to possible premiums that may or may not exist in the retail meat trade.

Some have suggested that the beef quality grading system in Canada may provide a useful model for the U.S. Canadian beef quality grading was privatized, beginning in April 1996. The privatization involved moving administration of beef quality grades out of Agriculture Canada to a private non-profit corporation, Canadian Beef Grading Agency. This agency administers grading using the same grading standards that were used by Agriculture Canada federal graders (i.e., the changes were in administration and not in quality standards). The process used to modify grade standards remained unchanged under this new administration (which is a process including introduction of proposed changes by a consultative committee made up of a broad set of industry and consumer representatives and placing changes up for public comment--much as is done in the U.S.). As a result, beef grading in Canada relies on quality grades with subjective standards not dramatically different from those in the U.S.

The primary motivation for moving the Canadian federal grading administration to a private agency was to reduce federal government costs. The number of graders were reduced and grading accuracy improved. Strong sentiments are still present in Canada to have an independent third party administer grades. Pork grading in Canada is completely mechanized and the packing plants own the equipment that does the grading. However, an independent third party monitors the integrity of the grading equipment.

### **Quality Assessment Summary**

Consumers have indicated a willingness to pay more for consistent high quality beef. Therefore, packers or processors that can efficiently identify beef quality more accurately than current USDA quality standards may be able to brand beef products to capture greater premiums. Federal beef quality grades still have a role in identifying particular quality attributes. However, current quality grading methods need to be reexamined as they are too subjective and they do not accurately predict consistent eating quality. As the industry moves more toward targeted beef products, with particular product specifications including trim, tenderness, etc., USDA grades may become less important than other quality attributes.

If long term agreements between retailers and/or food institutions are desired, it may be necessary to develop vertical alliances together with improved quality monitoring. This is because in order to meet long-term demands, contractual arrangements may be necessary between various segments of the industry to better ensure the quality of product demanded.

### **Pricing to Value**

As discussed in the previous section, considerable effort is being invested in improving our ability to identify and control beef quality. However, in conjunction with technological advancements in quality identification, fundamental changes are needed in the way fed cattle are priced. Changes are occurring and both feeders and packers interviewed expect further changes. This section discusses the nature of the problem and examines attempts by some to overcome price discovery problems by forming exclusive marketing agreements and strategic alliances and pricing fed cattle by formulas and grids.

### Pricing on Averages

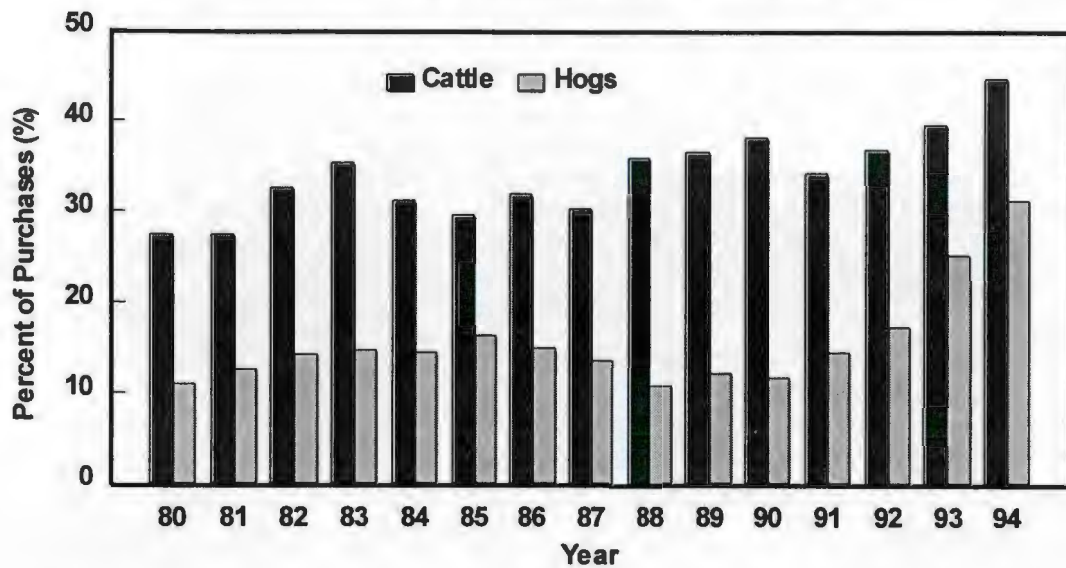
Fed cattle pricing has been based predominantly on a live weight basis, though Packers and Stockyards Administration data (GIPSA) indicate carcass weight or dressed weight pricing has trended up since 1980 (Figure 1). Recent research found the percentage of fed cattle priced on a carcass basis varies considerably among the major cattle feeding states (Figure 2), from 65.9 % in Nebraska to just 14.1 % in Texas (TAMRC 1996). Research in the 1960s clearly showed that pricing accuracy, i.e., how closely fed cattle prices reflect actual wholesale values, increases when fed cattle are priced on a carcass weight or dressed weight basis compared with live weight pricing (Stout and Thomas 1970). Research in the 1990s reached the same conclusion (Feuz, Fausti, and Wagner 1993). Pricing accuracy increases as cattle pricing moves from live weight, to dressed weight, to dressed weight and grade.

Cattle feeders have long complained that most fed cattle are bought "on the average." This implies both an average price and an average quality. They assert that higher quality cattle are paid the same price as lower quality cattle. Research shows that not to be the case (Ward 1981; Jones *et al.* 1992; Schroeder *et al.* 1993; Ward 1992; Ward, Koontz, and Schroeder 1996). Packers pay higher prices for pens of cattle with a higher percentage of Choice or Prime quality grade and a higher percentage of yield grade 1-3 cattle. However, Jones *et al.* (1992) found that differences in live weight transaction prices paid for fed cattle in western Kansas during 1990 reflected only about 25 % of estimated wholesale value differences. While price differences exist for cattle of varying qualities, price differences do not fully represent value differences at the wholesale level. And typically, price differences can only be detected by extensive statistical analyses. Therefore, price signals are not being sent clearly from packers to feeders. Most packers and feeders we interviewed agreed that buying cattle on averages is bad for the industry and that it does not send needed price signals to producers.

Price discovery needs include pricing fed cattle to more closely reflect wholesale value. Value based marketing and value based pricing are concepts meant to link price and value more directly. The direction needs to move from marketing a showlist at one price, to marketing each pen of cattle at a different price, to marketing each animal at a different price, i.e., a price reflecting its true value.

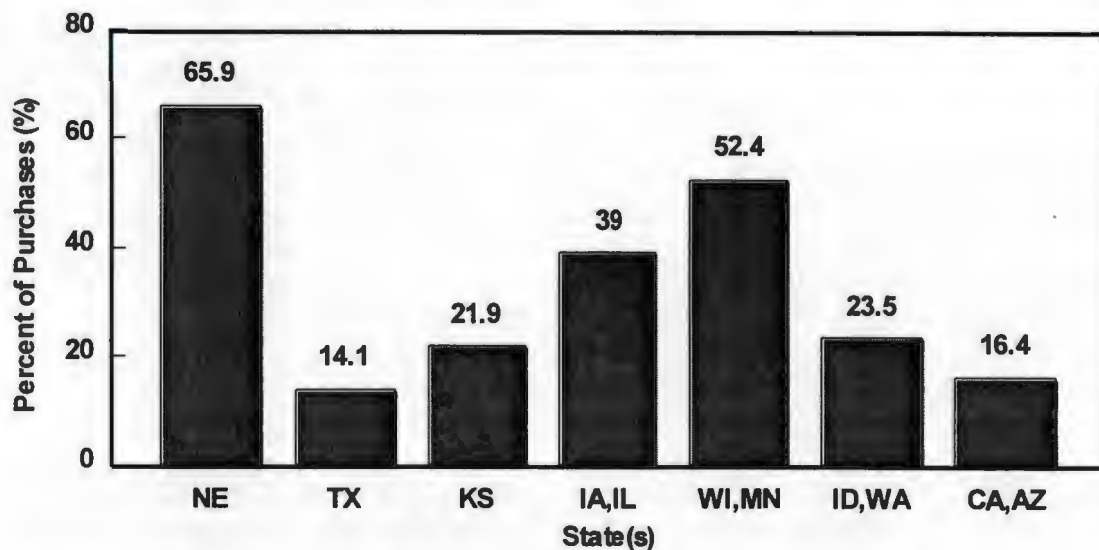
Value based marketing is a stated goal of the beef industry (Value Based Marketing Task Force), but achieving it is difficult. There are economic incentives in place today and have been for some time to trade cattle on averages. Many feedyards sell a large number of their own cattle with a quality distribution roughly equal to the distribution of all cattle in the region offered for sale that day. The typical packer also buys large numbers of cattle in that area that day. Both the packer and the feedlot gain by grouping cattle into one large lot and pricing them at the average price for the day. The feedlot benefits by not having to search for buyers and not having to separately determine asking prices and negotiate a price for each pen of cattle. The packer benefits by getting a large number of cattle, perhaps a significant percentage of its daily slaughter needs, from one location in a short period of time. This is a simple fact regarding transactions costs. In this situation, both the packer and the feeder benefit. In the end, the feedlot gets the same average price and the packer pays the same average price. Thus, feedlots have incentives to sell and packers have incentives to buy on averages in certain circumstances.

**Figure 1. Percentage of Slaughter Cattle and Hog Purchases on a Carcass Basis, 1980-94.**



Source: GIPSA, USDA

**Figure 2. Percentage of Slaughter Cattle Purchases on a Carcass Weight Basis (Excluding Formulas), by State, April 1992-April 1993.**



Source: Texas Ag. Mkt. Res. Cntr., Texas A&M



This argument changes if cattle in the feedlot are not all owned by the same individual. In this case, significant welfare losses occur to owners of high quality cattle who subsidize owners of poor quality cattle when both are combined in the same sale lot. But even in this case, the feedlot manager has incentives to sell a large group of cattle on the average and the packer still has the same incentive to buy them in this manner. Consider a custom feedlot manager's situation. The manager can sell cattle owned by several owners at the same price and tell each owner that their cattle received the "market price" for that day or week. Such economic incentives help explain why carcass-based cattle pricing is more popular in areas like Nebraska with smaller feedyards, often marketing their own cattle or cattle in retained ownership programs. These feeders have more control over the type of cattle they feed relative to larger custom feeding areas and larger feedlots such as in Texas and Kansas. Cattle feeders have more incentive to price cattle closer to true value when they benefit directly if their cattle are higher quality. Several feeders indicated that "northern" feeders are more willing to market on a carcass weight basis because they have better cattle, and research supports the observation that quality differs by region (TAMRC 1996).

Another incentive for pricing on averages was raised by packers. Whenever packers pay more for a pen of live cattle because some cattle are of higher quality, cattle feeders perceive the higher price as the new market price level and adjust their asking prices upwards accordingly. Thus, if packers can buy higher quality cattle without paying a higher price, they will. Current trading practices provide an incentive for feedyards and packers to trade cattle without reporting prices on the transaction. In this way the feedlot may get a premium for the whole showlist or, perhaps, just the pens of better quality cattle. The packer may be more willing to pay a premium, knowing the higher price will not be reported, thus not raising the market price for other cash market cattle.

For some large feedyards which own their own cattle, incentives to sell on averages may be large enough that no change is likely to occur. These feeders may be as volume driven and cost oriented as large packers. They may feed average or below-average cattle and not want to be paid according to true cattle quality. On the contrary, other large feedyards have provided the leadership to begin moving away from pricing on averages and toward value-based marketing. The distinction is not larger vs. smaller feedlots or feedlots with predominantly company-owned vs. custom fed cattle. The difference is management and management philosophy. Feeders and packers agreed; the industry needs to move toward pricing fed cattle according to value. Cattle owners with high quality cattle need to insist that they not subsidize prices for someone else's inferior cattle. Essentially, the only way to resolve this is for the cattle owner to insist that cattle are sold on a carcass basis with discounts and premiums reflecting yield and quality differentials.

### **Marketing Agreements and Alliances**

Several efforts have been made to move toward value based marketing and pricing. Among them are exclusive marketing agreements, strategic alliances, formula pricing, and grid pricing. One of the first and largest exclusive marketing agreements was formed in the late 1980s by Cactus Feeders and IBP. While different in many details, the Cactus-IBP agreement had some general characteristics similar to a profit-sharing joint venture between IBP and a cooperative of large cattle feeders in the Pacific Northwest in the mid-1970s. Both arrangements were controversial then and remain so today.

The Cactus-IBP agreement deviated from the common practice of negotiating with packers for each pen or showlist of cattle and all sales were on a carcass merit basis. Several other similar arrangements followed over the next few years. Essentially these exclusive marketing agreements are long-term, full-supply contracts. While described here as long-term contracts, they may be ended by either party with relatively short notice. They are long-term in the sense they are on-going, revolving contracts, rather than a contract for each pen or each showlist of cattle traded each week. Cattle feeders agree to provide cattle on a regular basis to a packer with price based on some type of formula arrangement. The formulas may specify an acceptable quality range of cattle, e.g., yield, quality grade, yield grade, and carcass weight, with provisions for cattle not fitting the specification range. The agreement details which party is responsible for determining the timing of deliveries to the packing plant. Feeders indicated that they usually specify the delivery week or day which means packers schedule other deliveries around the marketing agreement cattle.

The first feeder-packer arrangements were called marketing agreements. Cattle traded in these arrangements became known as marketing agreement cattle. Sometime later the terms strategic alliances, alliances, and partnerships came into vogue and the pricing method in marketing agreements was termed formula pricing or grid pricing. Exact distinctions between the terms are unclear and several variations are found. Marketing agreements and alliances are variations of contract integration. The strategic alliance project managed by the National Cattlemen's Association in the early 1990s (National Cattlemen's Association 1993) contributed to the use of the terms strategic alliances and alliances. Benefits from early marketing agreements and alliances contributed to their growth in the 1990s.

Sartwelle (1996) quotes the definition of an alliance from Webster's dictionary, "an association to further the common interests of the members." That states succinctly the intent of *most* marketing agreements and alliances. Exceptions will be noted later. Sartwelle categorizes several alliances into four types:

- (1) Breed association-sponsored carcass alliances, such as Certified Angus Beef;
- (2) Commercial beef carcass alliances, such as Farmland Supreme Beef Alliance;
- (3) Natural/implant-free carcass alliances, such as Coleman's Natural Meats; and
- (4) Other vertically oriented cattle and beef marketing programs, such as U.S. Premium Beef.

Some types of these alliances preceded the exclusive marketing agreements and NCA-sponsored alliance project mentioned above.

Several incentives can be identified for forming or participating in exclusive marketing agreements or alliances. Nearly all relate to moving toward value based pricing, improving the price signaling function between stages in the vertical production, processing, distribution channel, overcoming problems associated with and related to pricing on averages, and reducing the adversarial relationship between feeders and packers. Nearly all, therefore, are attempts to improve one or more aspects of price discovery.

Nearly all marketing agreements and alliances involve pricing fed cattle on carcass characteristics. This is a clear attempt to better link prices and quality by rewarding better cattle and penalizing poorer cattle. Certainly this is in accordance with both older and more recent economics



research (Stout and Thomas 1970; Feuz, Fausti, and Wagner 1993). Nearly all involve sharing information not typically shared in cash market transactions on a live weight basis. Packers return slaughter summaries or kill sheets to feedlots so feeders learn how their cattle performed on the rail.

Most base prices are computed on a weekly average, thus reducing the risk associated with pricing cattle on a specific day. Fed cattle prices exhibit distinct and significant within-week variability, but the high-price or low-price day of the week varies (Schroeder et al. 1993; Ward 1992; Ward, Koontz, and Schroeder 1996). Using weekly average prices removes the risk of day-to-day price fluctuations for feeders and packers. Marketing agreements and alliances eliminate the frustration expressed by feeders and packers with the "45-minute" trading week. Trades are arranged in advance of putting cattle on a showlist. Prices are discovered by formula without the time costs of negotiating fed cattle prices with packers.

Marketing agreements and alliances specify that fed cattle will be marketed to a specific packer, and possibly a specific plant. Market access is guaranteed in advance. Feeders reduce the concern expressed by some that packers will have their entire week's slaughter scheduled with captive supply cattle and will not be able to slaughter their cattle when the cattle are ready. Frequently, cattle feeders determine the day or week cattle will be delivered, giving them more control over deliveries and the terminal feeding date than in cash market trades.

### **Formula Pricing and Price Grids**

Value-based pricing, given current technology, requires pricing fed cattle on carcass traits, not live animal characteristics. Value-based pricing requires fed cattle to be priced on a carcass merit basis. Resistance to pricing on a carcass merit basis is not new. Meyer and Lang (1981) found that limited use of carcass-based marketing was due to cattle feeders' rather than packers' decisions. While several reasons were stated for nonuse of carcass merit pricing, many are judged to be symptoms rather than causes. Most resistance stems from a distrust of packers by cattle feeders. There have been concerns expressed that packers will mix cattle and pay feeders for someone else's lower quality cattle. Some are concerned that packers will not accurately measure carcass weights, and that USDA graders will not accurately determine quality and yield grades. These issues need to be resolved. Several persons interviewed said the adversarial attitude between cattle feeders and packers may be one of the biggest hindrances to progress faced by the beef industry. Meyer and Lang (1981) indicated one answer was education. Education certainly would help. Other alternatives are possible and are likely needed. Cattle feeder organizations could hire someone to be in the plants to check on packers, assuming cattlemen would rather hire someone than trust USDA regulatory agencies to do the same sort of checking.

Problems are also viewed as opportunities by creative, innovative businessmen and leaders. Thus, on the reverse side of the adversarial issue, there are opportunities for progress by feedlots and packers who choose to work together. In our interviews, cattle feeders and packers who developed mutual trust were working toward problem solutions and more toward value-based pricing than others who seemed disgruntled with each other and were pessimistic about the overall prospects for the beef industry. More progressive, and perhaps more successful feeders, saw packers as their customers, not competitors.

Most marketing agreements and alliances involve formula pricing and since most price cattle on a carcass weight basis, most are variations of a grid pricing system. Formulas need not be grid based, though grid pricing is usually a formula in the sense that the final price is only discovered after animals have been slaughtered. The pricing formula in most marketing agreements and alliances consists of a base price with specified premiums and discounts for carcasses above and below the base or standard quality specifications.

Packers comment that they have been buying cattle with grids for 20 years or more. In a sense they have, but in other ways they have not. Purchase orders have been given from the corporate or head buyer to field buyers on a carcass weight basis for years (Ward 1979). Buyers were told how much to discount various cattle with estimated carcass characteristics, i.e., Select (formerly Good), yield grade 4-5, and heavy carcasses. In that sense, packers have had a grid system for decades. But there are distinct differences today. The so-called grids of 20 years ago were internal to the packer and used internally to arrive at live weight bid prices. The grids contained discounts for poorer quality carcass attributes, but few premiums for desirable characteristics. Today, grids are more balanced in that they contain premiums for desirable carcass traits and discounts for undesirable traits. However, some feeders still feel the discounts are excessive and the premiums minimal. Grids are also more public today. More grids have a carcass weight base price and more involve assigning premiums and discounts to individual carcasses rather than estimates of carcass characteristics when the cattle are still alive.

Several base prices were mentioned in our interviews. One was the average price of cattle purchased by the plant where the marketing agreement cattle were scheduled to be slaughtered. The average cost of cattle purchased might be for the week prior to or the week of slaughter. Other base prices were specific market reports, e.g., highest reported price for a specific geographic market for the week prior to or week of slaughter. One base price was tied to a reported price for the live cattle futures market price. In some cases the base price was a negotiated price. Some base prices were stated on a carcass weight basis. Others were on a live weight basis, but based on actual yields of the cattle slaughtered. Many feeders expressed a preference for live weight quotes, based on their familiarity with live weight prices. However, more progressive cattle feeders recognized the need to think of prices on a carcass weight basis and move away from considering live weight prices. Some feeders expressed the need to tie the base price to boxed beef prices, especially if a means could be identified to accurately measure red meat yield for each primal cut. Alternatively, current technology would allow the base price to be tied to USDA's boxed beef cutout, on a daily, weekly, or moving average basis.

Premiums and discounts stated in grids or formulas varied. Some were based on plant averages. Others were negotiated. Some were simply accepted by a given packer as part of the grid based bid price. Some feeders indicated they considered the premiums and discounts estimated from software developed by Dolezal (1996) and tried to negotiate based on his estimates. Dolezal's (1996) premium and discount estimates are based on fabrication cutting tests of various quality and yield grades of close trimmed and commodity trimmed primals and subprimals. His estimates do not include significant reductions in value due to non-conforming or "misfit" cattle. Value differences based on cutting tests nearly always exceed market-derived values, but can serve as a starting point for negotiations.

Once cattle are slaughtered, there is no opportunity for price negotiation. The method of arriving at the final price has been predetermined by the agreed upon formula. As a result, some feeders feel like they give up control over selling prices if prices are not established until after cattle are slaughtered. One solution to this is better market information. The need for more and better market information is one of the key recommendations of the recent USDA (1996) Advisory Committee on Agricultural Concentration. Among the Committee's fundamental recommendations was "Achieve, as close as possible, equal market information for buyers and sellers" (p. 15). They went further to recommend that

"...contract or formula pricing premiums and discounts, based on carcass merit, should be captured and reported" (p. 19) and "the committee strongly encourages the Secretary [of Agriculture] to assist the beef industry in the development of a negotiated grid pricing structure, with the base price and spreads determined by competitive bidding between buying interests..." (p. 20).

The call for better market information regarding packer price grids has been heeded. The USDA Agricultural Marketing Service (AMS) office in Des Moines, Iowa started reporting national summaries of carcass premiums and discounts for slaughter steers and heifers on a weekly basis in October 1996. A sample of this report is provided in Table 1. The USDA price grid report should help cattle feeders compare prices offered by individual packers with market prices. In this case, cattle feeders may maintain some control over pricing by negotiating the base price with the packer as well as the possible grid premiums and discounts. The sample in Table 1 confirms what appeared evident from our interviews, that premiums and discounts varied widely.

Using grid pricing requires that cattle feeders know more about the cattle being sold. Most feeders and packers agree that feeders do not know the quality of the fed cattle they market. Related to this, all of the packers interviewed indicated a willingness to provide detailed slaughter summary or kill sheets to cattle owners regarding pens of cattle priced on a carcass basis. This is important information for cattle owners to have in order to provide them with the opportunity, over time, to target their cattle to the appropriate market or packer.

Given that several potential base prices can be identified and used and that premiums and discounts vary widely, it should be no surprise that one pen of cattle could be sold using various formulas or grids and its computed price vary greatly. Consequently, it is important that cattle feeders understand the options for choosing base prices, premiums, and discounts, and that they understand the trade-offs within the grids, especially regarding cattle quality. Feeders repeatedly told us that to use grid pricing effectively, cattle feeders need to understand the quality of their cattle. Feeders who tried grid pricing and moved away from it found, in some cases, that their cattle quality was not as high as they thought. Poor quality cattle received below average prices. While this is the proper economic price signal, lower prices were not what those cattle feeders expected or wanted. Consequently, they returned to average pricing on a live-weight basis.

**Table 1. Sample of Information Contained in the USDA-AMS Report on National Carcass Premiums and Discounts for Slaughter Steers and Heifers, for the week of November 18, 1996.**

| Quality                                 | Price Range<br>(\$/cwt) | Simple Average<br>(\$/cwt) | Change from last week<br>(\$/cwt) |
|---|-------------------------|----------------------------|-----------------------------------|
| Prime                                   | 3.00 to 10.00           | 5.71                       | 0.14                              |
| Choice                                  | 0.00 to 0.00            | 0.00                       | 0.00                              |
| Select                                  | -16.00 to -21.00        | -19.07                     | -5.33                             |
| Standard                                | -21.00 to -40.00        | -27.21                     | -5.18                             |
| Certified Programs<br>Avg Choice/Higher | 0.00 to 3.50            | 1.29                       | 0.07                              |
| Bullock/Stag                            | -17.00 to -63.00        | -35.50                     | -0.83                             |
| Hardbone                                | -16.00 to -40.00        | -27.71                     | -1.71                             |
| Dark Cutter                             | -20.00 to -63.00        | -37.00                     | -0.83                             |
| <hr/>                                   |                         |                            |                                   |
| Cutability<br>Yield Grade, Fat (in.)    |                         |                            |                                   |
| 1.0-2.0, <.1"                           | 0.00 to 3.00            | 1.71                       | 0.00                              |
| 2.0-2.5, <.2"                           | 0.00 to 2.00            | 0.89                       | 0.00                              |
| 2.5-3.0, <.4"                           | 0.00 to 2.00            | 0.89                       | 0.00                              |
| 3.0-3.5, <.6"                           | 0.00 to -1.00           | -0.14                      | 0.00                              |
| 3.5-4.0, <.8"                           | 0.00 to -1.00           | -0.29                      | 0.00                              |
| 4.0-5.0, <1.2"                          | -10.00 to -20.00        | -12.43                     | 0.43                              |
| 5.0/up, <1.2"                           | -15.00 to -25.00        | -18.14                     | 1.57                              |
| <hr/>                                   |                         |                            |                                   |
| Weight                                  |                         |                            |                                   |
| 400-500 lbs.                            | -10.00 to -30.00        | -21.29                     | -0.71                             |
| 500-550 lbs.                            | -10.00 to -28.00        | -15.83                     | -0.50                             |
| 550-900 lbs.                            | 0.00 to 0.00            | 0.00                       | 0.00                              |
| 900-950 lbs.                            | 0.00 to 0.00            | 0.00                       | 0.00                              |
| 950-1000 lbs.                           | -5.00 to -20.00         | -13.71                     | 0.14                              |
| Over 1000 lbs.                          | -10.00 to -25.00        | -18.00                     | 0.14                              |

Source: NW LS195, USDA, AMS.

## **Benefits, Costs, and Expectations**

Most, but not all, feeders we interviewed who had been involved in a marketing agreement or alliance and that relied on a formula or a grid said they learned a lot from the experience. All indicated grid pricing sends clearer price signals about what the marketplace prefers and does not prefer. Feeders said they quickly learned to respond to the premiums and discounts in the grid. They sought to purchase the kind of cattle that matched the grid premiums, bidding more for better quality feeder cattle and bidding less for poorer quality feeder cattle that would not meet the grid premiums. This represents a significant improvement in pricing efficiency, i.e. sending clear signals from cattle feeders to cattle producers. Feeders also commented that as more feedlots become involved in alliances and grid pricing, the premiums necessary to purchase the better quality feeder cattle increase, to the point of eroding the potential higher margins from better quality cattle. Some feeders quickly learned that sorting was necessary, both when cattle were placed on feed and again once or twice prior to marketing finished cattle. Feeders learned quickly how they needed to change their feeding regimes, especially eliminating over-finished and other "non-specification" cattle. Feeders said grid pricing helped them respond to market conditions, e.g., changing the length of time on feed in response to changes in the Choice-Select price spread. Alliances and grid pricing are not without costs. At least a couple of feeders learned their cattle did not perform well and returned to live weight pricing and pricing on averages. Prices sent the correct signal, but those feeders found it more profitable to sell their cattle on a live basis.

Cattle marketed through marketing agreements and alliances, by formulas or grids, bypass the traditional method of marketing and reporting prices. They are part of what the industry calls captive supplies. Some feeders are still concerned about potential negative effects captive supplies may have on remaining cash prices. Some feeders believe large inventories of captive supplies result in packers being less aggressive resulting in softer or downward moving prices. This issue is discussed in detail in a later section.

Some feeders are concerned that only the better quality cattle will move through marketing agreements and alliances and will be priced by carcass merit and grid methods. Then poorer quality cattle may be forming the base price for the better quality cattle. This concern relates directly to the type of base price used. It is most relevant when the base price is a cash-based price, such as a live weight reported price or plant average price. It is less of a concern if the base price is tied to an upstream price, such as boxed beef prices. However, the concern is present at the wholesale reported price level also. Dolezal argues that over the last few years, the USDA-reported boxed beef cutout values represent predominantly commodity trim beef rather than close trim beef. Reported boxed beef cutout values also exclude prices for exported beef, much of which is higher valued products.

Nearly all packers and most feeders interviewed expect alliances and grid pricing to increase in the future. Some caveats were stated, however. Comments were made that some feeders are confusing real value with perceived value. Some feeders continue to search for the best base price, to obtain the best current return, without recognizing the need to change the quality of feeder cattle purchased and fed. Some feeders are participating in alliances to share in large packer margins which are tied to the cattle cycle. When the cattle cycle moves into a tighter supply phase and packer margins decline, there may be less interest in alliances.



Caveats about the future growth of alliances and grid pricing represented a small minority of comments. Nearly all packers and most feeders expect alliances and grid pricing to increase. Feeders are more receptive now to carcass merit pricing than ever before. Packers and feeders recognize a need to tie cattle genetics to price and value. This need will increase further as more beef is branded and the need for consistent quality increases further. Branding is expected either through breed-based programs, expansion of packer brands, or increased use of private label retail brands. Most thought the use of alliances and grid pricing would expand to about 30 % of fed cattle slaughter. That percentage was believed by some to be the percentage of cattle that could benefit most from value based pricing. Persons interviewed remarked that the growth in alliances will level out when alliances account for about 30 % of fed cattle marketings. That represents a saturation point in the opinion of some. The message here is clear. Seventy percent of fed cattle currently will not benefit from value based pricing. The industry must find a way to identify that lower 70 % and eliminate the poorest quality from the slaughter mix. The bottom end of the quality spectrum is dragging down the upper end.

Alliances and grid pricing will increase, in the opinion of most people interviewed, because experience shows alliances and grid pricing help reduce the adversarial relationship between feeders and packers. Alliances can help the industry work together to solve common problems. Alliances help both partners understand value and changes needed to increase value to both parties. Alliances and grid pricing clarifies the signals which need to be sent from retail to packer to feeder to cow-calf producer. Some feeders want to be linked more closely with packers. This comment parallels the findings for hogs. A recent survey found that large hog producers expect closer coordination between themselves and packers in the future (Hayenga *et al.* 1996). The same view seems to prevail for fed cattle.

The authors believe, and our interviews confirm, both the need to move to value based pricing and a growth in value based pricing. The practice of buying cattle on averages does not coordinate consumer demand with cattle production and marketing. Clearer price signals improve price discovery. They signal needed changes in cattle genetics and production practices which might slow the long term erosion in beef demand. Cattle owners need to know the quality of their cattle, use sound management practices to target their cattle to desired markets, and get paid the value of those cattle when they are sold.

Many cattle feeders expect to receive bids in the form of grids, each packer having a separate grid. In fact, a packer could have multiple grids, each associated with procuring a specific type of cattle for a specific customer demand. Some feeders already receive multiple grid-based bids from packers. Some feeders compared this to hog pricing. Each packer has a different carcass merit program and a different base price. Hog finishers learn which grid fits their production best. Cattle feeders will have to evaluate each grid in relation to the quality of cattle for sale and target sales to specific grids.

With improved public information about pricing grids, cattle feeders are in a better position than ever to sell cattle on a carcass basis. Improved market information allows them to know more about market discounts and premiums so they can target their sales to the most advantageous market outlet. However, cattle feeders must realistically evaluate their cattle quality, e.g. expected yields, carcass weights, quality grades, and yield grades. The best way to learn more about these traits is to sell more cattle in this way. Consumers have indicated a willingness to pay more for consistent



high quality. Therefore, packers or processors that can efficiently identify beef quality more accurately than current USDA quality standards may be able to develop branded beef products and capture brand premiums. Being able to identify and guarantee consistent high quality beef products would allow packers to better target and segment their markets. Long term agreements with retailers and food service firms or institutions may be a necessary component of vertical alliances and these agreements may need to include improved monitoring of product quality.

### **Role of Market Information**

Availability of and access to market information has a big impact on price discovery in cattle markets. Broadly defined, market information includes all data and analysis used by market participants to make decisions. Historically, much of the information used by buyers and sellers in the cattle and beef markets has been provided by public institutions, such as the USDA and Land Grant Universities' Extension Services. However, there has been dramatic growth in the number of private firms collecting, analyzing, and disseminating information to clients. This evolution leads to questions regarding the roles of public vs. private information services in cattle markets. In addition, structural changes in the beef industry are leading to changes in both the type of information needed by market participants and the manner in which it is collected and disseminated. In particular, some market participants are becoming increasingly concerned that changes in beef industry pricing practices are leading to asymmetric availability of market information, which might contribute to price discovery problems. The remainder of this section discusses the functions of market information, concerns identified by industry participants, and changes taking place in the beef sector expected to impact information needs and availability. This section concludes with our thoughts regarding possible improvements in information gathering and reporting.

### **Functions of Market Information**

The primary economic function of markets is to coordinate the allocation of scarce resources among production alternatives. Markets must communicate information about relative consumer desires for products back to those who control the resources to produce those products. The beef cattle market is a complex production and marketing system composed of geographically diverse primary producers (cow/calf) moving through a multilevel production/marketing system that adds productive value (growing and feeding animals) in addition to the value added by a multitude of transportation, processing and storage activities. The complexity of the system is enhanced by two factors: Neither meat nor cattle can be stored long without changing the quality characteristics of the product, and beef production is a disassembly process where a single primary input is disassembled and sold into hundreds of wholesale and retail product markets. Movement of cattle from the cow/calf pasture gate to the consumer's plate involves at least one to, more commonly, four, five or six transfers of ownership. Prices are the primary thread that link this complex industry from primary supply to primary demand. The importance of prices in linking the various segments of the industry makes market information in the beef industry very important.

Market information serves several important functions. A primary function of market information is that of facilitating price discovery. In cattle and beef markets, price is the primary coordinating mechanism and market information helps market participants develop expectations regarding current supply and demand conditions to provide them with an idea of where to begin

price negotiations. Over the longer run, market information helps producers make production and marketing decisions. Market information is also employed by government agencies, private firms, and academic researchers to monitor and evaluate industry structure, conduct and performance.

The functions described above imply various users of market information have different needs with respect to quantity and quality of information. For example, in a relative sense, cow-calf operators' information needs are oriented more towards long run changes in the industry whereas cattle feeders, packers, wholesalers and retailers need information both for long- and short-run decision making. Timeliness is a critical component of information quality, particularly for price discovery and those interested in forecasting future price changes. In contrast, market performance monitoring and evaluation functions tend to use different information and focus more on longer time dimensions. Finally, the information needs of various users depend on the market structure at a point in time and may change as industry structure evolves.

### **Beef Industry Pricing Issues**

Pricing issues in the beef industry can be categorized into three principal areas of concern: information adequacy; asymmetric availability of information to buyers and sellers; and whether information will be collected voluntarily or on a mandatory basis. Some beef industry participants question whether currently available market information is adequate to accurately determine market values and convey consumer preferences to producers. Most cattle are still sold on a liveweight cash price basis, but an increasing percentage of fed cattle are being sold on dressed weight, grade and yield, formula price or on a price grid basis. The transition in pricing techniques suggests that both buyers' and sellers' information needs are changing, yet price reporting has been slow to change. Asymmetry of market information has long been a concern in agricultural markets. Some of the earliest justification for public price reporting was to correct a perceived imbalance between traders in centralized markets and farmers that lacked access to information (Henderson, Schrader and Rhodes 1983).

As the beef industry (packers and feeding operations) becomes more concentrated, proprietary information will become more valuable. This encourages more information asymmetry between buyers and sellers as both sides attempt to take advantage of their proprietary information. Concerns about concentration in the beef sector have been heightened as large firms have increasingly utilized non-market mechanisms, generally some form of captive supplies, to augment or replace traditional procurement and pricing methods. Declining acquisition costs and easier access to information have led some to suggest the government's role in providing information is declining (Just 1983), whereas others believe that the government's role will merely shift toward a greater emphasis on the information system rather than actually delivering the information (Bahn and Parham 1996). The unwillingness of some firms in an increasingly concentrated beef sector to voluntarily provide market data has led some participants to clamor for mandatory price reporting whereas others abhor the notion that price reporting be on anything but a voluntary basis. Thus, the governmental role in data collection and information dissemination has surfaced again.

### **Industry Viewpoint**

Participants in our interviews were primarily concerned with two fundamental problems regarding market information in the beef sector. Changes within the industry mean participants'

market information needs are changing and market information has not always kept pace. Examples cited include a need for information about carcass grid pricing and base prices used in both grid pricing schemes and various formula marketing agreements. Second, a number of cattle feeders expressed misgivings about the asymmetric availability of market information within the industry. In particular, cattle feeders were concerned that their lack of knowledge about the volume and timing of packers' captive supply make it difficult for them to assess potential packer demand in the price discovery process. Both of these problems are related to the degree of public involvement desired in providing market information to the beef and cattle markets.

Although private sector firms are providing a much greater percentage of the information desired by beef industry participants than in the past, it was clear from our surveys that most firms still rely heavily on data and information provided by public sector entities. Nearly all of the firms contacted in our surveys indicated they used both data and information published by the USDA in conjunction with private sector data and analysis. Most participants indicated they used USDA's inventory reports (e.g., *Cattle on Feed* and *Cattle* inventory reports) to judge longer term trends, although some cattle feeders expressed frustration with the revised *Cattle on Feed* report system implemented by USDA in 1996. Frustrations with the new report format included the small amount of historical data provided by USDA which, in the short run, made the reports difficult to use for forecasting and USDA's apparent difficulties in reconciling marketings estimates with steer and heifer slaughter estimates published in the monthly slaughter reports. Most of the cattle feeders interviewed indicated they also used various reports published by the USDA's Agricultural Marketing Service (AMS) such as daily live cattle and boxed beef prices, but many of them supplemented these reports with information gathered from private services such as Cattle-Fax and other consultants. Thus, our interviews substantiated growing use of private sector firms for market information, but at the same time confirmed the public sector continues to play a key role in providing the beef industry with information.

Growth in the volume of cattle sold on a dressed weight basis, grade and yield or via a price grid mean an increasing percentage of cattle producers need more detailed pricing information than in the past. Several cattle feeders indicated they use price grid information extensively when making marketing decisions. Until recently, price grid information was only available on a request basis from packers and was then sometimes circulated among a small group of cattle feeders and consultants. Price grids are now being reported on a weekly basis by the AMS. Cattle feeders that were aware of the new AMS price report generally felt it was a step in the right direction. One cattle feeder indicated that, if the industry moves toward selling a higher percentage of cattle using price grids, cattle feeders and packers will devote their energy to negotiating base prices used within the grid pricing system. This implies there will be a need for public reporting of base prices used and more information about the premiums and discounts employed in the grids.

Expectations that an increasing percentage of cattle will be marketed in ways other than live weight cash pricing led several cattle feeders, and at least one packer, to express a desire for improved reporting of boxed beef prices by AMS. The single biggest problem identified was the relatively low volume of trade upon which prices in the report are based. The low trade volume led users of the report to question whether the quoted prices accurately reflect current supply and demand conditions. One packer indicated that AMS needs to reconsider what prices it is willing to accept when obtaining price information and, in particular, should consider accepting prices from partial loads instead of requiring prices be reported only from full loads. Additionally, it was

pointed out that the percentage of beef sold as close-trimmed product is approaching 50%, but AMS does not report a close-trimmed price. Finally, another cattle feeder voiced an often heard concern that both reported boxed beef cutout values and hide and offal values understate their value to packers and, in that sense, might be misleading. The growing importance of wholesale prices in establishing cattle prices means that demand for better boxed beef price information will increase over time.

The possibility of shifting from voluntary to mandatory price reporting has been discussed for some time in the beef sector. The unwillingness of some firms to regularly report wholesale prices contributes to thin boxed beef price reports. The growth of non-cash price reporting schemes and the unwillingness of some participants to reveal prices from these agreements is leading to concerns that mandatory price reporting may be required in the future to ensure that price reports are representative and not just based on a small segment of the market. Packers participating in our surveys did not favor mandatory price reporting. Most cattle feeders were not in favor of mandatory price reporting either, but several indicated a willingness to consider mandatory reporting if, over time, it became apparent that voluntary price reports were not representative of the trade taking place.

Information asymmetry was a big concern among our survey participants, primarily on the part of cattle feeders. In particular they desired access to information regarding the movement and prices of cattle forward contracted for sale to packers and cattle marketed via the various formula pricing arrangements. Since packers know how many cattle they have obtained via forward contracts and formula price arrangements (at least for their firm) they possess better information than feeders regarding their need to purchase cattle in the cash market. One complaint voiced by some cattle feeders was, during some weeks, large volumes of cash trade occur in relatively short periods of time. Some cattle feeders indicated that the information asymmetry present in the fed cattle market was contributing to this shift in marketing behavior. They felt information asymmetry created fear among cattle feeders that they must sell cattle as soon as trading materializes or risk the possibility that packers will not need cattle for slaughter if their slaughter schedules have been filled with captive supply cattle. As a result, these cattle feeders indicated a desire to level the playing field by obtaining better information regarding packers' non-cash cattle procurement. A new weekly report first published by the AMS in the fall of 1996, *Forward Contract Slaughter Cattle Summary*, attempts to fill this gap by providing public access to regional estimates of forward contract cattle supplies by delivery month. Although the new AMS report provides information about the volume of forward contract cattle trade, little information is available regarding the volume of formula priced cattle or prices at which non-cash purchases are traded. Thus, it appears that the information asymmetry regarding both the volume and prices of captive supply cattle has not yet been eradicated.

Changes in beef industry structure are changing the quantity and, possibly, the quality of market information available to market participants. Some of the problems the industry faces today resemble those associated with thin markets. Early concerns about thin markets arose with the decentralization of markets and the decline of terminal markets as primary points of price discovery (Buccola 1985; Hayenga 1979; Tomek 1980). As price reporting practices evolved from simply observing prices revealed in centralized markets to confirmed direct trade reporting, these concerns were largely eliminated. Reduced use of cash markets and non-reportable prices associated with use of forward contracts and marketing agreements mean that a new era of thin price reporting concerns is present. Additionally, lack of standardization among various carcass weight and grade pricing



grids has also contributed to price reporting problems. Nelson and Turner (1995) indicated that prices obtained from thin markets exhibit no apparent bias, but price variability may be greater than in markets with greater trade volume. This suggests long term price averages calculated from thinly reported markets may be reflective of supply and demand conditions, but individual price quotes or negotiated transaction prices may vary considerably from longer term averages which means infrequent sellers are exposed to more price risk in thin markets.

### Summary

Availability of and access to market information has a big impact on price discovery in cattle markets. Historically, much of the information used by buyers and sellers in the cattle and beef markets has been provided by public institutions, such as the USDA and the Land Grant Universities' Extension Services. Although private sector firms are providing a much higher percentage of the information desired by beef industry participants than in the past, it was clear from our interviews that most firms rely heavily on data and information provided by public sector entities. However, unwillingness of some firms to report prices and trade volume voluntarily is creating concerns among information users that market reports might not be representative of actual trade. Although our survey respondents, in general, were not ready to call for mandatory price and volume reporting on fed cattle and boxed beef trade, a number of those interviewed were willing to consider mandatory reporting in the future if it becomes apparent the market reports are not representative of actual trade.

Many of the cattle feeders interviewed for this project expressed concerns about asymmetric availability of information among cattle producers and packers. Growth of non-cash market pricing agreements has created a situation where feeders have less access to information about packer demand than in the past. The USDA, responding to concerns expressed in a report from the USDA Advisory Committee on Agricultural Concentration, has begun reporting the volume of cattle forward contracted (by month) on a weekly basis. However, little information regarding short-term variation in formula priced cattle and their prices is available. Thus, the asymmetry in information availability remains a concern of cattle producers. Cattle producers' lack of information about cattle marketed via non-cash methods makes it difficult for them to assess future supply and demand conditions and make pricing decisions. A desire to correct a perceived imbalance between traders and farmers was one of the primary justifications for involvement of the public sector in collecting and disseminating market information. It is apparent there is still a need to provide information to minimize this information imbalance.

Evolution in the way cattle and beef are marketed means that the beef industry's information needs are changing. Growth in the volume of cattle sold on a dressed weight basis, grade and yield, or via price grids means an increasing percentage of cattle producers need more detailed pricing information than in the past. Although AMS has begun to report price grids on a weekly basis, more emphasis on reporting discounts and premiums offered for various carcass characteristics is needed as a greater proportion of cattle trade is marketed based upon these characteristics. Moreover, the industry will need frequent reports of carcass weight base prices used when pricing cattle via grids or formulas to facilitate the price discovery process. Finally, several cattle feeders and one major packer indicated the USDA needs to reconsider how it collects wholesale prices to ensure that they are more representative of actual trade in the marketplace.

## Live Cattle Futures Issues

Futures markets serve two primary roles. First, futures markets provide a risk transfer mechanism suitable for use by both cash market participants and speculators. Although risk can be transferred to other market participants via various types of cash market transactions, futures markets were developed because they offer several potential advantages over cash market risk transfer mechanisms. Second, futures markets are generally perceived to be an important component of price discovery, the process by which buyers and sellers arrive at specific transaction prices (Tomek and Robinson 1972). For commodities where a futures contract exists, futures trading typically interacts with cash commodity markets to play a large role in price discovery.

Futures markets offer several potential advantages over cash markets from a risk transfer and price discovery perspective. In a futures contract all of the contract terms, such as the total volume, commodity grade, maximum and minimum price changes, and potential delivery locations, are standardized. Consequently, traders focus their attention on the commodity's price since it alone can change values from one transaction to the next. This feature of futures contracts makes them attractive to both hedgers and speculators because they are interested primarily in either shedding or absorbing price risk and, hence, desire a trading vehicle where price is the focal point. The fact that price variation from one transaction to the next is not related to changes in contract terms also encourages use of futures markets as a price discovery marketplace since information about supply and demand are quickly reflected in price. Other characteristics of futures contracts that make them advantageous for both hedgers and speculators include the fact that futures markets provide a dispute settlement mechanism and the individual futures exchange serves as a guarantor of contract settlement and financial obligations associated with trading. These features of futures contracts mean traders do not have to worry about other trader's financial wherewithal and, in the event that a dispute arises, can expect it to be resolved more quickly via the exchange's dispute settlement mechanism than if the dispute had to be settled in the U.S. court system.

There are several other key points that are relevant to a discussion of live cattle futures markets. First, futures contracts are not designed to be an effective cash merchandising tool. When conducting cash transactions, cattle feeders and beef packers generally find it more economical to use cash contracts where the contract specifications can be structured to meet the individual needs of both parties rather than be constrained by the standardized terms in the futures contract (Garbade and Silber 1983). Consequently, if a futures contract results in a large number of deliveries it often is a sign that the contract is not well designed since deliveries only occur when an incentive to deliver the physical commodity exists. If deliveries are large it signifies the futures contract is not doing a good job of reflecting what is taking place in the underlying cash market.

Second, futures trading is well suited only for homogeneous commodities where one lot of the commodity is a good substitute for another lot (after price adjustments for quality differences). Development of differentiated production processes whereby various lots of cattle are no longer near perfect substitutes for one another could make the live cattle futures contract a less useful price risk transfer tool in the future.

Futures markets exist because producers and merchandisers need a market where they can selectively transfer risk from themselves to other traders. For a contract to remain successful, it must continue to provide a risk transfer mechanism that both buyers and sellers find useful. The use



of a futures contract for risk management requires the futures contract price be highly correlated with the underlying cash commodity price. Moreover, the differential between the futures contract price and the underlying cash commodity price, known as the basis, must be predictable and less variable than the cash price.

### **Industry Perspective on Live Cattle Futures**

Live cattle futures are an often discussed feature of the cattle feeding and beef packing industries. Interviews with cattle feeders revealed a wide divergence of opinions regarding the usefulness of the current live cattle futures contract as a price discovery mechanism and as a risk transfer mechanism. In general, packers did not report any significant concerns about the current futures contract's usefulness, but some cattle feeders expressed deep seated concerns about the live cattle futures contract's viability as a price discovery and risk management tool.

### **Price Discovery**

Nearly all cattle feeders and packers interviewed said they considered live cattle futures prices when determining what price to ask or offer for slaughter cattle. The influence of nearby live cattle futures prices on transaction prices has also been confirmed by various researchers. Results from models of individual fed cattle transaction prices confirm that nearby live cattle futures prices are an important determinant of cash fed cattle transaction prices (Jones *et al.* 1992; Schroeder *et al.* 1993; Ward 1981; Ward 1992; and Ward, Koontz, and Schroeder 1996). Aside from the live cattle futures market, most feeders indicated they also used the boxed beef market as a price indicator along with volume in both the boxed beef and fed cattle markets. Packers generally reported they used their own sales as a price indicator. The degree to which each relied on futures prices when formulating bid and offer prices varied, but nearly all interviewed reported using live cattle futures as an indicator. Research on the role of live cattle futures markets in price discovery indicates that cash market participants rely on futures prices for information. Oellermann and Farris (1985) concluded that futures market prices for live cattle were used extensively to price cash market transactions and that, in most instances, the futures market was the center of price discovery. Later work by Koontz, Garcia and Hudson (1990) concluded that direct cash markets dominate the price discovery process, but that futures play an important role, particularly when the cash markets are inactive. Comments from market participants and research results confirm that live cattle futures play an important role in the price discovery process.

### **Risk Management**

A broad consensus did not exist regarding usefulness of live cattle futures as a risk management tool. Little concern was expressed regarding live cattle futures usefulness for hedgers by packers and some cattle feeders, especially feeders located in the Northern Plains. However, among cattle feeders that were concerned about live cattle futures viability as a hedging medium, two principal concerns were expressed. First, a small number of feeders indicated that lack of volume, and a resulting lack of liquidity in the live cattle futures contract, was a long run problem because it makes execution of large hedge orders difficult. Second, cattle feeders in the Southern Plains indicated recent changes in delivery provisions of the live cattle futures contract (effective with the June 1995 contract) had an adverse impact on their ability to predict basis because both the

basis level and variability changed. As a result, several feeders indicated basis risk has become so large they believe the current contract no longer provides an effective price risk transfer mechanism.

### **Trading Volume**

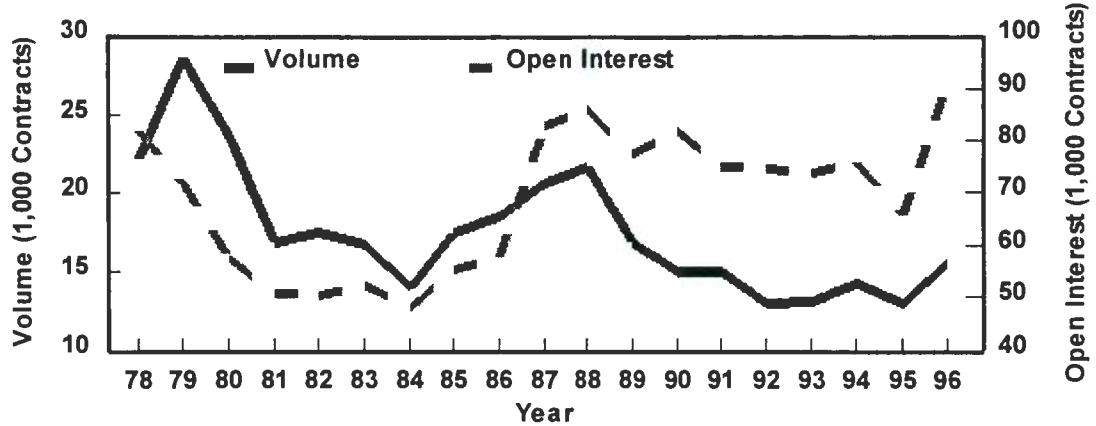
Trading volume in the live cattle futures contract has been a subject of much debate for some time. Several large cattle feeders indicated that, on occasion, they find it difficult to execute hedges because they represent a sizable portion of the open interest in live cattle futures and trading volume is inadequate to execute their hedges without causing a change in price. Trading volume data from the CME helps clarify the problem (Figure 3). Daily open interest and trading volume data from January 1, 1978 through October 1, 1996 indicate that, during this time period, annual trading volume peaked in 1979 at 7.2 million contracts, a daily average of 28.6 thousand contracts. Trading volume fell through 1985 before rising briefly in the mid-1980s. However, daily trading volume in 1995 averaged just 13 thousand contracts, less than half its 1979 peak. Open interest in live cattle futures followed a somewhat different path than average daily trading volume. Although open interest declined in the mid-1980s from its late 1970s level, it rebounded sharply by the early 1990s. Unlike trading volume, average open interest during the 1978-96 period peaked in 1996, at 91.3 thousand contracts. Although further study is needed to determine why trading volume has declined precipitously and open interest has actually increased, it suggests traders are holding positions longer than in the past. The decline in trading volume tends to validate concerns expressed by large feeders that executing trades without inducing a price change in the futures market is becoming a bigger problem. It is particularly troubling since it occurred during a time frame when the cattle feeding industry was consolidating which means that, potentially, there were more large hedgers trading live cattle futures in 1995 than in 1979.

### **Delivery Specifications**

Beginning with the contract that expired in June 1995, two fundamental changes, and a host of smaller changes, were incorporated in the delivery provisions of the Chicago Mercantile Exchange (CME) live cattle futures contract. Par delivery in the new contract called for 55 % of the cattle in a 40,000 pound delivery unit to grade Choice and 45 % of the cattle to grade Select. Previously, par delivery in the live cattle futures contract called for all cattle in a delivery unit to grade Choice, with no more than eight head of cattle to grade Select at a discount of \$0.03 per pound. Secondly, the new contract allows the buyer to decide whether the grading will be performed on a live or a carcass basis. Prior to the June 1995 contract, all grading was conducted on live cattle at the stockyards. Finally, other provisions were added to the contract which prescribed how the actual settlement price would be adjusted if the various grading specifications were not met. For example, if the pen grades more than 55 % Choice, settlement prices for animals exceeding the 55 % level are adjusted by multiplying the result of the USDA's Choice Yield Grade 1-3 Box Beef Cutout Value minus the Select yield grade 1-3 boxed beef cutout value on the day of slaughter by 0.63. Similarly, yield grade 4 cattle in the delivery unit, beyond the one head deliverable at par, are discounted \$20 per cwt. (liveweight) or 25 % of the futures contract's settlement price, whichever is greater.

The shift in contract terms altered the relationship between buyers and sellers. Previously,

**Figure 3. CME Live Cattle Futures Average Daily Volume & Open Interest, Annual, 1978-1996\***



Source: CME

\*1996 Data Through 10/31/96

buyers were forced to absorb the risk that not all cattle meeting the live specifications would meet the equivalent grade specification after the carcasses were graded. Under the new contract specification, sellers are exposed to the risk that the long accepting delivery will opt for carcass grading and that the cattle will not meet the contract's grade specifications, resulting in large discounts from the nominal settlement price for cattle not meeting par specifications. Delivery data provided by the CME indicates the majority of the cattle delivered since the contract specification change have been carcass graded suggesting longs prefer carcass grading over live grading. For example, delivery data from the June 1995 through October 1996 contracts indicates 74.1 % of the cattle delivered were carcass graded and, during two of the contract months, all deliveries were carcass graded.

Another problem identified by several cattle feeders was the arbitrary way in which carcass discounts were determined under the CME's delivery specifications. Specifically, feeders believed that the current system of applying predetermined discounts to cattle that do not meet the par delivery standards leads to an excessive amount of arbitrage. Currently, some longs accept delivery in the expectation cattle will be marketed to the packer slaughtering the cattle at less severe discounts than those prescribed in the CME's delivery specifications. Partly in response to these concerns, the CME is formulating a revised set of delivery specifications that rely on a market determined discount and premium grid, identified in the USDA's *National Premiums and Discounts for Steers and Heifers* report, for cattle that deviate from the par delivery specification. Although the details for this revision have not yet been finalized, this change appears to address concerns expressed about arbitrage taking place to take advantage of differences between market level prices and discounts identified in the live cattle futures contract specifications. Some concerns have been expressed, however, that the price grid reported by the USDA is only based on prices collected one day per week, that reports are only provided by one side of the market (packers), and that the grid

is not generated from transactions. If this report is used in the live cattle futures settlement specifications, refinements in the USDA's data collection process should be considered.

### **Live Cattle Basis Predictability**

A lack of trading in the live cattle futures contract by long hedgers has long been a concern. The most recent changes in the delivery specifications serve to reduce the uncertainty long hedgers have about the quality of the cattle received via the delivery mechanism and represented an attempt to encourage more long participation in the contract. Conversations with packers did not reveal a significant change in usage of the live cattle contract following the specification changes. Cattle feeders, particularly those in the Southern Plains that often have little carcass information about the cattle they feed, potentially face more basis risk than under the old contract. Not surprisingly, cattle feeders that were most concerned about the implications of the contract specification changes were primarily located in the Southern Plains, not the Northern Plains.

Whenever futures contract specifications change, there is a possibility that basis levels and patterns will change. Many of the cattle feeders interviewed indicated that the basis changed following the June 1995 live cattle contract specification change. In particular, Southern Plains cattle feeders were upset about perceived changes in both the level and variability of the live cattle basis. An examination of the daily basis in western Kansas for the June CME live cattle futures contract illustrates the nature of the complaint voiced by Southern Plains cattle feeders.

Basis levels appear to have shifted since the CME changed the specifications of the live cattle futures contract effective with the contract that expired in June 1995. Although basis during June 1995 did not differ appreciably from the average basis level observed during the previous five years, basis during 1996 was negative more often than exhibited previously. Western Kansas daily steer basis computed using the June CME live cattle closing futures price from the time the April contract expired until the June contract expired averaged \$2.15 per cwt. from 1990 through 1994. After the contract specification change in 1995, western Kansas steer basis over this same time frame averaged \$2.63 per cwt. However, in 1996, the second year of the new contract specification, basis became negative, averaging \$-0.56 per cwt. Basis at other locations and for other contract months also became negative more often following the live cattle contract change. The sharp decline in the basis level was not expected by many cattle feeders and, as a result, led to actual net sale prices for hedged cattle substantially below expected net sale prices forecast when short hedges were initiated. It's not yet clear whether the contract changes merely led to a one-time basis level shift or whether basis variability actually increased following adoption of the new delivery specifications. The shift in the basis pattern warrants further study to determine whether the contract's basis predictability has actually declined over the long run. The apparent shift in the basis pattern also points out that continually revising the live cattle futures contract specifications creates difficulties for risk managers during the transition period from one set of specifications to the next. Risk managers often find it difficult to fully assess impacts of specification changes until after the new contract has had an opportunity to trade for an extended period of time. In the interim, hedging results often suffer.

## Cash Settlement

Concerns about the viability of the live cattle futures market and its usefulness as a hedging vehicle have produced calls for changing the live cattle contract yet again. Aside from the possibility of fine tuning the delivery specifications, as discussed previously, a resurgence of interest in switching to a cash settlement from a physical delivery contract has also taken place. The principal reason futures contracts incorporate a delivery option is to force the cash price and the futures price to converge at the delivery point during the delivery period. Convergence helps ensure that futures contracts can serve as a hedging vehicle for cash market participants (Jones 1982).

Although the physical delivery option is designed to force convergence between the cash and futures prices, it doesn't always perform satisfactorily. There are two potential problems with physical delivery. First, if delivery costs are high, the futures and cash price may converge, but only within a relatively wide band. Within the band, cash and futures prices can move independently. Second, cash trading by futures market traders who plan to make or take delivery may cause the deliverable grade's cash price at the delivery point to differ from its commercial value (Garbade and Silber 1983). In both cases, the delivery option fails to force convergence between cash and futures prices and, as a result, hedgers will find the basis difficult to forecast accurately. Some users of the live cattle futures contract are convinced that both of these problems are inherent in the CME's current live cattle futures contract and, as a result, are encouraging the CME and the industry to consider cash settlement.

Table 2 outlines the key fed cattle market characteristics that make either cash settlement or physical delivery preferable. Characteristics can be sorted into two broad categories: delivery characteristics and pricing characteristics. Difficulties associated with physical delivery of live cattle indicate that a move to cash settlement would be preferable. Under physical delivery, short hedgers face potentially high delivery costs and have difficulty identifying cattle on a live basis that will meet carcass specifications outlined in the contract, problems that would be eliminated if cash settlement was adopted. Both longs and shorts face problems associated with delivery of a nonstorable commodity. However, there are difficulties associated with a switch to cash settlement as well. Garbade and Silber (1983) indicated that cash settlement would only be preferred to physical delivery if delivery costs are high and an accurate settlement index is available. Constructing an accurate cash settlement index which is not subject to manipulation is not easy. Problems associated with construction of an accurate index include the relatively high cost of collecting accurate cash market prices from buyers and sellers, the fact that a variety of different pricing methods are employed which are not easily compared (e.g., liveweight vs. carcass vs. carcass grade and yield vs. grid pricing), and the fact that cash trade is, at times, quite thin making it difficult to collect any cash prices that can be used to compute a settlement index.

Development of a reliable cash settlement index to use for the live cattle futures contract is an empirical problem that was examined in the late 1980s (Kahl, Hudson, and Ward 1989). They indicated that for cash settlement to be preferred over physical delivery, it must reduce basis variability, the cash price must be an accurate representation of commercial value, and the potential for manipulation of cash prices must be small. Although the authors examined more than one possible index, they offered no conclusive evidence that a switch to cash settlement would be advantageous. In particular, Kahl, Hudson and Ward (1989) expressed concerns about the representativeness of reported prices used to construct an index and the potential for the index's



manipulation. Modifications to the cash price reporting regime followed by the USDA since that time makes revisiting the cash price settlement index problem worthwhile. Specifically, USDA now reports volume weighted prices by region which offer less potential for manipulation than the high-low price ranges reported previously. Given the problems hedgers have experienced using the live cattle futures contract and the decline in trading volume that has occurred over time, it seems apparent that cash settlement of the live cattle futures contract should be reexamined in depth.

**Table 2. Fed Cattle Market Characteristics That Make Cash Settlement of Physical Delivery Preferable.**

| Fed Cattle Market Characteristic  | Cash Settlement Preferable | Physical Delivery Preferable |
|---|----------------------------|------------------------------|
| Delivery Characteristics:   |                            |                              |
| <i>High Delivery Costs</i>  | X                          |                              |
| <i>Difficult to Identify Deliverable Supplies on Live Basis that Meet Contract Specifications</i> | X                          |                              |
| <i>Nonstorable Commodity</i>  | X                          |                              |
| Pricing Characteristics:  |                            |                              |
| <i>Difficult to Collect Cash Prices</i>   |                            | X                            |
| <i>Variety of Pricing Methods Employed</i>  |                            | X                            |
| <i>Cash Trade Sometimes Thin</i>  |                            | X                            |

### **Dressed Beef Futures Contract**

Several cattle feeders indicated that, ultimately, they believe a dressed beef futures contract could resolve some of the difficulties inherent in the live cattle futures contract. Over time the percentage of live cattle priced on either a dressed weight or on a grade and yield basis has been growing. If this trend continues as expected, more cash market participants will want to use a dressed weight or boxed beef contract instead of a live cattle contract for risk management. A recent example of this occurred in the hog sector. The CME switched from a physical delivery live hog contract to a cash settled dressed weight contract effective with the February 1997 contract. The driving force behind this change was a dramatic shift in U.S. hog pricing away from live to grid based pricing which generally starts with a dressed weight base price.

A dressed weight or boxed beef contract would, by necessity, be a cash settled contract because of the inherent difficulties in physically delivering dressed carcasses or boxed beef to satisfy the delivery provisions of a futures contract. Thus, a move to a dressed contract will eliminate problems associated with the delivery system. But it will not eliminate the principal concern



regarding development of a live-weight cash settlement contract, namely the development of a dressed weight or boxed beef cash price index which can be used to settle the contract. Current thin price reports on both boxed beef and dressed weight prices suggest that better price reporting will be required before the development of a boxed beef or dressed weight futures contract can take place.

### **Summary**

The live cattle futures market provides a risk transfer mechanism to cattle market participants and plays an important role in price discovery. Interviews conducted with packers and cattle feeders revealed that packers did not have major concerns about the current live cattle futures contract's usefulness. However, some cattle feeders expressed concerns about the live cattle futures contracts viability as a risk management tool. Problems cited with the current live cattle contract were a lack of liquidity, which makes large hedge order execution difficult, and basis levels that are difficult to forecast accurately. A review of live cattle volume and open interest indicated that average daily trading volume fell sharply from the late 1970s to the early 1990s, which tends to substantiate the liquidity problems potentially faced by large hedgers. Additional research is needed to determine why live cattle futures trading volume declined so sharply over the last 20 years and to learn what impact it has had on the contract's risk shifting ability. Furthermore, historical basis data for various slaughter cattle markets suggest that live cattle basis levels shifted following the change in the live cattle delivery specifications that were effective with the June 1995 contract. More research is needed to verify the impact changes in contract specifications had on live cattle basis. Problems associated with the current live cattle futures contract led many cattle feeders to suggest that cash settlement of live cattle futures be reexamined. Previous research indicated the principal concern thwarting adoption of a cash settled live cattle futures contract was development of an accurate cash settlement index that was not easily manipulated.

The beef industry's risk management needs are expected to change in the next decade. More cattle are expected to be priced on a dressed weight basis today than ever before. As dressed weight pricing becomes more prevalent, demand from risk managers for a dressed beef futures contract will also increase. As the beef industry's risk management needs evolve, the live cattle futures contract will likely be replaced by a cash settled dressed weight futures contract. For this to happen, development of an accurate dressed beef price index that is not easily manipulated will be required which, in turn, means more accurate dressed beef and boxed beef prices will be needed to construct the index.

### **Captive Supplies in Fed Cattle Markets**

Vertical integration by beef packers into fed cattle markets, commonly referred to as captive supplies, has been a concern in the beef industry for nearly a decade. Recent cyclical declines in cattle prices and greater vertical integration by packers have fueled cattle producer concerns regarding integration and its impact on the fed cattle market. The purposes of this section are to:

- (1) outline motivations and benefits associated with vertical integration,
- (2) review economic concerns associated with vertical integration in fed cattle markets and summarize research results investigating the impacts of this integration, and

- (3) identify and assess potential policies to address impacts associated with beef packer vertical integration.

Included here is information from the U.S. Department of Agriculture's report on the subject released in 1996. The USDA study is noteworthy because it is the most comprehensive work to date examining short-run factors affecting fed cattle prices and the impacts of vertical integration on cash cattle prices. The studies analyzed data from all transactions involving 35 head or more for the 43 largest steer and heifer slaughter plants owned by 25 firms over the April 1992-April 1993 period.

### **Definitions and Background**

One approach to vertical integration in fed cattle markets has been packers' and feeders' 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 a packer two or more weeks prior to slaughter. This includes:

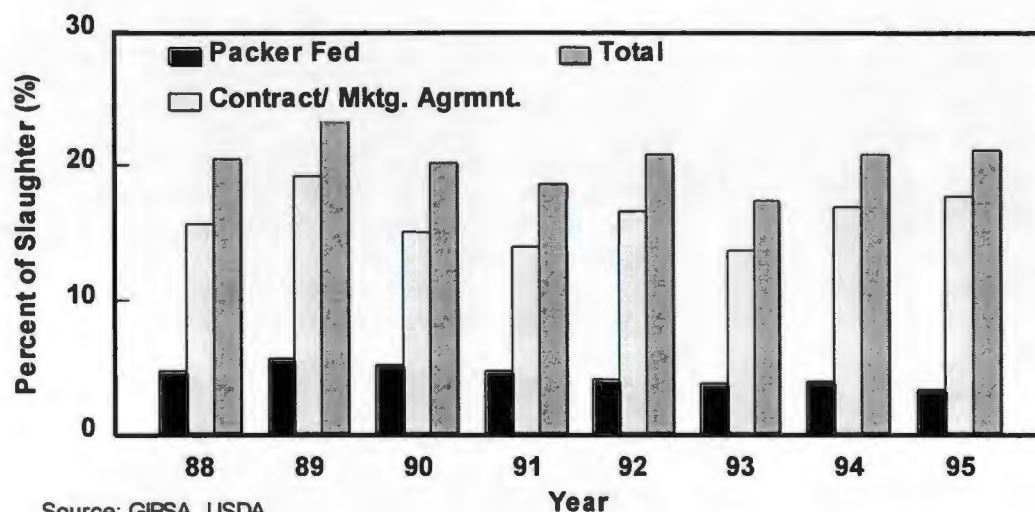
- (1) Cattle sold by feedlots to packers using forward contracts which are generally basis contracts or flat price contracts,
- (2) Cattle sold by feedlots to packers via marketing agreements with price typically established using a negotiated formula, usually consisting of a base price and perhaps stipulated premiums or discounts for quality differences, and
- (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.

The percentage of cattle procured via captive supply arrangements by the four largest beef packing firms in the U.S. from 1988-95 is summarized in Figure 4. The percentage of packer-owned fed cattle remained relatively steady over the period, representing about 3-5% of annual slaughter. Contract and marketing agreement cattle procurement varied from a minimum of about 13% in 1993 to a maximum of nearly 20% of slaughter in 1989. Combined, cattle procured under packer-owned, forward contract, and marketing agreement methods represent roughly 20-25% of annual commercial fed cattle slaughter. Over the past 8 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% to 50% or more of local slaughter. The percentage of cattle marketed using captive supply arrangements typically increases during April-May, declines during summer, and increases in December.

## Incentives to Enter Captive Supply Agreements

**Figure 4. Captive Supplies of Largest Four Beef Packers**



Cattle producers and beef packers both potentially benefit from entering into captive supply agreements. Table 3 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, guaranteed buyer for 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.

Captive cattle supply can also contribute to overall efficiency in the beef marketing system. Reducing risks 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. 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 estimated the size of beef packer efficiency gains associated with the use of captive supplies.

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.

**Table 3. Summary of Potential Incentives to Enter into Captive Supply Agreements**

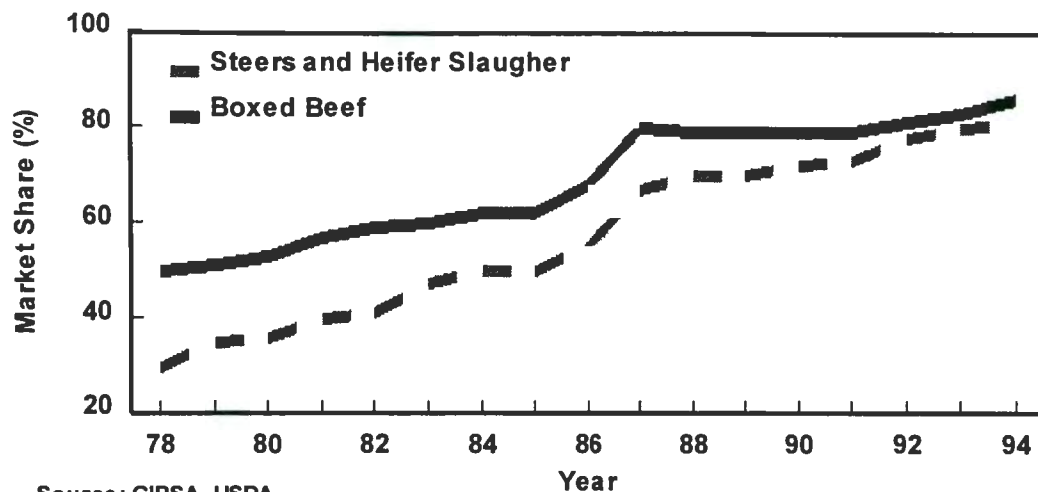
| Method of Captive Supply    | Cattle Feeder/Feedlot Benefits   | Beef Packer Benefits  |
|-----------------------------|--|---|
| <u>Forward Contracts</u>    | <ol style="list-style-type: none"><li>1. Reduce price risk if cattle are hedged or flat priced</li><li>2. Obtain favorable financing</li><li>3. Ensure a buyer for cattle</li><li>4. Reduce marketing cost</li></ol> | <ol style="list-style-type: none"><li>1. Secure slaughter needs</li><li>2. Secure quality supply</li><li>3. Reduce procurement costs</li><li>4. Reduce price risk</li></ol> |
| <u>Marketing Agreements</u> | <ol style="list-style-type: none"><li>1. Premiums for some cattle quality characteristics</li><li>2. Obtain carcass information</li><li>3. Ensure a buyer for cattle</li><li>4. Reduce marketing costs</li></ol>     | <ol style="list-style-type: none"><li>1. Increase cattle quality control</li><li>2. Secure slaughter needs</li><li>3. Reduce procurement costs</li></ol>                    |
| <u>Packer-Owned Feeding</u> | <ol style="list-style-type: none"><li>1. Increase feedlot utilization</li><li>2. Improve packer to feedlot relationship</li></ol>  | <ol style="list-style-type: none"><li>1. Secure slaughter needs</li><li>2. Increase cattle/beef quality control</li></ol>   |

Some captive supply agreements are also a step toward 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 spot 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. Figure 5 illustrates the significant increase in market share of the four largest beef packers since 1978. The four largest packers represented 36% of steer and heifer slaughter in 1980, and by 1994 this share increased to 81%. In contrast, during this same time period hog slaughter four-firm packer concentration increased from 34% to 46%. In some local regions, the four-firm beef packer market share is 100% causing increased concerns in local areas. One of the recent GIPSA packer concentration studies (Hayenga, Koontz, and Schroeder 1996) revealed that, although

**Figure 5. Market Share of Largest Four Beef Packers**



95% 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 and the GIPSA study found that larger plants and firms paid higher prices than smaller firms for fed cattle.

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 4. 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, 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% of cattle slaughtered in the region were from captive supplies.

**Table 4. 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.   |

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% increase in captive supplies was associated with less than a 0.003% 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.

The existence of captive supplies could alter the elasticity of demand for cash cattle. Since more substitutes for cattle purchased in the cash market (namely captive supply cattle) are available in the presence of captive cattle supply (relative to prior to its existence), demand for cash cattle could become more elastic making price less responsive to quantity changes than if captive supplies were not present. If this were the case, the typical range in cash market prices over time (not necessarily within a day) would be smaller in the presence of captive supplies than without captive supplies.

Alternatively, 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. The effects of this increased price variability resulting from reduced market information could easily be greater than declines in price variability associated with changes in demand elasticity.

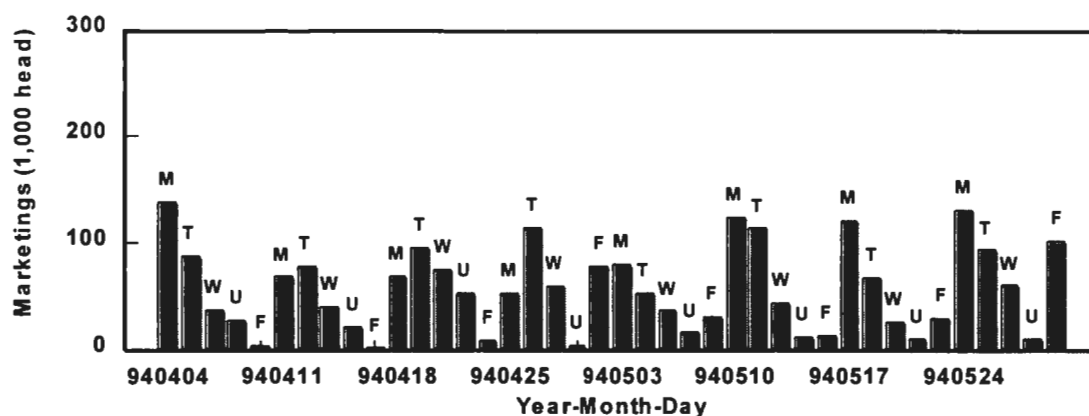
Terms of contracts and prices paid under marketing agreements with formula prices, forward contracts, or production contracts are not public information. During times when large quantities of cattle are being delivered under various captive supply arrangements, publicly reported price information, which reflects only cash market transactions, is not representative of all fed cattle traded. This creates two potential problems: (1) the cash market is a representative measure 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 cash 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 with many formula cattle purchasing arrangements in which the cattle feeder determines timing of cattle delivery.

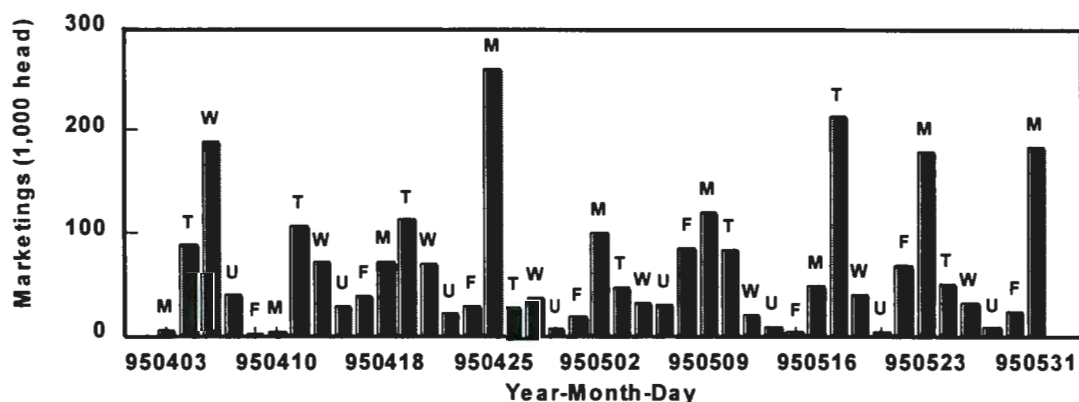
In interviews with cattle feeders, a lot of varied opinions about captive supplies and their impact on cash fed cattle trade surfaced. However, one significant concern was lack of market information. In discovery of fed cattle price each week, an important component of information is the current supply 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.

Daily fed cattle marketings have been highly sporadic, varying from nearly 200,000 head to less than 5,000 head marketed on any particular day in the 5 largest cattle feeding regions. Daily 5-region fed cattle marketings during the April-May periods for 1994-96 are illustrated in Figures 6A-6C. Greater variability in daily marketings was present in 1995 and 1996 than in 1994. Exactly what causes this marketing variability is not apparent. Some cattle feeders and packers indicated this was 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

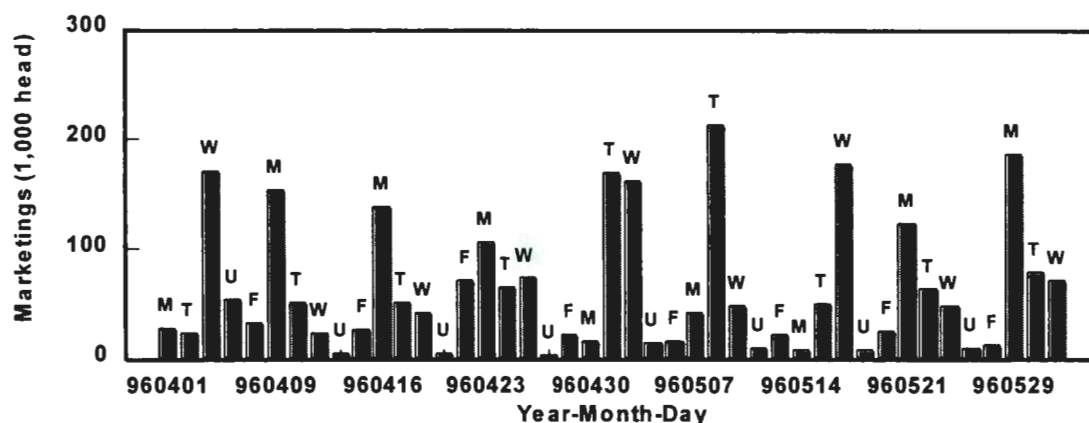
**Figure 6A. Daily 5-Region Fed Cattle Marketings  
Duing April-May 1994.**



**Figure 6B. Daily 5-Region Fed Cattle Marketings  
Duing April-May 1995.**



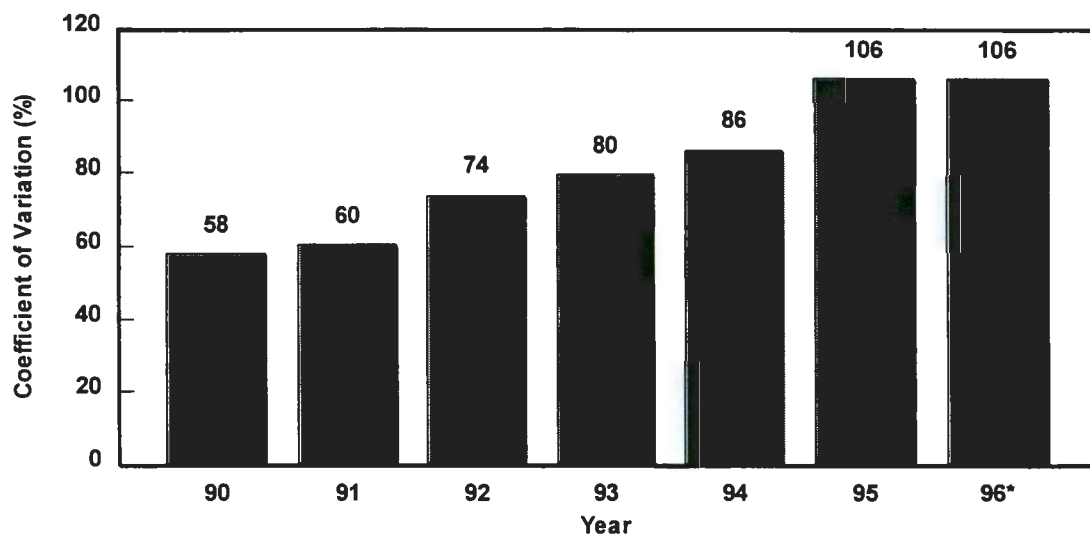
**Figure 6C. Daily 5-Region Fed Cattle Marketings  
Duing April-May 1996.**



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 quantity response to a positive day-to-day price change may be especially apparent when prices are in long-term downtrends as during 1995-96.

Variability in daily fed cattle marketings has increased considerably over the past two years. Figure 7 illustrates the coefficient of variation in daily fed cattle marketings on an annual basis over the 1990-96 period. This statistic measures variability in daily fed cattle marketings after adjusting

**Figure 7. Coefficient of Variation in Daily Fed Cattle Marketings, 5-Regions, 1990-96\***



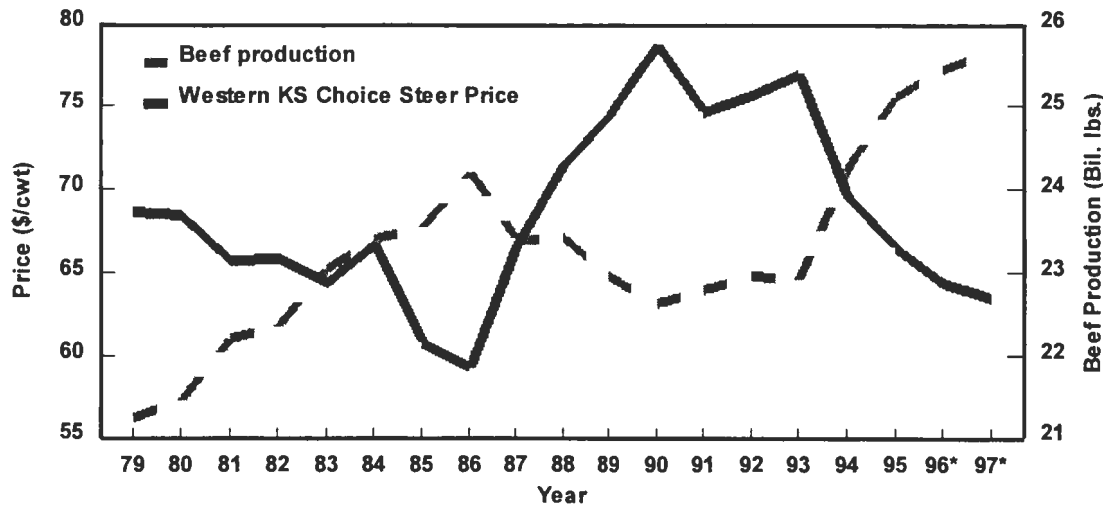
Source: USDA, 96\* is through August

for changes in total annual marketings. As is apparent, variability in daily marketings has nearly doubled over this time period.

### 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 aggregate beef supplies in particular. Figure 8 illustrates how the single most important determinant of fed cattle price, beef production, has induced prices to fluctuate over time. Beef production and prices are inversely related, having nearly mirror patterns in Figure 8. Beef production increased 9% from 1993 to 1995 while fed steer price declined 13%. Per capita beef supply in the U.S. was up modestly in 1996 from the 65-66 pounds of the early 1990s, and this

**Figure 8. Commercial Beef Production vs. Choice Steer Price  
1979-1997**



Source: LMC, USDA, \* indicates LMC Projection

combined with record levels of competing meat supplies will result in 1996 having nearly the highest ever per capita consumption of meat in the U.S. These large overall meat supplies depress prices more than all other factors combined.

Questions 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 high, and when production is low, margins tend to be low (Figure 9). Approximately 90% (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.

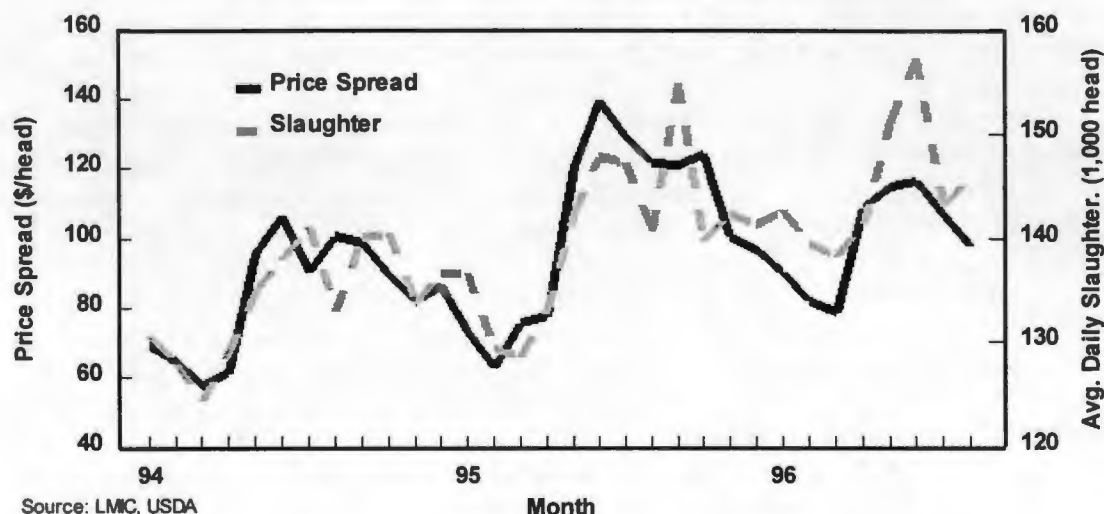
### **Future Prospects**

Most industry participants interviewed felt that captive supplies will not change much over the next 5 to 10 years, much as they have remained relatively constant over the last 5 years. However, most of those interviewed felt some form of alliances would 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.

**Figure 9. Monthly Farm-to-Wholesale Beef Price Spread vs. Commercial Cattle Slaughter, 1994-Aug. 1996**



### 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 concentration would remain unchanged, of course.

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 covers price risk by selling cattle in the futures market at the time price is established. Suspending forward contracts would 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.

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 that week makes cattle feeders anxious and may contribute to 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.

## Group Marketing Alternatives

Cyclically low fed cattle prices, cyclically high packer profits, and price discovery concerns have led cattle feeders to consider fed cattle marketing and pricing alternatives. Pricing alternatives such as grid pricing have already been discussed in previous sections. Other alternatives include groups of cattle feeders acting collectively. Three alternatives discussed here are electronic trading, bargaining, and closed cooperative integration.

Historically, marketing cooperatives have been organized in response to changing needs of producers, and changing economic conditions and technology (Haas *et al.* 1979). Agricultural producers have long recognized that cooperatives enable them to do collectively what they cannot do individually. Producers act together to offset the inherent disadvantages found sometimes from acting alone. While most group marketing efforts by producers are organized as cooperatives, not all are and not all need to be.

For each marketing alternative, cattle feeders individually or collectively must systematically approach the decision of whether to organize or participate in the marketing alternative. A few suggested steps are proposed here which need to be considered in deciding whether or not to organize or participate in fed cattle marketing alternatives (Ward, Bliss, and Hogeland 1993).

Cattle feeders need to understand the production and marketing environment in which they operate. That sounds basic, but there is strong evidence indicating it is more difficult than implied. Marketing means being customer oriented. Cattle feeders need to understand the needs and wants of their immediate customers, packers, and ultimate customers, beef consumers.

Cattle feeders must *specifically* identify the problem that needs to be addressed. Generalities are of little value. Cattle feeders need to focus on causes, not symptoms. An even more difficult task is to identify which alternatives can *realistically* reduce or eliminate which problems. There are several examples of money being thrown at perceived price discovery problems which had little chance of resolving the real problem.

Cattle feeders also need to state clearly their objectives in forming or participating in a marketing alternative. Again there are examples of efforts to form group marketing alternatives where the objectives for organizing or participating in the venture were not clear. As a result, the effort failed. The advantages and disadvantages, more clearly stated as the economic benefits and costs of each alternative, need to be assessed for each participant and for the industry as a whole.

### Electronic Trading<sup>1</sup>

Electronic trading provides a mechanism to centralize the price discovery process for fed cattle. Several electronic trading systems have been developed for livestock and meat (Bell *et al.* 1984). Some were implemented successfully and have operated for many years, such as computer auctions for slaughter lambs and satellite video auctions for feeder cattle. Others were designed, pilot tested,

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<sup>1</sup> The term electronic trading recognizes the dual function of marketing by sellers and purchasing by buyers.

and perhaps operated for some time before failing, such as a computer-assisted trading system for wholesale meat.

Feeders and packers either commented on or were specifically asked about an electronic trading system for fed cattle. In this section, electronic trading of fed cattle is discussed in general terms and comments made by feeders and packers during our personal interviews are summarized.

A primary objective of an electronic trading system is to expose fed cattle to more potential buyers, and simultaneously, to facilitate better access by buyers to more fed cattle. Trading volume is important in electronic markets for two reasons. First, large volume can reduce operating costs of the electronic market. Regardless of the type and design of the electronic market, it incurs costs which are borne by sellers. Such costs, while not necessarily large for individual sellers, are a visible cost to cattle feeders when compared with direct marketing to packers. A second volume-related aspect deals with maintaining meatpacker and cattle feeder participation over time. Volume attracts buyers. Buyers' interest, in turn, attracts additional volume from feeders. If packers can consistently purchase several truckloads of cattle from an electronic market, which in turn helps them meet their procurement requirements, they are more apt to participate regularly. Conversely, if only one or two available packers participate in the electronic market, sellers may lose interest and discontinue using it. Lack of adequate trading volume reduces packer interest, causing them to cease buying through the electronic market. Higher volume increases the probability of success, both for cattle feeders and packers.

Commodities traded electronically must have characteristics which can be communicated to buyers, and buyers and sellers must be willing to accept a common system for describing the commodity. Packer buyers may or may not physically examine fed cattle offered for sale through an electronic market. Consequently, buyers must rely on accurate and meaningful fed cattle descriptions by the sponsoring firm or organization. Persons interviewed commented on the difficulty of accurately describing fed cattle without visual inspection. Without accurate quality descriptions, the electronic market is doomed to failure.

Fed cattle may change quality appreciably if there is a several-day lag between the time cattle are described and when they are delivered to the buyer. Thus, a procedure is needed for reconciling differences between how the cattle were described and what the buyer expected to receive based on that description. Commonly-accepted terminology understood by buyers and sellers may need to supplement standard or official sex, weight, and grade descriptions. The key is helping buyers evaluate fed cattle being offered for sale so they can better match price and quality.

Participants in any given electronic market transaction may be unknown to each other. Since face-to-face communication does not occur in electronic markets, the sponsoring organization must provide a means to identify and certify potential buyers and must ensure that sellers will deliver what was offered. Persons interviewed said that some type of warranty or guarantee of cattle being described accurately was crucial in an electronic market. Similarly, they commented that some method of warranting buyer and seller behavior is also needed. Appropriate performance guarantees must be provided both for cattle feeders and packers, so all are assured they are dealing with reliable individuals and firms.



Evaluations of several electronic marketing systems reveal a number of rather consistent observations about their benefits to buyers and sellers (Bell *et al.* 1984). The magnitude and relative importance of each of these benefits can vary because of differences in geographic locations, commodity traded, market structure, type of electronic marketing system, and other factors. Three benefits have been realized in most instances, but would not be *guaranteed* in an electronic trading system for fed cattle: (1) improved market information and pricing accuracy; (2) improved market access for buyers and sellers; and (3) higher prices from reduced marketing costs and/or enhanced buyer competition.

Market information is generally considered to be a public good, in that the availability of accurate, complete, and timely information creates benefits to all market participants. Its importance in price discovery has been discussed in a previous section. Because electronic markets centralize the price discovery process, the collection of accurate and comprehensive information is enhanced. That in turn facilitates accurate and timely dissemination of market information for price discovery. Interviewees noted that electronic trading could eliminate the industry problem of non-reported trades by feeders and packers. Market information from electronic markets can be tied directly to how fed cattle are described. Then, statistical methods can analyze the price and volume data to determine the value of specific types of fed cattle or of specific animal characteristics. Such analyses can improve the price signaling process between packers and feeders, thus moving toward value-based marketing.

Access by cattle feeders to an electronic market and description trading can improve access to packers by sellers and improve access to cattle by buyers, especially when either is geographically dispersed or isolated. Because of the centralized nature of these markets, a greater number of potential trading opportunities exist than is typical in many direct trading situations. In particular, market opportunities for smaller feeders and packers are enhanced.

Buyers pay higher prices when they operate more cost-efficient plants (Ward, Koontz, and Schroeder 1996). To the extent that electronic markets reduce procurement costs for fed cattle, some of those cost savings may be passed back to feeders in the form of higher fed cattle prices. Cattle feeders noted in interviews that pricing on a grid basis was important to the success of an electronic market for fed cattle. Cattle feeders expressed the belief that packers could then bid higher on better quality cattle without raising the average or market price level for all cattle.

Increased competition is an objective of most electronic markets. An electronic market for fed cattle is intended to increase effective competition among buyers by exposing fed cattle to available buyers and by creating trading procedures that encourage competitive interaction. Ideally, a cattle feeder who sells by private treaty to one or two buyers might sell through an electronic auction to three or more buyers. The same potential competition exists in private-treaty selling as in electronic markets, but an electronic market converts what may be termed latent competitive potential into effective competition by ensuring that each potential buyer has the opportunity to purchase cattle offered for sale. Higher prices from enhanced buyer competition and reduced procurement costs is one of the most consistent findings from electronic livestock markets (Holder 1979; Ward 1984; Sporleder and Colling 1986).

Electronic trading systems also have costs or disadvantages for cattle feeders. Cattle feeders must make a commitment of fed cattle to the electronic trading system. Volume marketing is



important and cattle feeders need to support the electronic market by marketing most or all of their fed cattle through the electronic trading system. Cattle feeders may experience increased marketing costs, especially relative to direct marketing to buyers. Depending on the type of electronic market, there may be a small capital commitment for computers and related equipment. This investment is in addition to the operating costs, usually paid by sellers through marketing charges, for hiring a manager and staff to operate the electronic market.

A major difficulty with organizing and implementing an electronic market will be packer resistance. Some feeders expressed the view that packers were too tied to the current method of procuring cattle. Feeders noted that packers need an incentive to participate in an electronic trading system. That incentive might be better access to the quality and quantity of cattle they need or the opportunity to pay higher prices for higher quality cattle without paying higher prices for poorer cattle. However, any effort to increase competition and potentially raise prices, unless it simultaneously provides buyers with additional benefits (such as access to more cattle or lower procurement costs) will be resisted. If packers oppose electronic trading, they may bid higher for fed cattle in the area to discredit the new trading system. Sufficient commitment by cattle feeders must be present during early implementation of the electronic market to offset packers' attempts to undermine the electronic market before it becomes firmly established.

Several cattle feeders believed electronic trading would be desirable. The key as noted above is packer support. One evolutionary path mentioned is moving from spot markets to formula or grid pricing to electronic trading.

### **Bargaining**

One cattle feeding organization has been exploring a group bargaining approach to fed cattle marketing. There are also individuals and firms marketing cattle on behalf of several cattle feeders. This section does not describe either approach in detail. Rather, it discusses bargaining of fed cattle in general terms and summarizes comments made by feeders and packers during the personal interviews.

The alternative being discussed involves organizing to market fed cattle on behalf of one or more cattle feeders. A management team would be hired to organize the paper pooling of fed cattle for sale, negotiate sales on behalf of cattle owners, and coordinate delivery to packers. The organization would be involved to varying degrees in managing the flow of information between buyers and sellers, such as kill sheets to sellers, among other activities.<sup>2</sup>

The goal of group bargaining should be to improve coordination between cattle feeders and packers. Improved coordination should reduce buyer costs or improve the buyer's ability to procure desired cattle types and quantities, which in turn can enable a packer to pay higher prices for cattle purchased. At the same time, giving each available buyer the opportunity to bid on available cattle may result in added buyer competition and higher prices for fed cattle.

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<sup>2</sup> A group bargaining effort may involve an individual representing one or a group of cattle feeders, a privately-owned firm, or a cooperative. The term firm is used here to cover a range of alternatives.

The success of organized bargaining hinges largely on its ability to organize and control a sufficient volume of cattle to evoke a higher price or improve terms of trade with buyers. The firm may perform functions which assist packers in the procurement process and increase marketing efficiency. Examples include: delivering at specified times to meet the buyer's slaughter schedule, delivering quantities needed for efficient plant operation, meeting quality standards needed to satisfy wholesale buyers of beef and byproducts, etc.

The principal leverage a group bargaining effort might exercise is pitting buyers against one another for the volume handled in order to secure the highest bid. However, the firm will likely have more difficulty negotiating favorable prices or terms of trade on the basis of volume alone, than if it also improves coordination of fed cattle supplies with packers' needs. Large volume increases the probability that the firm can provide packers with the quantity, quality, and type of cattle desired where and when the cattle are needed. If the bargaining firm could guarantee to supply a high percentage of a packer's cattle needs for a given time period, the packer will likely be more interested in negotiating a price premium for the fed cattle. Volume combined with improved coordination offers potential benefits to packers which might translate into higher fed cattle prices. Several feeders commented that volume is necessary, but is not sufficient to leverage packers into paying higher prices.

For effective bargaining, the firm may need to exercise some control over the quantity, quality, and timing of fed cattle marketed. Then the firm can merchandise those services to a packer. In essence, cattle feeders may need to transfer some of their decision-making autonomy to the bargaining firm's hired management. Market volume will depend upon the willingness of feeders to commit cattle to the firm and to honor their commitment. Cattle feeders' commitment of cattle, in turn, will affect the size of packers' efficiency gains and how large a price premium it can afford to pay. As was noted by several cattle feeders, independent cattle feeders may be reluctant to transfer marketing decisions to a bargaining firm. Questions were also asked about operating procedures. For example, whose cattle would be sold first in rising or declining markets? In addition, group bargaining will almost certainly meet resistance from established buyers who may feel their competitive advantage is threatened. Buyers may offer above-market prices, better terms of trade, or engage in other practices to discourage feeders from organizing or participating in a bargaining program.

Bargaining success or effectiveness should be evaluated based on its net impacts, thereby considering both advantages and disadvantages. One potential benefit is an opportunity to obtain higher prices and better terms of trade for cattle feeders. If feeders unite to market large numbers of fed cattle, the bargaining firm may increase the price received for fed cattle. Bargaining does not increase the number of packers, but it can ensure that all available packers have an opportunity to bid on fed cattle marketed, thus increasing buyer competition.

A bargaining firm may negotiate with the packer to return slaughter results (kill sheets) to cattle owners. With slaughter results from packers, feeders can evaluate how their cattle performed in carcass form. As a result, they can make necessary changes in type of cattle fed, feeding programs, and timing of marketings. This type of information can be important and valuable to feeders over time. Some feeders thought a group bargaining firm could market cattle via grid pricing on a dressed weight basis, thus better matching price with product quality. As a result, there could be

enhanced pricing accuracy and an improved flow of market information and price signals from packers to producers.

Among the potential disadvantages (costs) to cattle feeders from effective bargaining, one already mentioned is reduced individual decision-making and transfer of specific marketing-related decisions to the cattle marketing firm. Both volume and commitment of cattle are necessary for success, and involve putting the collective good of the bargaining firm ahead of personal preferences. Giving up that individualism is difficult for many cattle producers.

Another problem mentioned several times was the adversarial relationship between feeders and packers with group bargaining. In many interviews, the need for reducing this adversarial relationship was mentioned. Group bargaining may increase the "us vs. them" attitude in the industry if the primary objective is to countervail packer's bargaining leverage. Group bargaining which relies on a leveraged marketing approach does not improve the quality of cattle or increase the supply of cattle. Furthermore, bargaining strength would be limited because fed cattle are a perishable product. Cattle being held for higher prices continue to gain weight, affecting their quality, cost, and the total production of beef in the market. Combined, this works to undermine the negotiating position of the bargaining firm. Group bargaining where the objective is to improve coordination may reduce the adversarial relationship between feeders and packers. Finally, some feeders also expressed concern about the higher costs associated with a bargaining alternative when beef production costs are already higher than for competing meats.

### **Closed Cooperative Integration**

Vertical integration into meatpacking allows cattle feeders to maintain control of fed cattle and resulting products farther up the marketing channel. Vertical integration enables cattle feeders to participate in *potential* profits generated by slaughtering fed cattle, fabricating beef, and marketing beef products and byproducts. Several groups are considering closed cooperatives as a means of integrating into beef marketing. These efforts are not described here. Instead, the intent of this section is to discuss this alternative in general terms and to report on comments made by feeders and packers during our personal interviews.

There are essentially two paths cattle feeders can take to develop integrated cattle feeding-meatpacking cooperatives. These divergent paths are referred to here as high-volume cooperatives and niche-market cooperatives. A high-volume cooperative would be organized by cattle feeders to compete head-to-head with the largest packers in the industry. A niche-market cooperative would be organized by cattle feeders to capitalize on new market development opportunities stemming from new customer markets, new products, new processes, or new packaging methods. Closed cooperatives being considered correspond more to the latter type of integrated cooperative rather than the former.

Before vertically integrating into meatpacking, cattle feeders must carefully consider the nature of the packing industry, requirements for successful operation, and goals and objectives of cattle feeder members. Disagreement among cattle feeders over the type of meatpacking cooperative to organize will likely destine the venture to failure from the beginning.

Meatpacking is typically characterized as a high-volume, high-risk, cyclical, low profit-margin industry. For a successful high-volume cooperative, cattle feeders must enter meatpacking on a large enough scale to be cost-competitive with large existing firms and to serve high-volume beef customers such as retail supermarkets and food service firms. Cattle feeders may enter meatpacking in one of three ways or some combination of the three: (1) build one or more new plants; (2) purchase one or more existing plants; or (3) contract with one or more existing plants to have cattle custom slaughtered and fabricated.

Limitations to building a new plant include adding slaughtering-fabricating capacity to an industry characterized by excess capacity. New plants are capital intensive, both investment capital and operating capital. They typically incur substantial start-up losses and require large amounts of capital to penetrate existing markets and secure market share from existing competitors. Existing packers may lower their beef product prices to customers and undercut new competitors. A new firm will not likely produce the same quality of products initially as existing packers. Consequently, a new entrant may have to significantly discount prices for its products in order to penetrate existing customer-supplier relationships. Such price discounts will likely mean unprofitable operations for some period of time until product quality can be improved, customer confidence secured, and prices raised to competitive levels consistent with customer services.

An alternative to building a new meatpacking plant is to purchase an existing meatpacking plant or firm. Purchasing existing slaughtering and fabricating capacity may have an advantage in market penetration. If a plant is currently operating, it has a management team, a labor force, feedlot-suppliers from which it purchases fed cattle, and regular customers to whom it markets beef products and byproducts. However, there may be significant disadvantages. Cattle feeders must always ask why the existing firm is for sale. Maybe the plant is not well-managed, not well-located, not cost-competitive, has poor employee relations and low-quality production, cannot secure adequate supplies of fed cattle, or does not have a cadre of satisfied customers. Some problems may be addressed with new management, but some problems may be inherent in the plant. The cooperative may simply be purchasing existing problems for which there are no satisfactory solutions. If the existing plant is idle, several of the same questions as to why it closed must be asked.

Lastly, custom slaughtering and fabricating is an option. As with a closed plant or one for sale, cattle feeders must ask why an existing firm would consider custom slaughtering and fabricating for a group of cattle feeders rather than slaughtering and fabricating for itself. There may be reasons why a custom processing arrangement could benefit both the existing packer and a new cooperative. The existing firm would only concentrate on plant operations such as slaughtering, fabricating, and byproducts processing, and not be concerned with cattle procurement or product sales. The custom arrangement would stabilize income flow and reduce price risk to the custom processor. The cooperative could potentially benefit by acquiring control of product without investing large amounts of capital for a processing facility. Cattle feeder members could supply cattle for custom slaughtering-fabricating and the cooperative could market beef products and byproducts. Investment capital requirements would be considerably lower than building or purchasing a plant, though operating costs (custom fees) may be higher unless the custom plant is cost-competitive with existing firms. Market penetration problems would likely still exist. Existing beef product and byproduct customers would need to be convinced they could continue purchasing the same or higher quality products from the cooperative that they had previously purchased from the existing packer.

Not all meatpacking operations serve the same market segments or customer groups. Cattle feeders may not have to enter the packing industry on a large-volume scale to be successful. Cattle feeders may find a small target market or niche market to serve and effectively improve their marketing position. Markets can be segmented or targeted in various ways. Most could be categorized into two broad groups: (1) products; and (2) services. Either of these may have geographic market opportunities or limitations as well. Closed cooperatives currently being considered are most interested in developing new, value-added products and focusing on increasing the quality and consistency of beef products. Several feeders and packers thought this was the right direction for the beef industry.

A niche-market cooperative must identify one or more target or niche market segments. Cattle feeders considering a niche market must ask why other firms have not identified the same niche and pursued it. There may be sound economic reasons why other firms have chosen not to venture into the seemingly untapped niche market. In many cases, there are profit opportunities but they may be insufficient to offset large costs. For example, the extremely high costs of developing branded products with brand loyalty may be higher than expected profits. Cattle feeders must evaluate whether or not those economic obstacles can be overcome with a new cooperative.

A niche-market cooperative may organize in a manner that enables it to explore several niche-market alternatives. Innovation coupled with careful study may uncover several opportunities. In some cases, physical facilities may be required. Much of the discussion pertaining to building or buying a large-volume meatpacking plant applies to niche-market cooperatives, but on a smaller scale. Several feeders and packers said that building new facilities was not a viable approach. As indicated earlier, a niche-market cooperative, while being concerned about procurement and processing costs, may need to devote comparatively more resources into product and market development, customer service, promotion and advertising, and product distribution and merchandising.

Capital requirements for a niche-market cooperative may not be significantly less than a large-volume cooperative. Investment capital for facilities will likely be significantly less. Operating capital requirements may be more, in order to develop and merchandise new products. There will also be considerable risk involved in penetrating untapped market niches.

Vertically integrating into meatpacking offers cattle feeders several *potential* benefits. Vertical integration can guarantee cattle feeders access to a market for their fed cattle. Cattle feeders would also retain ownership of beef products and byproducts through the wholesale market stage. Thus, cattle feeders would be positioned to participate in *potential* profits generated from slaughtering, fabricating, and marketing value-added products. A cooperative meatpacker could significantly benefit cattle feeders by increasing the flow of information back to its cattle feeder members. Cattle feeders need to know the quality and quantity of beef their cattle produce and how their cattle and feeding regimes measure up to a "standard" or "desired" animal. A meatpacking cooperative would be in a unique position to provide this needed information to its cattle feeder members. Perhaps a cooperative could more quickly and efficiently move the industry toward value-based marketing and pricing than under the current market structure, since the cooperative's primary purpose is serving its members' best interests.



Vertical integration, however, is not a panacea. Implementing a vertically integrated cooperative is not without problems. One of the most serious anticipated problems is cattle feeder commitment, which is a dual problem consisting of cattle commitment and capital commitment. Cattle feeder members would likely have to sign marketing agreements which limit them to marketing fed cattle solely through the cooperative. This commitment will likely include quality as well as quantity of cattle. Below-average or poor-quality cattle will have to be discounted severely in developing consistent, high quality beef products. Insufficient quality and quantity will increase operating costs and restrict the cooperative from guaranteeing customers the volume and quality of products they need.

As was mentioned, organizing an integrated cooperative will likely require a significant capital commitment by cattle feeder-members. Persuading cattle feeders to invest in a new cooperative which will engage in a high-risk, low-profit activity will be difficult. Persons interviewed expressed the view that many cattle feeders do not have reasonable expectations for closed cooperative performance. A competitive return on investment will be difficult to estimate and impossible to guarantee.

While vertical integration by cattle feeders into meatpacking offers potential opportunities, along with it are assured risks. Perhaps the single most important factor affecting the success or failure of such a venture is understanding clearly the objectives and expectations of the new cooperative. Having unclear objectives or unrealistic expectations will doom the initiative from the outset. Clear, specific objectives and expectations are essential for the cooperative to have a reasonable chance of succeeding. Integration into meatpacking is often thought by producers to be the answer to their market access and buyer competition problems. However, meatpacking cooperatives historically have experienced little success (Haas *et al.* 1979). Legitimate opportunities may exist, but cattle feeders must carefully study the feasibility of realistically succeeding in such a venture.

### **Summary**

In summary, cattle feeders interested in organizing or participating in innovative or group marketing alternatives for fed cattle must understand what they can *realistically* accomplish. Group marketing is not a guaranteed solution to their perceived marketing problems. Cattle feeders must consider such alternatives with open eyes and an open mind. There are economic reasons why the existing market structure has evolved to what it is today. Cattle feeders, by organizing group marketing alternatives, are attempting to alter the existing market structure in some way. They must understand the economic reasons which may favor the group marketing alternative's success, but must also understand the economic reasons which may be working against successfully implementing a group marketing alternative. Once those reasons are identified and a plan developed to overcome them, the probability of success increases.

### **Price Discovery: Future Prospects**

Improved price discovery and vertical coordination in the beef industry are essential for beef to maintain market share in the future. This chapter has detailed important forces influencing how price discovery and vertical coordination have evolved in the beef sector. The roles of technology,

pricing methods, market structure, risk management tools, market institutions, information, and management philosophies and strategies on price discovery and market coordination in the beef industry were assessed. The purpose of this section is to use key findings of this study to provide projections for the next decade.

Projecting the market environment, technology, market institutions, and management directions in such a complex sector as the beef industry is difficult. So many different factors are interrelated and dependent upon each other. About the only certain projections are that change is imminent and economics will dictate the direction of change. Change will occur as untapped profit opportunities are discovered by innovative beef market participants. Precisely who in the industry will step forward and be the leaders of change is not always apparent, but all market participants will be affected.

*One theme that pervades all change in the beef sector is that the industry desperately needs to produce products possessing greater value to consumers.* Value means the product must be priced competitively, it must be convenient, and it must provide a consistently desirable eating experience for consumers. These attributes, though simple conceptually, have proven immensely difficult for the beef industry to manage. A myriad of beef products and product qualities are produced from cattle and the target markets represent such a diverse set of consumer demands, that there is no simple solution to the industry's struggle for market share. This diversity of beef products and array of target markets suggests the industry and beef products are likely to become progressively more segmented in the future. In order for beef product segmentation at the consumer level to succeed, segmentation will increase at all levels of the cattle and beef production chain as each level strives to become more customer focused.

Significant forces influencing price discovery and vertical market coordination in the beef industry over the next decade are:

- *Technology to improve our ability to identify and sort beef products according to varying quality attributes and value will be developed and adopted commercially by processors.* Several such technologies are already being developed including beef tenderness tests, video imaging, and product identification tracking. Technology will create quantitative and/or mechanical quality determination procedures reducing subjective meat quality assessment. This is a necessary step toward better identifying and paying for quality attributes of fed cattle.
- *Federal beef quality grades are likely to be less important in 10 years.* Many different means will be adopted to measure and describe beef quality differences depending upon the targeted consumer. Because standardized quality grades are not likely to adequately measure all the different needs of varied consumers, standardized grades will have less general value. However, in transition, federal quality grades are *valuable* to the industry and should be *maintained*. They do not inhibit private beef product branding. In fact, federal quality grades are one of the quality specifications used to describe most branded beef products marketed today. The current grading system, however, does not adequately describe beef tenderness and, therefore, does not adequately characterize the eating experience consumers can expect. Thus, a significant overhaul of the quality grading system may be in order rather than attempting to fine tune the current system. Making even small grade changes has proven to be slow, divisive,

and ineffective. Because of inherent problems with the current quality grading methods and the difficulty in modifying the standards, a significant change in the system is needed.

- *Our ability to predict meat quality from visual inspection of live cattle will not improve much over the next decade.* Thus, live cattle price differentials will not adequately reflect cattle and beef value differences. This will lead to more fed cattle being sold on a dressed weight, carcass quality and yield grade basis.
- *Grid pricing will become more common in procurement of fed cattle by packers.* Pricing methods that more accurately reflect value differences will replace systems not based on product value. Grids may continue to have a variety of base prices and a range of premiums and discounts. It will continue to be important for the USDA to continue to collect and report grid prices.
- *More cattle will be produced under alliances that directly link cow-calf producers all the way to retail and food service outlets.* Alliances provide opportunities for clearer price signals encouraging producers to produce beef products targeted to specific consumers. However, only a relatively small portion of the industry will find alliances profitable as they involve considerable risk, coordination, infrastructure, and control, and generally offer only modest opportunities for additional profit. All parties involved in an alliance must benefit or it will not succeed. Alliances will not replace the predominant pricing methods, carcass weight and grade and live weight pricing. However, information exchanged in alliances will supplement price signals in the market place. Alliances may also contribute to better understanding between feeders and packers and a reduction in the disruptive adversarial relationship that plagues the beef industry.
- *The result of more fed cattle being sold on a dressed weight, carcass quality and yield grade basis, greater use of price grids, and increased alliances, will shift the center of price discovery more to the wholesale level.* This suggests greater need for continued efforts to improve boxed beef and byproducts price reporting by USDA.
- *Producer group marketing and closed cooperative efforts will increase, but they will not represent a significant portion of the fed cattle market.* The most probable beneficiaries of producer group marketing activities will be smaller and mid-sized operations. Group efforts for these producers may offer significant opportunities for information sharing and capturing of volume-premiums associated with grouping cattle for large beef processors.
- *Certified beef marketing programs may expand modestly in the future.* However, the success of these programs will depend critically upon the certification program integrity and whether the certified beef is perceived to be differentiated from other beef products.
- *An increased share of beef will be branded in the future.* However, who will take the lead in branding beef products may vary; some alliances may introduce branded products; some producer groups may initiate branded products; some certified programs already involve branded products; many restaurants differentiate themselves by the beef they sell with their name serving as a brand; some packers may brand beef products; and more retailer product branding could occur. Large beef processors appear to be a natural place for branding to

expand. However, large packers will not brand much beef until profitability of doing so is clear and they can make the large investment in capital required for a branded beef program. Relative to current large packer operations, successful beef product branding requires much more control over the type of cattle procured, careful beef quality measurement and sorting, extensive coordination between product merchandisers and commodity procurement, and national brand promotion programs. This more intensive management and control is costly and a large packer whose comparative advantage is large volume, low-cost processing sees little benefit relative to the increase in costs and risks associated with large-scale branding. This will slow development of branded beef.

- *Asymmetry of market information plagues the beef industry.* The USDA has been very responsive to industry demands by developing new information and reports. Even more information is needed especially regarding close trim and all boxed beef prices, export prices, hide and offal values, and short-run captive supplies. However, at times industry participants resist public reporting requests. *If industry participants do not cooperate and provide information as requested, mandatory reporting may be the inevitable policy solution.* The need for more market information regarding captive supplies is *not* an indictment against this marketing method or against packer concentration, it simply represents a need to balance information flows when these marketing alternatives are prevalent.
- *Market institutions need to evolve with the industry.* *The live cattle futures contract will see increased pressure to move to a dressed weight specification.* This was not necessarily a position held by most industry participants interviewed for this study. However, overwhelming evidence suggests that live cattle cash trade will decline and dressed weight pricing will increase in the future. *Carcass weight pricing will likely become the predominant fed cattle pricing method in 10 years, though a significant percentage of fed cattle will still be priced on a live weight basis.* In addition, the dressed beef contract will likely be cash settled because of the inherent difficulties in delivering dressed beef. Developing a cash settled dressed beef contract will require improved boxed beef and carcass price reporting by the USDA.
- *Electronic trade of fed cattle (either on a live or carcass basis) may have had a role at one time in the beef industry. However, it appears less likely it will play a role for large, integrated, vertically coordinated firms targeting beef to specific consumer segments.* An electronic market is likely to suffer from insufficient volume and therefore, is not likely to succeed.
- *Negotiation of cattle terms of trade will increase significantly in fed cattle marketing.* Larger operations, group efforts by producers, producer cooperative ventures, alliances, and product branding all require more negotiation of terms of trade than previous marketing methods. Beef product specifications, base prices, formulas for premiums and discounts, volume needs, and control and verification of production practices all associated with targeting products that focus on specific consumer demands increase the need for, and benefits of, negotiations among market participants. Increased negotiations require better market information, technology to more accurately measure negotiated meat product specifications, increased knowledge of how to control product quality, and more coordination among stages of the marketing and production system.



- *When technology and incentives for improved meat product market segmentation develop, the highly concentrated packing and increasingly concentrated cattle feeding industry structures will lead to rapid adoption throughout the industry. Conversely, if technology is slow to develop or market price differentials are inadequate to induce change, the beef industry will continue to lose market share.*
- *This report focused very little on feeder cattle pricing. However, better determination of value at the meat level and less emphasis on live fed cattle pricing may have implications for feeder cattle pricing. Many pricing issues may be transferred to feeder cattle markets if value determination at the fed cattle level improves. The risk of variable animal quality that was previously borne at the packer level will be passed back to cattle feeders and will heighten issues of pricing and value determination of feeder cattle. Considerable market coordination will continue to be needed between the cow/calf, stocker and feeder levels and improvements in fed cattle pricing will be followed by increased attention to latent feeder cattle pricing issues.*

Change in the way beef is produced and marketed, in the institutions used to coordinate the market, in the way product quality is determined, in the way markets are segmented and consumer demands are met, and in the information and skill needs of industry participants are inevitable. These changes will not come without costs, risks, resistance, and some failures. The beef industry has traditionally been slow and reluctant to change in accordance with market conditions. Many reasons contribute to the industry's sluggishness including significant biological production lags, decentralized production with divergent comparative advantages of producers in different geographic regions, commodity focused mentality of the industry, risk, and market structure. Ultimately, the beef sector will not maintain its market share unless the industry faces the changes necessary to meet consumer demand over the next decade. Those that successfully adapt will survive, those that do not will disappear. *A necessary condition to a return to a more competitive position and to an ability to command and hold a larger market share in the traditional price-based system will be improvement in price discovery. If significant improvement does not occur, then the industry can expect a still greater emphasis on contracts and other non-price means of achieving high levels of coordination across the production, processing, and merchandising of beef.*

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## CHAPTER 3

### *Pork Industry Price Discovery: A Look Ahead*

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#### Introduction

The process of industrialization in the swine industry has been written about extensively in recent years by Grimes, Barkema and Cook, Hurt, Rhodes, Boehlje and Schrader and others. The purpose of this paper is to concentrate on the pricing issues that have arisen in the process of industrialization. These issues include the diminishing role of open markets and the increasing role of carcass value pricing, contracting, vertical integration, and marketing supply contracts. Critical to these pricing issues is the question "Who is going to manage the price risk so inherent in the hog sector?" The answers to these questions have important implications to all segments of the pork sector, the futures markets, policy makers, regulatory agencies, and the general public as it debates the course of the swine industry in the future.

The ideas in the paper are gleaned from research on the swine industry in the Southeast since 1980 and review of trade publications, academic papers, and journal articles. These sources are used in an attempt to understand what has happened, what is happening, and what might happen in the next ten years. Hopefully these ideas will facilitate useful dialogue among all those interested in the swine industry and suggest some avenues for empirical work on this topic.

#### Conceptual Model

Many factors have led to industrialization in the swine industry. Some of these include changing consumer tastes and preferences (Hurt), profitability of producing hogs (Hayenga et al., Grimes, Lawrence), consolidation in the hog packing sector (Karlson and Eidman) and access and control of information (Boehlje and Schrader). Organizing these various factors in terms of their role in fostering industrialization, their relative importance in the process, and understanding where this process is headed is very difficult. Many industry and academic economists have attempted to explain this process with varying degrees of success. One of the most helpful models of structural change was developed by Reimund, Martin, and Moore (RMM) in 1981. They formulated their model after careful consideration of the structural changes that had occurred in the broiler, beef, and vegetable industries. I want to use their model to help organize my thoughts about the origin, process, and future of industrialization in the swine industry.

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\* Special thanks to Gary Kee and Wayne Purcell for help in the review of literature, collection of data, and insightful discussions.

The RMM model focuses on the process of structural change. The model first identifies important factors causing changes in structure, and then examines their role in the process of structural change. Structural change is defined as a significant change in the ownership, control, and organizational characteristics of resources used in the production of a commodity. The important factors causing structural change in the RMM model are presented in Figure 1. These three factors are 1) various forms of technological improvement (mechanical, biological, and organizational), 2) resource and product market factors, and 3) policy factors. Once one or several of these factors initiate structural change, the RMM model suggests the industry will pass through several stages on its way to becoming more industrialized. These stages are outlined in Figure 2 and are 1) technological change, 2) shift in production location, 3) growth and development, and 4) adjustment to risk. RMM analyzed in detail the broiler, fed cattle, and vegetable processing industries using this general model. Their model is helpful in organizing my thoughts concerning what has happened and what might happen in future years in the swine industry.

Figure 1. Preconditions for Structural Change

|         |  |
|---------|--|
| I.      | Technological factors  |
| A.      | Mechanical and Engineering Technology <ul style="list-style-type: none"> <li>• Housing design and materials handling in production</li> <li>• Substitution of machinery for labor in processing</li> </ul>                               |
| B.      | Biological Technology <ul style="list-style-type: none"> <li>• Breeding, nutrition, and disease control</li> <li>• Phase feeding</li> </ul>  |
| C.      | Adoptable Organizational Technology <ul style="list-style-type: none"> <li>• New structure needed to organize technology and coordinate production practices</li> <li>• Contracting and vertical coordination and integration</li> </ul> |
| II.     | Resource and Product Market Factors  |
| A.      | Potential Alternative Production Areas <ul style="list-style-type: none"> <li>• Need for new enterprises in areas experiencing decline in traditional commodities</li> </ul>   |
| B.      | Growth Markets   |
| C.      | Product Market Risks <ul style="list-style-type: none"> <li>• Price variability</li> <li>• Gaining market access</li> </ul>  |
| D.      | Input Market Risks <ul style="list-style-type: none"> <li>• Access and price variability of major inputs</li> </ul>  |
| E.      | Alternative Capital Sources <ul style="list-style-type: none"> <li>• Traditional sources reluctant to lend</li> </ul>  |
| III.    | Policy Factors   |
| A.      | Commodity Programs   |
| B.      | Antitrust Policy   |
| C.      | Tax Policy   |
| Source: | Reimund, Martin, and Moore, <i>Structural Change in Agriculture: The Experience of Broilers, Fed Cattle, and Processing Vegetables</i> , USDA, ERS, Tech. Bul. No. 1648, April 1981, pp. 5-6.  |

Figure 2. Structural Change Model for Agricultural Subsectors

- I. Technological change stage
  - New technology adopted by large producers
  - Capital requirements increase
  - Economies of size develop
- II. Shift in location of production stage
  - New producers and new capital enter in new producing areas
  - Interregional competitive advantage shifts to new areas
  - Production begins to concentrate in new areas
  - Producers in new area use new technology
- III. Growth and development stage
  - Innovative and aggressive entrepreneurs develop larger farms using new technology
  - Specialization and concentration in production occur
  - Market economies develop in all stages of subsector in new area
  - Output per farm grows rapidly
  - New information systems develop
  - Rapid growth and concentration alters risk
  - New producers are risk takers, aggressive, and innovative
  - Periods of overproduction amplify market risks
- IV. Adjustment to risks stage
  - New risk aversion strategies
  - New types of coordinating procedures are established
  - Use of forward sales and production contracts increases
  - More coordination develops
  - Control of product flows and product characteristics shifts from producers to nonfarmers or other stages of the food and fiber sector closer to the final consumer
  - All stages become more industrialized

Source: Reimund, Martin, and Moore, *Structural Change in Agriculture: The Experience of Broilers, Fed Cattle, and Processing Vegetables*, USDA, ERS, Tech. Bul. No. 1648, April 1981, pp. 54-55.

### RMM Model and Swine Structural Change

RMM applied their model to the swine industry in 1981 because it was frequently cited as a sector likely to undergo major structural change. They identified the preconditions for structural change as development of improved "lean" breeds of hogs, development of environmentally controlled production facilities, and advances in nutrition and medical practices. These advances made it possible to develop large-scale production units that could utilize the new technology and achieve economies of size. Favorable tax policies allowing investment credit write-offs on single-purpose structures and accelerated depreciation contributed to the growth of specialized hog production units. RMM did not include changing consumer demand or consolidation of the packing industry as a factor initiating structural change in the swine sector.

In 1981, major shifts in regional hog production had not occurred, as stage 2 of the RMM model suggests. But it is significant that the large-scale specialized production enterprises using the latest technology started outside the traditional hog production regions, primarily in North Carolina. Many of the new producers were integrated with feed manufacturers. Large-scale operations accounted for 1/6 of U.S. total marketings in 1978 and their output was increasing 17 percent per year. In the context of the RMM model, the swine sector was passing through stage 1 of technological changes and entering into stage 2 of "shift in location." There was some evidence that these new large production units were growing faster than more traditional production units, according to RMM.

Several other studies in the early 1970s and 1980s help document the initial causes and characteristics of large specialized production units. A North Carolina study by Ikerd and Higgins in 1973 found five different types of contracts being used with producers. Most of the contracting was done by feedmills who were attempting to maintain a dependable outlet for feed. Packing plants were offering contracts to keep their plant running near capacity and to upgrade the quality of hogs processed. Rhodes and Grimes reported that North Carolina was the leading state in number of producers marketing more than 5,000 head per year in 1974. These large units grew by 276 percent from 1965 to 1974. Van Arsdall reported that Southeast producers with annual sales over 2,500 head had average feed efficiencies of 3.15, compared to average feed efficiencies of 4.43 in the North Central region. In 1980, Van Arsdall and Nelson reported that 16.5 percent of hog sales were from farms with sales over 2,500 head per year in the Southeast. The comparable percent for the North Central region was 6.8 percent.

Kenyon and Mundy used the RMM model to analyze the Maryland, North Carolina, Pennsylvania, and Virginia swine industry in 1982 using a mail survey of producers and personal interview of packers and feed manufacturers. Like RMM, they found considerable evidence of stage 1 technological and biological change, and stage 2 growth of large firms outside historical production regions. By 1982, 4 percent of the hog producers in the region with annual sales exceeding 2,500 head were producing 36.8 percent of the hogs in the region. Seventy-four percent of the farms in North Carolina selling more than 25,000 hogs annually were specialized in hog production. Producers reported receiving premiums from packers for selling semi-loads of hogs on a regular basis. Over 20 percent of the North Carolina hogs were produced under production contracts for feedmills on a payment per head basis plus a premium for feed efficiency. Packers were not widely involved in contract production with producers. Thus, in the RMM model, the North Carolina swine industry was through stages 1 and 2, in the middle of stage 3 exhibiting rapid growth, and showing some signs of stage 4 where new risk management arrangements develop.

These early studies concentrate on innovations and changes at the producer level as the driving force behind expansion of new, large, efficient production units using the latest genetics, feeding, and animal health programs. The existing packing companies in the 1970s and early 1980s were not heavily involved with these new producers in terms of ownership or coordination, and the changing needs and desires of consumers are seldom mentioned as a driving force for change in the pork industry. These observations lead to the conclusion that during the 1970s until the mid 1980s, the driving force behind the rapid increase in large swine production units was the profits to be made in swine production.

University of Nebraska economist Mike Brown cited returns to capital in pork production for the "massive" capital movement into pork production at the 1994 World Pork Expo. He said

rates of return have averaged 26.7% in Iowa and 18.7% in Nebraska since 1988. The top one-third producers have averaged 40-50% rates of return (Table 1). He said operations marketing 1,800 hogs per year are showing profits of \$44,000 to \$50,000 per year. The North Carolina Swine Demonstration Project, operated as a 120 sow commercial farrow-to-finish facility using the latest available technology, averaged returns to labor and management of \$9.10 per cwt. from 1979 to 1990. According to Sony Faison, President of Carrolls' Foods, Inc., their company averaged 10 cents per pound profit in their swine operators from 1990 to 1994 (*Business North Carolina*). These and other similar data have lead Hurt, Hayenga et al., and Grimes and Rhodes to conclude that the rapid increase in large confinement swine facilities and mega producers (over 500,000 per year) has been a response to profit potential in swine production (Figure 3).

Table 1. Annual Rate of Return to Capital for Farrow-To-Finish Operations

| Year    | Nebraska |                   | Iowa    |                   |
|---------|----------|-------------------|---------|-------------------|
|         | Average  | High Profit Third | Average | High Profit Third |
| 1988    | 13.0     | 30.6              | 15.3    | 21.0              |
| 1989    | 25.6     | 56.6              | 24.4    | 46.2              |
| 1990    | 43.6     | 69.2              | 56.7    | 85.7              |
| 1991    | 5.4      | 25.0              | 23.5    | 45.2              |
| 1992    | 12.6     | 33.0              | 18.0    | 39.2              |
| 1993    | 12.1     | 33.4              | 22.4    | 42.6              |
| Average | 18.7     | 39.6              | 26.7    | 48.4              |

Source: Iowa and Nebraska Swine Enterprise Records, 1988-1992. *Feedstuffs*, June 29, 1994.

Figure 3. Profit in Swine Production

"... 26.7% and 18.7% returns to capital for pork production since 1988 have brought massive amounts of capital into pork production...."

-- Mike Bruman, World Pork Expo, June 1994

The pork industry is a high-margin business. Farms on the ISU records program achieved in excess of a 25% annual average rate of return on capital since 1980. High returns have attracted outside investors.

-- Dr. Chris Hurt, Purdue University, *Choices*, 1994

Average returns to labor and management for the farrow-to-finish herd averaging approximately 120 sows has been \$9.10 a cwt. from 1979-1990.

-- North Carolina Swine Development Center, annual reports

Carrolls' Foods, Inc. average profit from the swine division has been 10 cents per pound for the last five years.

-- Sony Faison, CEO, Carrolls' Foods, Inc., *Business North Carolina*, April 1994

The driving forces in pork production include its move to capital intensive production, its move to prices that are based on leanness and quality, ... and "its push to high return-on-investment (ROI), with good producers realizing 15-20% ROI."

-- Dr. Ralph Vinson, Minnesota Pork Congress, February 1996



In 1993, only 3 percent of U.S. hog production was vertically integrated with packers through ownership of production facilities (Rhodes). About 13 percent of U.S. production was marketed by 57 producers in 1993 (Rhodes and Grimes). Seven firms marketed more than 500,000 head and planned to grow at a rate of more than 20 percent per year in the future. These large firms were located outside the traditional production areas of the Midwest. So, in the RMM model, the structural change was initiated by technological change in production technology (stage 1), moved to non-traditional production areas (stage 2), and entered a period of rapid growth characterized by economies of scale and large profits (stage 3). But as RMM indicate, the rapid growth and concentration alters risk in stage 3 and causes a search for new ways to manage risks and coordinate production, packing, and retailing within the system in stage 4 (Figure 2).

### Pricing and Coordination Issues

As the industrialization of production was occurring in the 1970s and 1980s, the hog packing sector underwent a tremendous restructuring in the early 1980s. Between 1980 and 1985 at least eleven major hog slaughter plants closed. These plants had a combined annual kill capacity of 9.7 million hogs. Most of these plants were older, multi-storied plants (Karlson and Eidman).

The older plants were replaced by newer plants with improved efficiency. Output per production worker rose, and the new plants created excess capacity relative to hog supplies. Hog packers looked for ways to improve margins, and turned to reducing labor costs. IBP entered hog packing in 1983 and used non-union labor earning \$4.00 per hour less than most other packers. These lower wages caused other packers to obtain wage concessions. From 1977 to 1986, real wages in meat packing plants declined 31 percent (Table 2). By the mid 1980s the hog packing industry was substantially modernized with much lower labor costs (Karlson and Eidman).

Table 2. Real Earnings of Production Workers in Manufacturing and Meat Packing: 1977-1986

| Year                        | Manufacturing<br>(SIC Division D) | Meat Packing<br>(SIC 2011) |
|-----------------------------|-----------------------------------|----------------------------|
|                             | \$ / hour                         |                            |
| 1977                        | \$9.37                            | \$10.84                    |
| 1978                        | 9.46                              | 10.87                      |
| 1979                        | 9.23                              | 10.65                      |
| 1980                        | 8.82                              | 10.30                      |
| 1981                        | 8.79                              | 9.87                       |
| 1982                        | 8.79                              | 9.33                       |
| 1983                        | 8.87                              | 9.11                       |
| 1984                        | 8.85                              | 8.56                       |
| 1985                        | 8.85                              | 7.53                       |
| 1986                        | 8.88                              | 7.52                       |
| Percent Change<br>1977-1986 | -7%                               | -31%                       |

Source: Karlson, N. and V. Eidman, *Structural Change in Meat Packing and Processing: The Pork Sector*, Dept. of Agric. & Applied Econ., Univ. of Minn., SP P91-31, July 1991, p. 19.

### Carcass Value Pricing

With modern, lower cost plants, packers began to look for other avenues of reducing costs and improving margins. Packers knew that excess fat was costly to remove and the new health conscious consumer wanted lean meat. But the existing open market system of yields and grades was not sending the appropriate signal to producers to reduce the fat in market hogs. Hayenga et al. reported that only 10-12% of all hogs sold to packers were priced according to actual carcass performance using carcass merit evaluation pricing systems in 1984. Hayenga et al. demonstrated that a carcass value pricing system based on carcass weight, backfat, and muscle score could explain 79 percent of the variation in carcass value compared to 58 percent in a typical live-hog procurement system. They concluded that a carcass merit pricing system could be easily implemented by packers and would provide producers with clear signals concerning consumer demand for lean pork.

Hatfield Packing Co. of Pennsylvania, John Morrell & Co., and Geo. A. Hormel & Co. and a few other packers were the first to use objective carcass merit buying programs in the late 1980s (*Feedstuffs*, Jan. 4, 1994). According to Jeff Luckham, procurement director for John Morrell, Morrell was the first major packer to introduce a lean payment program in 1989. After introducing the program, average percent lean increased 3% in three years according to Luckham. Luckham indicated consumers were forcing all packers to produce a better product (*Feedstuffs*, Feb. 2, 1992). Adoption of carcass value pricing (CVP) caught on quickly among packers. In 1990, 25 percent of all hogs were purchased via CVP (Schroeder). By 1993, 75 percent of all hogs were purchased under a carcass merit system (Pork Chain Quality Audit).

All CVP systems include premium and/or discount schedules for backfat and weight sort. Some CVP programs include premiums and discounts for loin eye muscle depth, although these adjustments are generally much smaller than those for weight sort and backfat depth. Packers have consistently argued that variation in live hog quality is their number one problem (Figure 4). Table 3 documents that in 1993 the variation in hog weight, backfat thickness, and carcass muscle were large, with over one-third of all animals outside the desired ranges in CVP systems reported by Kenyon, McKissick, and Lawrence. More than one third of the live hogs weighed less than 220 pounds or more than 260 pounds, more than one half had backfat greater than one inch, and more than one third had carcass muscle less than 48 percent. The extreme variability that packers face in live hogs makes it very difficult for packers to produce uniform, consistent, high quality pork that consumers desire.

Under most CVP systems, the base carcass price is formula determined relative to cash prices reported in the Iowa-Southern Minnesota market. The live hog price is used to compute an equivalent carcass price using some standard formulas which may vary from firm to firm. But in almost all cases, the price is discovered in the live market rather than the carcass market. All packers in the Southeast region of the U.S. determine their base cash price off the Iowa-So. Minnesota cash price. Hence, hog prices in the U.S. are still primarily determined in the live hog market in Iowa-So. Minnesota where there are still many producers and a number of packers aggressively bidding for hogs.

The role of the CVP system is to communicate to producers the quality of these hogs by paying higher prices for lean, meaty hogs of desired weight. The implementation of CVP has reduced backfat levels among hogs, but there is considerable evidence accumulating that indicates many packers do not believe that the open market price system alone can generate the quality and

Figure 4. Pork Carcass Variation

In a single truckload of hogs, backfat typically varies between 13 and 43 mm (0.5-1.67 in).  
 -- D. K. Spell, procurement director, Lundy Packing Co., *Feedstuffs*, Feb. 2, 1992

U.S. packers are complaining that variation, not leanness, is the number one problem for them.  
 -- *Feedstuffs*, June 7, 1993

A typical trailer load of hogs comes from 29 producers. An average load of hams is derived from more than 50 herds. Those statistics underscore the pork industry's biggest hurdle in attaining better quality product. Excessive variation in genetics, management, nutrition, ...  
 -- Derrick Gee, PIC, *Feedstuffs*, Nov. 15, 1993

There is too much variation between hogs and there is probably more variation today than a few years ago.  
 -- Alan Schinckel, Purdue University animal scientists, *Feedstuffs*, Dec. 6, 1993

American Meat Institute, packers, processors and retailers all ranked lack of uniformity in live hogs, carcasses, and retail cuts as second or third most important quality issue facing the industry.  
 -- NPPC, Pork Quality Audit, April 1994

Our hogs are like peas in a pod, and that is very important to the Japanese. They are looking for a lean, uniform product in a given volume, and we are able to satisfy that demand.  
 --Jeff Luckham, director of procurement, Smithfield Foods, Inc., *Feedstuffs*, May 23, 1994

Table 3. Hog and Carcass Variation

| Category                    | Units       | Percent |
|-----------------------------|-------------|---------|
| Liveweight                  | < 220 lbs   | 8.8     |
|                             | 221 - 240   | 32.7    |
|                             | 241 - 260   | 33.2    |
|                             | 261 - 280   | 17.5    |
|                             | > 281       | 7.9     |
| Backfat thickness, last rib | < .60 inch  | 3.0     |
|                             | .60 - .79   | 11.5    |
|                             | .80 - .99   | 21.2    |
|                             | 1.00 - 1.19 | 27.6    |
|                             | 1.20 - 1.39 | 17.1    |
|                             | 1.40 - 1.59 | 10.9    |
|                             | 1.60 - 1.80 | 6.5     |
|                             | 1.80 +      | 2.2     |
| Carcass muscle, percent     | < 45%       | 11.6    |
|                             | 45 - 47.9   | 21.8    |
|                             | 48 - 50.9   | 33.8    |
|                             | 51 - 53.9   | 19.8    |
|                             | 54 - 56.9   | 10.7    |
|                             | > 57        | 2.3     |

Source: NPPC, *Pork Quality Audit*, April 1994, pp. 32-33.

consistency of hogs they desire. Hence, several packers have purchased or made arrangements with genetic seed stock companies. Smithfield-Carrolls' has exclusive rights to NPD genetics in the U.S. Farmland Industries requires all producers in their "uniform pork" program to use DeKalb genetics (Figure 5). The expanding production by Seaboard in Oklahoma, by PSF in Missouri, and by Circle Four in Utah all involve a complete integration of production and packing. These integrated firms use only one or two genetic lines to improve the uniformity of their hogs and processed products. The expansion of these operations in the last several years with specific genetic lines indicates that the carcass merit pricing systems alone have not been sufficient to improve the quality and uniformity of hogs to the level desired by packers.

Figure 5. Packers and Swine Genetics

The cornerstone of Smithfield's strategy is the NPD pig. The NPD is lean, long, and muscular, with half the backfat and with hams that are 33% leaner than the average pig processed at Smithfield. The "remarkable animal" has superior conversion and productivity and quality assurance traits, and each animal has its entire history documented.

-- Joe Luter, III, President and CEO, Smithfield Foods, Inc., *Feedstuffs*, Aug. 23, 1993.

Corporations will eventually control the swine genetic base. If they see it as an advantage, they will integrate to lock us out of the germ plasm business. When that happens, it's all over.

-- Dave Baldwin, Missouri swine producer, *Feedstuffs*, Aug. 15, 1994.

Farmland Industries, Inc. initiated a "uniform pork" program more than three years ago. To become a full-fledged "uniform pork" producer, members must access DeKalb genetics. They also must agree to coordinate nutrition and record keeping through Farmland.

-- Steve Marbery, *Feedstuffs*, Sept. 25, 1995

Vertical integration remains the company's primary strategy for improving quality and quantity of hogs and pork. A closely affiliated hog production network in genetics, feed, production practices, and marketing schedules is tightly controlled as the best means to improve the quality and maximize the value of every hog.

-- John Nielson, CEO, Smithfield Foods, Inc., *Feedstuffs*, Sept. 2, 1996.

### Marketing Supply Contracts

Marketing supply contracts are offered by packers to producers to line up supplies, to improve uniformity of hog supplies, and to improve overall quality. Producers use market supply contracts to assure market access and obtain higher prices. Most supply contracts are four to seven years in duration, and several require that the producer sell the packer at least 10,000 hogs per year (Figure 6). In most marketing supply contracts, the transaction price is still based on the live hog market price the day hogs are delivered. Some contracts have price windows that permit the packer and processor to share price risks above and below a predetermined high and low window price. Some market supply contracts provide a premium on all hogs sold, although the amount of this premium is not generally known. Packers justify this premium on the basis of reduced purchasing costs and reduced hog supply variability which reduces packing costs.

Figure 6. Long-Term Marketing Contract Terms by Packer

|            |  |
|------------|--|
| Monfort    | <ul style="list-style-type: none"> <li>• five price window contracts</li> <li>• 5-7 years duration</li> <li>• 10,000 - 150,000 hogs produced per year</li> <li>• prefers exclusive rights to sellers' hogs</li> <li>• 20% kill under long-term contract</li> <li>• want 70% under long-term in five years</li> </ul> |
| Farmland   | <ul style="list-style-type: none"> <li>• price window contracts</li> <li>• 4-7 years duration</li> <li>• hogs must be 50% lean</li> <li>• must sell 400 hogs a quarter</li> </ul>  |
| Excel      | <ul style="list-style-type: none"> <li>• price window contracts</li> <li>• 5-7 years duration</li> <li>• hogs must be 51% lean</li> <li>• minimum 10,000 hogs annually</li> </ul>  |
| Hormel     | <ul style="list-style-type: none"> <li>• 15-25% under long-term agreements</li> </ul>  |
| Smithfield | <ul style="list-style-type: none"> <li>• no price window contracts</li> <li>• quality premiums over Midwest prices</li> <li>• 5+ years duration</li> <li>• volume and quality minimum</li> <li>• 65% of hogs contracted</li> </ul>   |
| IBP        | <ul style="list-style-type: none"> <li>• no price window contracts</li> <li>• value managed relationships (hand shake)</li> <li>• pay three day rolling average industry price</li> <li>• buy all producers' hogs if sell exclusively to IBP</li> <li>• no minimum size required</li> </ul>                          |

Source: "New deals at the packing plants," *Successful Farming*, March 1995.

Lawrence conducted a survey of Iowa hog producers in 1994. Only 5 percent of Iowa producers reported being involved in a long-term supply contract. About a third of those with marketing contracts had a price window provision. There were little if any risk-sharing provisions in the contract. Some contracts require minimum meat quality standards and some stated minimum genetic standards. Eighty-three percent of the hogs in the survey were sold on the cash market. This survey indicates a small percentage (less than 5 percent) of Iowa hogs are under long-term marketing contracts or price window contracts.

The growing popularity of supply contracts between large producers and packers has been of great concern to smaller producers. Some of these concerns are listed in Figure 7. The two primary concerns are market access and "fair prices." When smaller producers hear that some packers have 80 percent of their kill capacity committed to five producers, or that other packers desire to have a large portion of their kill under contract, they become concerned about market access, especially when they learn that some packers require at least 10,000 hogs per year to get a marketing supply contract. The other big concern is unreported price premiums associated with market supply contracts. The nature and size of these premiums is largely unknown. Smaller



producers believe they should receive the same price as larger producers for equivalent quality hogs. These issues have been particularly acute in Iowa in recent years, where the Iowa Pork Producers Association has fought integration, marketing supply contracts, and called for more complete price reporting by USDA.

Figure 7. Marketing Supply Contracts

Since 1975, Iowa packers have been unable to own cattle or hog feedlots. In 1988, the statute was amended to exempt cooperatively owned packers from this restriction. Delegates at Iowa Pork Producers Association annual meeting in January 1993 narrowly defeated a resolution to remove the cooperative exemption. The IPPA voted unanimously for a resolution calling on NPPC to become more aggressive in combating pork industry concentration. The purpose of the resolution is to protect market access for independent producers.

-- Steve Marbery, *Feedstuffs*, Feb. 1, 1993

Roughly 80% of the hogs slaughtered and processed at the North Carolina plant derive from five large producers, including some of Smithfield's own herds.

-- Steve Marbery, *Feedstuffs*, May 23, 1994

Producers fear hog prices reported do not represent the full range of prices paid for hogs on that particular day.... Producers believe arranged marketing transactions may be adversely affecting market prices.... NPPC has asked for study on market access, value determination, and price reporting.

-- Steve Marbery, *Feedstuffs*, Sept. 4, 1995

Small producers are finding it harder and harder to sell their hogs. Even producers with 600 sows in fringe production areas are finding it difficult to find buyers.... Packers are forming long-term agreements with larger producers.... Sooner or later they won't need my hogs.

-- Steve Marbery, *Feedstuffs*, Sept. 25, 1995

It is important to understand that most marketing supply contracts do not change the traditional price discovery process for hog prices. Most prices under these contracts are still based on Midwest live hog prices. Hence, these contracts improve coordination between producers and packers, but they do not fundamentally change how prices are discovered in the market. In addition, the decision to expand or contract production still lies with the producer, although signing a marketing contract may put some bounds on production decisions. Hence, marketing supply contracts may improve coordination among producer and packer, but they do not increase the level of vertical integration in the industry.

The RMM model suggests both increased coordination and new risk transfer mechanisms in the fourth stage of structural change. Marketing supply contracts are one means of increasing coordination. The involvement of packers in swine genetics is another method of increasing coordination within the system. But what about new methods of sharing market risk? The price window contract is a recent development designed to spread the risk between the producer and packer.

## Price Risk Management

Price window contracts have been available to producers for approximately five years. According to Grimes and Rhodes, only 1.3 percent of U.S. hog production was covered under a price window or cost plus contract in 1994. Under these contracts, the packer specifies a price window inside which the producer receives the market price. Typical price windows are \$40-48 cwt., \$40-50 cwt., \$38-48 cwt., etc. Above the high price, the producer receives 50 percent of the amount the price exceeds the high price. During these high price periods, producers receive prices lower than the market price and packers pay lower prices. Since pork packing margins are typically squeezed and frequently negative during periods of high prices, the packer gains during these periods of high prices. During periods when prices are below the window price, the producer receives the lower window price minus 50 percent of the difference between the window price and the market price. During periods of low prices, the producer receives higher prices which helps reduce the impact of low prices on producer returns and cash flows. The packer pays higher prices during periods of low prices, but historically the packing margins are better during periods of low prices. Hence, the price window contract should theoretically benefit both producer and packer by helping level out cash flows over time. Hopefully, reduced price variation will lead to less quantity variation, making it possible to improve the coordination between producer, packer, and retailer and maintain a more consistent flow of product over time.

Hog prices have traditionally been very seasonal and cyclical at the farm level. Grimes (*Feedstuffs*, May 27, 1996) and many other economists argue that the traditional hog cycle indicators and hog:corn ratio are no longer good guides to producer/industry response to prices and returns. They argue that industrialization of hog production and coordination between the producer and packer have altered historical relationships. These relationships may have been altered some in recent years, but the extremes in prices have not. Since 1994, the industry has experienced \$28 cwt. prices in November 1994 followed by \$60 cwt. prices in August 1995. These low and high prices are right in line with previous cycle highs and lows since 1975 (Figure 8). The industrialization and coordination that have occurred in the industry through 1996 have not made much of an impact on price risks at the producer level.

Figure 8. Monthly 7 Market Hog Prices

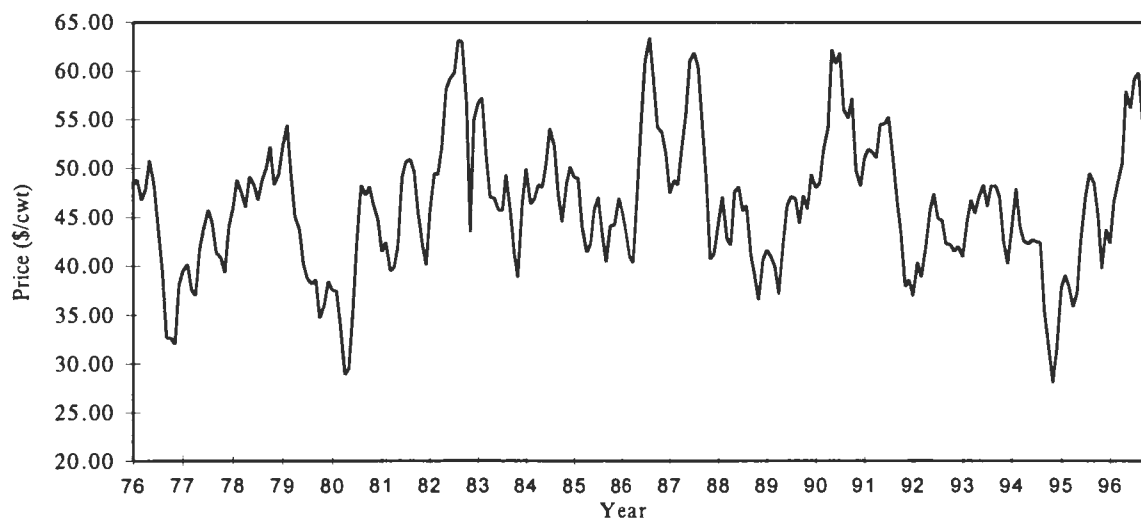


Table 4 suggests that the industry has made some progress in reducing monthly slaughter variation since 1970. From 1970 to 1979, the coefficient of variation in monthly slaughter across the years ranged from 6.5 to 13.3 percent. The average over this period was 11.4 percent during 1970-1974 and 13.4 percent from 1975-1979. Since 1979, the coefficient of variation has been below 10 percent each year. The average coefficient of variation across 1990-1994 was 8.7 percent. The coefficient of variation of monthly hog slaughter (CV) regressed against year from 1970-1996 gives the equation:

$$\begin{array}{lll} CV = 19.7 - .137 \text{ YEAR} & R^2 = .32 & F(1,25) = 11.53 \\ (5.8) (-3.4) & SER = 1.63 & DW = 2.19 \end{array}$$

This equation indicates the variation in slaughter from month to month across the years is declining on average by .137 percent per year. The equation does not explain why the CV has been declining, but increased industrialization and coordination in the swine industry must be one of the reasons. The increase in variation during 1975-1979 when corn prices were relatively high and the reduction in variation in 1985 and 1986 when corn prices were low would suggest part of the variation is induced from feed cost variability that makes up 50-60 percent of the cost of producing hogs.

Although Table 4 indicates variability in the swine production system is declining over time, Figure 8 indicates there is still substantial price risk in the swine industry. The vertical integration and coordination that have occurred to date have not made a substantial reduction in this risk. Producers and packers within the system are very concerned about how to manage this risk, especially after experiencing \$5.00 per bushel corn prices during 1996. At \$4-5 corn prices and \$40 hog prices, even large specialized efficient hog producers lose money.

Smithfield Foods, Inc. risk management strategy is to integrate production, packing, and processing (Figure 9). When production margins are low, packing margins are usually favorable and vice versa. By owning some production (Carrolls' of Virginia, Browns, Inc., and Circle Four), Smithfield hopes to level out company earnings over time. But the large mega producers and other large producers will have to use more traditional means of price risk management. Sony Faison of Carrolls, Inc. expects some very difficult price periods in the years ahead. Rhodes suggests that large specialized production units will have to develop financial reserves to survive the low price phase of the hog cycle, because they lack income from other sources to carry them when hog prices are low. These large specialized farms should have the expertise to use hog, corn, and soybean meal futures and options to manage their margins. The move from smaller hog-corn-soybean farms to specialized hog farms without a crop base may actually increase the demand for futures contracts.

### Hog Futures Market

The Chicago Mercantile Exchange (CME) changed their live hog futures contract to a lean hog futures contract starting with the February 1997 contract. The new contract is based on wholesale prices of 51-52 percent lean pork and is cash settled based on the weighted average U.S. carcass price for the previous two days. By switching to a carcass price contract, the CME is indicating that the industry is moving towards pricing at the carcass level rather than the live level. Initial trading results from the February 1997 contract indicate an increase in trading.

Table 4. Monthly Commercial Hog Slaughter Variability: 1970-1996.

| Year    | Annual Slaughter | Average Monthly Slaughter<br>1,000 head | St. Dev. Monthly Slaughter | Coefficient Variation Monthly Slaughter<br>% |
|---------|------------------|---|----------------------------|--|
| 1970    | 85,818           | 7,152                                   | 899                        | 12.6   |
| 1971    | 94,439           | 7,870                                   | 618                        | 7.9  |
| 1972    | 84,708           | 7,059                                   | 641                        | 9.1  |
| 1973    | 76,796           | 6,400                                   | 612                        | 9.6  |
| 1974    | 81,762           | 6,814                                   | 504                        | 7.4  |
| 1975    | 68,688           | 5,724                                   | 597                        | 10.4   |
| 1976    | 73,786           | 6,149                                   | 818                        | 13.3   |
| 1977    | 77,304           | 6,442                                   | 629                        | 9.8  |
| 1978    | 77,317           | 6,443                                   | 418                        | 6.5  |
| 1979    | 89,099           | 7,425                                   | 830                        | 11.2   |
| 1980    | 96,074           | 8,006                                   | 589                        | 7.4  |
| 1981    | 91,576           | 7,631                                   | 599                        | 7.9  |
| 1982    | 82,190           | 6,849                                   | 515                        | 7.5  |
| 1983    | 87,585           | 7,299                                   | 678                        | 9.3  |
| 1984    | 85,168           | 7,097                                   | 584                        | 8.2  |
| 1985    | 84,493           | 7,086                                   | 391                        | 5.5  |
| 1986    | 79,577           | 6,633                                   | 492                        | 7.4  |
| 1987    | 81,082           | 6,757                                   | 635                        | 9.4  |
| 1988    | 87,794           | 7,320                                   | 594                        | 8.1  |
| 1989    | 88,691           | 7,391                                   | 501                        | 6.8  |
| 1990    | 85,137           | 7,011                                   | 611                        | 8.7  |
| 1991    | 88,169           | 7,347                                   | 616                        | 8.4  |
| 1992    | 94,888           | 7,907                                   | 521                        | 6.6  |
| 1993    | 93,069           | 7,756                                   | 438                        | 5.6  |
| 1994    | 95,697           | 7,975                                   | 650                        | 8.2  |
| 1995    | 92,397           | 7,700                                   | 516                        | 6.4  |
| 1996    | 96,326           | 8,028                                   | 502                        | 6.3  |
| 1970-74 | 84,705           | 7,059                                   | 807                        | 11.4   |
| 1975-79 | 77,239           | 6,437                                   | 863                        | 13.4   |
| 1980-84 | 88,519           | 7,377                                   | 706                        | 9.6  |
| 1985-89 | 84,881           | 7,037                                   | 594                        | 8.4  |
| 1990-94 | 91,191           | 7,599                                   | 664                        | 8.7  |
| 1995-96 | 94,358           | 7,863                                   | 525                        | 6.7  |

Source: *Livestock Slaughter*, USDA, NASS, various issues.

The open interest in the February 1997 contract exceeded open interest in the February 1993, 1994, 1995, and 1996 contracts. The live hog contract was for 40,000 pounds. The new lean contract is for 40,000 carcass pounds. Given a yield of 74 percent, the lean hog open interest is equivalent to 1.34 pounds of live hog. Using this conversion factor, the open interests in 1997



lean hogs exceeded open interest each month of the year compared to 1993-1996. The average open interest of 5,898 equivalent live contracts was 33 percent greater than open interest in 1996, and twice the level of 1994 (Table 5). The industry appears to have accepted the new contract. Only time will tell if the open interest continues to outperform previous years. The new cash settlement provisions should make the contract attractive to exporters and importers as the export market grows in future years. And the new contract should be attractive to large producers who are familiar and comfortable with carcass value pricing systems that are based on carcass prices.

Figure 9. Producer and Packer Comments About Risk Management

"Because of the competitive forces within the food and feed industries, the penalty for poor risk management has grown sharply. Risk management is now critical to success.

— Christopher Kelley, *Feedstuffs*, June 6, 1994

We believe the U.S. hog industry is in for a very stormy period for the next 12-18 months. Anybody who thinks the hog business will undergo a smooth and orderly consolidation is dead wrong. Everything is driven by price. Traditional producers don't cut back on the anticipation of low prices. Periodic, nasty, price disruptions are an inevitable part of industry maturation.

— Sony Faison, President, Carrolls' Foods, Inc., *Feedstuffs*, May 15, 1995

The cyclical nature of pork processing both helped and hindered Smithfield Foods, Inc. in fiscal 1995. During the low prices of 1994, company costs of raw materials declined and margins for fresh pork increased. When hog prices rose in the spring of 1995, costs rose and margins slipped. This volatility underscores the strength of the company's integration strategy, explaining that low hog prices increase farming operation losses, but these are offset by increased returns in processing.

— Joe Luter, President and CEO, Smithfield Foods, Inc., *Feedstuffs*, Aug. 28, 1995

"As long as traditional producers have enough money to buy a pick-up and another six-pack of beer, they will produce hogs" remarked a dedicated mega producer, who would like to see small, land-based hog farmers retire so fluctuations in the hog cycle will smooth out and make accessing capital much easier.

— *Feedstuffs*, Oct. 23, 1995

### Impact of Consumer Demand

Barkema and Cook argue that changing consumer demand is the driving force behind industrialization in the swine industry. Their argument is that changing consumer tastes and preferences, especially for less fat, more consistency, and less preparation time, have led packers into developing pricing and ownership arrangements that make it possible for them to secure the type of hogs they can process efficiently into the product consumers want. Rhodes makes a strong case that the industrialization of hog production proceeded the involvement of packing plants into the ownership and control of hog production. In 1993, only 3 percent of national slaughter was directly controlled by packers. Hence, consumer preference and quality issues do not appear to be the initial driving force behind the level of industrialization found in production today.



Table 5. Monthly Average Open Interest of February Hog Contract<sup>a</sup>

| Month         | Contract Year |       |       |       |       |                    |
|---------------|---------------|-------|-------|-------|-------|--------------------|
|               | 1993          | 1994  | 1995  | 1996  | 1997  | 1997x <sup>b</sup> |
| Jan           | 45            | 16    | 119   | 115   | 219   | 294                |
| Feb           | 170           | 33    | 220   | 141   | 325   | 436                |
| Mar           | 280           | 67    | 241   | 247   | 379   | 508                |
| Apr           | 402           | 140   | 308   | 365   | 563   | 754                |
| May           | 673           | 168   | 575   | 621   | 939   | 1258               |
| Jun           | 872           | 328   | 795   | 1292  | 1592  | 2133               |
| Jul           | 1151          | 846   | 1236  | 2727  | 2264  | 3034               |
| Aug           | 1652          | 1968  | 2078  | 3758  | 3131  | 4196               |
| Sept          | 2087          | 2654  | 3830  | 5135  | 4621  | 6193               |
| Oct           | 5431          | 4185  | 6931  | 7352  | 7489  | 10036              |
| Nov           | 10496         | 7575  | 11238 | 10207 | 10414 | 13955              |
| Dec           | 15839         | 11673 | 14550 | 15500 | 13996 | 18754              |
| Jan           | 10040         | 8418  | 9976  | 10095 | 11281 | 15117              |
| Feb           | 2569          | 2207  | 2328  | 2461  |       |                    |
| Contract Avg. | 3780          | 2929  | 4007  | 4427  | 4401  | 5898               |

<sup>a</sup> 1993-96 is live hog contract, 1997 is lean hog contract.

<sup>b</sup> 1997x is lean hog multiplied by 1.34 to convert to live hog equivalent.

But consumer preferences are playing an important role in some of the pricing arrangements that exist in the industry today. Carcass value pricing by packers is an attempt to get producers to produce less fat in direct response to changing consumer desires. The substantial discounts for pork carcasses outside the desired weight range are a strong signal to producers that packers want uniform hogs. Almost 50 percent of all meals are eaten outside the home today (Figure 10). These consumers want high quality, consistent, nutritious meals that require little preparation. These consumer desires make it imperative that packers have uniform, high quality hogs to pack and process. The carcass value pricing systems of packers were designed to improve the uniformity and leanness of hogs in direct response to consumer desires.

But pork quality depends on a number of attributes in addition to uniformity in size and leanness. Consumers are also concerned about appearance, tenderness, juiciness, nutritional value, and food safety. The current CVP systems of packers do not measure these quality attributes. In fact, the industry is concerned that emphasis on leanness has come at the expense of other important quality traits important to consumers. According to a survey of Midwestern packers, 15 percent of all hogs processed produce pale soft exudative (PSE) pork (*Feedstuffs*, Feb. 22, 1993). The halothane or "stress" gene improves the dressing yield and loin production despite meat quality that is not desirable, including color and drop loss and toughness. The NPPC national genetics evaluation study found that 12 percent of all maternal line sows are carriers of the halothane gene (*Feedstuffs*, June 26, 1995). The current CVP systems of packers cannot "solve" this quality problem. The only way to eliminate this problem is to buy seedstock that is verifiably free of the stress gene. This particular quality problem and others like it explain why some packers have entered into the seedstock business or require their producers to use a certain genetic line of hogs.

Figure 10. Consumer Trends and Preferences

Changes in eating habits have driven consumers to demand convenience that will allow no more than 20-30 minutes preparing a meal. Pork products must be conveniently prepared with less saturated fat, cholesterol, sodium, and calories. New channels of communication are developing to ensure that pork products are properly engineered to meet the modern consumer's tighter specifications.

-- Barkema and Cook, "Consumers, Technology Push Hogs Industry Consolidation," *Feedstuffs*, July 12, 1993

Consumer food spending increased 0.9% in 1993 compared to 1992. Consumer spending in grocery stores grew only 0.2%. Consumer spending in the prepared sector grew 1.8%. Spending on fully prepared food products grew 5.8%. Purchases to take off premises grew 4.7%. The action is home eating, not home cooking.

-- William Hale, Food industry specialist, *Feedstuffs*, Oct. 17, 1994

Product uniformity is the driving force behind today's large integrated swine operations. By strictly controlling the swine genetics in uniform, large agricultural production units, these integrated food processors can produce uniform, consistent, lean pork products meeting consumers' demand. The name of today's economic game is control over products produced.

-- Harlan Hughes, *Feedstuffs*, Jan. 17, 1995

Forty seven percent of all food sales were away from home in 1994. More two-income households and higher women employment levels have reduced the amount of time available to prepare food at home.

-- Alden Manchester and Annette Clausen, "1994 Spending for Food...", *Food Review*, May-August 1995

Only 15% of consumers in future will buy "commodity pork." Consumers will buy brands they can trust because of consistency over time.

-- Mark Graves, Latigo Management and Marketing, *Feedstuffs*, Oct. 9, 1995

Smithfield's, Inc. new "lean generation pork" is 61% lower in fat than traditional pork and can be used to substitute for chicken in diets according to a Duke University nutritional survey.

-- Gordon Carlson, *Feedstuffs*, Oct. 16, 1995

The increasing evidence linking diet and health has not been lost among consumers--92 percent of food shoppers interviewed for the 1995 annual survey by the Food Marketing Institute reported having changed their eating habits to make their diets more healthful.

-- Elizabeth Frazao, "The American Diet: A Costly Health Problem," *Food Review*, Jan-Apr 1996

Consumers are also concerned about color, marbling, cholesterol, cooking loss, moisture content, tenderness, juiciness, flavor and chewiness. At present it is not possible to measure most of these attributes in an efficient, accurate, and cost effective manner at current packing line speeds. Much research is being conducted to determine methods and tests that could be used to include these quality traits in carcass value pricing systems. But until these tests are identified and adopted, packers will have continued incentive to control or coordinate producer genetics to

obtain the quality of pork they desire. Packers who buy from only a few large producers will find it much easier to coordinate their raw product quality attributes and the final processed product attributes designed for specific consumer markets. Hence, while these quality issues may not have been a driving force in the integration and coordination present in the pork industry today, they will be a more important factor in the future, especially as the pork industry expands into the export market.

### **Implications**

The RMM model hypothesis is that some external factor will initiate the process of structural change, and that this process, once started will move through four stages. In the case of the pork industry, the driving force behind the structural change has been the technological developments that have made specialized, large scale production of hogs a profitable business. The development of confined facilities, disease control, nutritional feeding by phase, new genetics, and improved waste management systems have permitted the rapid expansion of manufacturing style production systems. Once a few large producers became proficient in building and managing these systems, they were replicated in rapid order. These new units were capital intensive, very labor efficient, experienced economies of size, and were very profitable.

The rapid expansion of the new production system started in North Carolina outside the traditional production area (Midwest). Production increased rapidly in North Carolina, and then began to spread to other new production areas like Missouri, Oklahoma, Colorado, Wyoming, and Utah. During this time, production in the more traditional area began to decline. This is stage two of the RMM development process.

During stage three, rapid expansion occurs, and the industry becomes highly concentrated in the new production area. New technologies continue to develop as the industry expands. Some of these developments in the swine industry have been all-in/all-out systems, segregated early weaning, split sex feeding, and phase feeding. During rapid growth, new coordination mechanisms develop and market risks increase, with periods of overproduction amplifying these risks. The pork industry recently passed through these events in 1994 with overproduction and in 1996 with high feed prices that vividly reminded large producers of the risks involved in specialized production.

In the fourth stage, the industry develops new procedures for risk management and coordination of production with demand. In pork, these changes have been evidenced by marketing supply contracts between packers and producers to help coordinate supplies and demand. Price window contracts have been developed to help share the price risks inherent in the hog cycle. Carcass value pricing has been instituted to signal producers to produce a product more consistent with consumer desires. And a few packers have entered into production and purchased seedstock companies in an effort to better coordinate pork quality with consumer desires. The RMM predicts that the desire to improve coordination in the system results in the control of product flows from producers to non-farmers or other stages of the food system closer to the final consumer. Is this going to happen in the swine industry in the near future?

The Midwest cash live hog market (especially Iowa-Southern Minnesota) is the current focal point of the price discovery system. The existence of a large number of packers with excess slaughter capacity relative to local supplies of many relatively small producers has been



generating what most industry analysts consider a very competitive price. Almost all other prices across the U.S. swine production areas are tied to these prices (Kenyon, McKissick, and Lawrence). Although about 20 percent of U.S. hogs are produced under contract, the contracting is primarily between very large producers and their contract growers. The very large producers still transfer their market hogs to packers at market determined prices based on the Midwest live hog market. Only about 5 percent of the hogs produced in the U.S. are actually owned by packers (Rhodes). So, the current pricing system is still predominantly a live cash market in the Midwest with the rest of the U.S. deriving prices by formula from the Midwest market (Kenyon, McKissick, and Lawrence).

Under the current system, producers still control supply and carry the market risk of lower prices. Two new arrangements have developed in recent years to help coordinate supply and reduce risk. Marketing supply contracts between producers and packers help coordinate supplies between them. Packers receive a consistent, predictable supply of uniform, quality hogs that permit them to reduce packing costs and better coordinate the quality attributes of hogs with the quality attributes featured in their processed products designed to meet certain consumer market segments. Producers get guaranteed market access and a price premium from the packer. Many packers require 10,000 head or more annually in order to enter a market supply contract.

Smaller producers (<10,000 head) are very concerned about market access and fair and open pricing. Some packers have a large percentage of their kill capacity committed to a relatively small number of larger producers. For example, the new Smithfield plant in North Carolina obtains 80 percent of its hogs from five producers. Smaller producers are concerned that they may lose their markets as the system continues to become more coordinated through marketing supply contracts. These concerns were amplified during the recent period of overproduction in the fall of 1994 when smaller producers sometimes had difficulty finding a market for their hogs because packers were committed to their producers under market supply contracts.

The second feature of market supply contracts that disturbs small producers is the undisclosed premium paid producers with market supply contracts. Producers believe that hogs of equal quality should be paid equal prices. Since the market supply contract premiums are not public knowledge, smaller producers believe they are being discriminated against. These concerns relative to market supply contracts relating to market access and price premiums have led Iowa pork producers to call for more complete reporting of quantities and transaction prices paid by packers under market supply contracts. The prevalence of these contracts is likely to grow in the future given the benefits both packers and producers receive.

Price window contracts help both producers and packers reduce the impact of extremely high and low market prices on their profits. Less than three percent of market hogs are covered by these contracts. But the recent extremely wide swings in price from \$28 cwt. in November 1994 to \$60 cwt. in August 1996 will cause many producers and packers to investigate ways to manage market risks.

In all of the discussion about vertical integration, contracting, coordination, and market supply contracts, it is important to realize that large specialized hog operations still bear the risk of low hog prices. Vertical integration and price window contracts may have shielded up to 10 percent of production from the vagaries of the hog price cycle. But the remaining 90 percent are still exposed. The hog price cycle has not gone away, and the variability in production over time

is declining very slowly. So, over the next 5-10 years, the large specialized hog producers will need to be very concerned about managing their market risks. The new 1996 farm bill is expected to increase farm level price variability in grains and soybeans, so specialized producers may be entering a period of increased price risk from the cost side of the market. The demand for futures contracts for grain, soybean meal, and hogs may increase.

The alternative approach to risk management is to vertically integrate. This is the approach that Smithfield Foods, Inc. has chosen. They have developed their own production facilities (Browns) and have joint ownership with other large producers (Carrolls' of Virginia and Circle Four). Other large producers/packers like PSF and Seaboard may choose to spread risk across their entire production/packing/processing system. But as long as the mega producers (500,000+) and very large producers remain independent from packers, there are likely to be some very large swings in hog prices over the next ten years. How the industry decides to manage and share these risks will in large part determine the nature of the price discovery system in the future.

Hog production is continuing to decentralize across the U.S. Production has grown rapidly in North Carolina but declined in the Midwest. But hog numbers are increasing in Missouri, Oklahoma, Colorado, Utah, and Wyoming (Figure 11). These new large complexes are primarily being built by large producers, not packers, although packers are part of these systems. These new investments by large producers would argue that the industrialization process in the swine industry is continuing to be driven by potential profits from production. The industry is relocating in non-traditional areas because of environmental concerns in more densely populated areas and because of opposition by producers and rural residents in the more traditional production areas. The continuing decentralization of production may have implications for the future of the pricing system for hogs.

Swine complexes including production and packing plants in non-traditional areas are not likely to develop traditional open cash markets in these areas. In most swine complexes, the producers own the packing plant or the packing plant is an integral part of the system. In some new swine areas, only 3-5 producers supply all the hogs. It is unlikely that hogs from traditional areas will move to be slaughtered in these new production areas. Thus over time, the decentralization of the swine industry will put pressure on the current price discovery system based in the Midwest. Some of these new complexes may decide to tie their prices to retail pork prices which are about 50 percent less variable than wholesale and farm prices. With reduced price variability, they could potentially experience less variation in production and improved coordination between production and packing that would increase profits for the swine complex.

But there is a new trend developing that may give the Midwest based live cash hog market new life. Several of the mega producers have started raising feeder pigs in the Southeast and shipping them to the Midwest to be finished. Finishing hogs in the Midwest compared to the Southeast has two large advantages. Corn is 35-50 cents per bushel cheaper, and market hog prices are \$1-2 cwt. higher (Kenyon, Earles, and Beckman; Kenyon, McKissick, and Lawrence). Hence, finishing hogs in the Midwest can be potentially \$5-8 a head more profitable than in the Southeast. But Midwest producers will have to decide if they want these large producers. To date many Midwest states have made it difficult for these large producers to operate in their states. These states need to consider the long-run ramifications of declining pork production if they continue to decide to exclude these large producers.



Figure 11. Reported Expansion of Hog Production in *Feedstuffs* Magazine: 1992-1996<sup>a</sup>

National Farmers plan to triple its total operation with a 20,000 sow unit in western Texas, to go along with its 20,000 sows in Nebraska. (Apr. 13, 1992)

Tyson Foods is adding 30,000 sows in Oklahoma to augment 30,000 sows in Arkansas. (Apr. 13, 1992)

Murphy Farms of North Carolina plans to build facilities for 15,000 sows in southwestern Missouri. (Apr. 20, 1992)

National Farms is building 20,000 sow operation near Dalhart, Colorado, 40 miles from Guyman, Oklahoma. (Aug. 31, 1992)

In north central Oklahoma, Cimarron Pork is forming another 20,000 sow operation. (Aug. 31, 1992)

Tyson Foods is building a 30,000 sow contract production base near Holdenville, Oklahoma. (Aug. 31, 1992)

Smithfield is planning a 100,000 sow and two million head packing plant near Milford, Utah. (Oct. 16, 1992)

J. G. Boswell has 9,000 sows in California. (Oct. 16, 1992)

Wyoming Lean Pork proposes 20,000 sow operation in Wheatland, Wyoming. (Dec. 12, 1992)

Lattimore to develop 10,000 - 20,000 sow operation in northern Colorado. (Feb. 8, 1993)

Murphy's has to build 80 finishing floors in northern Iowa during 1985-1990. (June 7, 1993)

Seaboard Corporation plans to have plant kill four million head annually in Guyman, Oklahoma (200,000 sows). (Aug. 2, 1993)

Continental Grain is considering a 20,000 sow foundation unit in northern Missouri over the next two years. (Oct. 4, 1993)

Carroll's Foods is exploring sites for an initial 2,400 sow operation in northern Iowa. (Feb. 15, 1994)

Carrolls' is expanding in northern Iowa because of an abundance of grain and access to markets. (Aug. 15, 1994)

Midwest Farms is planning to build facilities for 10,000 sows in eastern Colorado. (Feb. 27, 1995)

Murphy Farms is planning a 17,400 sow farrow-nursery operation on approximately 2,000 acres 15 miles west of Clinton, Missouri. (Mar. 18, 1995)

(Continued)

Figure 11. Reported Expansion of Hog Production in *Feedstuffs Magazine*: 1992-1996 (Continued)

Hanor Co. of Rocky Mount, North Carolina, will finish 70,000 market hogs near White Hill, Illinois. The feeder pigs will come from North Carolina. (May 22, 1995)

Thorn Apple Valley will open one of the world's largest state-of-the-art pork and poultry processing facility in Ponca City, Oklahoma, this summer. (June 19, 1995)

Hitch Pork Producers, Inc. of Guyman, Oklahoma, is planning a 20,000 sow operation in the Panhandle area. (July 24, 1995)

Itoham, one of Japan's largest pork packers, is close to a Wyoming commitment that eventually could generate 400,000 hogs (approximately 20,000 sows) per year. (Sept. 25, 1995)

Seaboard Corporation is planning 50,000 - 100,000 sows in southwestern Kansas. (Oct. 16, 1995)

Midwest Lean Pork is attempting to build 20,000 sow operation in Kit Carson County, Colorado (Oct. 23, 1995)

Land O'Lakes wants to put 5,000 sows a few miles from Beardstown, Illinois. (Nov. 27, 1995)

Nippan Meat Packers, Japan's largest processor, formally requested air and water permits for a proposed 28,000 sow operation near Penytown, Texas. (Dec. 18, 1995)

Premium Standard Farms will have 100,000 sows in northern Missouri. (Jan. 8, 1996)

Prestage plans to place 20,000 sows in Mississippi and Alabama. (May 13, 1996)

Murphy Farms is planning 20,000 sow operation in Harper County, Oklahoma. (June 17, 1996)

Pennsylvania Family Farms plans to build 2,800 sow unit in Northern Pennsylvania near the New York border. This project could eventually involve 30,000 sows. (Oct. 21, 1996)

Murphy to house 43,000 sows in Oklahoma. (Oct. 21, 1996)

\* Some of these plans were not realized because of permit, zoning, and corporate law problems.

Sensitivity to changing consumer tastes and preferences will play a more important role in the pricing structure of the swine industry in the future. A number of the large packers are very tuned into consumer desires, especially in the new export market. These packers are going to continue to seek pricing arrangements that make it possible for them to source hogs that fit their product marketing strategies. Several changes are imminent. Hatfield Packing Company has been experimenting with the AUTOFOM system since 1994. If perfected, this system will measure the ham, loin eye, belly, and shoulder cuts with 90 percent or better accuracy. This will permit Hatfield to improve the precision of its current component pricing system and send even stronger price signals to producers. They could even choose to untie their prices from Midwest



market prices, and pay producers based on wholesale prices of primal cuts minus a processing margin.

Existing carcass value pricing systems only measure backfat and loin eye depth. There are many additional quality dimensions that are important to pork consumers. Much research is being conducted to find fast, efficient, accurate means to measure these attributes at packing plant line speeds. These new measures are likely to become part of the carcass value pricing systems in the next five years. If they do not, the packers will look for more ways to coordinate with producers outside the open market system to assure they receive the quality of hogs they need. Packers will make more contractual arrangements with producers that specify genetic lines, feeding programs, and health programs. The demand for a consistent, high quality, uniform, safe product will push packers to continue to coordinate with large producers to produce the types of hogs that permit them to serve their customer better and improve their returns.

The continued rapid growth of large producers, the decentralization of production, the need for improved risk management, and the desire to respond to consumer desires are likely to continue to move the pork industry toward increased concentration and coordination. These trends are likely to eventually move the price discovery process from the live hog cash market to the carcass market. Carcass value pricing systems are currently tied to live hog prices. Integrated swine complexes developing outside the traditional production regions do not need cash market prices. The futures market has already moved to a carcass price market. As large mega producers and packers deal more and more in the carcass market each day as part of their normal business practices, the importance of a live cash market price will decline. Eventually prices will be determined primarily at the carcass level by the large producers and packers that have the most and best information about supply, processing costs, and consumer demand.

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## CHAPTER 4

# *Important and Ignored Messages from the Packers and Stockyards Program's Concentration Research Study*

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### Introduction

A number of factors contributed to increased concerns among many livestock producers, economists, and policy makers during the 1980s and 1990s regarding livestock pricing and procurement practices by meatpackers. Perhaps the two major contributors were the continued rise in packer concentration, especially for fed cattle, and the increased use of non-cash-market procurement methods, commonly called captive supplies. In response, Congress appropriated \$0.5 million to the Packers and Stockyards Administration (P&SA), U.S. Department of Agriculture (USDA)<sup>1</sup> in 1991, mandating a study of meatpacking concentration. P&SA issued a request for proposals, had an interagency group review proposals received, and contracted six projects to several universities as specified in the Congressional mandate (Packers and Stockyards Program). Some projects consisted of two or three separate, though interrelated components. Some components consisted of alternative analytical approaches. P&SP, in consultation with contractors, collected primary data from meatpacking firms directly or by mail survey. Contractors also conducted mail or telephone surveys for some projects. A brief summary of data used is given in the Appendix. Listed below are the six projects and resulting reports. At least 25 individuals at the contractor institutions were involved in this study.

- Definition of Regional Cattle Procurement Markets by Marvin L. Hayenga, Stephen R. Koontz, and Ted C. Schroeder, GIPSA-RR 96-1, May 1996. (103 pages, three components)
- Price Determination in Slaughter Cattle Procurement by Texas Agricultural Market Research Center, GIPSA-RR 96-2, September 1996. (322 pages, three components)
- Role of Captive Supplies in Beef Packing by Clement E. Ward, Ted C. Schroeder, Andrew P. Barkley, and Stephen R. Koontz, GIPSA-RR 96-3, May 1996. (114 pages, two components)

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<sup>1</sup> A subsequent USDA reorganization created the Grain Inspection, Packers and Stockyards Administration (GIPSA) and the Packers and Stockyards Program (P&SP) became one part of the reorganized agency.



- Effects of Concentration on Prices Paid for Cattle by S. Murthy Kambhampaty, Paul J. Driscoll, Wayne D. Purcell, and Everett B. Peterson, GIPSA-RR 96-4, June 1996. (24 pages)
- Vertical Coordination in Hog Production by Marvin L. Hayenga, V.J. Rhodes, Glenn A. Grimes, and John D. Lawrence, GIPSA-RR 96-5, May 1996. (97 pages)
- Assessing Competition in Meatpacking: Economic History, Theory, and Evidence by Azzeddine M. Azzam and Dale G. Anderson, GIPSA-RR 96-6, May 1996. (141 pages).

Of course, number of research dollars, man-years, reports and pages mean little by themselves. But the resulting research reports have been virtually ignored by agricultural journalists, industry associations, analysts, and producers. Why? Perhaps because the results were not what producers and others wanted to hear. Perhaps, since results for one or two projects did not correspond to *a priori* expectations, some people dismissed or ignored the entire study. Anticipating findings not to their liking, the industry went to Congress and the Secretary of Agriculture prior to release of the study results and demanded another follow-up study. The Secretary of Agriculture responded by forming a USDA Advisory Committee on Agricultural Concentration. The advisory committee's charge was, in part:

"Duties and Responsibilities: a) Review market concentration in the meat packing industry, including red meat and poultry, through analysis of the recent USDA study of concentration in the red meat packing industry and other relevant studies." (USDA Advisory Committee on Agricultural Concentration, p. iii).

The 21-member advisory committee met several times, conducted hearings, and released its report, complete with three minority reports. Certainly, some of the committee's recommendations were useful and appropriate. However, only a few *paragraphs* of their 38-page report addressed the first charge given to the committee, that being to review the P&SP study findings.

Many contractors involved in the P&SP study have a long history of addressing concentration, pricing, and related industry issues. Our access to data was better for this study than any ever before undertaken. In many cases, data came from a broader segment of the industry, covered a longer time period, and contained information never before available. In short, this was the most thorough work done on these issues to date and the results should not be buried or ignored because some people had preconceived ideas not supported by scientific research. Certainly the work has limitations, some related to data, time available, and administration of the study. Some results surprised the contractors; others were very revealing. This chapter attempts to identify those findings which are believed to be especially pertinent, findings which will inevitably influence policy decisions and industry structure in the future. Each project is addressed individually.

### **Definition of Regional Cattle Procurement Markets**

This project consisted of three components (Hayenga, Koontz, and Schroeder). For the three components combined, there were multiple objectives and multiple approaches. In any

antitrust matter, one of the first steps is to determine the relevant market. Relevant markets are both product markets and geographic markets. Properly defining the relevant geographic market is essential to correctly describing the structure and assessing the conduct and performance of an industry.

Alternative approaches were considered. One component used publicly available market price data over several years to estimate linkages between markets from which fed cattle prices are reported. Another used transactions data for one year to map the procurement area of packing plants and to estimate the responsiveness of packing plants to price changes. The final component used transactions data for one year to estimate price leadership among plants, long-run spatial price relationships among plants, and the speed of price adjustment by plants.

In the first approach, arbitrage costs were estimated between price reporting markets. Low costs suggest pairs of comparison markets are in the same geographic market, while high costs suggest the comparison markets are in separate geographic markets. In general, it was found that average arbitrage costs were relatively low. Thus, the probability of finding arbitrage between market pairs was small. For neighboring markets, arbitrage costs approximated transportation costs. This suggests U.S. fed cattle markets for which market prices are reported are reasonably well linked. There were no clear market separations. However, there was some degree of market separation on the east and west coasts from markets in the central U.S. There was also some separation between the southwestern and northwestern markets.

Importantly, asymmetry was found among markets. Costs were lower for shipping fed cattle from a smaller volume market to a larger volume market with higher regional packing capacity. It was more costly to ship cattle the opposite direction. Thus, the potential for market power is reduced in smaller markets and smaller markets should not be considered part of the relevant market when examining market power in larger markets.

Geographic mapping of fed cattle purchases from the cash market over a year-long period was part of the second component. Procurement area mapping indicated that on average, plants obtained 64 percent of their fed cattle in the U.S. from within 75 miles of the plant, 82 percent from within 150 miles, and 92 percent from within 250 miles. Ninety-five percent of purchases came from within 270 miles of each plant on average. However, the average maximum distance a plant purchased cattle was 655 miles. Differences were found for plants located in different regions.

Procurement area overlaps were computed as one means of estimating the amount of competition among plants. An overlap was assumed when at least 10 percent of a plant's fed cattle procurement came from an area where cattle were also purchased by one or more other plants. Of the 43 plants studied, the fewest number of overlaps was one and the most was 22. More overlaps were found among larger plants. Plants in the west and east had fewer overlaps than plants in the plains and midwestern states.

The daily responsiveness of each plant to fed cattle price changes was estimated. Most plants' volume was found to be responsive to prices at one or two other plants. Estimated own and cross price elasticities were quite high. High price elasticities suggest small price changes significantly affect plant volume for the same and competing plants. Models estimating firm

responsiveness performed better than plant models. Firms were more frequently found to be responsive to other firms' price on the same day or one day earlier, partly because of the multi-plant nature of many larger firms.

In the third component, Granger causality analysis revealed strong causality among most plants with considerable information flowing among plants. Plants in Kansas and Nebraska tend to be geographic price leaders when both daily average prices or day-to-day price differences were used. Similarly, cointegration results found nearly all plants' prices are cointegrated and tend to move together. On a daily basis, a long-run spatial equilibrium price relationship was evident across nearly all plants. Prices did not significantly diverge from each other across plants.

Another approach found that Nebraska tended to be the center for price discovery. Plants in Texas and Kansas tend to follow prices discovered in Nebraska. Plants in other regions had weaker links to prices in Nebraska or other regions. Plants in Texas and Kansas react most quickly to price changes at plants in Nebraska and Colorado. Rapid adjustments by plants suggest those plants are in the same geographic market. Plants in Nebraska and other states react slowly to price changes in Texas and Kansas. Thus, plants in Texas and Kansas generally do not have a rapid influence on daily price adjustments in other states.

Cointegration increased for plants with overlapping procurement areas. Plants with overlapping procurement areas also are more likely to have significant price causality with each other. Plants purchasing a high percentage of their slaughter in the cash market are less likely to have prices cointegrated with other plants, are slower to adjust to price changes elsewhere, and are more likely to have price changes at other plants influence their prices.

Larger plants have prices that are less likely to be cointegrated, respond more slowly to deviations from spatial equilibrium, and are less apt to have prices affected by price changes at other plants. These results suggest larger plants operate somewhat independently relative to smaller plants in discovering daily prices. They may operate with greater concern for volume needs and high levels of plant utilization than for market prices. Plants operated by the same firm were more likely to have cointegrated prices. Firms having plants in different locations can more easily ship cattle between plant locations or purchase cattle from the fringe of each plant's trade area and ship cattle to either plant.

Distance among plants was not as important as other factors in determining price causality but was important for determining cointegration and speed of adjustment. Cointegration declined as distance increased from 100 to 1,500 miles.

In summary, regardless of the various approaches and data used, general results were quite consistent. A few states, primarily Nebraska, Kansas, and Texas represent the core geographic market for fed cattle and the center of price discovery. All other cattle feeding areas are linked to this market center but the strength of the linkage diminishes as plants are located farther from the core. The weakest linkages and areas most likely to comprise a separate geographic market are in the eastern and western U.S. Linkages were stronger when considering firms rather than plants.

## Price Determination in Slaughter Cattle Procurement

The primary objective of this project was to describe and assess the pricing and procurement practices of meatpackers (Texas Agricultural Market Research Center). Transactions data provided information on *what* packers' pricing and procurement practices for fed cattle were and a survey of packers and feeders provided insight on *why* such practices were followed. There were two approaches to the *what* component and one to the *why* component. The following paragraphs contain some descriptive characteristics of the transactions data as well as results of statistical modeling.

Cash market transactions accounted for 82.3 percent of the sale lots; market agreements, 8 percent; forward contracts, 7 percent; and packer-fed transactions, 2.7 percent. Live weight pricing was used for 45.6 percent of the transactions; carcass weight, 37.6 percent; and formula prices, 16.8 percent. Consequently, cash market transactions with pricing based on either live weight or carcass weight accounted for three-fourths (74.7 percent) of all transactions.

An average sale lot consisted of 115 head of 1,157-pound steers and heifers. A high percentage of sellers (88.8 percent) sold less than 1,000 cattle and 74.3 percent of all sellers had fewer than 5 transactions during the one-year data period. On average, 53.8 percent of the transactions were all steers; 32.2 percent all heifers; and 5.7 percent dairy (including fed Holsteins). The average percentage Choice grade was 57.2 percent, with 35.2 percent Select cattle. Carcasses in the average sale lot were 49.4 percent yield grade 2 and 42.1 percent yield grade 3. Yield or dressing percentage per sale lot averaged 62.6 percent.

Data were provided by P&SP on packer capacity. From that and the transactions data, capacity utilization was estimated. Plant utilization differed widely for larger versus smaller firms. The three largest firms had an average daily capacity in their plants of 3,026 head and an average capacity utilization of 80.4 percent. Comparable figures for the next five largest firms were 1,542 head and 72.1 percent, while for the remaining, smaller firms, the figures were 451 head and 59.4 percent. In theory, larger firms which have plants capitalizing on economies of size should be able to pay more for fed cattle. However, if larger firms are exercising market power, they will pay less for fed cattle. Data showed that plants both with larger capacity and with higher plant utilization paid higher prices on average for fed cattle compared with smaller, less efficiently utilized plants. Consequently, efficiency gains were being passed back to cattle feeders in the form of higher fed cattle prices. There was evidence that as regional concentration increased,<sup>2</sup> fed cattle prices declined, but the authors termed the magnitude "negligible." Small price declines were offset by higher prices associated with keeping plants operating at high rates of capacity utilization.

Packers also paid higher prices for cattle sold in larger sale lots and for cattle sold by larger cattle feeders (feedlot capacities of 16,000 head or more). Higher prices were paid for marketing agreement cattle compared with cash market cattle, while lower prices were paid for forward contracted cattle. Higher prices were paid for cattle in the most geographically concentrated cattle feeding areas, i.e. west north central and southern plains states. Packers

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<sup>2</sup> Regions were chosen for this component without benefit of results from the regional market definition project.

paid a small premium for cattle purchased from within 100 miles of the plant and a small discount was found for cattle purchased from over 300 miles of the plant. These results suggest packers are not exercising spatial monopsony pricing. Packers paid higher prices for sale lots of cattle which were predominantly yield grades 2 and 3 and there was evidence that packers preferred uniform sale lots.

Survey questions to packers and feeders were asked in a manner such that they were mirror images of each other and could be compared. Results below reflect respondents' responses to the surveys. Packers and feeders clearly agreed in some areas but not in others.

Packers and feeders ranked their preferred pricing methods similarly with a preference for live weight pricing. Interestingly, other research suggests packers gain more than feeders when pricing on a live weight basis compared with pricing on a carcass weight or carcass weight and grade.

Packers preferred a longer delivery period than feeders for contract cattle. Packers preferred 30 days or more while feeders preferred 10 days or less. In 1993, feeders reported delivering most contracted cattle either within 10 days or more than 30 days, while packers reported contracting most cattle for delivery more than 30 days.

A majority of packers and feeders agreed that premiums were paid for higher quality cattle. A higher percentage of packers than feeders indicated a premium was paid for sorting privileges. The reverse was the case for whether premiums were paid for shorter distances to the plant. A higher percentage of feeders than packers said a premium was paid for cattle purchased closer to the plant. Feeders perceived packers discount cattle only for dark cutters and excessive mud. Packers agreed to discounting for those factors, along with inconsistent quality, high yield grade (i.e., yield grades 4-5), large framed cattle, small framed cattle, excessive ear/loose skin, weighing conditions, and reputation of the cattle.

Packer and feedlot respondents rated the same three feedlot services/characteristics highest in importance in purchase/sale of fed cattle; i.e., honesty, reliability, and dependable delivery dates. However, packers rated the first two significantly higher than feeders. Packers also rated the following factors as more important than feedlots; feed primarily non-Brahman cattle, feed mostly steers or feed mostly heifers, and sorting pens to finish evenly.

Packers and feeders also ranked highest the same three reasons for lost sales, though not in the same order. Packers rated type of cattle highest, followed by quality of cattle, and cattle often priced too high. Feeders ranked cattle often priced too high first, followed by type of cattle, and quality of cattle. However, while the same three were ranked highest, packers placed more importance on type of cattle, weighing conditions, feedlot delivery practices, inconsistent cattle quality, and quality of cattle.

In summary, in terms of *what* packers were doing, larger and more efficient packers appeared to be passing back some of their efficiency gains to feeders in the form of higher prices. Larger packers paid higher prices in general. They paid higher prices for cattle purchased from the most concentrated feeding areas and paid higher prices for cattle purchased closer to their plants. Higher prices were paid for fed cattle purchased by marketing agreements, while lower prices were paid for forward contracted cattle, both relative to cash market cattle. As to the *why* of purchasing/marketing fed cattle, there appeared to be more



agreement among packers and feeders than disagreement and more than might have been expected by many cattlemen and others.

### Role of Captive Supplies in Beef Packing

Use of alternative fed cattle procurement methods has increased in recent years. Three alternatives to cash market purchases include packer feeding, forward contracting, and marketing agreements. Combined, these three procurement methods are commonly called captive supplies. Captive supplies, along with packer concentration, were two of the primary concerns which led to the P&SP study. Consequently, this project was one of two for which expectations were highest. In some cases, the expectations were very specific, that captive supplies would have a profound negative effect on fed cattle prices.

The captive supplies project consisted of two components, one estimating long-run impacts from captive supplies and the other estimating short-run impacts (Ward et al.). The objective for the long-run component was to identify the determinants for packers using contracts and marketing agreements. This was the first research attempting to measure the factors affecting packers' use of captive supplies. The short-run component consisted of multiple objectives and approaches, but the overriding objective was to estimate the impacts captive supplies had on cash transaction prices.

A model was estimated using special captive supply survey data for the long-run study to identify those factors which affect how much a plant uses contracts and marketing agreements for fed cattle procurement. Transactions data were used for the short-run impacts study and three models were estimated, each taking a slightly different approach to measuring the effects of captive supplies on cash market prices. Models focused on the effects *deliveries* of captive supply purchases had on cash prices, impacts an *inventory* of captive supply purchases had on cash prices, and *differences* between prices paid by packers for fed cattle purchased by alternative methods, i.e., captive supply methods versus cash market purchases.

In examining monthly captive supply data collected by P&SP, it was found that forward contracting (including here marketing agreement purchases) and packer feeding varied greatly among plants. Use of captive supplies was higher for larger plants compared with smaller plants. Average monthly captive supply purchases were nearly three times higher for larger than smaller plants (17,872 and 5,818 head per month, respectively, across all plants). Larger plants also had higher plant utilization than smaller plants. Use of packer feeding was relatively constant during the year, whereas use of forward contracts and marketing agreements was more variable, increasing in April, June, and December.

The captive supply determinant model found that larger plants use captive supplies strategically. Captive supply usage increased as cash prices increased for larger plants but not smaller plants. Captive supply usage increased as cash price variability increased, more so for larger plants than smaller plants. Captive supply usage also increased as plant utilization increased. Lastly, for larger plants, contracting and marketing agreements were substitutes for packer feeding. Therefore, in summary, larger plants used captive supplies to increase plant utilization and to mitigate rising or more variable prices. Cattle availability over the five-year data period did not affect captive supply levels.

No previous research recognized that decisions by packers to use captive supplies are made simultaneously with decisions of whether to purchase cattle in the cash market and how much to pay for cash market cattle. In one of the short-term impact approaches, simultaneity was found in the *decision* to deliver forward contracted and marketing agreement cattle and the *decision* to purchase cash market cattle. The same simultaneity was not found for packer fed cattle. This suggests packers feed cattle for different reasons than they use contracts and marketing agreements. Packer feeding may be motivated more by cattle feeding profit opportunities and maintaining a steady flow of cattle to the plant, and less by using packer fed cattle strategically to reduce procurement costs via its influence on cash market prices. As the percentage delivery from the inventory of forward contracted cattle increased by one percent, transaction prices were found to decline by \$0.03-\$0.05/cwt. (dressed weight prices).<sup>3</sup> The range of price effects corresponds to several modeling approaches. Captive supply inventory periods of 14 days and 28 days were considered and some models included variables for plants while others used firms. A consistent negative relationship was also found for marketing agreement cattle. As the percentage delivery from the inventory of marketing agreement cattle increased one percent, cash market transaction prices declined by \$0.10-\$0.41/cwt.

Another approach measured the impacts between the *size* of captive supply inventory and level of transaction prices. Results again were mixed. For the total inventory of captive supply cattle, results were consistently negative but small. Cash market transaction prices declined by \$0.01/cwt. or less as the inventory of captive supply cattle increased by 1,000 head.<sup>4</sup> For forward contracted cattle, the cash market impacts were consistently positive; for packer fed cattle, the impacts were mixed; and for marketing agreement cattle, the impacts were consistently negative but small (\$0.01-\$0.04/cwt.).

This study was the first to compare prices paid by packers among fed cattle procurement methods. Importantly, price differences were found among procurement methods. Compared with cash market prices, packers paid \$3.02-\$3.16/cwt. less (dressed weight prices) for forward contracted cattle over the one-year period. Packer-fed prices were about the same as cash market prices and prices paid by packers for marketing agreement cattle were \$0.07-\$0.10/cwt. higher than for cash market prices. These results suggest cattle feeders pay a risk premium to packers for forward contracting cattle. And while not large, the higher marketing agreement prices may suggest that packers provide a small incentive to feeders for the higher quality or quantity of fed cattle they purchase via marketing agreements.

Modeling results confirmed prior research as well as research from other projects of the P&SP study and revealed some additional insights into packer procurement and pricing. Transaction prices changed as boxed beef cutout values and live cattle futures market prices changed. Packers paid higher prices as sale lot size increased and as the percentage of Choice quality grade and yield grade 1-3 cattle in the sale lot increased. However, the higher price associated with better quality cattle may have been less than what many believe it should be.

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<sup>3</sup> Price changes associated with a one percent change in deliveries from an inventory of captive supplies assumes average percentage deliveries during the one-year study period.

<sup>4</sup> Price changes associated with a 1,000 head change in the inventory of captive supplies assumes average captive supply inventory levels during the one-year study period.

Substantial price differences were found among packing plants and firms. Highest prices were found in general for plants in the Kansas area though not corresponding to state boundaries. Compared to a base plant, plants in or near Kansas paid about \$0.36/cwt. higher prices on average. Prices tended to decline as plant locations increased in distance from that core area. Prices were about \$0.90/cwt. lower on average for plants located in an area bounded by South Dakota, Colorado, the northern half of Texas, and Missouri. Prices were about \$2.63/cwt. lower on average for plants located outside that bounded area. These results corresponded to findings in the regional market definition component of the P&SP study.

In summary, larger plants made greater use of captive supply procurement methods to keep plant utilization high. Larger plants tended to use captive supplies strategically, i.e., increasing the use of captive supplies as cash market prices and price variability increased. Decisions to deliver cattle from an inventory of purchased cattle by captive supply methods and decisions to purchase cash market cattle were interrelated for marketing agreement and forward contract cattle. Price impacts from captive supplies were often negative, though small. A large price difference was found between forward contracted cattle and cash market purchases. Plants in the vicinity of Kansas, not necessarily corresponding to the state's boundaries, paid highest prices for fed cattle, similar to findings in the regional market definition and price determination projects of this study.

### **Effects of Concentration on Prices Paid for Cattle**

As indicated earlier, the perceived impacts of packer concentration on prices paid for fed cattle was one of the two primary concerns which led to the P&SP study. Thus, this project was one for which expectations were highest. For many producers and others, the expected results were clear; concentration impacts on fed cattle prices would be large and negative. Results from this project of the overall study were perhaps the most disappointing to producers and to the research team. No concrete conclusions about the effects of concentration on fed cattle prices were made (Kambhampaty, *et al.*). Data limitations hampered the analysis more for this project than others. Cost and revenue data were collected by P&SP by mail survey and data were sometimes not available or data were not kept uniformly across packers. Follow up phone contact by P&SP failed to resolve many of the problems. Since this project contained the term concentration in the title, this was to some people the hallmark of the overall study. Perhaps the relevant findings from other projects and their implications to questions about concentration impacts were overshadowed by the inability to determine concrete answers in this one project.

This project was the first attempt to estimate packer concentration impacts with detailed weekly and monthly cost and revenue data from packers for individual plants. Most previous attempts used aggregated time series data. Previous research indicated data aggregation harmed efforts to estimate market power by a widely employed methodology. Therefore, the opportunity to test for market power with weekly data was welcomed. However, imprecise and inaccurate cost and revenue data hampered the ability to draw definitive conclusions. Observed patterns in the data were often inconsistent with expectations and also caused the researchers to start to question whether the plants (or firms) were acting as strict short-run profit maximizers.

A model was developed to test the widely employed assumption that packers attempt to maximize profits, both for packers that slaughter only and packers that slaughter and fabricate.

Results suggest packers are not strict short-term profit maximizing firms. Deviations from profit-maximizing output levels occurred as frequently as 16 percent of the time for some plants. The deviations were not random. Nearly 80 percent of the time, output levels were below the profit-maximizing level. Packers are apparently constrained by contractual sales commitments and labor commitments to such an extent that they do not deliberately and consciously choose weekly production levels to maximize profits. Importantly, the study was able to show, even with the data problems, that the long-assumed, short-run profit-maximizing behavior is not met by beef packers. This finding will likely change the methodology and analytical models that researchers use in testing livestock markets for the presence of market power.

One conclusion from this project, therefore, was that more information is needed regarding packer behavior. Goals of packers, if not strict profit maximization, need to be better understood to identify ways of estimating packer concentration impacts on fed cattle prices. Strict profit maximization is an underlying assumption for the methodology used in virtually all of the research efforts to date in estimating or searching for the existence of market power. Past researchers have indicated that if the profit maximization assumption is not met, then their methodologies would be inappropriate and any inferences about market power would be suspect. More emphasis, therefore, needs to be placed on understanding and analyzing firm behavior in imperfect markets, and this is especially important for regulatory agencies that monitor the livestock markets.

### **Vertical Coordination in Hog Production**

This project was the only one dealing exclusively with hogs (Hayenga et al.). It focused on the largest packers, feed companies, and hog producers/contractors. Its objectives were to identify and estimate the relative importance of current vertical coordination arrangements, determine projections for vertical coordination changes, and identify implications from those changes.

The largest pork packing firms purchased about 87 percent of their hogs from the cash market in 1993. Nearly 11 of the remaining 13 percent were supplied by long-term contracts. Changes expected in the next five years are noteworthy. Purchases from the cash market are expected to decline from 87 to 66 percent by 1998. Conversely, long-term contracts are expected to increase, from 11 to 25 percent in the same five-year period. The sharp reduction in use of cash markets has clear implications for price discovery and price reporting. Fewer prices will be publicly available to report and be used in discovering contract prices. However, if nearly two-thirds of hogs marketed still are purchased in the cash market, price discovery may not be hampered significantly.

Many long-term marketing contracts were formal, written contracts for a fixed time period (often 4 to 7 years). Half of the packers involved in long-term contracts reported requiring a minimum number of hogs and either a minimum quality or specified genetics. The dominant pricing arrangement was a formula price consisting of a base price tied to a reported market price and carcass merit adjustments based on cutout value of the hogs. Some innovative risk-sharing contracts were found. The two most important reasons for long-term contracts were improved quality and reduced quality risks. More advantages of long-term contracts were mentioned by packers than disadvantages. Financial benefits to hog producers, either increased

capital availability or lower financial risk, were cited most often as the primary advantages. The most frequently mentioned disadvantage for producers in the view of packers was reduced flexibility. Not surprisingly, given the above, the largest packers expect closer producer-packer linkages in the next five years.

The largest hog producers expect to increase production from the 1993 level of 13 million head to 30 million head by 1998, an increase of 144 percent. Nearly three-fourths of the hogs they marketed in 1993 were contracted to packers. Larger producers also expect closer ties with packers in the future. By 1998, they expect to market only 10 percent of their hogs in the cash market. A larger percentage of hogs in 1998 than in 1993 is expected to be produced by packers or in joint ventures with packers, but forward contracts will comprise nearly three-fourths of expected marketings.

Large hog producers cited a guaranteed market outlet as the primary benefit from forward contracts. Reduced market risk was second, followed by a tie between better prices and reduced transaction costs. Producers verified what packers indicated about disadvantages of contracts. Producers cited the inability to shop for better prices as the biggest limiting factor surrounding contracts. Producers cited the assurance of hog supplies as the most important benefit to packers. Lower buying costs and better quality hogs ranked second and third. Relatively few disadvantages for packers were mentioned by producers. Nearly 80 percent of the largest hog producers were involved in hog production contracting of a type similar to the broiler industry. Besides closer ties with packers in the future, large hog producers anticipate a reduced role in hog production by commercial feed companies, though large feed companies anticipated a slightly larger role in hog production.

Survey results indicated large packers contract with large hog producers. Most contracts were not fixed price contracts, thus not transferring price risk from hog producers to packers. The primary motivation for long-term contracting was a guaranteed outlet, especially among those hog producers marketing a half million hogs or more annually. Those largest producers can account for a substantial percentage of daily slaughter for many packing plants. Long-term contracts also reduce transactions costs for producers and packers and aid quality improvement over time.

In summary, larger hog producers expect to continue their rapid growth rate in the next five years. They expect closer relationships with packers and less reliance on cash market prices. Price discovery concerns which have plagued the beef industry the past couple years may simply be preceding similar price discovery concerns in the hog industry. Contracting has advantages for both buyers and sellers, from financing hog production to guaranteeing supplies to operating larger slaughter plants more efficiently. Reasons for using marketing contracts in hogs parallel those found for fed cattle.

### **Assessing Competition in Meatpacking: Economic History, Theory, and Evidence**

All projects of the P&SP study contribute to future research regarding issues related to packer competition and pricing. This project (Azzam and Anderson) was specifically intended to review an extensive literature pertaining to the meatpacking industry and its relative competitiveness. The historical development of the packing industry is discussed prior to



reviewing the economic theories and methods related to assessing the competitiveness or non-competitiveness of the industry.

Ultimately, the report attempts to determine whether the empirical evidence is persuasive enough to conclude that competition in the packing industry is deficient. Limitations with each of the two major approaches to studying industry competition are reviewed. The structure-conduct-performance (SCP) approach attempts to link industry structure, such as number, size, location, and concentration of firms, with industry performance, such as prices paid and received, innovativeness, and profitability. The new empirical industrial organization (NEIO) approach attempts to focus more on conduct of firms in the industry. A major limitation of the SCP approach often relates to alternative interpretations or explanations of empirical results. Major limitations of the NEIO approach often pertain to inadequate data, thus they rely more on aggregated data over time and/or space.

While each approach has limitations, numerous studies undertaken to date make a contribution. In total, the authors conclude that the body of empirical evidence is *not* persuasive enough to conclude the industry is non-competitive. However, failure to prove the industry is non-competitive is also *not* persuasive enough to conclude the industry *is* competitive.

In summary, empirical research to date fails to show *conclusively* that the packing industry is non-competitive. A pattern of growth and innovation in the packing industry is evident. In the lone study attempting to measure cost efficiency gains in meatpacking vs. market power losses, results suggest cost efficiency gains from economies of size outweighed market power losses from the decline in competitiveness. The question is raised whether or not the static, textbook theory of perfect competition is really the appropriate benchmark in a dynamic real-world market. Textbook theories clearly show misallocation of resources in static, imperfectly competitive markets. However, there is evidence that imperfectly competitive markets may achieve greater efficiencies over time through growth and innovation. Therefore, the authors conclude that policies steering the packing industry toward rivalrous behavior are preferable to policies that attempt to ensure a specific market structure, i.e., number, size, and location of firms or level of concentration. As with the conclusion from the concentration project, future research should focus on meatpacker behavior.

### Conclusions

A number of findings from the six projects of this study were consistent. A few major cattle feeding states, primarily Nebraska, Kansas, and Texas represent the core geographic market for fed cattle and the center of price discovery. All other cattle feeding areas are linked to this market center but the strength of the linkage diminishes as plants are located farther from the core. Highest prices for fed cattle are paid in the core geographic area.

Larger and more efficient packers appeared to be passing back some of their efficiency gains to feeders. Higher prices were paid for larger sale lots of fed cattle and to the largest feedlots. Higher prices were paid by larger packers which had larger slaughter capacities and higher rates of plant utilization. Higher prices were paid for cattle purchased closer to their plants. Higher prices were paid for marketing agreement cattle but lower prices were paid for contract cattle, both relative to cash market cattle.

Larger plants made greater use of captive supply procurement methods to keep plant utilization high. Larger plants tended to use captive supplies more when cash market prices were increasing or when price variability increased. Decisions to deliver cattle from an inventory of purchased cattle by captive supply methods and decisions to purchase cash market cattle were interrelated for marketing agreement and forward contract cattle. Price impacts from captive supplies were small, though often negative. A large price difference was found between forward contracted cattle and cash market purchases.

The hog industry appears to be following some of the trends of the past several years in the fed cattle industry. For example, larger hog producers expect to continue their rapid growth rate. Closer ties with packers and less reliance on cash market prices are expected, which can be interpreted as more captive supplies in the hog industry and more concerns about price discovery in the next few years. But as with fed cattle, hog contracting has advantages for both buyers and sellers, from financing hog production to guaranteeing supplies to operating larger slaughter plants more efficiently.

In summary, empirical research in this study coincides with the assessment of previous empirical research. Research fails to show *conclusively* that the packing industry is non-competitive and there is evidence of efficiency gains through growth and innovation in the packing industry.

Did this study find negative effects from concentration? No. Did this study exonerate packers from questions about use and abuse of market power? No. Questions remain. Should the static, textbook theory of perfect competition be the benchmark for assessing competitiveness in a dynamic real-world market? How many resources should be devoted to further understanding the conduct or behavior of large firms in a concentrated, imperfectly competitive market? How many resources should be devoted by regulatory agencies to monitoring market performance? These and other questions were not and could not be answered by the P&SP study. In this author's opinion, contributing to a growing body of knowledge regarding competitiveness in the packing industry is important; and the P&SP study contributed importantly both to the research literature and policy-making process.

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## Appendix -- Data

Several sources of data were used in the six projects. P&SP sent teams of their employees to the 43 largest steer and heifer slaughtering plants to collect data on each transaction of 35 head or more for the period April 5, 1992 to April 3, 1993. Total transactions numbered 200,616. Transactions data were used for two components of the regional market definition project, two components of the price determination project, and one component of the captive supply project.

Public data from the Agricultural Marketing Service (AMS) of USDA, Knight-Ridder, and the Chicago Mercantile Exchange supplemented the transactions data for specific components of the regional market definition and captive supply projects. Public price data from AMS covering the period from January 1980 to December 1992 for 16 markets were used for one component of the regional market definition project.

P&SP collected operating costs and revenue data by mail survey from the same 43 plants and for the same time period as the transactions data. These data were used in the concentration impacts project and supplemented the transaction data for one component of the price determination project.

For one component of the captive supplies project, data used were from the special survey of the 15 largest steer and heifer slaughtering firms which P&SP has been conducting since 1988. Data included number of steers and heifers purchased by various captive supply and cash methods by month and by plant. These data had not been used for captive supply research prior to this study.

Special surveys of industry firms, including packers, feedlots, large hog producers, and commercial feed companies, were conducted by the contractors for specific components of the price determination, captive supply, and vertical coordination in hog production projects.





## CHAPTER 5

### *The Role of Market Information in Price Discovery and Market Structure*

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#### Introduction

The U.S. Department of Agriculture (USDA) has long been involved in collecting and disseminating price and related market information. In the 1990s, some of the state partners in a federal-state joint market news activity have dropped out altogether or reduced their financial support and participation. Table 1 shows aggregate data across 15 states for 1994-1997 for the livestock and grain sectors. If the estimates for 1997 prove accurate, the \$1.675 million contributed by these 15 states to Federal-State Market News activities will be 53.3 percent of the 1994 budget. In the fruit and vegetable sectors, states' contributions are down to an estimated \$1.1 million (in 1997) from \$2.5 million in 1990.

Table I. State-Level Budgets in Federal/State Market News Service and Changes, Livestock and Grains, 15-States,\* 1994-1997

| Years  | Budget     | (Change) |
|--|------------|----------|
|  | (1,000 \$) |          |
| 1994   | 3,140      | (NA)     |
| 1995   | 2,536      | (-604)   |
| 1996   | 2,147      | (-389)   |
| 1997**   | 1,675      | (-472)   |
| * The 15 states are Arizona, California, Florida, New York, Texas, Washington, Alabama, Kentucky, Wyoming, Kansas, Mississippi, Iowa, Illinois, Virginia, and Ohio |            |          |
| ** Levels and changes for 1997 are estimates.  |            |          |

Source: Original aggregated data from AMS, USDA.

Communication is easier and cheaper than ever, and we are in an era where everything is presumably available on the "net." Private firms, it is now being argued, can and will provide needed market information. Those private firms would presumably provide information on a "user fee" basis so that only the users who benefit directly, not the general taxpayer, will pay for the service. The inevitable question is then raised: Why is there public involvement in market news collection and dissemination via tax supported USDA activities?

The discussion, becoming a debate, needs to be broadened on at least two fronts. First, there needs to be a revitalization of the notion that public involvement in market news activities is justified because there is a *public good* dimension to those activities. In simple terms, this means that the public receives benefits from publicly supported market news activities that would not be

present if it were left to the for-profit private sector. This reason for public involvement was more prevalent in the early literature on this subject than it is today, and it should arguably be brought to the front again.

The second, and perhaps the most important, “front” that begs for more consideration is the relationship between *the adequacy of the market information base, the effectiveness of price discovery, and the organizational structure of the marketplace*. In the 1990s, as we move close to the 21st century, market structure is on everybody’s mind. Consolidation and concentration are occurring in virtually every commodity sector and most producers and producer groups don’t like the trend. But not many of those concerned about the trend recognize or think about the relationship between price discovery and structure, especially where market failure due to ineffective price discovery processes prompts moves to concentrated markets and non-price means of coordination.

These two issues will be pursued in this chapter. In an era where it is in vogue to develop new policies, look toward increased regulation of the marketplace, and try to legislate solutions to economic problems, it is important to step back and reflect on how it all fits together. In pursuing this agenda, my working hypothesis is that the livestock and meat markets will continue to consolidate and move to non-price means of coordination. Further, this trend will occur at least partly because of market failure and price discovery processes that are less effective and efficient than they could be. One reason price discovery is and will be less effective is the lack of a public willingness to support the gathering and disseminating of important market information.

### **The Public Good Issue**

In general, the benefit to the public--and thus the “public good” component--of information on markets comes through a reduction in discounts for uncertainty and a resulting improvement in resource allocation decisions. Most livestock producers are risk averse to some degree, which means exposure to risk brings with it a discounting for that risk. This can take the form of a reduction or leftward shift in the supply that producers offer to the marketplace. Situation and outlook information is important, along with market prices and other market information, in this decision on resource allocation. *Any decrease in industry supply that can be traced to a lack of market-related information means consumers face a smaller supply and higher prices than might otherwise be possible.* Consumers would benefit if better (or more complete) market information prompted a larger supply.

The discounting for risk and uncertainty also occurs on the demand side, and this may be the area where market news is of special importance. To the extent slaughter livestock producers have difficulty estimating the value (price) of their livestock because of inadequate market information, they discount for the uncertainty by trying to buy feeder animals at lower prices. Over time, this can cause the demand for feeder livestock to shift to the left (and/or rotate so that it is steeper). The result is what economists call a “deadweight social loss” due to imperfections in the market, and one important source of market imperfection is less than socially optimal levels of market information.

The public good component of information has been questioned across recent years in the presence of the newer rational expectations model as a way to describe decision making. The rational expectations model assumes that producers use all available information when preparing

price forecasts and do not make systematic forecasting mistakes (Muth). This "model" leads, predictably, to a result that says the markets are efficient and that market prices reflect all available information. In this situation, public programs to report price and market information cannot improve price discovery, cannot ignore resource allocation and the efficiency of needed reallocations of resources, and cannot improve social well-being. The public good argument appears to be nullified.

But assuming such a rapid and frictionless convergence to the correct market equilibrium price(s) is assuming too much. It makes more sense to recognize (1) producers learn the market parameters only over time, and (2) a cost is involved in that learning process.

Stein (1992a, 1992b) has looked at these issues and concludes that the speed with which decision makers learn about the markets and move to discover the true underlying (but unobservable) equilibrium price is a function of the cost of information. Not surprisingly, he finds the market equilibrium prices are "discovered" quicker when information is less costly. Stein's findings suggest public involvement could help in (1) speeding the process of price discovery, and (2) collecting information at less costs than private firms.

The research dealing directly with the public good or public value dimension of information gathering and disseminating is limited and much of it deals with situation and outlook information. Antonovitz and Roe reported social benefits to improved formation of price expectations by cattle feeders. Freebairn looked at the social value of commodity price outlook information for a number of agricultural commodities and found significant social value. In a much-quoted article, Hayami and Peterson generated measures of the social benefits of reducing sampling error of USDA livestock and crop statistics. The authors estimated that \$1 spent in increasing the accuracy of the USDA processes could increase net social welfare by more than \$600. Irwin found a basis for the value of a public presence when the marketplace is not assumed to be all-knowing and frictionless in its convergence on an equilibrium price. His article looks at the theoretical issues and raises important questions about the use of the rational expectations model.

There is, then, a *public good* component to market information when price discovery is made more effective and more efficient by public market reporting activities. Getting to the "true" prices more quickly and with less error smoothes the process of reacting to informational shocks in the marketplace. Exposure to the risk of volatile prices throughout the system is reduced. There is, consequently, less discounting for uncertainty and a more efficient allocating of resources, all of which means larger supplies and lower prices to consumers. Since prices of agricultural commodities tend to approach the cost of production over time, lower prices to consumers do not translate into lesser profits for producers. Over time, the producers' resources will earn a return commensurate with their marginal contribution, and the sector will be bigger and command a larger market share in the presence of a well-informed marketplace and effective price discovery processes.

In a recent and special research effort specifically designed to estimate the impact of market information on price discovery for fed cattle, Anderson *et al.*, found (1) fed cattle prices became more variable as access to market information was decreased in a controlled experiment, (2) the use of contract (captive supply) arrangements between cattle feeders and packers increased when market information was decreased, (3) there was more reliance on cost and break-even information when information on markets and market prices was withdrawn, and (4) there was

more tendency for slaughter weights to vary from the level that was most cost effective for the entire sector. There are, based on this important work, clearly negative implications to social well-being from the withdrawal of market information. The increase in variability of fed cattle prices means added risk exposure, a risk that must be paid for by someone. Research shows that when exposure to risk increases, system participants (especially processors) will have to extract a larger margin for their services if they are to stay in business. The result in the cattle sector will be lower fed cattle prices in the short run and reduced supplies of beef, higher prices to consumers, and a smaller beef sector in the long run.

There are, then, social benefits to the providing of market information. The argument is made that the private sector can and will provide the needed information--that there is no need for public involvement. But this argument is seriously flawed. There is widespread recognition of the "free rider" problem which would make it hard for a private firm to collect for its services without users gaining access at no cost. There is also the issue of access. The USDA gets reasonable cooperation on a voluntary basis and collects certain types of information on a confidential basis. It is not at all clear private firms could get comparable cooperation although there are examples (Cattle-Fax, Urner-Barry, etc.) of private firms collecting at least some original (non-USDA) information. But perhaps most importantly, there are reasons to argue the for-profit firm would collect less information than does the USDA as a public agency.

The research clearly supports the position that quicker convergence to economic solutions (via improved price discovery) has benefits to society, and that more information tends to speed the important price discovery processes. Without appealing to the economies of size argument which would say the USDA can collect and disseminate at lower cost than a number of private firms, the participation by for-profit private firms drives a wedge into the process. Let's define:

- MC = the marginal cost of collection/dissemination,
- MV = the marginal benefit to better decision making and to more effective price discovery, and
- $\Pi$  = profit margin needs for private for-profit firms.

Even if the MC measures were the same for the public and private activities (questionable at best), we could argue information will and should be collected so long as

$$MB \geq MC.$$

But for a for-profit firm, the expression will be

$$MB \geq MC + \Pi.$$

If we assume MB measures the private and/or social benefit of information and recognize that the marginal value of each added piece of information has diminishing value, then *less information will be collected by the private firm*. Not only collection/dissemination costs but also profit needs and target returns on investments must be met. The public will not be well served by turning this important function over to the private sector unless their marginal costs of collection/dissemination are sufficiently low to offset the profit wedge. This suggests that attention needs to focus on the costs involved, and the economies of size accruing to the large effort by the USDA will, in all likelihood, add another important reason for the "public" to be involved. But it is important that the public recognize that there are important reasons for being

involved in market news that extend beyond, and in no way diminish the importance of, the "public good" rationale. There is an important and growing market structure impact.

### The Market Structure Issue

The conventional marketing systems for food and fiber products have been open market exchange systems. Prices and pricing signals have been the coordinating mechanism and have, presumably, been the agent of change to ensure that what is produced is consistent with what is in demand at the consumer level. To be effective in this important role, the prices evolving from the competitive auctions and the one-on-one direct negotiations need to be based on good information. Grades must effectively categorize important value-related product attributes at the consumer level, and both buyer and seller must be negotiating from a common understanding of what constitutes value. And very importantly, the seller—especially the small producer of agricultural products—must have something approaching an equal knowledge of the underlying supply-demand forces that determine the "true" underlying but unobservable equilibrium price. If these conditions are not met, then the price signals are not sharp, the communication effectiveness of the entire system slips, and we face the possibility of what Williamson and others started to identify as early as the late 1960s and early 1970s as a "failure" of the open market price-based systems.

The efforts by Williamson and by Purcell in the 1970s continued a theme, a warning, that other agricultural economists had raised in the 1950s and 1960s: *If the price-based open exchange systems do not improve inter-level coordination of activity in our production-marketing systems, they will eventually be replaced by contracts or vertical integration which allow coordination to be ensured by management directives.* Purcell and Dunn and Rathwell and Purcell found evidence of goal conflicts and operational inconsistencies (a lack of vertical coordination) in the beef systems in the 1970s. Williams and Farris documented efficiencies and lower cost production in integrated production systems compared to systems where each level of activity involved a purchase and later sale in the open market. Other researchers have reached similar conclusions concerning the superior technical efficiency of integrated systems.

In the late 1990s, there is an abundance of evidence to suggest the long-standing warnings are coming true—that price-based markets that are not effective in achieving coordination vertically across functions will be replaced by contractual arrangements and integrated structures. Alchian and Demsetz had put this issue forward in an interesting way over 20 years ago. They discussed types of cooperative action and organizations and advanced the idea *that a firm, by bringing a number of the technically related inputs and functions under its control, starts to compete with the conventional markets. The firm becomes the coordinating mechanism, and it ensures a level of coordination the price mechanism may be unable to achieve with available information and within existing market structures and related profit-center behavior.* The market structure then tends to change to earn these benefits of coordination, and that is precisely what the pork processors of 1997 are doing as they control genetics, reduce quality variability, schedule slaughter from owned or contracted production programs, and accomplish low-cost operations and an alignment between what is being produced and what modern consumers demand.

In cattle, it is the controversial *captive supplies* that would appear to have developed at least partly because of the long-predicted failure of the open market price system. It is true that these approaches to procurement came with packer concentration, but one has to reflect on the



why of the changes. Some would argue packers use captive supply cattle to drive prices down, but the research evidence (Ward *et al.*) shows no major price impact. It may be that the need to keep costs under control and to coordinate production and processing was the motivating force.

Paul, among others, argued many years ago that certain production processes will tend to be combined under a single management (or combined by contract) because of the joint nature of the production process and the need for joint decision making. The problem a firm faces is one of finding the optimum vertical enterprise combination for the firm. Paul identified technological change and the desire for risk-sharing arrangements as factors redefining the vertical scope of firm activity. The vertical disintegration of the traditional corn-hog, farrow-to-finish farm combination into separate farrowing and finishing operations is a good agricultural example where changing technology resulted in a new vertical enterprise combination and a new industry structure. That process has now taken a turn toward close working relationships between processors and a few mega-sized hog finishing operations, and industry structure is changing rapidly.

Paul recognized that changing the vertical organization of the production marketing system may result in new patterns of risk distribution. He emphasized that as the degree of economic specialization changes, new risk-sharing arrangements evolve. A firm might choose to integrate vertically with an adjacent stage even if costs are not reduced so long as the variability of costs and thus rate of return variability was reduced. In fed cattle, packers have said in public interviews that contracting and scheduling cattle into the plant *does* reduce their costs. *There are clearly powerful reasons to move to non-price means of coordinating these technically related stages in the livestock-meat production and marketing system if the traditional price system fails to achieve that coordination.*

There is, then, a possibly compelling reason for public involvement in information and outlook, a reason that may not have received enough attention. *If society values an atomistic structure in production agriculture made up of many independent producers, then there is reason to seek to improve the performance and effectiveness of the pricing mechanism by improving the information available to buyers and sellers--especially sellers.* That could mean, for example, pricing fed cattle and hogs on a carcass evaluation basis to eliminate the uncertainty that still characterizes liveweight purchases, especially in cattle. Clearly, grades would have to be effective. There could be no significant value differences within grade tied to tenderness or other important determinants of palatability and consumer satisfaction that are not identified and brought into the pricing process. It could mean an even more pervasive and more sophisticated system of market news than now exists. But one can argue investments in market news are worth it because our conventional market systems--which we have valued so highly in our farm and rural development policies--are clearly at risk.

The critic might again object to all this, to public expenditures, and argue that the private sector will provide the needed information. I doubt it. Gorham argued some years back that private services tend to "fill in the gaps" rather than compete with USDA and other public sources. He is probably right today, and the need for information would possibly reach crisis proportions before the private sector steps in. The "profit wedge" introduced earlier is still there. And before the crisis swells to proportions such that private reports *do* fill in, it may well be that the large firms in our increasingly concentrated markets become the "market" and eliminate reliance on prices--which is, to repeat, exactly what is happening in pork today. *It does in fact appear that there is a compelling reason for the public to ensure that quality information is*

*available to buyers and sellers in our price-based exchange systems if we value those systems and the independent entrepreneurial producers who have long been the hallmarks of those systems.*

In the research by Anderson *et al.*, there emerged the tendency to rely more on cattle futures prices when cash market information was withdrawn. This has an interesting if indirect implication. If there is available a market and price discovery process that is highly efficient, where efficiency is related to how completely all available information has been incorporated and imbedded in the discovered price, then the value ascribed to other market information efforts might well be diminished. Most analyses conclude the futures price discovery markets are relatively efficient and incorporate most or all of the available information. And it appears the private sector agrees and makes wide use of the futures price quotes. How many firms still pay private consulting firms for forecasts of prices, inflation rates, and interest rates?

The possibilities *are* intriguing. Have the persistent and, some would say, growing criticisms of public efforts in providing market information focusing on the cash markets paralleled the growth in futures markets offerings and trade? Is there cause and effect here, or is there just association? If improvement in public market information efforts is not to be forthcoming because of a lack of funding, a lack of interest, or a lack of ability, we might see by default a move to focus on the information needs of analysts, traders, and market participants who are active and involved in discovering futures prices. The needed information then flows indirectly to the small producers or entrepreneurs, but the viability of their operations and the viability and effectiveness of the open exchange systems might still be somewhat protected. There is a cash market for corn in the U.S., for example, but the important function of price discovery has been passed to the futures markets. Cash contract bids for future delivery of corn to the producer's local grain elevator are tied directly to the futures market. It could be that the livestock markets are headed in the same direction, and reduced support for reporting cash markets would surely speed any such transition.

Not all will want to see the price discovery function shift totally to futures. Most researchers, and I am one of them, see no inherent problem with reliance on futures for price discovery. But I also see (and most futures advocates agree) a need for effective and efficient price discovery in the cash markets for livestock. *Price discovery may be best, most effective, when well-informed participants in both futures and cash markets are actively involved in price discovery.*

### Looking Ahead

The discussions about public involvement in information gathering and dissemination will continue as we move toward the year 2000, and they will intensify. The criticisms of recent months and years will not disappear. We are caught up in an era of change. It behooves us, then, to try to focus attention on the truly important issues and to move the dialogue about policy formation into the arenas where the public interest is or should be most apparent.

It will not be easy. We need a broad and analytical treatment of an area of activity that has not been, historically, conducive to breadth and analytical rigor. In the collection and dissemination of economic information, the public involvement spans the land grant universities, state agencies, the Department of Commerce at the federal level, and many agencies within the bounds of the U.S. Department of Agriculture. It is, then, not difficult to see why actions and

policies are often fragmented and micro in orientation when a broader, more nearly macro, and analytical approach that ties all the pieces together is what is needed. And it is very difficult to conduct research in this general area that generates empirical measures of the benefits to market information.

Having recognized it will not be easy, it is imperative that we get it done. The public interest in the late 1990s goes far beyond the historical thrusts of getting information to the small producer to level the playing field and to try to ensure producers will be protected by at least a modicum of competition between and across the increasingly large buyers. Those were and still are admirable goals and we should not ignore them. But in the late 1990s, the public information efforts are being carried forward in a significantly different operating environment. Markets for food and fiber products are concentrated to an extent without historical parallel. There are huge and powerful players, especially at the processing level, who are becoming increasingly impatient with perceived inadequacies in our traditional exchange-oriented and price-driven marketing systems. As discussed earlier, there are powerful economic reasons to argue that if those price-oriented systems do not become more effective as coordinating mechanisms, the price-based systems will be replaced.

There are numerous and clear signals in our farm and rural development policies that the public is interested in perpetuating an economic structure characterized by a number of aggressive, innovative, and competitive independent entrepreneurs. That type of structure typically relies on transaction prices to move the food and fiber product from the producer as a profit center to the processor as a separate (but technically related) profit center, and on up toward the final consumer. If the large processor in our increasingly concentrated livestock markets gets the raw material inputs it needs from independent producers when needed and at a consistent quality, the incentive to integrate vertically into production and/or control production by closely specified contractual arrangements is diminished. It is reduced to the incentives associated with being more efficient in production, and there are numerous indicators that an independent producer who is large enough to spread fixed costs over at least modest production levels and can put together truckload lots of consistent, high quality hogs or fed cattle, can compete in production efficiency. *It will be the lack of inter-level coordination--the wrong quality, high levels of quality variation, poor or unscheduled timing in the quantity flow into the plants--that will then drive the processor toward coordination by non-price means. It will be failure of the pricing systems and of price discovery that drives that change.*

It is essentially a tautology that pricing, price discovery, pricing accuracy, and pricing efficiency are tied closely to the available information base. Price cannot be effective as a coordinating mechanism if the information on which it is based is inaccurate, inappropriate, or comes up short along important dimensions. A pork processor who is responding to the consumer market by offering a high quality cut of branded fresh pork that reduces preparation times in the kitchen must have the right hogs in terms of quality and timing if brand identification, promotion, and guarantees of satisfaction are to be extended. But if the livestock producer is to meet those needs, what the processor needs must be made clear during the pricing process. *All significant value-related dimensions of the product offering must be brought into the pricing process, and that pricing process must be reported in some depth and detail.*

The need, then, is for quality information along a broad continuum. Grades and product descriptors must be refined and highly specific. If there is still lots of value variation within #1-2 barrows and gilts weighing 230-250 lbs., we need (and we *are* getting) more refined grades,

descriptors, and transaction terminology. And if current dialogue is any indication, the need is much more pressing in beef. *If there is in fact significant eating quality variation within the Choice grade, then it has to be broken out, categorized, and identified. Effective price discovery is impossible unless those consumer-important traits are identified and reported by market news disseminators. If these things are not done, there are powerful economic reasons (costs, quality assurances, inter-level coordination) for processors to bypass the pricing system and go to non-price means of coordination.*

If we have lacked the public will to make the investment needed when the traditional reasons for public involvement in market news were examined, perhaps the willingness will be there if we recognize that we are also setting the stage for the organizational structures we will see in the decades ahead. We clearly do care, as a collective public, how our markets are structured. And anyone who does not recognize that failures in our pricing mechanisms (traceable at least in part to inadequacies in our market and market-related information base) have contributed to the demise of our pricing systems in many sectors of our livestock economy has not been paying attention to the developments of the 1990s.

For many market-related reasons, then, we *must* have high quality information that is not fraught with error and is not presented in such a way that still allows for widely varying interpretation by users. Pricing to value must be accomplished. Risk associated with significant price volatility and uncertainty that can be traced to the lack of market information must be eliminated or reduced to tolerable levels. Whatever the distribution mechanism, these needs have to be met and we have to do what is necessary to ensure they are met. If there is no other overriding message in the literature, there is one that consistently points to a positive net value for public involvement to help ensure competitive prices and efficient economic activity. If that traditional and persistent message is not sufficient to prompt us to fix a system that appears to be broken along several dimensions, then I hope extending the reasons and the discussion to include helping to ensure the viability of pricing systems we have valued as a society will prompt the needed actions and the needed commitment.

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