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CHARACTERISTICS OF BEEF CATTLE THAT DETERMINE THE PRICE DIFFERENCE BETWEEN TRADITIONAL AND CPH SALES

Terry L. Lunsford
University of Kentucky, tlluns0@uky.edu

ABSTRACT OF THESIS

CHARACTERISTICS OF BEEF CATTLE THAT DETERMINE THE PRICE DIFFERENCE BETWEEN TRADITIONAL AND CPH SALES

Cattle producers are faced with difficult decisions on how they market their calves. This study examines the different characteristics that play a role in determining the price of a group of animals. Identifying characteristics that determine price differentials relative to the price premium given to producers participating in CPH sales is important information when producers are making a marketing decision. The model developed in this study provides producers with evidence of what characteristics generate the highest price, as well as relative differences between sales locations and types of sales. The more information available to producers, the better equipped they are to make decisions.

KEYWORDS: Livestock Marketing, CPH, Beef Price Determinants, Price Analysis, Econometric Modeling

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By

Terry Logan Lunsford

_____
Director of Thesis

_____
Director of Graduate Studies

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THESIS

Terry L. Lunsford

The Graduate School
University of Kentucky
2005

CHARACTERISTICS OF BEEF CATTLE THAT DETERMINE THE PRICE DIFFERENCE BETWEEN TRADITIONAL AND CPH SALES

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture
at the University of Kentucky

By
Terry L. Lunsford
Lexington, KY

Director: Dr. David Freshwater, Professor of
Agricultural Economics

Lexington, KY
2005

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure

CHAPTER ONE
INTRODUCTION AND BACKGROUND

Beef producers are being introduced to marketing techniques that provide more opportunity for them to customize their production techniques, thus providing an increased price for their animals. The purpose of this thesis is to determine the benefits associated with participating in a Certified Pre-Conditioned for Health (CPH) type sale compared to a traditional sales approach. In order to do this an econometric model will be used to compare prices received under the traditional selling method to the CPH prices. In the model specific characteristics of cattle are identified that appear to influence the price received by farmers.

The objective of the thesis is to examine the commercial beef industry in order to determine the differences between traditional sales and Certified Pre-conditioned Herd (CPH) sales. Previous work has indicated the new marketing systems that include health management practices make more profits, but it is questionable if that is the reason for the increase in price (Ward). Determining what the differences are between the two sales types, as well as the characteristics that determine the price of an animal, will be established. After the characteristics are determined, data from both types of sales will be used to compare the two practices. One important concept that will need to be explored is the information flow that is associated with each type of sale. The increased amount of information being given to all buyers through CPH sales should increase prices paid by buyers since less risk will be associated with those cattle. Traditional sales rely on individual relationships between buyers and producers to pass along needed information, resulting in only a select few receiving the available information. Buyers gain more from their relationships with large producers, so smaller producers are at a disadvantage.

The developed model should identify characteristics that help determine the price of cattle. By identifying these characteristics it will be easier to identify what portion of the new marketing procedures are benefiting producers. The model should provide evidence about which type of sales procedure provides the

producer with the best price. It should also show any benefits large producers have over smaller producers. By examining the data from both types of sales rather than one type, the results will provide producers with more meaningful information, resulting in actual advantages being revealed. Sales locations across the state will also be examined to see if there is a price difference depending on which sales location a producer decides to use.

The CPH sale procedure brings the promise of higher prices for producers allowing further specialization of their production process, as well as providing incentives to produce a higher quality animal. This type of system is gaining popularity as beef producers struggle to keep their operation profitable. This can be seen by the increased number of cattle sold through CPH sales as well as the increased number of locations that have CPH sales. It is important for producers to see how they can benefit, as well as to look at what changes they can make in order to identify which marketing system provides them the most benefit.

With the increased management requirements of the CPH marketing systems producers may incur increased cost if they are not currently producing animals under a health program. For some, this may only change the type of records kept, if they are already producing animals using a health program that meets the requirements of the CPH marketing procedure. Producers need an adequate amount of information about the different types of markets so the benefits and costs of each can be identified before a marketing decision is made, remembering the best choice for one producer may not be the best choice for another producer. The benefits of the CPH system have been hypothesized, but estimates of the actual results have not been previously developed. Without empirical evidence that one system is superior, producers can enter a marketing system that is not their optimal choice. Today's marketing system is more complicated compared to the system twenty or thirty years ago, because of the increased diversification of sales facilities and selling options.

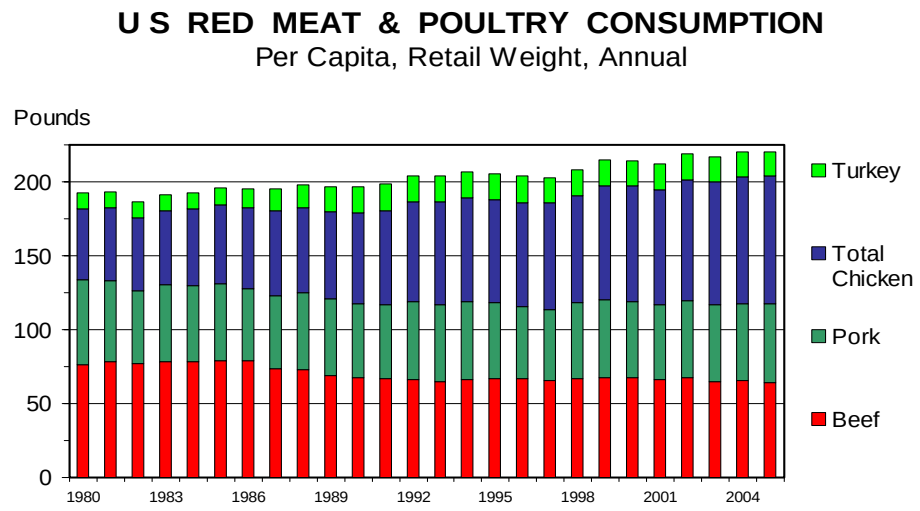
The empirical analysis of this paper will determine the difference between the traditional marketing system and the CPH system, allowing producers to understand what characteristics provide them with the highest price. The

common belief is the health requirements associated with CPH provides increased prices. The data will provide information on what characteristics lead to a higher CPH sale price received by producers.

Overview

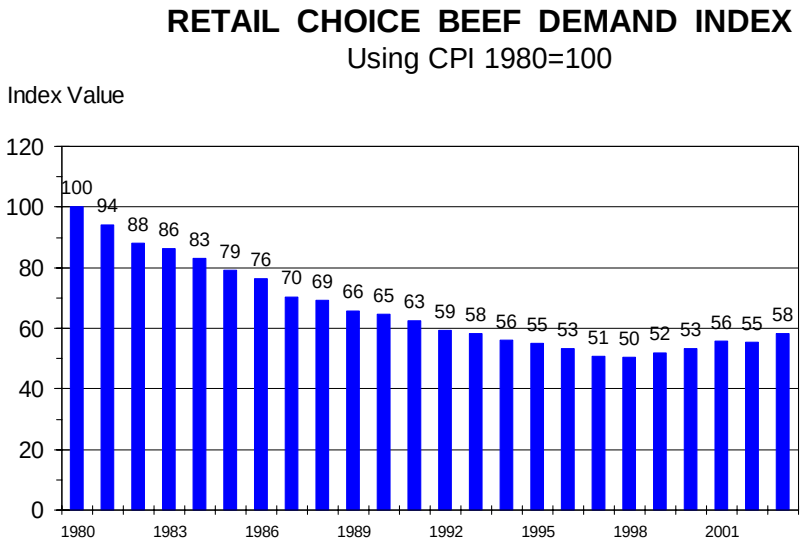
The downward trend in beef demand has producers looking for alternate practices to produce and market their animals. The industry has linked the decrease in demand to numerous production methods being employed and the lack of information for consumers about the quality of the resulting animals. It has been estimated that after accounting for the quantity of substitutes, as well as consumers income, the demand of beef may have decreased by as much as 72% from 1960 to 1997 using Purcell's pricing model (Purcell, pp.1-26). This can be seen by the below figures showing the consumption of red meat changes over time as well as the change in the beef demand index. In recent years producers are changing what they are producing as well as how they are producing. These new marketing systems appear to be improving overall demand.

Figure 1.1



Livestock Marketing Information Center

Figure 1.2



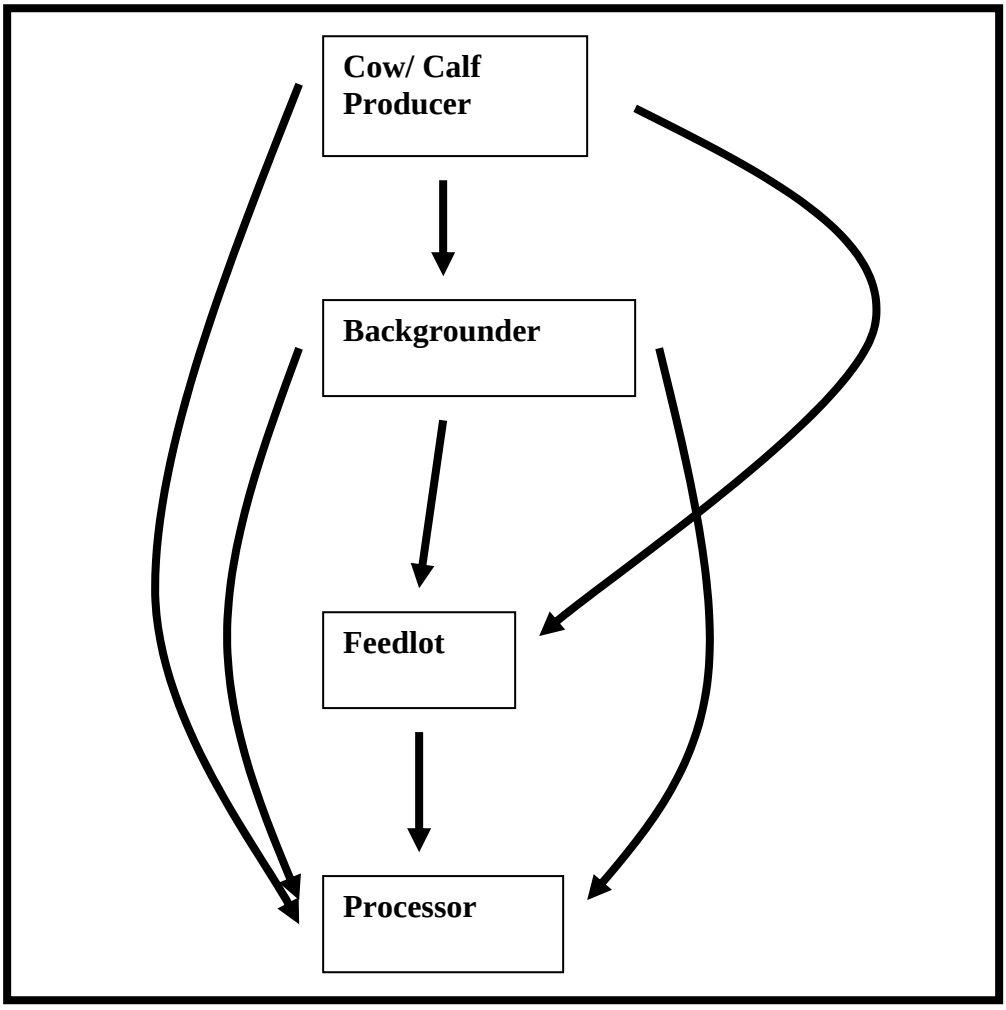
Livestock Marketing Information Center

Production Process

Before looking at why producers aren't supplying what buyers and processors are demanding, an understanding of the production process is required. Beef production can be divided into four main components: the cow-calf producer, stocker producer, feedlot, and processor. Figure 1.3 indicates the paths animals can follow, with each arrow representing a possible path of ownership between stages.

Figure 1.3

Lifecycle of a Calf



The Cow-calf portion is a farmer or rancher who has a herd of cattle that is managed and reproduces on an annual basis. A cow has a gestation period of nine months, allowing a calf to be produced once a year. The average size of a cow-calf operation in the United States is 42 cows (Chicago Mercantile Exchange, p.3). Without concentrating on the conception rates, the average producer can produce approximately 40 calves with the ratio of steers and heifers being fifty-fifty. Calves nurse their mothers for at least six months before the producer decides which path the calves will take to the processing plant. Some producers retain ownership of their animals, while others market the animals before the next stage of production.

The stocker stage of production is where calves are weaned from their mother's milk and placed on different combinations of protein and forage. This process requires an additional six to ten months until the animals reach a weight range of 600-800 lbs. At this time ownership may change again, but some producers will retain ownership.

In the third stage, the animals are placed into a feedlot where they are placed on a higher protein feed ration. The animals on average will not be slaughtered until they reach 1200 lbs. Estimating that cattle can gain 3 pounds a day which requires 8 lbs of feed for every pound of gain, feeder animals are usually sent to the feedlot weighing approximately 700 lbs. A 700 lb steer in the feedlot will be fed approximately 166 days before it reaches the finished weight of 1,200 lb. Feedlots vary in size from facilities that can handle less than 100 animals to those that can handle over 50,000 animals; with the majority of feedlots having the ability to handle 1,000 head or less. This is an important number for cow-calf producers as well as stockers, since feedlots are the buyers for the majority of calves. The number of feedlots determines the number of buyers. Higher numbers increase competition between buyers, which affects overall demand.

When the animals reach the desired weight, they enter the final stage of production, which is processing. At a processing plant the animals are

slaughtered and cut into wholesale or retail cuts. Carcasses that are only cut into wholesale cuts may be transported to another processor for additional processing or shipped directly to the local meat case. The retail cuts are shipped to local grocery stores or to a restaurant or hotel.

Complications of Production

To someone not familiar with the beef industry, it may seem like a simple three stage production process that takes a baby calf, and turns it into a 1200-pound feeder animal. To an insider the process is much more complicated. The cow-calf producer may retain ownership through the entire process, which means the producer has more information than other producers have about animals that have changed ownership throughout the process. Producers who retain ownership know more about what they are producing, providing them more knowledge about how their calves are finishing. If a producer sees his animals are performing poorly in the feedlot, he can start changing his production techniques to a process that allows him to produce higher quality animals more efficiently. Retained ownership is limited at the early stages of the process, due to the large amount of resources required to finish an animal. The average farming operation lacks the needed feed and space to finish their own animals, assuming the brood cows produce second calves before the first calves are finished.

The system is more complicated when the animals change ownership throughout the production process, due to the limited information passed from owner to owner. With the traditional marketing system, cow-calf operators can sell their animals at any time during the production process, but to simplify the process, we will assume animals do not change hands until they are to be weaned from the cow. When they enter the sale ring at the local auction barn, buyers are forced to purchase the animals based on the characteristics they see, since other information is not available. Producers are not required to provide production information, including age of the animals, health programs, and whether or not the animals have been properly weaned.

A backgrounder typically buys the animals and places them on pasture. If this is the original producer, they are familiar with the animals and know how the animals have been produced. However, if the backgrounder is not the same person, production costs can be drastically increased due to lack of information. Without records, the backgrounder will use health vaccines they feel are necessary, and often give precautionary treatments in order to maintain the animal's health. But, the newly purchased animals may have already received the health vaccines, causing the new owner to spend money on vaccines that are not necessary, thus reducing their profit level. Precautionary treatments are typically not necessary if the animals have been properly taken care of. Since this information is not available, and the animals could have been traded from producer to producer, it is cheaper to give the precautionary treatments, compared to losing an animal to illness.

At the feedlot stage buyers are faced with the same information problems if ownership of the animals is not retained, or as long as there is no relationship with the previous owner. There is no way for buyers to know what health program the animals have been produced under, or the number of times the animals have been traded which increases the stress level on the animals, leading to an animal that is more susceptible to illness, and lowers weight gain efficiency.

Given the average age of the animals another significant factor that influences profitability is uncertainty about pregnancy. Animals prematurely bred will not mature into finished animals of the same quality as a similar animal that a producer guarantees to be open, or not bred. Every unknown aspect of the process reduces the amount the buyers are willing to pay for a given animal, based on the increased risk of purchasing an animal without adequate information transfer.

From the feedlot, the animals go to slaughter, which is where the actual value of the animal is ultimately established. After slaughter, there are fewer questions about what you are buying. The buyers are no longer required to guess how the animals will dress, or what quality the final products can be processed into, unless they have also purchased live animals. For this reason processing

plants are changing the way they purchase live animals from feedlots. They are transforming to a system that pays producers after the animals have been slaughtered. This means high quality animals provide feedlot producers with a premium and low quality animals are given a discount, which encourages feedlot operators to purchase animals that are expected to grade high. In turn if the feedlot has information on which producer's animals were prime animals, they should be willing to pay that producer a premium for their animal whereas producers' animals that had a poor grade would receive a discount if they chose to sell their animals to the same feedlot.

Feedlots and slaughter facilities are becoming integrated, but this paper concentrates on the first three stages of production, looking at what producers can do in order to improve the received price. Even if producers are willing to change the way they produce, they must be informed about what needs to be changed. Producers need to be informed about what characteristics are desirable in a live animal and what price can be expected for producing an animal that possesses these qualities. For this change to take place, information must pass from each stage of production to the next stage in the process, allowing necessary changes to be made. One way for producers to find ways to communicate across stages of production supplying the needed information is through animal identification. Allowing producers access to improved information allows a better decision making process.

Traceability

The pork industry as well as the poultry industry has vertically integrated, where every firm associated with the process has information on other stages of production. The resulting system has led to the reduction of production cost, as well as reducing the number of times that a given product changes ownership. A good example of this is that a day old Tyson chicken is still a Tyson chicken several months later when it is sitting on a grocery store shelf.

The beef industry has been less effective in terms of integration among different levels of production. There has been little or no communication across

or within production processes. The lack of consistency in resulting cuts of beef reflects the limited information in the production process. This has led many people to reduce the amount of beef products they are purchasing since the final producer can't say for certain how the animal was produced before it reached the processing facility. The new marketing techniques provide more information and often source verification, allowing a way to link an animal to the producer that produced it. This information's usefulness, with the recent food safety issues such as the "mad cow" disease and the European Union's concern about genetically modified products, has caught the attention of buyers as well as producers who want more information.

The CPH system has the ability to change the way the beef industry operates by providing records allowing an animal to be traced back to its original owner regardless of how many times the animal may have changed ownership. An obvious benefit is that it gives food safety officials the ability to trace the path of an animal if a disease were to enter the food chain. Producers keeping more records have also provided more incentives for producers to coordinate their efforts with other producers.

The increased coordination of the industry, generated from the pricing mechanism, has operators considering the benefits of communication (Coase, 1937 pp.388-389). If producers have placed a group of cattle on a vaccination program, those animals are more valuable to the next producer, so the amount of money the original producer receives should be increased. If the price mechanism did not make it profitable to vaccinate and produce calves under a specific health program, there would be no reason for the producer to spend the extra time and money on the animals, regardless of whether the animals are sold or retained.

By understanding what characteristics processors and feedlot operators are looking for, producers will be able to examine their own operations allowing them to see how they can improve their herd and production techniques. The importance of record keeping and providing buyers with accurate information will be determined so producers will have a better understanding of what types of records need to be kept as well as the benefits of keeping the needed records.

In the remainder of this paper the work of economists and specialists in the beef field will be examined to ensure the model developed here provides results that will be meaningful to producers. After the evaluation of the literature, an econometric model will be analyzed to determine the characteristics that provide producers with the highest price. This will provide producers a better understanding of what makes them receive a price, or at least what will provide them with the best chance of receiving a profitable price. After looking at the preliminary results it will be possible to draw some conclusions about which type of sale yields higher prices as well as reveal what other types of studies are needed to further producer understanding.

CHAPTER TWO
LITERATURE REVIEW AND UNDERLYING THEORY

A general understanding of the beef industry is needed to ensure all parties are viewing the industry by the same standards; examining what others have done will strengthen the model by providing support from other models, as well as by filling in some gaps in other models. The result will be the intermingling of beef analysis and economic theory allowing the developed model to provide answers about which sale type producers should participate in.

Considering the beef cattle industry as being analogous to a manufacturing firm allows the use of the same economic methods and theories as other industries; however some differences are specific to the cattle industry. To gain a better understanding of the industry the economic background must be explored to provide a detailed explanation of the economic concepts applicable to the industry. After reviewing the background information, analysis of the gathered data will provide information that can assist producers in making valuable decisions about their production practices.

The Theory of the Firm

After reviewing the general process of the beef industry it is important to take a closer look at beef production from a producer's perspective. To gain a better understanding of the beef industry an explanation of why firms exist within the cattle industry is a logical place to begin. R. H. Coase's paper, "The Nature of The Firm," provides insight on why firms exist within an industry. As with any economic study the two main questions that must be answered are, is the model tractable and is it relevant to the real world. Coase explores several thought processes on the existence of firms within an industry.

When examining the requirements for, and benefits of, a firm the pricing mechanism must first be looked at. If an industry is run entirely by the pricing mechanism, the industry doesn't need firms because supply and demand will dictate all that happens within the industry, leading to a system that is automatic,

elastic, and responsive, or "works itself"(Coase, p.387). This leaves the question of why this is not the case for most industries that can be seen in the real world. D. H. Robertson explores the notion of "islands of conscious power in the ocean of unconscious cooperation like lumps of butter coagulating in a pail of buttermilk" (Coase, p.388). By co-coordinating some processes, the transaction cost between processes can be reduced or removed, providing a lower production cost for the firm. So why is there ever more than one firm within an industry, since this would remove all the transaction cost associated with a given production practice? This can be answered by looking at the marginal returns of a firm as well as the minimum efficient size of a firm. After the firm passes the most efficient size, costs start increasing, allowing another firm to be profitable by producing the same good. This supports the fact that someone must organize the production process.

The allocation of resources into the most productive role is also an important concept when looking at the size of a given operation. If an operation becomes too large the manager will not be able to efficiently allocate the resources that he has access to, thus creating increased cost. The misallocation of resources creates the possibility of mistakes being made by managers, which can be linked to resources being spread over too large of an area, or one person in charge of too many aspects of the operation. Contracts have emerged between firms, which have reduced the amount of transactions, but have not completely placed the producing firm under the control of the firm that it is supplying to. Restrictions or qualifications can be placed on the final product, but it is up to the individual producer to decide the best production method for the job. It is important to note that the longer time period associated with a contract means more variations left in the hands of the primary producer. If a producer is not able to remove some transactions cost, and produce the product cheaper, contracts will not be made since it is cheaper to revert back to the open market, which is always an option. The level of uncertainty associated with the production process magnifies the need for managers, supporting the claim that firms are needed in the separate production processes.

Coase's argument for the emergence of a firm is strengthened by investigating what other economists have used as reasons for firms. One reason is the division of labor, which creates the need for an integrating force to keep the system from going into chaos. The pricing mechanism should keep the marketing system from reaching chaos, which can be supported by economic science showing that specialization doesn't lead to automatic chaos. Another view given by Professor Knight, says that there is no need for management, can be interpreted as no need for firms if uncertainty is removed (Coase, pp.393-394). Without uncertainty individuals are able to make the right production decisions automatically, leaving no room for error. With uncertainty comes the need for management because uncertainty increases the likelihood of mistakes. This raises the question about whether or not certain individuals are better suited to make good decisions. If an individual is able to make a better decision than another individual, it is more profitable for the first individual to make the decision, leading to the formation of firms.

When looking at individual firms it is important to remember that a firm will only produce output up to the level of production where marginal cost equals marginal revenue. After this point on the production curve, the firm is no longer profit maximizing. As integration occurs, a point where it is no longer profitable for the firm to continue expanding will be reached.

After looking at why different economists believe that firms are present in our marketing system, it can be simplified to the real world by looking at the concept of a "master and servant" or "employer and employee". Giving the variability associated with production, the master or employer must have control to ensure the result is what the firm was contracted for. If the outcome is not desired, the purchaser will find another producer willing to supply what is wanted, which relates us back to the pricing mechanism. Only firms that can efficiently produce the demanded products will remain in production. Firms that are poorly managed will be replaced by more efficient ones, resulting in only the best managed firms surviving. The risk associated with being efficient and surviving in the marketplace is placed in the hands of the manager. The manager also has

the role of convincing customers why they should buy his product rather than someone else's.

After looking at "The Nature of The Firm", the beef industry is a good fit for the generic industry that is referred to. Many producers would agree that it is the pricing mechanism that dictates the decisions of producers, but it is also important to look at the concept of minimum efficient size and coordination across levels of production. The lack of integration in the beef industry could be related to firms operating at the most profitable point in the production process, but it is likely the result of individuals being able to make better management decisions, supporting the findings that one manager is only able to properly manage a limited number of operations before it is more profitable to have another separate operation. The large amount of space needed for a cow-calf or stocker facility, limits the ability of a single manager both by resources and the time that is required to properly produce the animals, when compared to other industries.

Profitability

Regardless of the industry, the main objective of the firm is profit. In the cattle industry, firms produce an annual output without a guaranteed profit. Cattle producers, like many other types of farmers, have years when they are not profitable. If an individual firm has too many unprofitable years linked together, they will be forced to stop producing.

Improved record keeping could improve overall profitability. To gain a better understanding of what records can do for a beef producer, source verification needs to be examined. Source verification is seen as a significant way to improve the information flow and provide incentives to producers for better herd management. Research has been conducted on the beef industry and the feedlot and retail sections of the industry have been examined, but this does not provide sufficient information back to the farmer that starts the production process (Schroeder, p.89). To provide information back to the cow-calf and stocker producers an understanding of the demand changes and the desires of the

final consumer is required. This can be examined by looking at the work done for the slaughter and retail sections of the beef industry.

The structure of the beef industry results in livestock producers being price takers, unless producers can develop a method of differentiation for their product, that provides them with market power, and an increased price. Implications on how the variability and input cost associated with production increase the amount that the middlemen are going to retain for themselves is also discussed (Purcell, 2000 p.1). He believes the recent increases in vertical integration are due to failure of the traditional price driven system, which relies on grades that are not reliable; this is pushing producers to develop marketing systems that produce a branded product that provides more information to the consumer. The meat case at any grocery store provides consumers with evidence of how the meat industry is trying to become a branded industry as companies are allocating more money to the development and promotion of labeling and attractive packaging for their products.

Demand/Supply Factors

The decrease in demand is linked to limited convenience of the product as well as a lack of uniformity of the retail beef products. Critics compare the chicken industry to the beef industry by noting the uniformity and overall consistency of chicken products, compared to the lack of uniformity and inconsistency of beef products. It has been estimated that for the same quantity of beef when compared over a twenty year period the price of beef has declined by half (Schroeder, 2002 p.1).

In response to decreased demand Schroeder challenges beef producers by looking at the pricing system and explaining what needs to be done. He believes that producers have two options. The first option is to continue being price takers. The second option, which is the option more helpful to the producer, is to start collecting data on what is being produced and following animals through production so that producers know what they are producing compared to what is being looked for. This approach provides high quality producers with a premium

compared to a discount for producers producing low quality animals. If producers don't want to be price takers, more work and money is required from them, but the return will outweigh the cost.

Another approach to improve profit is through an analysis of the cow-calf enterprise. This work was done so producers would gain a better understanding of how the production aspects of the cow-calf operation affect overall profit, even if it doesn't affect the market price. Factors that were evaluated were: production costs, percent of cows weaning a calf, and weaning weight of calves (Jones). By keeping production cost records producers are able to compare their production to other production practices, allowing them to see areas that need improvement. This includes culling cows that are costly to maintain, and changing feeding programs in order to improve profitability.

The percent of cows in a herd weaning a calf is an important measure in determining the profitability of an operator. Cows that aren't producing quality calves can decrease profitability. Replacing those animals will result in better calves becoming available. Weaning weight records provide a means to see which cows are producing high quality calves.

With more information on animals, a backgrounder or feedlot manager is able to reduce risk and improve the chance of being profitable, due to the coordination within the industry. This allows managers to make a better judgment on what the animals need in order to be prime animals when they reach the processing plant. The purchasing price at each level should increase since the buyers no longer underbid due to uncertainty. Giving only the necessary vaccinations allows production cost to be reduced, increasing the chance of profit.

Profit Maximization

To maximize profits, producers are exploring alternative marketing techniques, hoping they will provide a profitable way of producing and marketing animals. A wide variety of programs designed to help improve profitability for beef cattle producers have been developed, with most including the transfer of information across production levels. The traditional marketing technique has

limited information flow. Producers are looking for ways to signify their animals are a higher quality than their competitors' animals. Top quality producers are trying to improve the way the public looks at beef products. Increased information and branded products provide signals of higher quality beef products that should enhance pricing accuracy. Increases in the retail price of beef allow producers to increase the price received for their product as well as increasing the dollar value of replacement animals.

Alliances

Looking at the different types of marketing options available to producers, the term "alliance" has been developed as a way to describe mechanisms to improve coordination. An Alliance is considered to be any group of people or organizations within the beef industry that are coordinated to produce a final product, in order to improve the overall production process. However alliances can be broken down into different types. This decomposition provides more information, on what is required to be a member, as well as the benefits of becoming a member.

Branded Alliance

Branded alliances highlight the characteristics that make the breed they support superior to other breeds, and try to convince consumers that those characteristics are the characteristics that should be looked for in the supermarket. Both the Certified Angus Beef Corporation and the Certified Hereford Beef Corporation claim that their product is the best, i.e. that it is consistently tender, juicy, and full of flavor. Both groups also claim they produce products in a way that is superior to other organizations. This is intended to assure consumers that their products are the safest on the market. However looking closer at the two it is evident that the products are not the same. Certified Angus claims superior flavor comes from the larger amounts of marbling and fine texture, which provides a consistent flavor and tenderness. They also believe that by tracking the origin of the beef through the entire life of the animal that their product comes

from a higher quality animal. The Certified Hereford products claim related to flavor, tenderness, and juiciness of their products is that their product doesn't contain "excessive amounts of marbling," which is seen as a quality that makes their product superior. Most major beef breeds have an alliance that promotes the breed's characteristics as being the best.

Specialty Alliance

A Specialty Alliance, as the name implies, produces a specialty product that is produced under a specific set of guidelines. The most common characteristic is that the animals were produced naturally, or without growth hormones and antibiotics. This type of product is usually leaner when compared to traditional products, and is considered healthier. The naturally grown, healthier products have been introduced as consumers are shifting to healthier ways of eating. Laura's Lean Beef and Nolan Ryan's All Natural Tender Aged Beef are two good examples of these types of products. Both groups stress that their product is healthier, and has been produced and processed under higher safety standards. Nolan Ryan's products are guaranteed natural for the last one hundred days of feeding, while Laura's Lean beef has two categories of products. One group is guaranteed for the past twenty months and the other group is guaranteed to be naturally produced for the animal's entire life. Both of these alliances remove animals that have been treated with either growth hormones or antibiotics. An animal that becomes ill and needs medication can be treated with the necessary medication, but can't be sold under the company name. This requirement prevents producers from injecting healthy animals with unneeded antibiotics.

Cooperative

The only cost incurred by participating in either of the previous two types of alliances has been through changes in production practices in order to meet the guidelines of the alliance. By contrast a cooperative requires producers that wish to join to pay a fee, for the benefits of the alliance. A cooperative is a producer

owned entity, which means that shares of the company must be bought or leased in order to market animals through the cooperative. Having possession of a share allows a producer to sell an animal. The downside is that if a producer doesn't have an animal to supply, the producer is required to pay a fee to the cooperative. These non-performance fees are designed to maintain the cooperatives cattle supply. This type of alliance provides producers the greatest opportunity for increased price. Good examples of cooperatives are Farmland National Beef and US Premium Beef. Farmland National Beef is the only farmer-rancher owned beef processor in the country. Both cooperatives concentrate on producing retail beef through the entire lifecycle of the animal. The belief is that high quality beef starts at the farm level, and producers need more production information in order to change their production practices and the kinds of animals produced.

Alliance Overview

The three types of alliances have the same objective of improving consumer perception of the final product. Their goal is also to improve the relationships among production levels, leading to increased prices for producers that are willing to participate. Participation of producers is the controlling factor of the success or failure of alliances because without producer participation no cattle will be supplied to the alliance. Producers must be willing to change production practices as market demand changes.

Regardless of the type of alliance chosen, producers will be required to keep records that previously weren't available. Cow-Calf producers are required to pass their records on to the backgrounders, who in turn will have to keep additional records to be passed on to the feedlots and processors. Records include: the types of vaccinations given, weaning dates, as well as the origin of the calf. Producers gain information that is useful in their own production process, as well as receiving access to processor information on how their cattle grade. Without coordination the producer doesn't know how the animals they produce perform, so they don't know if they are producing the most profitable animal for the backgrounders and the feedlots. If an animal is going to be more

profitable in the latter stages of production, it should also be more valuable when it leaves the farm. An increased price for all stages of production is possible with this approach.

Pre-conditioned Sales

CPH

An alternate method of marketing in Kentucky, which is considered an alliance but doesn't fit the guidelines described above, is to sell the animals through a Certified Pre-conditioned Herd (CPH) sale, which requires animals to be produced following a pre-determined set of guidelines (see appendix). Producers are required to keep records including the length of time the animals have been owned by the producer, the length of time that the calves have been weaned from the cows, and a guarantee that the animals have received all necessary vaccinations. Steer producers guarantee all calves have been properly castrated and no bull calves are present. Heifer producers are required to guarantee calves are open at the time of sale. At the CPH sale animals are inter-mingled, with other producer's animals that possess similar characteristics, which is not the case in the traditional market. This allows purchasers to obtain larger groups of uniform animals. If the subsequent stages of the beef cycle are able to purchase larger groups of calves with similar characteristics and are assured they have been produced in a similar fashion, a portion of risk is removed.

The Oklahoma Cattleman's Association combined with the Oklahoma Cooperative Extension Service developed a sale similar to the CPH sale known as the Oklahoma Quality Beef Network (OQBN). They estimated the cost of pre-conditioning to be between $55-$75/head (Ward, p.1). The premium associated with OQBN cattle in terms of marginal cost and revenues was estimated to be $5.79/head if a $5/cwt premium was awarded and a $16.34/head decrease was generated from a $2/cwt price premium (Ward, p.7). Increasing the premium to $8/cwt created a premium of $16.86/head (Ward p.7).

The data studied provided a wide range of results. Some sales were found to have no significant difference in prices. Others showed a discount associated

with the OQBN sales, while others showed a price premium. If a premium was present it ranged from $3.94/cwt to $14.33/cwt. This significant variability provides producers with few answers.

Iowa and Missouri producers have developed a similar approach to Kentucky's CPH sale, developed as the Iowa Missouri Beef Improvement Organization or IMBIO sale. This type of sale has similar characteristics, compared to the CPH sale, and studies have shown that producers receive a price premium for their animals, ranging from $4.00 to $8.00/hundredweight (Yeboah, p.69). The premium has been linked to the source verification of the animals, with a smaller amount of the premium being linked to the pooling of the animals, resulting in buyers being able to purchase larger lots of animals (Yeboah, p.70).

Select Vac Program

Another organization that developed a system of sales designed to be beneficial to producers and buyers is the Pfizer Animal Health & Data Transmission Network. Pfizer has developed a system of sales that allows producers to receive a portion of the benefits even if they are not able to wean and complete a vaccination program that requires the use of Pfizer products. They have developed a system of sales known as The Electronic Cattle Drive: "Select Vac" program, which consist of four types of sales.

Table 2.1 Select Vac Value Added Calf

	Prime Vac	Pre Vac	Wean Vac	Stocker Vac
Vaccinate 3-4 Months of age	Yes	Yes	Yes	Yes
Re-vaccinate prior to weaning	No	Yes	Yes	Yes
Wean for 45 days	No	No	Yes	Yes

The "Prime Vac" program is for producers who are not able to wean and complete a vaccination program. Producers are required to start a vaccination program, which can be seen as starting the process, since many of the vaccinations require a second dose after the initial treatment.

The "Pre Vac" program is the next step in the life of a feeder animal. Producers are required to give the animals their first round of shots and then follow up with a re-vaccination before the calves are scheduled to be weaned. This allows producers who are willing to try and improve their herd to gain some benefit for their time and effort but, isn't limited to producers who have the facilities to properly wean and background the mandatory 45 day period.

The third type "Wean Vac" is much like the CPH sale, which has already been discussed. Producers are required to vaccinate the animals twice, as well as wean and background the animals for a minimum of 45 days. This type of sale offers producers the most benefits, as the first two sales are steps in the process. The "Stocker Vac" is another available option, designed to benefit producers who want to gain benefits from having a health program. This type of sale requires producers to vaccinate their animals twice as well as background the animals for a minimum of 45 days. Weaning is not a requirement since at this stage in the cycle; the animals would have already been weaned by the previous purchaser or at least over the 45 day backgrounding period.

Other Marketing Options

Other organizations have developed similar sales, but all follow the same basic set of guidelines, with the difference being in the specific types of vaccines required and whether or not parasite control is mandatory or optional. Most systems, as well as the Select Vac program, have optional guidelines for producers. These can also be passed along as extra information, for buyers when they are bidding on the animals.

Producers that are not participating in a "special" sale can participate in the traditional Kentucky marketing system, allowing the ownership of an animal to change numerous times. This must also be looked at in order to see what

transformations are being made to the marketing system by alliances. Production in this manner allows the producer to sell an animal without records or ways to link animals back to their origin, under this mechanism the cow-calf producer has no contact with the local stocker who sells his product to the feedlot, which in turn sells to the slaughter facilities. With this procedure the slaughter facility doesn't know where the animal came from, so they can't go back to the producer and help him change the product he is producing.

Traditional sales facilities usually allow producers to sell their animals whenever they choose, with basically no questions asked. Each producer's animals are combined at the auction site into uniform size classes. It is not uncommon to see a group of animals that consist of different breeds as well as groups that consist of bulls and steers. No information is given on whether a heifer has been exposed to a bull prematurely.

Records

Moral Hazard Issues

The Cooperative Extension Service at Kansas State University performed a recent study that looked at a lot of characteristics that affect the profitability of cattle producers for calves weighing between 300 and 900 pounds (Sartwelle). Their report was based on feeder calves, looking at breed, genetics, health conditions, horns versus no horns, heifers versus steers, fill, and time of sale. These are all characteristics important to beef producers; however, this is not a complete set of factors that affect the overall profitability of producers. These characteristics provide a starting point that will provide comparable numbers to those developed in this thesis. The results also allow the examination of the effect placed on different size producers.

The increased amount of records that cow-calf operators, as well as backgrounders, are supplying with their animals is to overcome a problem known as the "Market for Lemons," or information asymmetries. Mixing a few low quality calves with a group of calves that are of a significantly higher quality results in a problem for purchasers to determine the appropriate price. George

Akerlof identified the Market for Lemons and how it was related to the used car industry. He divided cars into four groups, which consisted of good new cars, lemon new cars, good used cars, and lemon used cars (Akerlof, p.489). He determined there was a certain probability that a given car was a lemon, with a used car having a greater probability of being a lemon than a new car. One of the main parts of the study was that there was no way to determine if a given car was a lemon or not until it was purchased and the new owner had possession of the car.

Another important point raised by Akerlof is that the price of a good product is reduced, since there is a chance that it will be a lemon. It is advantageous to the person selling the item to sell a lower quality good described as a high quality item, if there is no way for the person buying the good to know. The effect is to cause a price decrease for all products (Akerlof, p.488). The lack of information given to the consumer increases the probability that the consumer will purchase a bad product, causing the consumer to only be willing to pay a lower amount for the product purchased. Whenever there is risk associated with a decision, consumers will demand that the purchase price be reduced, in order for the consumer to be willing to take the risk and purchase the product. Both points made by Akerlof can be carried over to the cattle industry. If there are no verifiable records on a given set of animals, which forces the buyer to use only his perceived judgment on what he sees as the value of the group, higher levels of risk result in lower bids.

Along with looking at the probability of whether or not a product is a lemon or not comes the probability that a good product will be marketed. Akerlof discusses the likelihood of a good product being sold versus someone selling a bad product that they are unhappy with (Akerlof, p.489). This is also a characteristic to consider in the traditional cattle market where a group of heifers may contain cattle that were prematurely bred, or a group of steers contains bull calves that should have already been castrated. The new marketing techniques of the cattle industry are faced with the possibility of dishonest producers pushing the market out of existence. This would push cattle producers back to the open

market which provides no incentive for record keeping. Without a marketing system that promotes overall consistency producers will be faced with lower demand and prices.

Producers are trying to become more profitable by providing more information to cattle buyers, but this can lead to individuals trying to take advantage of the system, resulting in moral hazard issues. Each producer is the only person who really knows what has been done to a group of cattle, which results in imperfect information. As with any firm, the principal who hires an agent to manage the firm doesn't have the ability to observe the agent's decisions, only the final outcome or product (Hagerty, p.425). Using logic, the best final products will come from the best agents. Agents who are not suited for the job will not be able to make a profit, so they will not be selected over the longer term. The process of eliminating unsuitable candidates can be described as a talent search that only accepts candidates that are suitable for the job (Hagerty, p.427). This theory suggests only suitable agents will continue to survive in this type of marketing agreement, which limits moral hazard issues. This is a logical result, given that unsuitable candidates, who aren't profitable, can't continue producing in the long run.

By increasing the required amount of information provided to cattle buyers, producers could be tempted to give false information about their animals. For this reason many of the new marketing programs require that the producer provide proof of what health programs the animals have been exposed to. Providing evidence of production practices requires producers to keep a better set of records that can be interpreted by others within the industry. It is no longer acceptable for a producer to rely upon "word of mouth" to explain how his animals were produced. The "word of mouth" technique has been successfully used by larger producers who had ongoing relations with the buyers that were bidding on their animals. Larger producers were able to develop reputations at the local auctions barn allowing a producer who traditionally produced top quality animals to receive a premium for his animals. However a smaller producer who

was not known by the cattle buyers with the same production techniques would not have received the same premium.

This brings us back to the average size of a cow-calf operator, which was discussed earlier. The average producer is a small family owned operation, who is penalized for not being able to produce a large number of animals, due to relationships among buyers and sellers. More producers are beginning to understand that information is valuable because it permits individuals to increase the expected utility of their decisions; therefore more information leads to buyers willing to pay more for the product (Nicholson, p.562). Without the proper records and proof that producers are producing under the guidelines that they are reportedly producing under, buyers are going to be faced with an adverse selection dilemma. If the producers information can not be properly identified the buyer will be more likely to purchase a different group of animals he can be certain about how they have been produced.

Record Keeping

Accurate record keeping by producers helps ensure the buyers are purchasing the product they think they are purchasing. In the cattle industry, a lemon product would be a calf that was described as a healthy animal that had received all of the necessary vaccines and undergone other necessary health practices, but after the buyer got the animal to the farm or feedlot, it became apparent the animal had not been produced in the way it had been described by the previous owner. This has led to buyers requiring more evidence that a given animal has been produced by the methods the producer is claiming. Many marketing techniques ban animals that have received certain types of medications for different types of illness. These animals must be sold in the traditional market in most cases, which can lead to a producer receiving less for that given animal as well as potentially reducing prices for all animals. This can also lead to the "Lemon" problem if the producer falsely markets the animals in a market that does not permit the use of the medications the producer administered. Without a

verifiable record, there is no way to determine what treatments a given animal has received.

Free-riders

With the new marketing systems, producers are beginning to combine animals with similar characteristics, in order to improve the lot size that is available to the cattle buyers. The traditional system only allows a single producer's animals that have similar characteristics to be sold in a lot. With accurate, detailed, record keeping this allows the individual producer's animals to be part of a larger group of animals, resulting in a premium for the increased lot-size. Without accurate records, producers have the opportunity to become "free riders" within the industry. Like the market for lemons, which was discussed earlier, if producers aren't keeping accurate records that can be reported to the auction facilities, animals that haven't been produced under the guidelines could be included in a larger lot of animals. This could cause the honest producers that have worked to produce top quality animals in the group to lose all of, or at least part of, the premium they otherwise would have received for their animals.

The problem of free-riders was first identified in 1848 by J.S. Mill, but has since been examined by several different economists. Alison L. Booth developed a Social Custom Model of Trade Union Membership model, which can easily be applied to the cattle industry as well as the CPH marketing system (Booth, 1985 pp.253-261). In her model, there are four main assumptions. The first is there is only one union, membership is not required, and the only goods available are reputation and wages. The second assumption is there are benefits to being in the union. The third assumption is all participants can be seen as identical, and have the same preferences for the two available goods. The last assumption is the utility function is assumed to be a strictly increasing, continuous, twice differentiable, concave function (Booth, pp.256-257). Under these assumptions, the model indicates there is not likely to be a free-rider problem, regardless of whether there are a small or large number of members in the union. The reason the problem will not arise is that if free-riders become a problem the productivity

of the group will be reduced, which would lead to the formation of a new group or union that had a more efficient way of producing or marketing the good. This would phase the original union out of production, given that the current union doesn't have monopolistic powers.

The CPH marketing plan can be looked in the same way that Booth looked at a union. All of the assumptions are met and there is no monopoly. Booth also indicates that even if the benefits and efficient production don't prevent free-riding, the reputation of all cattle producers as well as peer pressure should keep free-riders out of the union. In the cattle industry this should also be the case because if consumers see the beef industry as dishonest, or begin looking down on its producers the overall demand for beef products will be reduced, which would reduce the amount of cattle that producers could produce, and still be able to make a profit.

With accurate record keeping animals can be traced back to the producer that brought them to market, so any necessary punishment or future restrictions on that producer would stop any misrepresentation. It is also possible producers who have adopted a production practice that exceeds the requirements of the marketing system may not be able to receive more of a premium than a producer who produced their animals by the minimum requirements, since the animals may be grouped together by the auction facility, and the same amount of records given to the buyer for each producer's animals. The guarantee of records made to the buyer removes some of the risk placed on the buyer, regardless of whether or not the buyer ever actually looks at a specific set of records.

Processor Records

Processors are also demanding more information on the animals they are purchasing. They have the ability to be selective and choose the types of animals they want to purchase. One way that processors are demanding more from producers is through grid pricing. By requiring feedlots to sell their animals on a grid, processors are reducing the amount of risk that they have to take. Schroeder and Graff looked at grid pricing and what it had to offer producers. They

concluded that grid pricing was beneficial to high quality producers and paid low quality producers less than the cash market. Grid Pricing values each carcass in an individual lot, against a base animal, which can be considered an average animal, giving a price premium or discount per cwt to each animal based on the characteristics that the animal possesses. An example of a base animal would be something like a choice yield grade 3 weighing between 550 and 950 lbs. A select carcass with a yield grade of two, will receive a discount, when compared to the base animal, a prime animal with a yield grade 4. Their results were that high quality calves subsidized low quality calves by as much as $30 per head. This result supports previous results that producers must know what they are producing in order to properly market what they have (Schroeder, p.89).

Processors are no longer buying what they believe the live animal will be able to produce, they are only buying what the animal has produced after it has been slaughtered, which forces prices to match quality. This forces the feedlot to be more selective in the animals that they are buying, in order to reduce the amount of deductions they receive if the animals do not grade well. Marketing arrangements between feedlots and backgrounders then applies pressure to the backgrounder, as well as to the cow-calf producer. The more information the feedlot can obtain on a given animal, improves their judgment on how the animal will grade when it is processed. This determines how much money they will be able to get out of the animal when it is processed.

The operator is also able to benefit from outlays on increased record keeping, by knowing how his animals are grading when they reach the processing plant. If a producer has a group of animals that aren't producing top quality calves, the producer can alter his herd, so that his next calf crop will improve. Improved records also allow producers to see which cows are earning the most money for the producer. If a cow that has a high production cost is not producing as much as a cow that has a lower production cost, the higher cost cow should be replaced with a cow that will produce more for less.

Market Integration

The high concentration of the beef processing industry has led many outsiders to ask the question of why the beef industry has not become integrated like the poultry and swine industries. The main difference in the beef industry is that the production process has more steps than the poultry or swine industry. Cattle are marketed numerous times in their life before they reach the processor. This means that there are a lot more people to integrate than in the poultry industry. The figure on the lifespan of a calf provides evidence of the numerous paths that an animal can follow, with the possibility of ownership changing numerous times. In the poultry industry the same producer has the ability to start with a day old chick and keep it until it is ready to be processed. Cattle producers that operate a cow-calf operation or a backgrounder operation typically don't have the ability to finish the animals that they produce. Another key factor in the process is that most cattle contracts place limitations on producers, but don't tell them how to produce a given set of animals. This is not the case in the poultry industry. Contracts in the cattle industry resemble what R. H. Coase refers to as a contract "one whereby the factor, for a certain remuneration, agrees to obey the directions of an entrepreneur," leaving other production factors to the agent (Coase, p.391).

Efficiency of the industry is also a reason the industry has not become integrated. With numerous steps in the production process it would be impossible for one manager to make all the necessary decisions a cattle producer is faced with. With the beef industry competing with other meat industries it is important to remember that a merger can increase the price of the final good, which would reduce the quantity of the product demand (Salinger, p346). Increasing final product price would force some consumers to substitute away from beef products, decreasing beef demand hurting producers. Grazing is a main portion of cattle diets, but in some areas, and under certain weather conditions such as a drought, mangers must provide a supplemental source of feed to the animals; by contrast, poultry or swine can be produced under the same feeding practices regardless of

where they are being produced due to the standard rations and the small amount of space needed for production.

A survey of feedlot owners also provided some insight into what they saw as the problems the beef industry has been plagued with. The survey showed more producers were deciding to sell their animals through an alliance because the system coordination provided the producer with more information about his product and often times provided the producer with a price premium. This assumes that producers were already producing animals using an adequate health program (Schroeder). It was also concluded feedlot owners didn't think packers should be allowed to own or feed cattle; however, they did feel contractual agreements with producers should be permitted. The producers surveyed felt that, even thought the beef packers were becoming more concentrated, there was no need to break up the largest packers or retailers into several smaller companies. The four largest beef packers control 82% of the steers and heifers that are slaughtered (Schroeder, p.7). Reasoning for this is that efficiencies associated with integration provided more benefits compared to what lost due to the market power of the firms.

Consumers are also able to benefit from changes in the nature of available information, since there is now more information on the product. Information is available on an animal that has been produced naturally, or has received any growth hormones. Consumers have the ability to choose from a larger variety of products. Beef products are becoming branded, so consumers are no longer forced to go to the market and purchase a piece of meat they know nothing about.

Production Cost

When each production level works with other levels of the industry more information is available. If data recorded by the slaughtering facilities is available to the farmer that operated the cow-calf operation, that farmer has more information on how his calves are performing. If the data shows that a 1000 lb cow produced a higher priced calf, compared to a 1500 lb cow from the same producer, replacing the larger cow to increase profitability would need to be

considered. The larger cow is more expensive to maintain because more feed is required. Without records producers don't know how their cows are producing; they are forced to make their decisions based on what they think is happening, without actually having the information available.

Also, by having information from the different stages of production the cow-calf producer may see that an undesirable trait is present in his animals. This could lead him to changing the sire of his next calf crop. The information may also show producers that it is time to change the breed of cows they are producing, if they want to start improving the type of animals they produce. With this information, a producer who would normally keep the heifers he produced may decide to send his heifers to the feedlot and purchase different replacement animals, to add a different characteristic to the herd.

After looking at the choices producers face, it is easy to see why they are uncertain about what marketing system is best for their operation. It is also apparent that the managers in charge of the new marketing systems are only willing to highlight the valuable traits that are associated with their marketing system. For producers it is important to look at the larger picture because there can also be some negative effects associated with the different types of marketing arrangements. The negative aspects include limited sales dates and locations as well as increased production cost associated with increased records and improved health programs. It is also unclear from looking at the different types of marketing systems how much additional profit is available.

This chapter has defined what is happening in the industry, as well as what economic models and theories are needed in order for producers to have the information they need to make better marketing decisions. This general analysis will improve the understanding of the econometric results as well as provide more insight as to what the results mean for producers. Without meaningful results there would not be a need for the econometric model and producers would not gain experience any benefits from the study.

CHAPTER THREE
EMPIRICAL ANALYSIS

An empirical model is developed to identify the different characteristics in a beef animal when it is sold. Other characteristics that alter the final price of an animal that can't be controlled by the producer are also considered. Each of these characteristics will influence price premiums or discounts. From this it can be determined if there is a price premium associated with participating in a CPH sale compared to a traditional marketing system.

Desirable Characteristics

Regardless of the type of sale a producer decides to use, the sale will promote a select group of characteristic believed to benefit the producer. Sales that concentrate on a specific breed highlight desirable breed characteristics. Other sales concentrate on health issues associated with production by highlighting the vaccines and other health requirements. As a producer's choices increase it becomes less apparent which type of sale is the best choice. However, several characteristics have been found as desirable in the live animal, and records are needed for each. This study will look at the price change each characteristic provides, through either a price premium or discount.

Theoretical Model

The theoretical model that will be used to evaluate the cattle market is an application of hedonic pricing. The hedonic pricing model takes observed product prices and uses a number of characteristics to define a set of implicit or "hedonic" prices, with the main hypothesis being that a specific good is given value by the characteristics or utility-bearing attributes that it posses (Rosen, pp.33-34). This is a suitable model since the objective of this thesis is to find out what characteristics provide producers a price premium. Rosen describes the model as one that provides a description of competitive equilibrium in a plane of several dimensions, where both buyers and sellers locate (Rosen, p.35). Each set

of goods has a unique set of objectively measured characteristics. In this case the plane would contain points with each having a different amount of the characteristics being studied. In this type of model it is important to remember that one seller can't influence the market and that buyer and seller must be perfectly matched, with price indicating what quantities will be supplied and demanded. If each auction facility allowed public access to the records on the animals sold during a year, each facility would need to be included in the model to get the best representation of the value associated with selling at a specific location. Within the available locations, information on the number of animals would also be needed and each group of animals would posses certain characteristics. The specific characteristics used in this study are as follows.

Lot size

It has been shown that buyers are looking for a consistent and uniform product and a characteristic that allows this is a large number of similar animals in a single lot. This allows the purchase of a "good" that possesses desirable characteristics. Buying single animals makes it harder for buyers to purchase a uniform set of animals, since each animal is unique and each buyer would likely have a different perception on the level of certain characteristics present. A load of cattle is considered to be between 48,000-52,000 pounds. A uniform group that makes up a load is substantially different from a uniform lot that consists of only one or two animals. It is expected that, as producers sort uniform groups of cattle into lot loads, buyers will pay a premium for these groups of cattle. However, the combining of cattle to make a load takes time, which means that the first part of a load spends more time at the yards, hurting the overall performance of the animals. There is also risk of placing an unhealthy animal in a group of healthy animals, possibly infecting the healthy animals, and again hurting overall performance.

Fill

The fill of an animal helps determine what buyers are willing to pay. Buyers do not want an animal that has been under or over fed. They are in the cattle feeding business; they are the ones who want to finish the calf. An animal that has been overfed prior to marketing will not bring a premium because buyers know the animal will shrink before it reaches the feedlot. For this reason, the CPH sales shrink each lot's average weight by two percent, before the weight is reported so the number of pounds purchased is received. Under filled cattle are seen as cattle that are ill or will likely become ill. Risk is added to cattle buying if buyers purchase ill cattle that could contaminate other healthy animals. It also takes feedlots longer to get these cattle into a condition that will allow them to start growing and producing muscle at a faster rate. For these reasons the CPH sales retain the right to reject animals that are over or under-filled. In the live-cattle market there is no scientific way to determine fill. Market fill is determined by individual buyers and the sales manager determines fill for the CPH sales.

Breed

Producers have individual tastes and preferences when it comes to the breed they want to make up at least a portion of their herd, while there are other breeds they "wouldn't allow on the place". In this study, three of the major breeds will be the focus of concentration.

Black Angus are expected to bring a premium because the meat eventually sold at the retail level contains more marbling, improving the overall taste of the product. However the black color of the cattle makes them unfavorable in hotter climates, so some producers choose a different breed, such as a crossbred animal.

The next type of cattle considered is a black-white face. This is typically a Black Angus crossed with the traditional Hereford breed. The Hereford breed is known for being able to survive on its own, while the white face makes them more susceptible to pinkeye, which greatly reduces a producer's profits, and the overall condition of the animal. Black-white face calves also capture some of the increased marbling of the Angus breed. Producers are not willing to give a

premium for the pure Hereford cattle, so producers have to limit the amount of Hereford blood their animals inherit, which provides evidence of the changing demand for beef products since Hereford cattle have sold for a premium in the past.

The third breed considered is the Charolais Producers like the breed because of the faster growth rate and they mature into a larger animal than the above two breeds, with popularity depending on feed prices. With high feed prices, their growth rate makes them popular. Charolais also withstand more heat than the Angus.

Sale Location

The sales location must also be considered to see if different markets provide a price premium. This could be related to how close the interstate system is to the sales facilities. This type of premium is expected to increase as fuel prices increase. Increases in the transportation cost of the animals, ultimately increases the total acquisition cost. Lower shipping charges could also benefit producers who market their cattle closer to feedlots, since proximity reduces transportation cost. A premium should be associated with each of these categories because large trucks used to transport loads of cattle run into difficulty when traveling on small rural roads. Transportation cost closer to the feedlots should also decrease, but the final product price isn't adjusted, so buyers should pay a premium to get the product closer to its destination.

Selling cost must be considered when deciding which type of auction to participate in. Any producer's profitability depends on pounds, price and production cost. The CPH sale may give them more per pound, but there is also an additional cost that is added to production if producers consign calves in this type of sale, possibly outweighing the premium received. This may mean the traditional sale is more profitable to the producer even though it is providing less per pound for the animals. This aspect of the production cycle is often ignored, but must be remembered when producers are deciding which type of sale is more profitable for them.

Producers must market when the cattle are ready, versus when demand is high. With the traditional system, cattle can be marketed five days a week on a weekly basis. With the CPH system, only select locations have sales and this is often done on a monthly basis in the spring and fall. This can make it difficult for producers who want to sell their calves but have other obligations at sale time. It is also difficult for producers to sell during the summer months, since most CPH sales occur in the spring or fall.

It is important to note that buyers are not limited to a specific yard or type of sale. Buyers will attend auctions of either type over a large area, allowing them access to a different sale each day of the week. This is important to the model if there is a price difference in the two markets, since only the less expensive one would be considered (Rosen, p.37). This reduces arbitrage across markets by pushing individual market prices to a uniform market price.

CPH VS. TRADITIONAL SALES

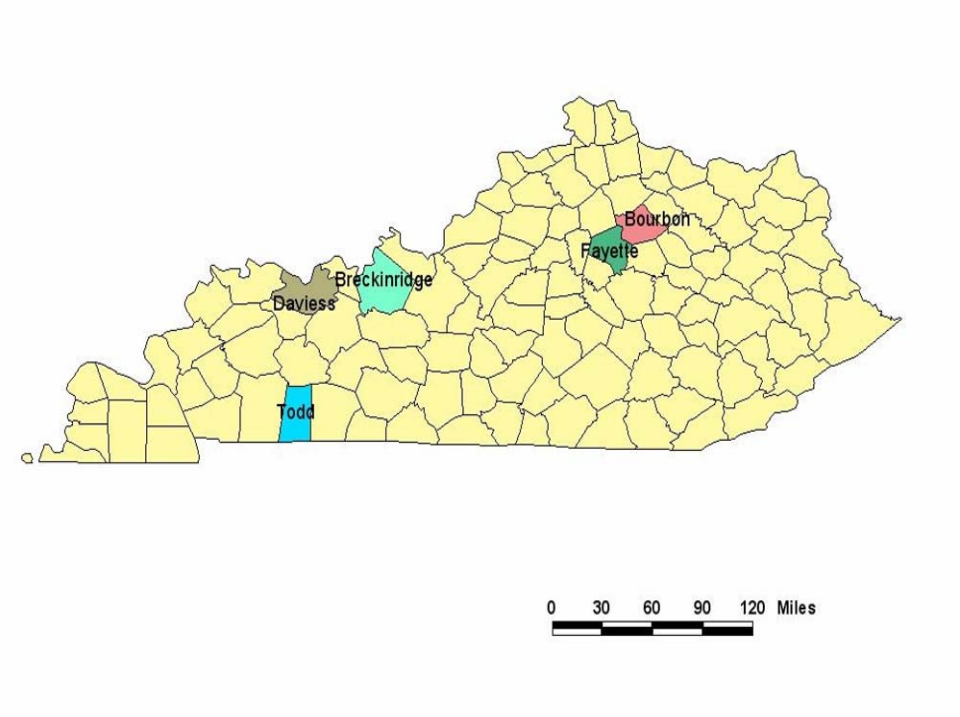
Empirical Model

An econometric model was used to perform a regression, to identify variables that provide a price premium. This allowed isolation of the effect of each variable, so the magnitude of each premium could be obtained. The first variable considered was sale location for the five major locations in Kentucky. The first location was Bluegrass Stockyards located in Fayette County, which is denoted as BG. The second location was the Bourbon County Stockyards, which is represented by the variable named Paris and is later used as the base location. The third location is the Pennyrile Stockyards, which is located in Todd County and is denoted by Penny. The fourth location is located in Davies County and it is represented by Owens. The last location that was employed in the study was the Irvington stockyards located in Breckinridge County, which is represented by the variable called IRV. The location variable contains a one “1” if the sale occurred at that location and a zero “0” if it did not occur at that location. Bluegrass Stockyards sells approximately 275,000 head annually which makes them the largest facility on this side of the Mississippi river. They accept cattle from

ninety counties within the state and from as many as eleven surrounding states. The traditional cattle market accounts for a larger number of cattle than CPH sales (35,000 head annually). However, more locations are starting to hold CPH sales and current locations are constantly increasing the number of these sales.

Figure 3.1

Cattle Markets Used in Analysis



The next two variables examine how a specific lot's price was affected by how close it was to a lot-load. The first variable looks at the number of pounds in the lot and is represented by lotpds. The other variable concerned with how close the lot is to a full lot-load is called (load2). This variable represents the percent of a lot load assuming any weight over 48,000 pounds is a full load. The third variable represents the average weight of a lot in order to identify what happens to the price per pound of an animal as weight is gained.

The variable "gender" was created to differentiate between steers and heifers. This variable will be one if the animal is a steer and zero will represent heifers. It is expected that steers will bring a higher price, but this isn't considered a premium, since producers do not have control over this characteristic.

The fourth type of variable was the breed of the cattle, to see if there was a premium given to any one breed over another. The three major types of cattle Black, Black-white face, and Charolais were each compared to other breeds of cattle that had been sold. The Black cattle are denoted by black. The black-white face cattle are denoted by bbwf. The Charolais cattle are represented by the variable called char. All other breeds, which will be used as a base breed, are considered as other in the data.

The last type of variable was sale type. The traditional market was used as the base and it is denoted by Trad. The only market considered was the CPH sales, which are denoted by CPH. A one is used to represent a CPH sale. A variable called feedind represents the cash feeder cattle index, which accounts for sales being held at different times of year, and accounts for variability between sale dates. The indexes were obtained from the Chicago Mercantile Exchange.

A needed variable is the grade of the animals in each lot; however, many locations do not provide accurate results, so this information was not available. CPH sales provide a grade for the animals, but traditional sales usually do not report a grade. Each sale location should have weekly reports that supply the needed information, but this is not the case for many locations. For this study, the five major markets across the state were used, since they had the best records. The three main breeds were also the only breeds considered, since records for the other breeds were not abundant. In a perfect market, information on each animal would also be available, including animals that were sold in a single lot, but marketing agencies fail to report this data.

Data Sources

Comparable dates for each sale type were used since cattle prices often fluctuate at different times of the year (Hughes). The CPH data was gathered from CPH sale reporting forms. These were obtained from the Kentucky Beef Integrated Resource Management program (IRM). The KY Beef IRM is an organization sponsored by the University of Kentucky that concentrates on helping producers become more efficient and cooperative across production levels in order to improve production. The forms recorded how many lots each location sold on a given date, along with the characteristics and the price the lot was purchased for. For traditional markets, access to the Kentucky Livestock and Grain reports ranging from Fall 1999-Spring 2004 provided data on lots with at least twenty head. The Kentucky Livestock and Grain Report is a weekly publication produced by the United States Department of Agriculture, which provides producers with pricing information as well as the quantity sold, for hogs, grain, cattle, sheep, and goats around the state. Individual groups from each type of sale were not comparable since exact matches across sales were extremely uncommon.

Identifiable characteristics were used to determine the price of an animal and after these characteristics were determined they were assigned an expected sign, signifying whether the expected price premium was achieved. The determination of the characteristics will determine the value of the econometric results. If the proper variables are not included it will be impossible for producers to have the information needed to decide the type of marketing system best for them.

Table 3.1 Descriptive Statistics

Variable	Mean	St. Deviation	Min.	Max.
Feedind	$84.57	$7.7197	$76.58	$105.25
BG	.495	.5002	0	1
Penny	.0071	.2547	0	1
IRV	.1788	.3833	0	1
OWENS	.1416	.3488	0	1
Lotpds	29625.296lbs	28672.60lbs	363lbs	211385lbs
Load2	.47795	.3429	.0069	1
Gender	.6308	.4828	0	1
WT	634.85lbs	152.46lbs	72.75lbs	1103lbs
Black	.2167	.4122	0	1
BBWF	.1077	.3101	0	1
Char	.1200	.3251	0	1
CPH	.6533	.4761	0	1

After determining the variables to be used in the model, different formulas were applied, to ensure the model was compatible with the data. A linear model was first applied and appeared to be a good fit for the data, accounting for 73% of the price variability, with all variables being statistically significant and having parameter signs that were expected, based on what is known about the industry. The next approach took the natural log of the variables, as well as the square of the variables, to see if a nonlinear model was a better approach. Looking at the

parameter estimates as well as the amount of variability each equation was representing, the linear equation provided the most meaningful results.

After determining the form of the model, diagnosis of the data was performed to ensure the data fit the required OLS assumptions. The first test was to check for multicollinearity. Multicollinearity is present when two or more of the dependant variables are linearly related. Using Variance of Inflation Statistics, it was determined that multicollinearity was not present in the data. The next test performed was a check for heteroskedasticity, or that the equal or common variance assumption is not violated. To do this, the model was ran saving the residuals from the model and then regressing them against the explanatory variables and it was determined that heteroskedasticity was present in the weight variables.

Correcting for heteroskedasticity can be performed by weighting the variables or dividing each variable by the variable creating the heteroskedasticity. Given that one of the variables associated with the weight of the animal was causing the heteroskedasticity, the equation was divided by each of the weight variables (wt, load2, and lotpds). Variations of the weight variables, such as the square and natural log were also considered as options for correcting the problem but these changes did not correct the problem. Leaving heteroskedasticity in the model decreases efficiency and violates the OLS assumption of minimum variance. This causes the variances of the variables to be larger, reducing the level of significance, but isn't a problem for this data set, since all variables remain statistically significant.

The model used to determine the price of feeder cattle may help producers see what they are being paid for. The equation expresses price (P) as a function of the other variables and can be written as

$$P = B_0 + B_1 BG + B_2 Penny + B_3 IRV + B_4 OWENS + B_5 lotpds + B_6 Load2 + B_7 Gender + B_8 Wt + B_9 BLK + B_{10} BBWF + B_{11} Char + B_{12} CPH + B_{13} Feedind$$

The equation provides a good fit for the hedonic pricing model and the application is similar to an approach used by Combris, Lecoq, and Visser (pp.393-401), looking at the Bordeaux wine market. Their study looked at the characteristics contained in a given bottle of wine, to determine the effect of sensory characteristics versus the objective characteristics role in price determination. The live cattle market is similar to the wine market in the sense that important characteristics are not easily seen by the buyer. This study also looked at the validity of the reported data, noting that it was often the more expensive brand that had the most available information (Combris p.392). They were able to conclude that the objective variables or the variables on the bottle label, determined the price and the sensory variables determined the rate given to the wine by professional wine tasters (Combris p.401). In the cattle market, buyers are faced with the same situation; buying a group of animals given only the characteristics visible, and guessing or using past experience to evaluate the characteristics they are not able to see.

Table 3.2 Expected Sign of Parameter Estimates

Variable	Variable Definition	Expected Sign
Feedind	CME feeder cattle index	positive
BG	=1 if sale at Bluegrass Stockyards, 0 otherwise	positive
Penny	=1 if sale at Pennyrile Stockyards, 0 otherwise	positive
IRV	=1 if sale at Irvington Stockyards, 0 otherwise	positive
OWENS	=1 if sale at Owensboro Stockyards, 0 otherwise	positive
Lotpds	Number of pounds in a lot	positive
Load2	percentage of a load of cattle if <1, 1 otherwise	positive
Gender	=1 if steer, =0 if Heifers	positive
WT	Average weight of animal	negative
Black	=1 if lot consist of Black Cattle, 0 otherwise	positive
BBWF	=1 if lot consist of black/black-whiteface cattle, 0 otherwise	positive
Char	=1 if lot consist of Charolais, 0 otherwise	positive
CPH	=1 if sale was a CPH sale, 0 otherwise	positive

Another hedonic model application by Wiggins and Raboy (1996) also provides insight into how the cattle market determines price. This study looks at price differences between name brand and generic bananas and it found name brand producers received a higher price for their product due to the perception of name brands having higher quality products and improved shipping methods. One aspect of their study was the fact that retailers developed long-term relationships with producers. This was interpreted as resulting in less risk,

associated with the quality of the product, since the retailers can't view the product before shipment.

The traditional cattle market operates in similar fashion. Buyers are not able to see all characteristics but, over time, some cattle producers and buyers develop relationships that provide some buyers with advantages over other buyers who are not familiar with a given producer's techniques. The amount of information flow is not evident in the CPH sales since information given to buyers and producers is required. Wiggins and Raboy also pointed out that retailers buy name brand and generic products and then combine products. This allows them to receive the same price for both goods. However, less risk is encountered when name brand products are purchased. In the cattle market, products are not branded, so similar products receive the same price, but the cattle that weren't produced under a required health program place more risk on the feedlot operators as well as on processors, who are the first people to actually see all of the animal's characteristics.

CHAPTER FOUR
RESULTS AND CONCLUSIONS

By determining the effect of characteristics on price, producers can look at their own production process and determine the marketing system best for their situation. Producers can look at what they are producing in comparison to the animals the model suggests they produce. This allows producers to see what premiums are associated with certain characteristics. It is now possible for producers to identify characteristics to concentrate on to improve efficiency and the price received.

Empirical Results

Beef producers are always looking for a way to make the animals they produce more profitable, and some producers have been able to use the new marketing techniques to do just that. After running an econometric analysis on the available data, it is apparent the model that has been developed is a realistic model, since the variables that have been studied previously have the expected signs and this equation represents approximately 73% of the variability. It is also reassuring to find that the magnitude of the effects of previously studied characteristics is similar to the findings of this study.

There is a significant premium given to Bluegrass, Pennyrile, and Owensboro, when compared to the Bourbon County Stockyards. For Bluegrass the premium was an additional $2.31 per hundred pounds of stock. The Pennyrile yard returned a discount of $2.47 per hundred. Owensboro provided a modest premium of $1.93 per hundred, when compared to the first two locations. There was no statistically significant difference between Irvington compared to Paris, therefore it is impossible to determine any difference in price at either of these locations.

As was hypothesized, the size of the lot and weight were both significant variables in determining the price of the cattle. Weight had a negative estimate, which should be expected as the size of the calves increase. For every hundred

pounds of increased weight the producer will receive a price that is $3.49 less than for a comparable animal that is one hundred pounds lighter. Cattle that were able to be marketed as a lot-load also received a significant premium. The premium associated with having at least a lot-load was $5.77 per hundred weight.

As expected, the gender of the animals also made a difference in the final price. There is $8.94 per cwt. price adjustment for steers over heifers. This is not a premium because producers have no control over what their cows produce and if they are buying the animals in order to background them, they should also purchase the heifers for less than comparable steers. These characteristics affect the price received by the producer, but must be considered an exogenous variable, so the producer has no control over this variable.

The Black category provided the highest premium at $2.32 per hundred weight, while BBWF provided a $1.70 premium and Charolais returned a premium of $1.59. This was expected since certified Angus beef is in high demand in retail stores. For a producer to receive the largest breed premium, Angus cattle must be produced.

The CPH characteristic, which was also significant, provides evidence about the benefits of the different types of marketing systems with a premium of $1.59. This can be used to help producers decide which type of marketing system is best for them. The results can be seen in Table 4.1.

Table 4.1 Econometric Results

Variable	*Estimate*	*Standard Error*	*Pr>[t]*
Intercept	27.69639	2.13450	<.0001 *
Feedind	.81232	.02215	<.0001 *
BG	2.31557	.51968	<.0001 *
Penny	-2.46573	.98991	.0010 *
IRV	-1.10213	.95192	.0772
Owens	1.92821	1.02482	.0031 *
Lotpds	-.00002502	.00001	.0262 *
Load2	5.76758	1.26758	<.0001 *
Gender	8.93662	.42014	<.0001 *
WT	-.03494	.00150	<.0001 *
Black	2.32379	.58980	<.0001 *
BBWF	1.70362	.83600	.0024 *
Char	1.59703	.73982	<.0001 *
CPH	1.58562	.42536	<.0001 *

* denotes statistical significance at the .01level

The data suggest buyers are willing to pay a price premium for calves that have been produced under stricter health requirements; however, the increase may not be economically significant. An increase of $1.58 may not cover the cost of participating in the sale. One reason for this could be buyers have relationships with individual producers who communicate with each other, so more information is available to these buyers when they are purchasing a group of calves. These types of relationships would be more common between the buyers and the larger producers, since it is more beneficial to buyers if they are able to gain extra information about a larger portion of the animals they are purchasing. This additional information and the ability to purchase larger groups of cattle reduce transaction costs. By reducing the transaction cost, buyers can afford to pay the producer a higher price without decreasing the amount of return they receive.

The characteristic that has the most effect is the lot-size variable. The only way small producers can sell a large group of animals is to inter-mingle the animals with other producer's animals, which is permitted in the CPH sales, but not in the traditional marketing system. Smaller producers have more to gain from CPH sales, but all producers play a role in improving the quality of cattle marketed.

Larger producers depend on the calves they produce more than most small producers, since a larger portion of their income comes from cattle production. Therefore, they are more likely to take steps to manage the health of their herd. In the past before the development of the new marketing techniques many smaller producers would not go through the trouble of ensuring their animals were healthy, since a large portion of these producers are what are referred to as weekend farmers, or farmers that "hobby" farm. The smaller producers have other means of income, so they are not dependant on the money that comes from cattle production. This gets us back to the main reason for the development of the new marketing systems which was to improve the overall quality of animals that were produced. Increasing the quality of beef should also help to improve the price producers receive for their products.

All cattle producers stand to benefit from the development of the new types of selling procedures, whether or not the price can be directly related to which type of sale they choose to participate in. For this reason, it could be beneficial for large producers to participate in the new types of sales. Since many are already operating under the same or a similar health program they face no increase in cost, but may obtain an indirect benefit. The larger producers may not be provided an explicit gain in profit, but by improving the overall perspective of how people look at beef has the potential to improve both traditional and specialty markets. The continuation of the specialty sales influence the traditional sales on an economic basis even if the price difference associated with participating in these sales doesn't cover the cost of participating.

Recommendations for Further Research

These results provide producers with more information than they previously had, but there is still more needed information for producers to be able to accurately choose the best type of marketing system for their production practices. In this study there was not a variable that concentrated on the different qualities of the groups of cattle. In both types of marketing systems groups of animals that may have been uniform were marketed together but there are

differences, even to the naked eye that make the groups of animals different, which were not identifiable by the available data. This type of data is important so top quality animals aren't being compared to lower quality animals, but is not collected by the different agencies.

Another important characteristic that needs to be looked into further is the influence of breeds and the way that they are recorded. Only four of the major breeds were usable in this study, because after the four main breeds there was a large amount of variation in how the remaining breeds were combined and what they were referred to as in the data, so they were not comparable across the different locations. This is important information to all producers, but especially producers of cross-bred animals or animals that are not one of the four main breeds.

After more of the necessary variables are recorded, a profitability assessment should be examined. This would give producers an even stronger supply of evidence that would allow them to choose the best sale for their operation. In order to do this the production cost of both sale types would need to be included in the model. This would allow the model to look at profit, rather than only at the price.

A follow up study similar to this should be continued because the price differences as well as the production cost associated with the different types of sales are not necessarily the same year after year. More locations are beginning the new sale techniques in addition to the traditional markets and the locations that have already entered into the CPH market are increasing the frequency of their sales, as producers and buyers begin changing the type of sale they participate in, allowing new markets to continue emerging. If the majority of top quality animals are in a certain type of sale, it may be beneficial for a producer of low quality animals to refrain from entering that type of marketing arrangement, since the animals would not be able to be intermingled with animals of other producers.

The more locations that can be compared and the longer the time period they are compared over, is also an important concept when making this type of

marketing comparison. In this study, the variability of time was removed from the model but it is entirely possible that one type of sale would prove to be more beneficial at a certain time of year compared to other times. Time may also play a more important role as producers and consumers become familiar with the new types of markets available.

This study should be beneficial to the producers as well as the buyers within the industry, but there is still more work that is needed in order to gain a full understanding of what is happening to the beef industry. Increasing the data range and variables studied will provide needed information to the industry, allowing producers and consumers to be better equipped to make the best marketing decisions. Improving the ability to make these decisions will improve the overall competition within the industry. The improved competition will lead to the strengthening of the beef market, removing some of the risk from producers and processors, allowing them to make the best decision possible given their current situation, keeping in mind the given situation may change over time.

Appendix: CPH Sales

History

The Certified Pre-Conditioned for Health (CPH) sales procedure is not necessarily a new procedure, but has caught the attention of more producers and buyers in the past few years, which has allowed the number of sales to increase as well as the number of cattle and producers participating. The first sale began in 1977, which was the result of the cooperation of four organizations; the Kentucky Veterinarian Medical Association, the Kentucky Beef Cattle Association, the Kentucky Department of Agriculture, and the University of Kentucky Cooperative Extension Service. The first sales were held at yards located in Boyle and Pulaski County, but were not successful, due to the lack of participation. Ron Parker and Dewayne Miksch began a similar sale in Christian County in 1980, which was successful and is the longest running CPH sale (Absher).

Rules & Procedures

If a yard wants to begin having CPH sales, a sales committee must be put in place in order for the sale to be recognized by the developers mentioned above. The job of the sales committee, which should consist of participating producers, a facilitator, local extension agents, and local stockyard management, is as follows. Prior to the day of the sale an approximation of the number of cattle participating must be determined, so that the identification tags can be properly distributed. It must also be determined how the recorded information will be collected and inspections of participating producers will be performed. The day of the sale the committee should assist in the receiving of the cattle and ensure that all requirements are met and any disturbances are settled, such as which calves should be included and what should be done with animals that do not qualify.

Health and Management Requirements

Each producer must be Beef Quality Assurance Certified and have had ownership of the animals for a minimum of 60 days, with the calves being

weaned for a minimum of forty five days. The calves should be trained to eat and drink from a trough. Only calves that don't possess horns will be allowed to participate, with the male calves being castrated and heeled, and the heifer calves being guaranteed open at the time of sale. The animals must have been treated for grubs, lice, and dewormed with an endectocide no more than 60 days prior to the sale date. Participating animals must have been vaccinated for Clostridia and provided a booster vaccine for IBR, PI_3, BVD, and BRSV. An official Kentucky CPH-45 tag must be present and the animals must have been maintained on a free choice of mineral supplements. Cattle that are determined to have physical defects or that are of severely poor quality will not be allowed to sell through a CPH sale. Calves possessing the following traits will be rejected: sick or poor condition, horns, impaired vision, improper castration, lameness, warts or excessive ringworms, bob tails, rattails, cropped ears, dairy characteristics, or any other qualities that the grader deems inappropriate. Upon arrival, calves will be sorted, graded, and weighed, with all ineligible calves being removed.

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VITA

Terry L. Lunsford
Born: June 6, 1980 in Nicholasville, KY

EDUCATION

Master of Science in Agricultural Economics
University of Kentucky, Lexington KY, May 2005

Bachelor of Science in Agricultural Economics
University of Kentucky, Lexington KY, May 1998

Relevant Courses: Statistics, Advanced Micro and Macro Economics, Quantitative Economics, Calculus, Advanced AG Policy, Production Economics, multiple Econometrics classes

Undergraduate GPA: 3.175
Graduate GPA: 3.00

EXPERIENCE

Greystone Farm Nicholasville KY, 1986-Present

Farming division

- Experienced in all aspects of running seven hundred acre family farm
- Managed employees on daily operations
- Made product and marketing decisions
- Produce fifty acres of tobacco on farm
- Maintain cattle herd of 500 head

Horse division

- Shown Tennessee Walking Horses since 1986
- Work in Training operation, preparing horses

TSE Tattersalls

- Participated in every aspect of running a Horse sale
- Worked with other employees as well as customers on a daily basis

University of Kentucky

- Worked under Loys Mather assisting him with Aec 305, Gen 100, and Aec 422 classes
- Developed spread sheet for Steve Riggens, which was used to calculate grades for students in Aec 422.

HONORS/LEADERSHIP

- Nicholasville Christian Church Deacon
- Nicholasville Christian Church Sunday School Teacher
- Awarded Highpoint Amateur for Showing Tennessee Walking Horses
- Awarded Amateur Sportsman Award for Showing Tennessee Walking Horses
- Received American FFA Degree
- College of Agriculture Deans List
- Accepted into Doctoral Program at University of Kentucky