2005

# KENTUCKY FEEDER CATTLE PRICE ANALYSIS: MODELS FOR PRICE PREDICTIONS AND GRAZING MANAGEMENT

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ABSTRACT OF THESIS

KENTUCKY FEEDER CATTLE PRICE ANALYSIS:
MODELS FOR PRICE PREDICTIONS AND GRAZING MANAGEMENT

Kentucky plays an important role in the complex U.S. beef cattle industry. This study focused on the feeder cattle production sector of Kentucky's beef cattle industry. Primarily a cow-calf state with a substantial backgrounding sector, Kentucky is a large supplier of feeder cattle to the cattle finishing sector. Price relationships within the market for Kentucky feeder cattle were examined using historical price data from Kentucky livestock auction markets. This research revealed many interesting price relationships that Kentucky producers may use in order to increase the profitability of the cow-calf and/or backgrounding operations. A segment of this research includes a Grazing Management Decision Tool which was constructed to enable producers to evaluate the potential profitability of various grazing scenarios using current market forecasts.

KEYWORDS: Feeder Cattle, Backgrounding, Grazing Management, Livestock Marketing, Price Analysis

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KENTUCKY FEEDER CATTLE PRICE ANALYSIS:
MODELS FOR PRICE PREDICTIONS AND GRAZING MANAGEMENT

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THESIS

Roger Wayne Eldridge

The Graduate School

University of Kentucky

2005

# KENTUCKY FEEDER CATTLE PRICE ANALYSIS:
# MODELS FOR PRICE PREDICTIONS AND GRAZING MANAGEMENT

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THESIS

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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

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2005

MASTER'S THESIS RELEASE

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# CHAPTER ONE

# INTRODUCTION

The beef cattle industry encompasses several different segments, ranging from cow-calf operations to feedlots, that work together to supply inputs into the production of beef. Cattle, like many agricultural commodities, experience a biological production lag. It is not unrealistic for cattle to be over two years of age when they are slaughtered. However, cattle differ from other agricultural commodities in the fact that many different producers may own the cattle as they go through segments of the production process. Corn, for example, isn't usually sold until its production as a raw commodity is complete. Cattle, on the other hand, are commonly sold two or more times before they go to slaughter.

The beef cattle industry is comprised of production levels where farmers generally specialize in a certain portion of the production process. The location and specialization chosen by these producers often depends on relative efficiencies and costs of production. Finishing cattle involves feeding a ration with relatively high proportions of concentrate feeds to fatten the cattle. Therefore, access to large quantities of grain and other commodities gives the Midwest a comparative advantage in the finishing segment of the beef cattle industry. However, Kentucky has a comparative advantage in forage production, which is a vital part of cattle nutrition in the early stages of the production process. Cow-calf and stocker or backgrounding operations are able to capitalize on these available forages to put weight on calves at a cost somewhat less than with feeding grain or commodities [U.S. Department of Agriculture 2004b, p. 1].

These multiple production levels, coupled with a large geographic dispersion and many marketing levels, help to make the beef sector one of the most complex parts of the U.S. agriculture industry. Beef production becomes even more complex after slaughter as carcasses are disassembled into a colossal assortment of consumer goods and by-products. The complexity and volatility of the beef cattle sector have made it the focus of several research and extension projects across the country and around the world. This study is intended to highlight a portion of the industry and analyze the factors affecting its corresponding marketing level.

Feeder cattle prices are a major factor affecting the profitability of beef cattle producers in Kentucky, which is primarily a cow-calf state, due in large to the abundance of forages. Kentucky producers sell calves to either stocker operations or feedlots. Therefore, feeder cattle prices play a significant role in the price they receive for their calves at weaning. Kentucky is also home to many stocker operations. Stocker operations buy calves and enhance their weight, age, maturity, and in many cases, quality [Peel, p. 1]. Stocker operations basically allow the calves to "grow up" after weaning so that they are better suited to go into a feedlot to be finished.

Since stocker operations are buying calves and selling them as feeder cattle, their profitability is also greatly influenced by the procurement and marketing decisions they make. If they pay an excessive price for calves relative to feeders, or the market prices go down while they have ownership, then profitability when they sell these calves as feeder cattle will be virtually non-existent. This paper will incorporate a feeder cattle price prediction model into a Grazing Management Decision Tool for Kentucky cow-calf producers and stocker operators. This prediction is intended to be a tool for Kentucky beef cattle producers to use as they consider selling a group of calves immediately or selling them later at a heavier weight. With a focus on weight gain through grazing forages, this model also incorporates expected average daily gains that vary monthly through the grazing season.

## Objectives

One might hypothesize that Kentucky producers have a tendency to evaluate backgrounding programs based on their overall profitability instead of considering alternative marketing and feeding choices to increase profitability. The hypothesis would be that many producers simply pasture the cattle until the grazing season fades or the forage source runs out. On the contrary, certain producers feel that they can increase profits in certain situations by offering supplemental feeding, as opposed to forages alone, and/or choosing different sale dates to take advantage of ever changing market indicators.

The development of this project will allow producers to continually evaluate profitability at different points in the backgrounding program. Kentucky's forage base has a tendency to decline in terms of both quality and quantity under dry summer conditions. This leaves some producers holding calves into the fall to make up for the lost profits they incurred during late summer. At the end of the grazing season, they evaluate the operation and determine if it was profitable. What they don't always consider is how profitable would it have been to sell the cattle in July or use supplemental feeding in August to compensate for lower average daily gains off of pasture alone. An initial hypothesis of this research is that there will be instances when producers could increase or at least hold profits steady by selling cattle earlier in the grazing season before forages diminish from a standpoint of both quality and quantity.

This model is designed to predict prices for Kentucky feeder cattle assuming that current market conditions do not change dramatically over the prediction period i.e. supply and demand do not dramatically shift. Undoubtedly, prices will differ significantly from the prediction if markets change due to an outbreak of BSE (Bovine Spongiform Encephalopathy), some other disease, trade disruptions, changes in consumer preferences, and so forth. No price prediction model could correctly predict nor account for the impact of such events. Price risk will always be present in the cattle industry, as well as in other agricultural commodities, and producers must realize the market price risk they run and account for the possibility of such.

However, many years often go by without such an event that drastically changes cattle markets over a few months time period. This model is designed as a planning and decision tool using current market forecasts. If market conditions do not change over the next three months, when should I sell a certain group of calves? Will it be more profitable to sell them now in July at 650 pounds, or should I wait and sell them in October at 750 pounds? This model is intended to shed light on questions such as these that Kentucky beef cattle producers should be asking themselves throughout each grazing season.

Along with the prediction model and decision tool, this research will also delve into the issue of how certain characteristics affect the sale price of particular groups of feeder cattle. Unlike other commodities such as corn or wheat, prices vary significantly between different groups or lots of feeder cattle. Using historical price data from Kentucky auction markets this research will attempt to explain these variations.

Stocker operators have many choices as they buy calves each year. The choices they make concerning what to buy at what weight affects profitability each year. By shedding light on how these different characteristics affects the market prices they receive, these decisions can become more well-informed and profit driven. The same is true for cow-calf producers when they select the genetic make-up of their herd. Through heifer replacement decisions and bull selection, the calf crop can be changed significantly over time. For both types of operations, there is a direct correlation between the knowledge of what to expect when their calves or feeder cattle go to market and their ability to make profit-driven management decisions.

# CHAPTER TWO

## U.S. BEEF CATTLE INDUSTRY – FOCUS ON STOCKER OPERATIONS

Cattle and beef production has played a large role in the nation's economy for many years. "The U.S. beef industry is worth an estimated $175 billion with cattlemen operating 800,000 individual farms and ranches. Cattle are produced in all 50 states and their economic impact contributes to nearly every county in the nation and they are a significant economic driver in rural communities" [National Cattlemen's Beef Association, p. 1].

"The U.S. has the largest fed-cattle industry in the world, and is the world's largest producer of beef, primarily high-quality, grain-fed beef for domestic and export use" [U.S. Department of Agriculture 2004a, p. 1]. This has been made possible by the abundant forage production and large grain supply from the U.S. agriculture sector [U.S. Department of Agriculture 2004a, p. 1].

The U.S. beef cattle industry is often divided into two main production sectors: cow-calf operations and cattle feeding or finishing operations. Stocker or backgrounding operations act as a "middleman" between these two production sectors. This research is devoted primarily to the stocker cattle industry and the feeder cattle it produces. A basic overview of the cow-calf and cattle feeding operations is provided along with a more detailed look into stocker operations.

### Cow-Calf

Cow-calf operations can be found across the United States. They are primarily located on land that isn't suitable or needed for crop production. Cows make use of forages to maintain themselves and raise a calf with very little or no consumption of grain [U.S. Department of Agriculture 2004a, p. 1]. The cow is maintained on pasture and hay year round. The calf will remain on the cow and have a similar diet until it is weaned. In some cases, if the availability of forages permits, calves will be retained for additional grazing and growth before they are sold. However, a large percentage of cow-calf producers choose to sell calves at weaning because of a lack of pasture and/or handling facilities among other reasons.

The U.S. cow herd is comprised of individual herds ranging in size from a few to several thousand cows. As a rule, many cow-calf operations are relatively small while a select few large operations account for approximately half of the total cow inventory.

> "The average beef cow herd in the U.S. is 40 head, but operations with 100 or more beef cows comprise 9 percent of all beef operations and 51 percent of the beef cow inventory. Operations with 40 or fewer head are largely part of multi-enterprises, or supplemental to off-farm income" [U.S. Department of Agriculture 2004a, p. 1].

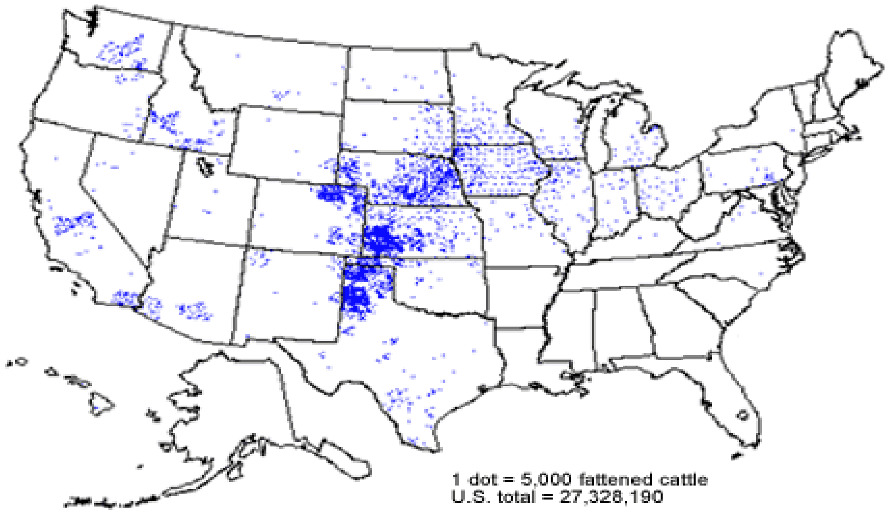
**Cattle Finishing**

The feedlot sector of the U.S. beef cattle industry is the principle source of beef consumed in the U.S. [Meyer, p. 10-1]. Cattle feeding or finishing is not nearly as spread throughout the U.S. as are cow-calf operations.

> "Cattle feeding is concentrated in the Great Plains, but is also important in parts of the Corn Belt, Southwest, and Pacific Northwest. Cattle feedlots produce high-quality beef, grade Select or higher, by feeding grain and other concentrates for about 140 days. Depending on weight at placement, feeding conditions, and desired finish, the feeding period can be from 90 to as long as 300 days. While most of a calf's nutrient inputs until it is weaned are from grass, feedlot rations are generally 70 to 90 percent grain and protein concentrates" [U.S. Department of Agriculture 2004a, p. 2].

Figure 2.1 illustrates where the majority of cattle are fattened in the U.S. Notice that the distribution of cattle finishing operations seems to be correlated with the availability of grain. Since grain and other by-products make up a significant portion of finishing diets, cattle feeding has generally remained in areas with an abundance of grain production. Let's consider as an example Florida, a state with slightly over 1,000,000 beef cows, but little or no cattle feeding [Florida Agriculture Statistics Service]. It is more efficient to ship cattle out of Florida to the grain producing states than to ship the grain to Florida. This is the case for many states in the Southeast, including Kentucky, which wean a significant number of beef calves each year, but account for little or no cattle feeding.

**Figure 2.1 Cattle Fattened on Grain and Concentrates and Sold**
**Source: 1997 Census of Agriculture**




The U.S. cattle feeding sector is made up of many small feedlots and a relatively small number of large feedlots. Although feedlots with a capacity of 1,000 head or more just account for 5 percent of total feedlots, they market 80-90 percent of the fed cattle each year. Those feedlots with a capacity of 32,000 head or more market 40 percent of fed cattle in the U.S. Like many industries, the U.S. cattle feeding sector continues a shift toward a limited number of large specialized feedlots which become more vertically integrated with processors and cow-calf operations each year [U.S. Department of Agriculture 2004a, p. 2].

## Stocker / Backgrounding

The cow-calf and cattle feeding operation are the two main production sectors of the cattle industry. However, backgrounding or stocker operations play a considerable, yet often overlooked, role in the industry. For a variety of reasons, calves sold at weaning do not go directly to the feedlot. Instead, they will enter a stocker operation for varying lengths of time, whereupon leaving they will be better suited to enter the finishing stage. Stocker operations are not confined to a certain age, size, or class of cattle. In some instances, cattle are backgrounded in the same geographic region in which they were born. In other cases, they may go through a stocker operation in the Midwest, several states away from the cow-calf operation from which they originated.

Stocker operations are not confined to one particular production system. Stocker operations across the U.S. are composed of a variety of different production activities with a common set of characteristics. These characteristics include animal growth, some level of forage dependence, and their ability to stand alone as an independently viable economic enterprise.

Growth is comprised of development of the animal's frame and muscle as opposed to the fattening that occurs in the feedyard. Stocker operations increase the value of the calves by enhancing their age, weight, maturity, and often times, quality [Peel, p. 1]. These enhancements work in conjunction to add value to the calves through the growth phase. Along with these enhancements, stocker operators strive to assemble groups of similar sized frame, breed, and weight calves as they approach the end of the backgrounding phase. Calves sold at weaning are often not ready to be shipped thousands of miles to a feedlot. When this occurs, sickness and death loss increase to rates that may not be sustainable for feedlot operators. For this reason, many feedlot operators would prefer to purchase calves that have been pre-conditioned or backgrounded after weaning. This pre-conditioning sometimes consists of a 30-45 day weaning program that is designed to enhance the profitability of a cow-calf enterprise. If this type of program is not a part of the cow-calf operation, the calves will often go through a separate stocker enterprise where their quality and maturity should improve, making them more suitable for efficient feedlot performance.

The second characteristic of most stocker enterprises is that there is usually an emphasis on forage based rations. These rations often consist heavily of grazing, but can be limited to confinement or semi-confinement systems [Peel, p. 1]. This is one of the most advantageous characteristics of the stocker cattle industry from a standpoint of profitability and low production costs. Stocker enterprises derive a significant portion of their income from adding weight to cattle for some cost less than the value of this gain.

Lastly, stocker operations must be recognized as a single viable economic enterprise. A pre-conditioning program, as mentioned earlier, is not considered a viable economic enterprise [Peel, p. 2]. In most cases, this 30-45 day program is only an addition to the cow-calf enterprise, which is the main activity. Stocker operations, on the contrary, stand alone as a separate economic activity in which commercial feeder cattle are the end product. Calves are either transferred from a cow-calf operation or purchased through auction markets. These cattle will then remain in the stocker operation until they reach a point where they are ready to make the transition into a finishing operation, whether profitable (hopefully) or not.

> Programs fitting these three characteristics can be found in all regions of the U.S. However, "some of the most important concentrations of stocker production occur in the winter wheat grazing areas of Oklahoma, Kansas and Texas; summer grazing in the Flint Hills of Kansas and the Osage area of Oklahoma; summer grazing in the high plains areas of New Mexico, Texas and Colorado; and fall crop aftermath grazing (corn and sorghum stubble fields) in Nebraska and Kansas. Other cool-season based winter grazing is widely scattered across the southeast and Delta states. Backgrounding programs (often using harvested forages) are widely scattered across Appalachian, Corn Belt and Northern Plains regions" [Peel, p. 3].

**Economic Roles of Stocker Operations**

Stocker operations, although often overlooked, fulfill many economic roles within the beef cattle industry. Perhaps one of the most important roles is the fact that the cheap gains stocker operations achieve through the use of forage based nutrition work to keep the industry cost competitive. Without these cheap gains, the cost of production for the industry would increase thereby driving up the price consumers must pay for beef at the retail sector [Peel, p. 3]. These higher relative prices would likely decrease the quantity of beef demanded by consumers as they chose substitutes such as chicken and pork. This substitution effect would lead to a smaller cattle sector over time as the quantity of beef demanded by consumers decreased.

Stocker production also plays a vital part in managing cattle inventories across as well as within years. The key to a viable beef production system is having a uniform flow of slaughter cattle throughout the year. This can be achieved by varying the intensity at which cattle are pushed through the production process. This varied intensity allows the age of cattle at slaughter to differ by twelve or more months. One of the most practical and economically feasible ways to vary this production intensity is through the stocker sector [Peel, p. 3]. This variation in production intensity is relatively more difficult for cow-calf operators and cattle feeders to achieve. Cow-calf operators have an economic incentive to maintain a tight calving window so that all of their calves can be marketed in one or two uniform lots. This incentive comes from the fact that cattle buyers are willing to pay a premium for uniform groups.

Relative to stocker operations, feedlot operators incur a higher cost if they must hold cattle back during the finishing process. They are working to achieve high average daily gains so that the cattle will cover the variable yardage costs when they are sold. Yardage costs are basically a daily maintenance fee allocated to cattle on feed to cover labor, fuel, and other costs that are incurred each day they remain on feed. Variable costs such as yardage and a certain amount of feed costs are present as long as the cattle remain in the feedlot. Keeping these variable costs at a minimum as well as the incentive to "turn" more cattle in order to lower average fixed costs can make it costly for feedlots to slow cattle down.

Compared to feedlots, stocker operations have relatively low variable costs, due in part to the forage based rations, and can slow down the gain of cattle in a more cost effective manner. For instance, summer grazing budgets compiled by the University of Kentucky allocate pasture and mineral variable costs at less than $0.20/head per day. Stocker operators also have the incentive for such actions based upon what the market is telling them. When the market is showing that feeder cattle prices will rise in the coming month(s), they have the incentive to hold the cattle and reap the benefit of the rising prices. On the same note, if "outlooks" point to a decline in prices, they may sell the cattle early allowing them to reach a feedlot earlier and start gaining quicker on the higher concentrate rations. Although feedlots may be able to push the cattle, or hold them back to an extent, based on market indicators, being the last leg of the live cattle supply chain limits the effectiveness and increases the cost of such actions.

Some cattle will not go through a stocker operation at all. Others will go through a relatively short backgrounding period. Others may spend several months grazing pasture and gaining considerably less per day than they would in a feedlot. Combine these scenarios and the ability to maintain a uniform flow of cattle through the year can be achieved. This ability also allows the industry to adjust to the cyclical nature of feeder cattle supplies from year to year.

The ability of stocker operations to maintain the economic balance between livestock, grain and forage markets may be their most important role. Grain and forage production can vary significantly from year to year. This variation can lead to considerable price changes as the forces of supply and demand work together to ration the available grain supplies. The ability of stocker operations to substitute forage for grain allows the beef industry to absorb the majority of feed industry shocks [Peel, p. 4].

One important role of the stocker industry is to facilitate the movement of cattle from cow-calf operations to feedlots. A large number of cow-calf producers sell their calves in groups which are not large enough to fill a semi-trailer headed to a feedlot. This leaves cattle buyers to mix and match cattle at the yards in order to fill orders for loads of cattle heading into the interior U.S. to be finished. Most stocker operators have the resources to sort out groups of cattle large enough to fill one or more trucks heading to a feedlot, allowing feedlots to receive uniform loads of cattle. It isn't economically feasible to ship cattle long distances in small groups. Large load lots weighing around 50,000 pounds are the only practical method of shipping cattle relatively long distances (tractor-trailers can haul 50,000 pounds of feeder cattle). Stocker operators may buy calves from 100 different herds. Yet when they are sold, they are likely to be shipped in ten or twelve 50,000 pound uniform groups. This process of moving the calves from the cow-calf herd to the feedlot wouldn't run nearly as smoothly without stocker operators putting together load lots of feeder cattle.

These attributes collectively suggest that perhaps the most important role of stocker operations might be as a shock absorber for the beef industry. Stocker operations provide the industry with the flexibility to manage cyclical and seasonal variations as well as exogenous shocks [Peel, p. 4]. Without stocker operations, the ability of the beef industry to provide a constant flow of slaughter-ready cattle would undoubtedly be hindered. As a shock absorber for the industry, the number of cattle in stocker programs as well as the length of time they are there will vary from year to year. As variations in the supply and demand of both feeder cattle and grain occur, profit driven stocker operators make decisions based upon price signals and other market trends both on the input and output side of the production process.

For instance, when the price of corn is relatively high, stocker operators may choose to keep cattle in a backgrounding program consisting primarily of forage based rations longer, based on price signals passed down from the cattle finishing sector. This increase in forage based rations lowers the quantity of corn demanded by the cattle finishing sector and puts downward pressure on the price of corn. As the corn price lowers, cattle finishers will increase their bids for lighter cattle, relative to their heavier counterparts, and the number of days cattle remain on forage based rations will decrease as stocker operators realign their marketing decisions and begin selling lighter feeder cattle.

## Stocker Profitability

Stocker operators must be efficient managers and stay current with market conditions in order to maximize profits, or in some not so fortunate situations, minimize losses. Basically, there are three key factors impacting stocker profitability. They are, in no particular order, value of gain, upgrading cattle quality, and speculation on market trends. Although each of these may be present to some extent in every stocker enterprise, the relative importance of each will vary as market conditions change [Peel, p. 4].

Although upgrading cattle quality and speculation on market trends may reap the most profits in some years, value of gain is the backbone of profitability for many stocker operations year after year. Whether producers are feeding hay in winter backgrounding programs in Kentucky or turning calves out to spend the summer grazing in the high plains of New Mexico, they seek to put weight on cattle at a cost less than the value of this gain. Stocker operators try to maximize the returns to the feed resources used in that operation, no matter what the actual feed resource may be. The idea is to put inexpensive weight gain on the cattle by letting them make use of forages by either grazing or feeding them mechanically harvested forages such as hay. As long as the cattle gain weight at a relatively low cost per pound of gain, the backgrounder is in position to turn a profit year after year.

Another source of profits for stocker operators is to upgrade the quality of cattle that go through their facility. Most in the industry would agree that there are always opportunities for backgrounding or stocker programs to make money by "fixing other people's mistakes" [Peel, p. 4]. Fixing these "mistakes" can range from dehorning to castrating, as well as other improvements in health. Some stocker programs seek out "value or bargain" cattle that they feel present the best opportunity for upgrading. These cattle often have a lower gain potential but the potential upgrade value outweighs the lost value of gain potential. These cattle can be purchased at a significantly discounted price and sold in a uniform load lot for a premium. This market premium that is usually rewarded to sellers who have a uniform load lot (approximately 50,000 lbs) allows stocker operations to receive a premium for the same "bargain" cattle that they bought just months before. This can sometimes be a high risk – high reward investment strategy. "Bargain" cattle are sold at a discount for a reason. Many of these cattle may end up in the "sick lot" before they make it into that "load lot". Cost of production can increase quickly as treatments of sick cattle and death losses start to rise. A producer doesn't have to lose very many head of these "bargain" cattle before that high potential for profit has been dwindled away to what they can only hope will be a break-even situation.

The final way to generate profits from a backgrounding or stocker operation is through price management. Stocker operators can do little to change the market, but they can recognize certain trends and use them as an opportunity for profit. The potential or opportunity for general price levels to trend upwards between animal purchases and sales is met with the risk that price levels could decrease. This opportunity and risk can make for the most profitable years as well as the years when the threat of bankruptcy looms over producers. Backgrounding is an investment in the cattle market. If the market remains relatively steady, then producers can usually generate a profit. If it trends upwards, the potential for profits can be very enticing. If general market levels fall….well that is the type of situation that causes sleepless nights for backgrounders across the country and keeps other cattle producers out of the backgrounding sector.

Although stocker operators have no control over what happens to prices between animal purchases and sales, the difference between these two prices will always be the most important factor affecting profitability. The difference between whether a stocker operation garners profits or losses on a particular group of cattle can be as little as a few dollars per hundredweight difference in the buy and sell margins. The outcome of these margins will determine the value of weight gain while in the stocker program. If these margins spread too wide, then no amount of efficient production and cost minimization can prevent stocker operations from losing money on this particular load of cattle. However, when margins sway in a more favorable manner, the producer may increase overall profit levels by increasing the amount of weight gained per day, even if the cost of gain per pound of gain increases. The difference between the purchase and sale price, along with the overall price level, determine the value of gain for cattle in a stocker operation. The higher this value of gain, the more profit potential a stocker operation has per pound of gain.

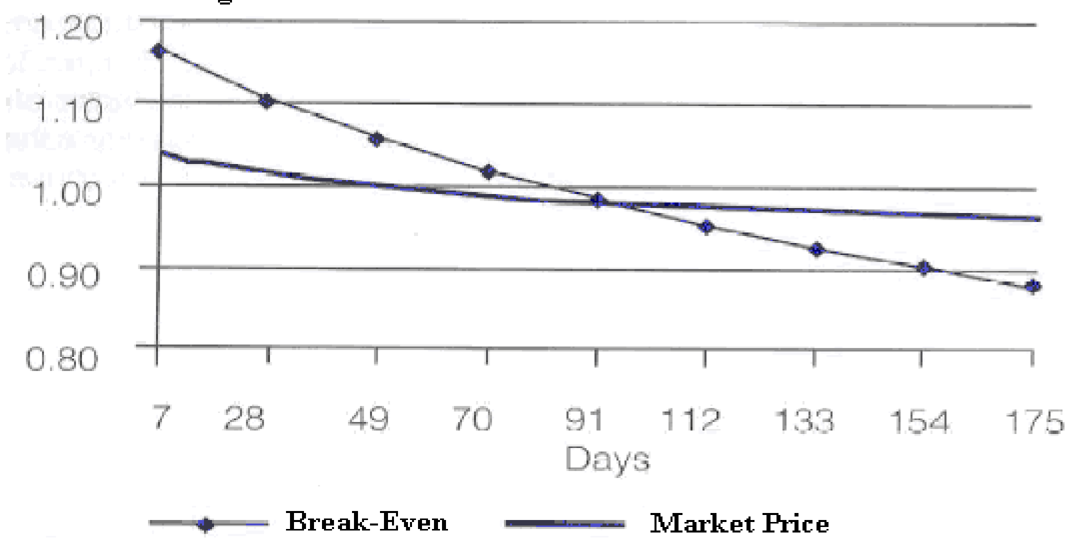
There is a relatively simple method to calculate the average value of gain for animals in a stocker operation. For example, consider a 500 pound steer calf purchased at a price of $110/cwt. This steer gained 300 pounds and was sold for $95/cwt weighing 800 pounds. The value in was 5 cwt. x $110 = $550. The value out was 8 cwt. x $95 = $760. The difference in value is $210. This $210 divided by the 300 pounds of gain equals the average value of gain. So the average value of gain is $210 / 300 or $.70 per pound.

The nature of stocker operations is one in which a high initial investment is needed to purchase calves and relatively low variable costs are incurred for each additional day the cattle remain in the enterprise. This causes the break-even selling price to decline reasonably fast as the cattle gain weight [Peel, p. 6]. Of course the overall animal performance is directly correlated to how quickly the break-even selling price declines. The quicker and more efficiently an animal gains weight, the faster the break-even price declines.

When cattle prices trend upward between purchase and sale dates, the cattle will become profitable at a relatively quicker rate. That is to say, that when prices increase, the break-even sale price will meet market prices sooner. On the contrary, downward trending prices can decrease market prices to a level below an achievable break-even sale price for a particular group of cattle. In this instance the cattle must be eventually sold at a loss due to the negative effect of the price slide pushing market prices even lower. The price slide, which will be discussed more thoroughly in Chapter Three, causes the price per pound to decrease as the weight of the animal increases. In normal production seasons, the rate of break-even price decline is faster than the rate of decline for added weight. Analysis conducted by Derrell Peel of Oklahoma State suggests that in a typical year, it takes about 90 to 100 days for the break-even sale price to drop to below the market price, allowing the stocker enterprise to become profitable. Until this point, the break-even sale price lies at some point above the market price and selling the animals would result in a loss for the enterprise [Peel, p. 6].

Figure 2.2 illustrates this point. Notice how the slope of the break-even price curve is much steeper than that of the market price curve. This example represents a time of steady overall market prices. The negative slope of the market price curve is due to the negative effect of the price slide. As the cattle remain in the backgrounding program, they continue to gain weight and the price slide pushes the market price lower.

**Figure 2.2 Stocker Break-Even Versus Market Price**




**Source: Stocker Cattle: Shock Absorber for the Beef Industry, pg 6**

# CHAPTER THREE

# LITERATURE REVIEW

In order to develop a Kentucky feeder cattle price prediction model, one must first know what determines feeder cattle prices. The fact that cattle feeders buy feeder calves for finishing has already been established. The question of what accounts for the differences in feeder cattle prices has yet to be addressed. A careful examination of literature on feeder and fed cattle prices was essential to develop a better understanding of what determines feeder cattle prices.

## Background

Feeder cattle price levels are a function of supply and demand forces working to reach a point of market equilibrium. As supplies increase relative to demand, market forces act to push prices lower to a new level of market clearing equilibrium. As the demand for feeder cattle increases relative to supply, prices will increase to a new point of market equilibrium.

Cattle feeders set the demand for feeder cattle. This demand is based upon their expectations of future slaughter cattle prices as well as feed and other finishing costs. If feedlot managers expect slaughter cattle prices to rise in the future, then they will increase their bids for feeder cattle. If, on the contrary, they expect future slaughter cattle prices to decrease and/or the price of feed ingredients such as corn to increase, they will lower their bids for feeder cattle [Meyer, p. 10-2]. Although this rationale seems relatively simple, further discussion will present many complicating factors affecting the bids for feeder cattle and the corresponding feedlot profitability.

As documented previously, the cattle finishing industry is increasingly dominated by large specialized feedlots with one-time feeding capacities well over 1,000 head. Unlike many industries, increasingly large feedlots take advantage of economies of size as they employ the full utilization of their investments in labor and infrastructure to lower their overall production costs. These increasing returns to size, or economies of size, are present in any industry where the long run average cost curve is decreasing [Kay and Edwards, p. 160].

Feedlots, like any profit maximizing firm, operate based on short and long run production rules. In the short run, they will continue to place cattle as long as expected returns are greater than the expected minimum average variable cost. Even if current market outlooks don't reveal an opportunity to yield returns greater than average total costs, they can minimize losses by covering variable costs and some portion of their fixed expenditures. Of course, in the long run, a feedlot will be forced to shut down when they feel that these negative returns will be long lasting or permanent [Kay and Edwards, p. 156].

Applying these economic cost concepts to the cattle finishing industry sheds light on why feedlots aren't always profitable. Even when feedlots are losing money in the short run, feeder cattle bids don't always reflect a profitable finishing outlook. As the industry continues to invest in fixed expenses such as infrastructure and salaried employees, cattle feeders continue to find themselves in situations where cattle are placed on feed at a price that appears to reflect little opportunity for positive net returns above total costs. Average fixed costs decline as the number of total head increases, so feedlots have the incentive to continue placing cattle at a price offering an opportunity for some positive return above variable costs, even if this return is only large enough to cover a portion of fixed costs.

When examining feedlot profitability and the corresponding demand for feeder cattle, the biological production lag that is ever-present in cattle finishing must also be considered. Kansas State University feedlot data, dating back nearly 13 years to 1992, suggests that the average days on feed for steers is approximately 145 days. Market forecasts can change dramatically in a period of days. Yet feedlot owners must bid on placements nearly five months before they will, on average, be marketed as slaughter ready cattle. With this amount of uncertainty coupled with the earlier discussed short run production rules, it would be relative easy for one to hypothesize why feeder cattle bids are not always perfectly correlated with future slaughter cattle market outlooks.

Supplies of feeder cattle depend on the size of the cow herd and individual producer's decisions to expand or liquidate the herd. When cow-calf producers retain or purchase additional heifers to expand their breeding herd, the supply of feeder cattle decreases. Every heifer that goes into the breeding herd is one heifer that will not be available for the feedlot. Although this herd expansion decreases supplies in the current year, the supply of feeder cattle will increase in years to come as these heifers add to the reproductive capacity of the herd. The cyclical pattern of herd expansion and liquidation is often referred to as the cattle cycle.

This cyclical pattern of herd expansion and liquidation is directly linked with profitability at the cow-calf level. When calves are bringing relatively high prices and generating a profit for cow-calf producers, there are generally more heifers retained and/or purchased as managers try to expand the size of their herd. This expansion at the cow-calf level eventually increases the national herd size, therefore increasing the supply of beef. This increase in the supply of beef lowers the price of beef to a new market clearing equilibrium. As the price of beef decreases, so do the bids for slaughter cattle. These lower prices flow down through the entire beef cattle sector. As cow-calf producers are faced with lower prices and little or no profits from their calf crop, they decrease the size of the herd by either selling off cows or culling cows and not retaining an adequate number of replacement heifers. As this smaller herd size leads to reduction in the supply of beef, the price for beef begins to rise, and another cattle cycle begins. Since beef production is faced with a biological lag, cattle cycles typically last 8 to 12 years [Meyer, p. 10-2].

Cattle feeders also have the opportunity to capitalize on seasonal trends within the cow-calf industry. Since many producers choose a spring calving season, there is often a glut of calves that hit local auction markets across the country each fall. Some of these calves will be pre-conditioned and will go directly into the feedlot. Others that haven't been pre-conditioned will end up in stocker operations across the U.S. and still others will go directly off the cow to the feedlot with no pre-conditioning or weaning period. With such a large supply of calves and feeder cattle, cattle feeders and backgrounders alike can often fill their orders at prices lower than their maximum bids [Meyer, p. 10-2].

The forces of supply and demand determine the price that feedlots are willing to pay for feeder cattle. The place utility theory has an impact on regional differences in the prices of feeder cattle. This theory of price differences between regions can be summarized as follows: "Price differences between any two regions (or markets) that trade with each other will just equal transfer costs" [Tomek and Robinson, p. 151]. This spatial relationship is no different than that of any agricultural commodity. Assuming all other characteristics to be equal, there will be differences in price reflecting transport costs.

Since feeder cattle must be shipped to feedlots, their relative proximity to feedlots will account for differences in prices. Therefore, holding all other characteristics constant, feeder cattle in Kansas will bring more (on average) than those in Kentucky. This difference in price just accounts for the relative transportation costs to get the cattle to the feedlot. Since cattle in the Midwest are relatively closer to the majority of cattle feeding operations than those in the Southeast, they will usually bring a higher price at auction because feedlots will have to incur less transportation costs to ship the cattle to their operation. The total investment in cattle arriving at a feedlot may not be significantly different for cattle from different regions of the country, but the relative transportation costs will dictate the actual auction price of the feeder cattle.

Differences in prices between regions, based on transportation costs, are common in most agricultural commodities. However, unlike other agricultural commodities such as corn, there are significant differences between groups of feeder cattle and the price feedlots are willing to pay for them. Characteristics other than location affecting feeder cattle prices include weight, health, lot size, breed, gender, as well as an assortment of other characteristics. All of these variations among different lots of feeder cattle affect the potential profitability for cattle feeders. As order buyers bid on feeder cattle for their customers (cattle feeders and stocker operators) they adjust their bids based on these variations. Previous studies in Oklahoma (Smith et al., 2000) and Kansas (Sartwell et al., 1996) have shown that characteristics other than spatial differences have a significant affect on the price of feeder cattle. In these studies, prices varied significantly for cattle sold within the same region.

Gender had a significant impact on price in both the study in Oklahoma as well as the study in Kansas. In Oklahoma, studies conducted in 1997 and 1999 showed that heifers, on average, were discounted $10.56/cwt. and $7.43/cwt. respectively when compared to steers [Smith et al., p. 2]. This discount for heifers compared to steers reflects the fact that heifers demonstrate lower feed efficiencies and average daily gains when compared to steers. Buyers often lower their bids for heifers due to the risk of pregnancy and the difficult births that could ensue in the feedlot. When examining differences in prices received for heifers compared to steers, one must also consider the fact that since a portion of the "highest quality" heifers are retained as replacements to enter the breeding herd, the overall quality of steers may be slightly higher than that of their counterpart heifers that weren't chosen for the breeding herd [Smith et al., p. 2].

Buyers' perceptions relating to different breed types and their relative feedlot performance and carcass traits have been shown to significantly affect the price received for feeder cattle. Feedlot profitability depends on the efficiency and timeliness that cattle are able to gain weight as well as the carcass traits that affect their slaughter value. As more emphasis has been placed on carcass quality in recent years, these perceptions have changed. One of the major changes in these perceptions has been the added value placed on Angus genetics due in part to their perceived higher value carcasses. In two similar studies of the impacts of selected characteristics on feeder cattle prices conducted by Kansas State University in 1986/1987 and 1993 the relative premiums and discounts for different breeds of feeder cattle changed. In 1986/1987 Angus cattle were discounted relative to Herefords. However, in 1993, this trend reversed and the data showed that, relative to Herefords, Angus cattle received a premium [Sartwell et al., p. 2]. Studies conducted by Oklahoma State University in 1997 and 1999 confirmed that breed premiums had reversed as Angus cattle again received a premium over Herefords [Smith et al., p. 3].

Other premiums and discounts remained somewhat consistent between the two studies in Kansas and Oklahoma. Cattle with dairy, Longhorn, or more than ¼ Brahman influence sold for prices significantly discounted from Angus cattle. In both studies, Exotics (or Continental) cattle sold at prices relatively the same as those received for Angus cattle. Both studies showed Exotic crosses selling for slight premiums compared to Angus [Smith et al., p. 3] and [Sartwell et al., p. 2].

Perceptions of health can also have a significant impact on the sale price of feeder cattle. Since these cattle are likely to be hauled long distances to feedlots, stress and health problems are a concern for all cattle that leave the auction barn. Cattle that enter the auction ring already showing signs of health problems will receive significant discounts. Cattle that appeared sick or lame were discounted over $17/cwt. and $13/cwt.

respectively in the studies conducted in Kansas. Cattle with a bad eye were discounted nearly $3/cwt in the same study and those cattle entering the ring with rough or muddy hair were discounted over $1/cwt. [Sartwell et al., p. 5]. These same discounts were either consistent or increased in the Oklahoma study.

The size and uniformity of sale lots also had a significant impact on price in both the Kansas and Oklahoma studies. Order buyers prefer to buy load lots (50,000 pounds) of cattle from one source rather than commingling cattle from different farms or ranches to achieve a full load. This preference stems from the fact that commingled cattle are perceived to have more health problems along with the fact that cattle purchased in a full load lot will often be shipped out relatively quickly. Cattle purchased as singles or in small groups are likely to remain in the stockyards for several hours and possibly overnight while buyers work to put together a full load. The longer these cattle remain in the yards, the more chance they have of getting sick due to the stress and increased exposure to other cattle. Uniformity within the load lot is also important when the cattle arrive at the feed yard. Uniform groups of cattle are more likely to feed out together and be ready to go to slaughter at the same time. Large variations in weight and size within a group of cattle means the feedlot will have to devote more resources to sorting and mixing these cattle after they arrive. This is especially important to smaller feedlots that don't have the facilities to efficiently sort cattle. They prefer to buy a group of cattle and place the entire group in a pen together to feed until they are all ready for slaughter.

In the 1993 Kansas study, buyers paid $6.37/cwt. more for cattle in a 65 head lot than those sold as singles. In the Kansas study, the largest premiums were realized for cattle sold in groups of 65-75 head [Sartwell et al., p. 6]. The 1997 Oklahoma study found that steers sold in groups of two or more sold for $4.01 to $7.14/cwt. more than those steers sold as singles. However, multiple head lots that were not uniform sold for approximately $2/cwt. less than their uniform counterparts [Smith et al., p. 4]. Discounts for non-uniform lots were also prevalent in the Kansas study.

One can see that a variety of different characteristics impact the sale price of a particular group of feeder cattle. The one characteristic that has yet to be discussed is weight. Likely the most important factor affecting price per cwt. and the overall sale value, the average weight of a particular group of feeder cattle will determine the price range they fall into. Other characteristics such as breed and lot size will then determine whether these cattle fall in the top, middle, or lower portion of this price range. The relationship of weight to price per cwt. is often referred to as the price slide. Considering the relative importance of this particular characteristic, an entire section has been devoted to how weight affects the price received for a group of feeder cattle.

## Price Slide

It would be irresponsible, if not impossible, to discuss feeder cattle prices without devoting some thought to the price slide. Possibly one of the most significant factors affecting the profitability of stocker operators, the price slide is an ever present issue in the minds of many cow-calf producers as well as stocker operators as they consider selling calves or feeder cattle. In many cases they have available forages to put extra weight on the cattle, yet they are faced with the dilemma of the price per pound decreasing as the cattle gain weight. The heavier feeder cattle are when they are sold, the less profit opportunity that remains. Cattle feeders make money by putting weight on cattle at a lower cost per pound than what they will sell for per pound. Feed efficiency decreases as weight increases [Bailey and Holmgreen, p. 1]. As cattle reach heavier weights, this feed efficiency drops off and there is less weight gain left for the feedlot before the cattle are ready for slaughter. Since there is less weight available for feedlots to "put on" these heavier cattle, they would bring a lower price per cwt. even if feed efficiency didn't decline.

For example, consider two steers purchased by the feedlot for the same price with the same cost of gain expectation. Both steers will be slaughtered at 1250lbs and the cost of gain will be $50/cwt. for each. The first steer weighs 600lbs and was purchased for $100/cwt. or $600. With 650lbs left to gain before reaching 1250lbs at a cost of $0.50 per pound, the feedlot will have $600 + (650 * $0.50) or $925 invested in this steer at slaughter. Assuming the 1250lb slaughter weight, the feedlot would need $74/cwt. at slaughter in order to break-even on this steer. Now, consider a 900lb steer purchased for $100/cwt. or $900, with 350lbs left to gain. At a 1250lb slaughter weight, the feedlot would have $900 + (350 * $0.50) or $1075 invested in this steer. The feedlot would then need $86/cwt. in order to break-even on this steer. These steers are very unlikely to receive significantly different slaughter prices, so the feedlot would have less profit opportunity from the steer purchased at 900lbs. This example shows why it is important to consider the total dollars per head investment by the feedlot. As cattle gain weight, feedlots adjust their bids to keep the total dollars per head invested at slaughter somewhat even close between cattle that were purchased at different weights.

This relationship of weight to price is known as the price slide. As demonstrated above, it is generally accepted that on average the price slide will be negative, i.e. as cattle gain weight their value per pound decreases. Many factors play into the magnitude of the price slide. “Differences in feeder cattle prices across weights depend on the relative profitability of backgrounding and finishing programs. Moreover, expected fed cattle prices, feeder cattle prices, corn prices, interest rates, and feeding performance all affect cattle feeding profitability” [Sartwelle, p. 3].

Since these factors are constantly changing, there is no set price slide that producers can count on. Previous studies have shown that the price slides changes seasonally as well as over time. Cattle feeding performance varies by season, so although not dramatic, this accounts for some variation in the price slide across seasons [Dhuyvetter and Schroeder, p. 309].

Corn price at the time of sale has a large impact on the price slide. Weekly price data studied by Schroeder and Dhuyvetter on individual lots of cattle sold at the Winter Livestock Auction in Dodge City, Kansas over a ten-year period from 1987 through 1996 showed large variations in the price spread between 500 and 800-pound steers. Their research showed at a corn price of $1.68/bushel the spread was over $20/cwt. However, with a corn price of $3.52/bushel, the spread narrowed to around $7/cwt. When corn price is lower, weight can be added to lighter cattle at a relatively cheaper cost per pound of gain than when corn price is higher. Therefore, the prices per pound of lighter weight cattle are bid up relative to heavier cattle [Dhuyvetter and Schroeder, p. 304].

This same data also showed how the expected fed cattle price significantly affected the relationship between weight and price. As fed cattle price expectations increased, the price spread between 500 and 800lb steers increased substantially. “With a $79.37/cwt fed cattle futures price, the price spread between 500 and 800lb steers is about

$21/cwt, whereas with a fed cattle futures price of $60.21/cwt, the spread is approximately $6.50/cwt. [Dhuyvetter and Schroeder, p. 304].

Producers must stay in touch with current market trends and use the information they have available to them to make sound management decisions that will hopefully be profitable. Price slides are constantly changing as these producers use current information and forecasts to decide on the optimal weight of cattle to buy and in turn alter their bids for different weight groups. Variations in the price slide as well as the overall level of market prices causes margins between purchase and sale prices to fluctuate. In fact, in years of increasing demand for beef or decreasing supply of cattle and/or beef, backgrounders and finishers may experience positive margins. In this case, cattle markets as a whole trend upward while they are in possession of the cattle and they actually sell the cattle at a significantly heavier weight for a higher price per pound. Although very profitable, this occurrence is relatively rare and hard to predict in the cattle industry.

One of the most recent occurrences of this was in 2003 when a BSE (Bovine Spongiform Encephalopathy) outbreak in Canada closed the U.S. border to Canadian beef and cattle imports at a time when demand for beef was on the rise. Stocker operators and feedlots suddenly found themselves with a very profitable outlook for calves they had purchased months before the close of the border. Cattle traded at all-time record highs across the U.S. and many stocker operators and feedlots experienced some of the most profitable margins ever witnessed in the industry. Since 2003, the U.S. has had its own outbreak of BSE and many feedlot operators have been forced to sell cattle at margins not nearly as profitable. On the contrary to what happened in 2003, they had to pay higher prices per pound for calves coming into the feedlot, only to see the market trend downward and experience large negative margins on these cattle when they were sold.

## CHAPTER FOUR

## DATA AND METHODOLOGY

The Kentucky Department of Agriculture publishes weekly Livestock and Grain Market Reports. These weekly reports contain price ranges and average prices for different weight groups of feeder cattle sold in each of the regions across the state. Each weekly report also contains a section displaying the price, gender, breed or color, and average weight of individual lots containing 20 or more head sold that week. Although this is reported for each stockyard in the state, the number of lots sold in each yard varies depending on the size of the yard and the time of year. Kentucky, primarily a cow-calf state, sells many calves in small groups or as singles. However, as discussed earlier, there are many backgrounders or stockers around the state who put together larger groups as well as large cow-calf operators who are able to put together uniform groups of 20 or more head.

These historical Kentucky Livestock and Grain Market Reports were used to compile a database containing sale price, breed or color, gender, average weight, and sale week for over 7,000 lots of cattle sold in Kentucky from October, 2000 to January, 2005. These data were accumulated from four stockyards in Kentucky over the time period. Blue Grass Stockyards, KY-TENN Livestock, United Producers Owenton, and United Producers Paris were the four yards chosen for this research.

These four yards were chosen based upon their location and size. Blue Grass Stockyards in Lexington, KY is the largest in the state. The relative size and reputation of Blue Grass Stockyards brings many large groups of cattle there each week. KY-TENN Livestock in Guthrie, KY was the farthest west of any of the yards chosen. Usually second to Blue Grass Stockyards, in the number of individual lots reported each week, KY-TENN Livestock is one of the larger yards in the state with a relatively large number of individual lots reported. These two stockyards made up the majority of the sale data accumulated because of their sheer size and number of head sold each week.

United Producers Paris and United Producers Owenton were chosen more for their location than the number of lots reported each week. Compared to Blue Grass and KY-TENN, they had a relatively small number of individual lots sold each week. United Producers Owenton in Owenton, Kentucky was chosen because it pulls many of its cattle each week from north central Kentucky. United Producers Paris in Paris, Kentucky, although relatively close to Blue Grass Stockyards, pulls many cattle from the northeast region of the state as well as central Kentucky. Many different combinations of stockyards could have been chosen for this research. However, in order to represent different regions of the state and accumulate a large database of lots sold, these yards were deemed to be the best choice.

This individual sale lot data was part of an econometric analysis intended to reveal how certain characteristics affect the price of feeder cattle sold in Kentucky. In order to accurately predict what a certain group of calves will be worth at some point in the future, one must first be able to estimate how particular characteristics such as lot size and gender will affect the sale price. Econometric modeling has often been used to estimate price relationships in livestock markets. In order to develop a model that would explain how certain characteristics affect the price of feeder cattle, other data that helped explain general price movements in feeder cattle had to be collected. The more explanatory power the model possesses, the better it will be able to estimate how the characteristics concerned in this research work to affect the price of individual lots of feeder cattle.

**Kentucky Feeder Cattle Price Model**

The following model was developed after reviewing literature and similar studies that had previously been conducted.

Pfeedercattle = f (Gender, Breed, Market, CPH, Weight, Lot Size, Corn Price, DFLive, Seasonality)

Where Gender represents whether the lot was steers or heifers, Breed represents the breed of the lot, Market represents which of the four markets where the lot was sold, Weight represents the average weight of the lot, Corn Price represents the cash price of corn, DFLive represents the deferred Live Cattle futures price which will be explained in more detail later, and Seasonality is a variable intended to capture seasonal trends in feeder cattle prices.

## Data Sources and Expectations

Gender was available in the Kentucky Livestock and Grain Market Reports. Each lot of cattle recorded in the database was either feeder heifers or feeder steers. In order to capture this difference in gender a dummy variable was created to account for the lots consisting of heifers. It is expected that there will be a negative relationship between the heifer dummy and price. This negative expectation is due to characteristics associated with females such as lower average daily gains, decreased feed efficiency, estrus, as well as unexpected pregnancies and the difficult births that follow in the feedlot [Smith et al., p. 2].

Breed differences are also reported in Kentucky Livestock and Grain Market Reports. Although this characteristic is referred to as breed for purposes of this research, it is actually more of a reflection of color, and in some instances, breed. The structure of the feeder cattle auction system is concerned more with color than actual breed. The majority of feeder cattle are not purebred animals. They may have a purebred dam or sire, but it is likely that the calves are some cross between a dam and sire of different breeds. This leads to cattle being characterized by a combination of color and breed. For instance, a certain lot of calves may have Angus genes crossed with some other breed(s). On a market report, these calves are likely to be reported as blk, for their black hide. Many groups of cattle will be reported as mixed because they are a combination of animals with different genetic makeup and color. This is a very common occurrence as backgrounders buy cattle from various different sources in small groups or as singles and put them together to make larger groups.

The expectation is that those groups classified as “blk” will receive a premium relative to their “mixed” counterparts due to their black hide and potential to receive Certified Angus Beef premiums when they reach slaughter. It is also expected that cattle classified as “Holsteins” would be discounted relative to all others in the sample. This expectation is based upon previous literature and research that showed cattle with dairy influence receiving discounts.

The market identity information was also available from the Kentucky Livestock and Grain Market Reports. This simply captures which of the four markets where a particular group of cattle were sold. The four markets included United Producers Paris, United Producers Owenton, KY-TENN Livestock, and Blue Grass Stockyards. Since each of these markets is in Kentucky, and none are relatively close to significant cattle finishing areas, the expectation is that there will be no large difference in prices across these markets with one exception. KY-TN Livestock is an in-weigh market as opposed to the other three which are out-weigh markets. Since in-weigh markets weigh the cattle upon arrival as opposed to when they are sold, as is done in an out-weigh market, one might hypothesize that this market will receive lower prices. Cattle lose weight through the excretion of waste (commonly referred to as shrinkage) while they are in the yard waiting to be sold. Buyers may adjust their bids, on a per cwt. basis, based on the knowledge that in-weighed cattle will have experienced less shrink before they are weighed, due to the fact they are weighed immediately upon arrival. The cattle may bring the same amount per head as they would in an out-weigh market, but since there are more pounds to sell due to less shrinkage, the price per cwt. may be slightly lower.

Weight refers to the average weight of a particular group of cattle sold. This information was obtained from the Kentucky Livestock and Grain Market Reports. The average weight for the lots sold in this data set ranged from 225 pounds to 1236 pounds. Based upon previous research and the theory of the price slide, the expectation is that weight will be negatively correlated with price per cwt.

Lot size was also available on the Kentucky Livestock and Grain Market Reports. This variable accounts for the number of head in a particular lot sold. The lot size in the sample ranged from 20 to 508 head. Although many smaller groups are sold, the Kentucky Livestock and Grain Market Report only lists individual lots of 20 or more head. The expectation is that lot size will be positively correlated with price per cwt. This is based upon the assumption that order buyers would rather buy large lots in order to fill their feedlot orders quicker and not have cattle waiting as long in the yard as they try to put together truckloads of 50,000 pounds. However, beyond a certain point, lot size may discourage bids if buyers don't have open orders large enough to handle lots with 200 or more head.

Corn price represents the cash corn price in Kansas City for the corresponding sale week. This data was available through the Livestock Marketing Information Center. It is generally accepted that grain costs make up a significant portion of feeding costs in a feedlot. A large percentage of this grain is corn. It has been estimated that 80 percent of the grain consumed by U.S. livestock is corn. Since many feeder cattle sold in Kentucky will go to feedlots in the Midwest, where corn often makes up a significant portion of the finishing ration, it was concluded that the cash corn price in Kansas City, Kansas would be a good choice for this model.

Based on the fact that corn accounts for a significant portion of feedlot cost-of-gain, one would assume that corn price would be negatively correlated with feeder-calf prices. As feed costs increase, feedlots are forced to lower their bids for feeder cattle. As break-even bid prices decline for all feedlots, the demand for feeder cattle decreases, pushing the price to a lower level [Meyer 2003, p. 3].

The variable DF Live represents the deferred Live Cattle futures price for each particular lot sold. The Live Cattle futures contracts are the industry's best estimate of what slaughter cattle will be worth months into the future. This deferred futures price is based on an estimated time to slaughter that is calculated using a formula based on current weight and probable slaughter weight. The formula assumes a 1250 pound slaughter weight and an average daily gain of 3 pounds for each day from the recorded sale date to slaughter. Based on these assumptions the formula for calculating a slaughter date is: Sale Date + (1250 – Sale Weight) / 3.

Once the estimated slaughter date is calculated, the corresponding deferred Live Cattle futures price is recorded for each sale week. These historical Live Cattle futures prices were obtained through the Livestock Marketing Information Center. One would expect a positive relationship between the deferred Live Cattle futures price and the actual sale price for a particular lot of cattle. Since this deferred futures price is the industry's best estimate of what a particular group of cattle will be worth at slaughter months into the future, one would expect feeder cattle prices to increase as their corresponding deferred Live Futures price increases. As the Live Cattle futures price increases, feedlots increase their bids based on the increase in expected slaughter cattle prices.

Seasonal differences are common in most cattle markets. They are the result of supply and demand changes that occur somewhat regularly during the year. These seasonal price changes result from factors such as calving seasons and holiday demands.

For example, Kentucky has a significant number of calves born in the spring. This leads to an increase in the supply of calves at local auction markets in the fall. On the demand side, increases in beef consumption due to holidays or summer grilling seasons may cause increased demand for feeder cattle during certain times of the year [CME, p. 26].

The Seasonality variable is included in order to capture these seasonal price differences in Kentucky feeder cattle. This variable was created using the following formula intended to capture seasonal differences in price:

COS(3.141592654 * 2 * (Cnt - Adj) / 52)

Where Cnt was simply a counter of each of the sale weeks included in the dataset and Adj was an adjustment number that could be changed in order to best capture the seasonal price differences. The adjustment number was chosen based on a Pearson Correlation between price and the seasonality variable. The adjustment number was changed until this Pearson Correlation reached a maximum, meaning that particular adjustment allowed the seasonality variable to best capture the seasonal differences in price. This was completed for each of the eight weight groups.

**Empirical Models**

The average weight of the lots of cattle included in the data set ranged from 225 to 1236lbs. Previous literature has shown that cattle prices respond differently to market forces according to their relative weights. For instance, the impact of an increase in the price of corn has been shown to be greater for lightweight cattle relative to their heavier counterparts [Meyer 2003, p. 3]. In order to account for these differences, the following empirical model was estimated for each of the eight weight groups, using an OLS regression. This model is a linear function in variable levels.

$P_F$ = f (DHEIFER, DHOLST, DBBBWF, DBLK, DCHAR, DCHARBLK, DOWEN, DPARIS, DKYTN, DCPH, WEIGHT, HEAD, CASHCORN, DFLIVE, SEASON)

For each of the eight models, $P_{F24}$, $P_{F45}$, $P_{F56}$, $P_{F67}$, $P_{F78}$, $P_{F89}$, $P_{F91}$, and $P_{F1000}$ refers to the price of 200 to 399 pound, 400 to 499 pound, 500 to 599 pound, 600 to 699 pound, 700 to 799 pound, 800 to 899 pound, 900 to 999 pound, and 1000 pounds and up feeder cattle.

DHEIFER is a gender dummy variable intended to capture feeder heifers. DBBBWF, DBLK, DCHAR, and DCHARBLK are breed dummy variables intended to capture those relative breeds or colors of the lots sold. DOWEN, DPARIS, DKYTN, and DCPH are market dummy variables intended to capture the market where a particular lot of cattle were sold. DOWEN captures those cattle sold at United Producers Owenton. DPARIS captures those lots sold at United Producers Paris. DKYTN captures those cattle sold at Kentucky Tennessee Livestock in Guthrie, Kentucky. DCPH captures lots that were sold in a CPH sale (Certified Pre-Conditioned for Health) at United Producers Paris or Blue Grass Stockyards in Lexington, Kentucky. The intercept is a mixed group of steers sold in a non-CPH sale at Blue Grass Stockyards.

It is important to note that $P_{F91}$ and $P_{F1000}$ did not include DCPH. This is due to the fact that CPH sales are traditionally designed to offer a premium for lighter weight calves. Rarely, if ever, would you find a group of 20 or more head with an average weight greater than 900 pounds in a CPH sale. Since there were no CPH lots over 899 pounds in the data used for this research, that particular dummy variable was removed. The dummy variable DKYTN was also excluded from these two equations since there were no lots with an average weight greater than 899lbs recorded from this auction market. The same is true for the dummy variable DHEIFER in the $P_{F1000}$ equation. There were no groups of heifers weighing over 999 pounds recorded in this data so that particular dummy variable was eliminated from the $P_{1000}$ equation.

Results from these regressions will be shown and discussed in Chapter 5. Descriptive statistics from selected variables in the models is displayed in Table 4.1. Table 4.2 presents the number of total observations in all eight models broken down by the distribution in selected variables. Table 4.3 presents the expected sign for each of the variables in the eight models.

Table 4.1 Descriptive Statistics - Selected Feeder Cattle Price Model Variables

| | MAX | MIN | MEAN | S.D.** |
|---|---|---|---|---|
| | 225 - 399lbs -- 212 Observations | | | |
| PRICE* | $147.00 | $73.25 | $105.30 | $14.74 |
| DFLIVE | $94.33 | $66.22 | $75.27 | $4.82 |
| CASHCORN | $3.21 | $1.73 | $2.26 | $0.38 |
| HEAD | 66 | 20 | 27.53 | 7.55 |
| WEIGHT | 399 | 225 | 362.19 | 26.52 |
| | 400 - 499lbs -- 929 Observations | | | |
| PRICE* | $140.50 | $63.00 | $97.01 | $14.02 |
| DFLIVE | $88.65 | $66.25 | $74.76 | $5.12 |
| CASHCORN | $3.21 | $1.73 | $2.22 | $0.36 |
| HEAD | 115 | 20 | 37.7 | 18.08 |
| WEIGHT | 499 | 400 | 461.16 | 23.71 |
| | 500 - 599lbs -- 1334 Observations | | | |
| PRICE* | $131.25 | $55.00 | $93.37 | $13.07 |
| DFLIVE | $89.20 | $63.25 | $75.00 | $5.37 |
| CASHCORN | $3.21 | $1.73 | $2.24 | $0.36 |
| HEAD | 260 | 20 | 45.25 | 27.11 |
| WEIGHT | 599 | 500 | 549.87 | 23.46 |
| | 600 - 699lbs -- 1423 Observations | | | |
| PRICE* | $128.00 | $53.75 | $88.79 | $12.71 |
| DFLIVE | $90.71 | $63.25 | $74.84 | $5.63 |
| CASHCORN | $3.21 | $1.73 | $2.24 | $0.34 |
| HEAD | 508 | 20 | 47.22 | 35.26 |
| WEIGHT | 699 | 600 | 647.01 | 26.31 |

**Denotes Dependent Variable* **Standard Deviation

**Table 4.1 (Continued)**

**Descriptive Statistics - Selected Feeder Cattle Price Model Variables**

| | MAX | MIN | MEAN | S.D.** |
|---|---|---|---|---|
| | **700 - 799lbs -- 1462 Observations** | | | |
| PRICE* | $124.20 | $50.50 | $87.66 | $13.02 |
| DFLIVE | $90.71 | $63.25 | $75.58 | $6.37 |
| CASHCORN | $3.21 | $1.73 | $2.22 | $0.34 |
| HEAD | 257 | 20 | 52.8 | 33.43 |
| WEIGHT | 799 | 700 | 749.12 | 28.61 |
| | **800 - 899lbs -- 1208 Observations** | | | |
| PRICE* | $116.90 | $51.00 | $84.28 | $13.09 |
| DFLIVE | $90.56 | $60.68 | $74.93 | $6.80 |
| CASHCORN | $3.21 | $1.73 | $2.21 | $0.34 |
| HEAD | 237 | 20 | 56.4 | 28.39 |
| WEIGHT | 899 | 800 | 843.68 | 27.52 |
| | **900 - 999lbs -- 421 Observations** | | | |
| PRICE* | $113.10 | $49.70 | $80.42 | $13.35 |
| DFLIVE | $90.51 | $60.68 | $75.74 | $7.20 |
| CASHCORN | $3.16 | $1.73 | $2.17 | $0.31 |
| HEAD | 197 | 20 | 57.73 | 31.05 |
| WEIGHT | 999 | 900 | 936.48 | 27.84 |
| | **1000 - 1236lbs -- 86 Observations** | | | |
| PRICE* | $104.60 | $52.95 | $75.63 | $12.95 |
| DFLIVE | $95.33 | $62.50 | $75.31 | $7.38 |
| CASHCORN | $2.88 | $1.76 | $2.16 | $0.28 |
| HEAD | 128 | 20 | 53.64 | 29.64 |
| WEIGHT | 1236 | 1000 | 1032.78 | 35.53 |

**Denotes Dependent Variable  **Standard Deviation*

Table 4.2 Total Number of Observations – Organized by Selected Variables

| Market | # of Sale Lots |
|---|---|
| Blue Grass Stockyards | 3936 |
| KY-TN Livestock | 2302 |
| United Producers Owenton | 543 |
| United Producers Paris | 294 |
| Gender | |
| Steers | 4585 |
| Heifers | 2490 |
| Breed | |
| HOLSTEINS | 497 |
| CHAR & CHARX | 499 |
| BLK | 1560 |
| BBWF | 941 |
| MIX | 2846 |
| CHARBLK | 732 |
| CPH | |
| Blue Grass Stockyards | 204 |
| United Producers Paris | 72 |

**Table 4.3 Independent Variables by Model:**
**Expected Sign of Parameter Estimates**

| Independent Variables | 225-399lbs | 400-499lbs | 500-599lbs | 600-699lbs |
|---|---|---|---|---|
| DHEIFER | Negative | Negative | Negative | Negative |
| DHOLST | Negative | Negative | Negative | Negative |
| DBBWF | Positive | Positive | Positive | Positive |
| DBLK | Positive | Positive | Positive | Positive |
| DCHAR | Positive | Positive | Positive | Positive |
| DCHARBLK | Positive | Positive | Positive | Positive |
| DOWEN | Negative | Negative | Negative | Negative |
| DPARIS | Negative | Negative | Negative | Negative |
| DKYTN | Negative | Negative | Negative | Negative |
| DCPH | Positive | Positive | Positive | Positive |
| HEAD | Positive | Positive | Positive | Positive |
| WEIGHT | Negative | Negative | Negative | Negative |
| CASHCORN | Negative | Negative | Negative | Negative |
| DFLIVE | Positive | Positive | Positive | Positive |
| SEASON | Unknown | Unknown | Unknown | Unknown |

**Table 4.3 (Continued) Independent Variables by Model: Expected Sign of Parameter Estimates**

| Independent Variables | 700-799lbs | 800-899lbs | 900-999lbs | 1000-1236lbs |
|---|---|---|---|---|
| DHEIFER | Negative | Negative | Negative | N/A |
| DHOLST | Negative | Negative | Negative | Negative |
| DBBWF | Positive | Positive | Positive | Positive |
| DBLK | Positive | Positive | Positive | Positive |
| DCHAR | Positive | Positive | Positive | Positive |
| DCHARBLK | Positive | Positive | Positive | Positive |
| DOWEN | Negative | Negative | Negative | Negative |
| DPARIS | Negative | Negative | Negative | Negative |
| DKYTN | Negative | Negative | N/A | N/A |
| DCPH | Positive | Positive | N/A | N/A |
| HEAD | Positive | Positive | Positive | Positive |
| WEIGHT | Negative | Negative | Negative | Negative |
| CASHCORN | Negative | Negative | Negative | Negative |
| DFLIVE | Positive | Positive | Positive | Positive |
| SEASON | Unknown | Unknown | Unknown | Unknown |

# CHAPTER FIVE
# DIAGNOSTICS AND RESULTS

## Diagnostics

SAS (Statistical Analysis Software) was employed to analyze the data using the OLS (Ordinary Least Squares) method. In order to assume the results of OLS unbiased and efficient, the assumptions associated with OLS method must hold.

The first of these assumptions tested was that of normality. This assumption is based on the hypothesis that the disturbances are normally distributed with constant variance and zero mean [Green, p. 17]. The Bera-Jarque test for non-normality was used to test this assumption.

Seven of the eight models failed the Bera-Jarque test for non-normality. Only the model concerning feeder cattle 1,000 pounds and over passed the Bera-Jarque test. The other seven suffered from infinite error variance; therefore they failed to meet the normality assumption. It appeared that the infinite error variance was a product of outliers present in the data set, as well as the substantial number of dummy variables present in the model. To correct this problem, a number of observations would have to be deleted or other alternatives would have to be pursued. So it was decided to ignore this problem because the data contained in the dummy variables is in fact significant and beneficial to the model. It is also important to note that failing to meet this assumption has no impact on the estimates being unbiased and efficient.

Another assumption of the classic linear regression model is that the explanatory variables of the model contain no multicollinearity. The presence of multicollinearity essentially means that there is a linear relationship between some of the explanatory variables within the regression model [Gujarati, p. 171]. A Variance Inflation Factors test is commonly used to test for the presence of multicollinearity.

The VIF test was conducted to check for the presence of multicollinearity within the eight models. The rule of thumb used in this study was that a variance inflation statistic greater than 20 would indicate harmful collinearity [Belsley et al., p. 73]. In each of the eight models, there seemed to be no problem with multicollinearity, since none of the variance inflation statistics were greater than 10.

The next step was to test for autocorrelation. Initial expectations were that since this model uses time-series data, autocorrelation would be a problem. Auto-Correlation is present when the disturbance term relating to an observation is influenced by the disturbance term of another observation. When using time series data, errors from one time period are often related to errors in other time periods [Gujarati, p. 220]. As expected, the Durbin-Watson test indicated first order autocorrelation in each of the eight models. This was corrected by using a first order lag variable of the disturbances.

Once the issue of autocorrelation was addressed, the regression model was tested for heteroscedasticity. One of the assumptions of the classic linear regression model is that the disturbances in the regression function are homoscedastic. In other words, they all have the same variance. Heteroscedasticity is likely to be encountered when using cross-sectional as opposed to time-series data [Gujarati, p.195]. Although the dataset in question is considered time-series since it covers weekly feeder cattle prices over a four year time period, it could also be considered a cross-sectional data set. This is due to the fact that weekly market data recorded in the series consists of several individual observations. With this in mind, one might hypothesize that this data set will violate the homoscedastic assumption.

In order to test for the presence of heteroscedasticity, the residuals from each model were saved and regressed against the corresponding explanatory variables in each model. In seven of the eight models, there appeared to be a problem with heteroskedasticity among some of the variables. The only model that did meet the homoskedasticity assumption was the one concerning lightweight calves with an average weight ranging from 225 to 399lbs.

Particularly the variables used to address the cash corn price, average weight, deferred live cattle futures price, as well as the seasonality variable used to address seasonal feeder cattle price trends in Kentucky suffered from heteroskedasticity. The heteroskedasticity problems in these residuals as well some of the dummy variables used to capture gender, market, and breed type had to be corrected in order to meet homoskedasticity assumption. One of the repercussions of correcting for the heteroskedasticity within these residuals is that the coefficient of determination in each of the models may be inflated. These coefficients are reported in the Results section, but one must remember that they may be inflated.

## Results

### *225 to 399lbs*

The first equation examined price relationships in calves weighing 225 to 399lbs. This model had the least amount of explanatory power among the eight models included in this analysis, with a coefficient of determination of approximately 76%. With only seven of the 15 explanatory variables having statistical significance at the 90% confidence level, this model also had the least number of significant explanatory variables. The results of the regression equation are displayed in Table 5.1.

Table 4.3 listed the expected signs of the parameter estimates for this regression equation concerning calves weighing 225 to 399lbs. Due to the lower feed efficiency of heifers, one would expect the dummy variable capturing heifers to have a negative parameter estimate in each of the eight models. As expected, DHEIFER had a parameter estimate of -10.24 which was significant at the 99% confidence level. Based on the fact that calves with dairy influence bring significantly less at feeder cattle auctions, the initial hypothesis was that all eight models would have a negative parameter estimate for the dummy variable included to account for Holsteins. Indeed, this model had a parameter estimate of -23.81, which was also significant at the 99% confidence level.

Initial expectations were that the dummy variables capturing lots of black cattle and those with Charolais influence would have a positive parameter estimate. According to Kansas research, one would expect these lots to receive a premium [Sartwell et al., p. 2]. Since the intercept for these eight equations were lots of steers classified as "mixed" which may include any breeds other than Holsteins, this seemed to be a rational hypothesis. However, only DBLK, which is the dummy variable which captures lots of cattle classified as "black" had a significant positive parameter estimate, which was 2.78 and significant to the 95% confidence level. The dummy variable DBBWF, which captures lots of cattle classified as "black and black baldies" was positive but not significant to at least the 90% confidence level. The dummy variables DCHAR and DCHARBLK, which represent cattle classified as "Charolais or Charolais cross" and

"Charolais and blacks together" respectively, both had negative parameter estimates and were not found to be significant at the 90% confidence level.

The dummy variables DOWEN, DPARIS, and DKYTN account for cattle sold at the Producers Owenton, Producers Paris, and Kentucky Tennessee Livestock auction markets respectively. The intercept was steers sold at Blue Grass Stockyards in Lexington, Kentucky. Initial expectations were that the parameter estimates for these variables would be negative. Although not previously researched, it was assumed that prices would tend to be higher at Blue Grass Stockyards based on their sheer size and larger volume of cattle. Blue Grass consistently had more lots of cattle sold each week over the four years of this study and that fact alone would seem to attract more buyers which could entail higher prices. However, the regression results showed that DPARIS and DOWEN had positive parameter estimates, although not significant at the 90% confidence level. DKYTN had a parameter estimate of -5.27 which was significant at the 90% confidence level. Producers Paris and Producers Owenton are both within an hour and a half of Blue Grass in Central and Northern Kentucky, so evidently this relatively close location keeps prices at all three yards in the same range, even with their relative size. Kentucky Tennessee Livestock is a Western Kentucky market and evidently this location along with their smaller size contributed to their meeting the negative parameter estimate expectation.

The initial hypothesis was that DCPH, which is a dummy variable accounting for groups of cattle sold in a Kentucky Certified Pre-conditioned for Health sale, would have a positive parameter estimate. Case studies conducted by the University of Kentucky demonstrated that CPH sales generate a premium for participating producers [Burdine and Johns, p. 3]. On the contrary, this regression equation found a negative, although not significant, parameter estimate. Part of this could be due to the fact that CPH sale prices are often compared to average prices and not to prices for 20 head or larger lots which were included in this study. As a rule, groups or lots of cattle bring more than cattle sold as singles, so this difference in comparison could account for the unexpected parameter estimate.

The number of cattle in a particular lot was captured using the HEAD variable. Based on similar research from Kansas, it was anticipated that as the number of head in a particular lot increased, as would the price per cwt., [Sartwell et al., p. 5]. Although not significant at the 90% confidence level, this variable did yield a positive parameter estimate. The fact that this study includes only lots of 20 head or more could add to the possible underestimation of the impact of lot size. If price data was obtained for smaller groups and singles sold, the impact of lot size may have been more prevalent.

Based on previous literature, one would expect price per cwt. to decrease as average weight and/or corn price increases. The negative correlation between average weight and price is based solely on the price slide discussed in detail in Chapter 3. As corn price increases so do feedlot cost of gain, simply because corn is a significant ingredient in many finishing rations. This increased input cost for feedlots leads to the negative correlation between corn price and feeder cattle price per cwt. Based on these assumptions, it was hypothesized that the CASHCORN and WEIGHT variables would both have negative parameter estimates. The regression equation produced the expected results for both. WEIGHT had a parameter estimate of -.094 and CASHCORN a parameter estimate of -5.25, both of which were significant at the 99% confidence level.

One would predict the variable accounting for deferred Live Cattle futures prices to yield a positive parameter estimate since this variable is included as a means to track the expected demand for feedlot output. When the anticipated demand for feedlot output increases, one would expect feedlot bids to increase for their main input, feeder cattle, to increase as well. Indeed, this model showed the DFLIVE parameter estimate to be 2.21, which was significant at the 99% confidence level.

The final independent variable in this regression model was the SEASON variable which was intended to capture seasonal price trends in Kentucky feeder cattle price markets. The parameter estimate for this variable was positive but not significant.

Although this model contained the same explanatory variables as the models for the heavier weight cattle, it isn't surprising that it has the least amount of explanatory power. As noted previously, the average slaughter weight of cattle is around 1250lbs. The lighter cattle are when they are sold, the more uncertainty buyers and feedlots have about their potential slaughter value which may be over a year away, the more variation one would expect in the corresponding bids. It isn't unreasonable to assume that this added uncertainty and variation would lead to less explanatory power from a regression equation that is attempting to identify price relationships, especially considering the fact that this model included the second smallest number of observations. This added uncertainty with the lighter weight calves could also contribute to the fact that there were fewer statistically significant variables in this model.

***400 to 499lbs***

The second equation examined price relationships within the market for 400 to 499lbs calves. Relative to the first model, the second had more explanatory power with a coefficient of determination of approximately 83%. With nine out of the 15 explanatory variables having statistical significance at the 95% confidence level, these variables did a relatively better job explaining price relationships in Kentucky feeder cattle markets. Table 5.2 displays the regression results from this equation.

As with the first regression equation, Table 4.3 lists the expected signs of the parameter estimates for this regression equation. Since each of these variables is expected to have the same general affect on price in all eight models, the expected signs will be the same for each model. Although the absolute values are expected to differ with each weight group, initial hypothesis don't expect the signs to change from one model to the next, especially on those variables with statistical significance.

DHEIFER again met initial anticipations with a parameter estimate of -10.98, which was significant to the 99% confidence level. So too, DHOLST had a somewhat expected parameter estimate of -17.11, which was also significant to the 99% confidence level.

Two of the four dummy variables intended to capture breed influences on price again failed to yield any statistically significant findings in this regression equation. DCHAR and DCHARBLK had a positive and negative parameter estimate respectively, neither of which was statistically significant to the 90% confidence level. However, DBLK had a parameter estimate of 2.55 and DBBWF had a parameter estimate of 2.19, both of which were significant to the 99% confidence level.

Although the signs changed from positive to negative for the parameter estimates of DOWEN and DPARIS, neither were significant in this regression model. The parameter estimate for DKYTN followed expectations with a -2.13, which was even more significant at the 99% confidence level in this equation, although much smaller (about half) in an absolute value sense as it was in the first regression.

DCPH returned a more expected result in this equation. The parameter estimate was 5.93 and it was significant to the 99% confidence level. This was nearly a $10/cwt. swing in the parameter estimates from the model addressing the 225 to 399lbs calves, although the first wasn't significant.

As in the first model, the HEAD and SEASON variable failed to yield a statistically significant parameter estimate. While the parameter estimate for HEAD remained positive, the SEASON parameter estimate was negative in this equation as opposed to positive in the first.

The three remaining variables WEIGHT, CASHCORN, and DFLIVE all produced parameter estimates that were again significant to the 99% confidence level. As expected, WEIGHT and CASHCORN each had negative parameter estimates of -0.061 and -3.00 respectively. DFLIVE again produced a positive parameter estimate which was 2.10.

***500 to 599lbs***

The third equation examined price relationships for 500 to 599lb calves. Although 12 of the 15 variables yielded significant parameter estimates, the relative explanatory power of this model was lower than that of the second model. The coefficient of determination for this model was approximately 78%. Again, the expected signs of the parameter estimates from this model can be found in Table 4.3. The results from this regression can be examined in Table 5.3.

Following initial expectations as well as the first two models, the parameter estimates for the DHEIFER and DHOLST were negative as well as significant to 99% confidence level. These parameter estimates were -9.67 for DHEIFER and -17.07 for DHOLST.

Unlike the first two models, each of the four variables intended to capture price relationships relating to breed or color were significant in this model. DBBWF and DBLK had parameter estimates of 2.65 and 2.99 respectively, both of which were again significant to the 99% confidence level. DCHARBLK also yielded a parameter estimate that was significant to the 99% confidence level, which was 1.78. The parameter estimate of 0.71 for DCHAR was significant to the 90% confidence level. Notice that this was also the first model to yield parameter estimates with the expected positive sign.

Yet again, the parameter estimates for both DOWEN and DPARIS were negative although not significant to the 90% confidence level. In an apparent trend, the parameter estimate for DKYTN was -4.31 and significant to the 99% confidence level.

Although it didn't meet expectations in the first model, DCPH again produced a positive parameter estimate that was significant to the 99% confidence level. For 500 to 599lb calves, the parameter estimate indicates that those sold through CPH-45 sales will receive approximately a $3.57/cwt. premium.

Unlike the first two models, the HEAD variable was significant in developing price relationships within the 500 to 599lb feeder cattle market. The parameter estimate was 0.029 and significant to the 99% confidence level. DFLIVE also had a positive parameter estimate that was significant to the 99% confidence level. In this particular regression, the parameter estimate for DFLIVE was 1.76.

CASHCORN and WEIGHT continued to follow expectations with negative parameter estimates. Two fundamental pieces in the feeder cattle market are price slide and feedlot cost of gain. These two variables account for such fundamentals with WEIGHT having a parameter estimate of -0.062 and CASHCORN a parameter estimate of -2.56. CASHCORN was significant to the 95% confidence level and WEIGHT was significant to the 99% confidence level.

As in the first two models, the SEASON variable wasn't significant in explaining price relationships within the market for 500 to 599lb feeder cattle. The corresponding parameter estimate was negative in this particular model with no particular trend other than a lack of significance becoming apparent.

***600 to 699lbs***

The fourth regression equation documented price relationships in the market for 600 to 699lb feeder cattle. As expected, the explanatory power of this model was significantly higher than that of its lighter-weight counterparts. The coefficient of determination was approximately 90% and 12 of the 15 independent variables were found to be statistically significant. The results of this regression equation can be found in Table 5.4 while the expected signs of parameter estimates are noted in Table 4.3.

Following initial hypothesis, DHEIFER and DHOLST exhibited parameter estimates of -7.46 and -16.97 respectively. Both of which were significant to the 99% confidence level.

Three of the four dummy variables intended to capture breed or color influences on price were found to be significant at the 99% confidence level. DBBWF, DBLK, and DCHARBLK yielded parameter estimates of 2.05, 1.90, and 1.13 respectively. Although positive, as expected, DCHAR failed to prove significantly different from the intercept in this particular model.

Of the three dummy variables intended to capture the affect of market location on price, DPARIS and DKYTN were the only ones found to be significant with parameter estimates of -0.98 and -3.37 respectively which were significant at the 99% confidence level. The feeder cattle prices from this study must not have been statistically different at Producer's Owenton and Blue Grass Stockyards, based on the fact that DOWEN wasn't statistically significant at the 90% confidence level.

DCPH again proved to be significant at the 99% confidence level in this regression equation. Based on its corresponding parameter estimate of 1.62, feeder cattle in this weight group sold in CPH-45 sales should receive a small premium over their counterparts sold in traditional sales.

HEAD and DFLIVE were again significant at the 99% confidence level with parameter estimates of 0.023 and 1.66 respectively. So too were WEIGHT and CASHCORN with parameter estimates of -0.036 and -3.46 respectively. Each of these variables continues to meet preliminary expectations as to the sign of their parameter estimate.

As in previous models, SEASON yet again did not prove to be statistically significant in deriving price relationships in the 600 to 699lb feeder cattle market. It is a well documented fact that Kentucky feeder cattle prices follow seasonal trends even though it may not seem apparent thus far in the current study [Meyer 2003, p. 8].

*700 to 799lbs*

The explanatory power of the regression equations continues to improve with weight as the coefficient of determination is approximately 93% for the model examining price relationships within the market for feeder cattle weighing 700 to 799lbs. Although the makeup of which independent variables were statistically significant differed from the previous model, 12 of the 15 variables were still significant to the 95% confidence level. The results from this regression equation can be found in Table 5.5 and the expected signs of the parameter estimates are listed in Table 4.3.

Not surprisingly, DHEIFER and DHOLST were again statistically significant to the 99% confidence level. Following sign expectations, the parameter estimate for DHEIFER was -6.27 and that of DHOLST was -17.06.

As in the previous model, only three of the four dummy variables intended to capture influences of breed or color on price were statistically significant. DBBWF, DBLK, and DCHARBLK were each significant at the 99% confidence level with corresponding parameter estimates of 1.68, 1.23, and 1.28 respectively. Again the price of lots of feeder cattle classified as Charolais or Charolais cross didn't receive a price deemed statistically different from that of their "mixed" counterparts.

In a change of significant variables capturing the affect of market location on price, DOWEN and DKYTN were found to each be significant at the 99% confidence level. Their corresponding parameter estimates were -0.73 for DOWEN and -.3.93 for DKYTN. Unlike the previous model, DPARIS was not found to be statistically significant.

Although significant in other models, the dummy variable intended to capture the affect of CPH-45 sales on feeder cattle prices wasn't found to be significant in the regression equation concerning feeder cattle weighing from 700 to 799lbs. Perhaps the significance of CPH-45 price influences are negatively correlated with weight, as the absolute value of the parameter estimates have been decreasing with weight in the three previous models and is now not significant in the current model.

The variables HEAD, WEIGHT, CASHCORN, and DFLIVE were again significant to the 99% confidence level. The corresponding parameter estimates for HEAD and WEIGHT were 0.022 and -0.036 respectively and those for CASHCORN and

DFLIVE were -3.98 and 1.60 respectively. Note also that these parameter estimates continue to meet the sign expectations listed in Table 4.3.

The SEASON variable was statistically significant for the first time in this model. Although the actual parameter estimate of 2.89 isn't of much applicable value, the significance of this variable undoubtedly contributed to the relative explanatory power of this model. It is surprising that in this model it was significant to the 99% confidence level, yet it hasn't been significant to the 90% confidence level in any of the four previous models.

***800 to 899lbs***

With 13 of 15 independent variables displaying statistical significance, the model concerning feeder cattle weighing 800 to 899lbs had the most explanatory power of the six models discussed thus far. The coefficient of determination for this regression equation was approximately 95%. The results for this model can be found in Table 5.6 and the expected signs of the parameter estimates are available in Table 4.3.

DHEIFER and DHOLST were again significant to the 99% confidence level. The corresponding parameter estimate for DHEIFER was -6.02 and the parameter estimate for DHOLST was -14.59. On par with initial hypothesis, these two variables continue to yield negative parameter estimates as proof of the relative discounted prices of heifers and Holsteins in the feeder cattle market.

DBBWF, DBLK, and DCHARBLK continue to produce positive parameter estimates, all of which are significant to the 99% confidence level. Their corresponding parameter estimates in this particular model were 1.99, 1.82, and 1.05 respectively. The parameter estimate for DCHAR, although positive, again failed to be statistically significant from the intercept.

In the first and only model to do such, all three dummy variables intended to capture market location and its relative affect on price were significant. DKYTN was again significant to the 99% confidence level, with a parameter estimate of -4.31. DOWEN was significant to the 95% confidence level with a parameter estimate of -0.71, and DPARIS was significant to the 90% confidence level with a parameter estimate of

-0.41. Not only were all three significant for the first time, but parameter estimates also matched sign expectations for all three.

Again the dummy variable, DCPH, which is intended to capture feeder cattle price impacts of CPH-45 sales failed to be significant in this model. The parameter estimate was larger than in the previous model and still negative. With CPH-45 observations in the two remaining models, it seems that the premium only exists for cattle 400 to 699lbs.

The variables HEAD, WEIGHT, CASHCORN, and DFLIVE all proved to be statistically significant at 99% confidence level once again in this regression equation. HEAD had a parameter estimate of .0017 and WEIGHT a -0.033. CASHCORN had a parameter estimate of -4.13 and DFLIVE yielded a 1.40 parameter estimate. SEASON was also statistically significant to the 99% confidence level in this regression equation. It was again positive with a 6.46 parameter estimate.

***900 to 999lbs***

The model examining price relationships within the market for feeder cattle weighing 900 to 999lbs displays the most explanatory power of any of the eight models. With only 13 variables, 11 of which were statistically significant, this model had a coefficient of determination of approximately 99%. The variable DCPH was not included in this model or the one concerning feeder cattle weighing 1,000 to 1,236lbs since there were no CPH-45 observations within these weight groups in the dataset. There were also no observations from Kentucky Tennessee Livestock in these two models, so the dummy variable DKYTN is not present in neither this nor the remaining model. The results from this regression are available in Table 5.7 and the expected parameter estimate signs are shown in Table 4.3.

DHEIFER and DHOLST once again were significant to the 99% confidence level. DHEIFER yielded a parameter estimate of -4.74 and DHOLST produced a -13.16 parameter estimate.

As in the lighter-weight regressions, DCHAR failed to prove statistically significant from the intercept. DBBWF and DBLK had parameter estimates of 2.40 and 2.02 respectively, both of which were significant to the 99% confidence level.

DCHARBLK was also significant to the 99% confidence level, with a parameter estimate of 0.94.

DOWEN was positive but not significant in this model. DPARIS however was significant to the 90% confidence level with a parameter estimate of 1.19. This is the first and only model to significantly show Producers' Paris having a premium over the intercept, which is Blue Grass Stockyards. Rather unexpected as it was, initial hypothesis concluded that in relation to market location variables of statistical significance, signs of the parameter estimates would remain unchanged throughout the eight models.

HEAD, WEIGHT, CASHCORN, and DFLIVE yet again were found to be statistically significant to the model to the 99% confidence level. The parameter estimates for each were 0.018, -0.031, -4.38, and 1.41 respectively.

SEASON was again statistically significant to the 99% confidence level with a parameter estimate of 4.23. This continues to strengthen the theory that its effectiveness in the model was underestimated in the lighter-weight models.

***1000 to 1236lbs***

The eighth and final regression concerns feeder cattle weighing 1,000 to 1236lbs. As mentioned in earlier chapters, Kentucky is primarily a cow-calf state with very little cattle-finishing. This is illustrated with the fact that although the same time period applies, only 86 observations were available for this regression compared to well over 1,000 in some of the lighter-weight models. Relatively few groups of cattle weighing over 1,000lbs are sold in Kentucky, leaving this model with far fewer observations. As mentioned previously, this model doesn't contain the dummy variables DKYTN or DCPH since no observations in the dataset fell into these categories. There were also no heifers in this dataset, so the dummy variable DHEIFER was also excluded making the total number of independent variables 12. Out of these 12, only seven were found to have statistical significance.

This model had a coefficient of determination of approximately 95% which gives it the second most explanatory power of all eight models. This is surprising considering the relatively small number of observations it contains. The results from this regression are displayed in Table 5.8 and the expected signs of the parameter estimates for each of the independent variables can be found in Table 4.3

DHOLST remained significant in this model with a parameter estimate of -12.17, which was significant to the 99% confidence level. Of the other dummy variables intended to capture breed or color influences on price, DBBWF was the only one with statistical significance. The parameter estimate for DBBWF was 4.05, and it was significant to the 90% confidence level.

Of the dummy variables intended to capture market location and its relative influence on price, none were significant. The parameter estimates for DOWEN and DPARIS were both positive, but not statistically significant from the intercept.

HEAD, WEIGHT, and DFLIVE were again statistically significant to the 99% confidence level. Their respective parameter estimates were 0.048, -0.052, and 1.13. CASHCORN was significant to the 95% Confidence level in this regression, with a parameter estimate of -6.58. SEASON was again significant, but only to the 90% confidence level, with a parameter estimate of 6.13.

Table 5.1 Regression Results: Feeder Cattle – 225 to 399lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -10.2390*** | 1.1253 |
| DHOLST | -23.8140*** | 3.2702 |
| DBBWF | 2.0162 | 1.4467 |
| DBLK | 2.7773** | 1.2283 |
| DCHAR | -0.9370 | 2.0697 |
| DCHARBLK | -6.3141 | 4.7804 |
| DOWEN | 3.1622 | 4.4210 |
| DPARIS | 4.2188 | 5.5963 |
| DKYTN | -5.2674* | 2.8065 |
| DCPH | -4.0894 | 5.9076 |
| HEAD | 0.0056 | 0.0670 |
| WEIGHT | -0.0940*** | 0.0210 |
| CASHCORN | -5.2549*** | 1.8391 |
| DFLIVE | 2.2130*** | 0.1247 |
| SEASON | 1.4783 | 3.5201 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.7609** | |

Table 5.2 Regression Results: Feeder Cattle – 400 to 499lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -10.9770*** | 0.3081 |
| DHOLST | -17.1073*** | 0.9612 |
| DBBWF | 2.1878*** | 0.4489 |
| DBLK | 2.5496*** | 0.3735 |
| DCHAR | -0.0936 | 0.6019 |
| DCHARBLK | 1.5996 | 1.2134 |
| DOWEN | -0.3904 | 1.1131 |
| DPARIS | -0.1804 | 1.4118 |
| DKYTN | -2.1337*** | 0.5441 |
| DCPH | 5.9299*** | 1.1150 |
| HEAD | 0.0073 | 0.0098 |
| WEIGHT | -0.0614*** | 0.0073 |
| CASHCORN | -2.9988** | 1.2376 |
| DFLIVE | 2.0993*** | 0.0618 |
| SEASON | -1.0912 | 1.7268 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.8265** | |

Table 5.3 Regression Results: Feeder Cattle – 500 to 599lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -9.6664*** | 0.2070 |
| DHOLST | -17.0700*** | 0.6186 |
| DBBWF | 2.6485*** | 0.3169 |
| DBLK | 2.9920*** | 0.2546 |
| DCHAR | 0.7136* | 0.4290 |
| DCHARBLK | 1.7839*** | 0.4644 |
| DOWEN | -0.6617 | 0.6188 |
| DPARIS | -0.7086 | 0.4977 |
| DKYTN | -4.3095*** | 0.2795 |
| DCPH | 3.5694*** | 0.7140 |
| HEAD | 0.0290*** | 0.0046 |
| WEIGHT | -0.0621*** | 0.0053 |
| CASHCORN | -2.5588** | 1.0314 |
| DFLIVE | 1.7628*** | 0.0483 |
| SEASON | -0.0616 | 1.2055 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.7794** | |

Table 5.4  Regression Results: Feeder Cattle – 600 to 699lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -7.4561*** | 0.1869 |
| DHOLST | -16.9749*** | 0.4815 |
| DBBWF | 2.0464*** | 0.3337 |
| DBLK | 1.9037*** | 0.2513 |
| DCHAR | 0.2084 | 0.3362 |
| DCHARBLK | 1.1344*** | 0.3558 |
| DOWEN | 0.0107 | 0.4610 |
| DPARIS | -0.9851*** | 0.3758 |
| DKYTN | -3.3693*** | 0.2434 |
| DCPH | 1.6169*** | 0.5586 |
| HEAD | 0.0233*** | 0.0029 |
| WEIGHT | -0.0362*** | 0.0041 |
| CASHCORN | -3.4649*** | 0.8570 |
| DFLIVE | 1.6650*** | 0.0347 |
| SEASON | -0.7598 | 0.9803 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.9049** | |

Table 5.5 Regression Results: Feeder Cattle – 700 to 799lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -6.2661*** | 0.1811 |
| DHOLST | -17.0609*** | 0.4152 |
| DBBWF | 1.6808*** | 0.2869 |
| DBLK | 1.2307*** | 0.2505 |
| DCHAR | -0.1414 | 0.3527 |
| DCHARBLK | 1.2829*** | 0.2509 |
| DOWEN | -0.7272** | 0.3323 |
| DPARIS | 0.0297 | 0.2774 |
| DKYTN | -3.9278*** | 0.2783 |
| DCPH | -0.6373 | 0.8451 |
| HEAD | 0.0219*** | 0.0026 |
| WEIGHT | -0.0355*** | 0.0034 |
| CASHCORN | -3.9789*** | 0.7419 |
| DFLIVE | 1.5961*** | 0.0310 |
| SEASON | 2.8879*** | 1.0144 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.9278** | |

Table 5.6 Regression Results: Feeder Cattle – 800 to 899lbs (Dollars / cwt.)

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -6.0213*** | 0.2549 |
| DHOLST | -14.5940*** | 0.3135 |
| DBBWF | 1.9911*** | 0.1999 |
| DBLK | 1.8213*** | 0.2110 |
| DCHAR | 0.2838 | 0.2916 |
| DCHARBLK | 1.0461*** | 0.1566 |
| DOWEN | -0.7108** | 0.3539 |
| DPARIS | -0.4121* | 0.2350 |
| DKYTN | -4.3131*** | 0.7016 |
| DCPH | -1.0382 | 1.4959 |
| HEAD | 0.0168*** | 0.0023 |
| WEIGHT | -0.0333*** | 0.0027 |
| CASHCORN | -4.1350*** | 0.8696 |
| DFLIVE | 1.4006*** | 0.0332 |
| SEASON | 6.4559*** | 1.4713 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.9521** | |

**Table 5.7 Regression Results: Feeder Cattle – 900 to 999lbs (Dollars / cwt.)**

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHEIFER | -4.7436*** | 0.8522 |
| DHOLST | -13.1647*** | 0.5848 |
| DBBWF | 2.3968*** | 0.4566 |
| DBLK | 2.0225*** | 0.5224 |
| DCHAR | 0.5453 | 0.7795 |
| DCHARBLK | 0.9405*** | 0.3521 |
| DOWEN | 0.6961 | 0.9203 |
| DPARIS | 1.1922* | 0.6080 |
| HEAD | 0.0181*** | 0.0043 |
| WEIGHT | -0.0307*** | 0.0065 |
| CASHCORN | -4.3826*** | 0.7863 |
| DFLIVE | 1.4094*** | 0.0246 |
| SEASON | 4.2269*** | 1.2364 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.9942** | |

**Table 5.8 Regression Results: Feeder Cattle – 1000 to 1236lbs (Dollars / cwt.)**

| Variable | Parameter Estimate | Standard Error |
|---|---|---|
| DHOLST | -12.1748*** | 1.1907 |
| DBBWF | 4.0504* | 2.1147 |
| DBLK | 2.0208 | 1.5288 |
| DCHAR | -2.1933 | 2.7624 |
| DCHARBLK | -0.4915 | 1.2134 |
| DOWEN | 2.9591 | 2.1189 |
| DPARIS | 0.4848 | 1.9351 |
| HEAD | 0.0482*** | 0.0150 |
| WEIGHT | -0.0521*** | 0.0119 |
| CASHCORN | -6.5804** | 2.4920 |
| DFLIVE | 1.1299*** | 0.0758 |
| SEASON | 6.1311* | 3.6203 |
| *, **, and *** denotes statistical significance at the .10, .05, and .01 levels, respectively | | |
| $R^2$ | **0.9542** | |

<u>**Overall Results**</u>

Although the results from each of the eight regressions have already been discussed, the trends of how certain variables affect price differently based on the weight of the sample is also an interesting point. The following discussion examines how the relative impacts of individual variables changed through the eight weight-group regressions. These relative impacts are easier to notice in Table 5.9 located at the end of the chapter.

With the HEAD variable there is no apparent trend in how the parameter estimates differ from model to model. However, something to note is that, as mentioned previously, HEAD was not a statistically significant variable in the first two models. Perhaps, with lighter-weight calves, lot size is not as positively correlated with price as it appears to be with the heavier lots. This could be due to the fact that many of these light weight calves are likely to be backgrounded locally before they are shipped to a feedlot.

Although merely a hypothesis, this could stand to reason considering that many local hauls are on smaller trailers that haul closer to 10,000lbs as opposed to the 50,000lbs hauled by their pot-load counterparts. Also with local hauls it isn't as essential to "fill" a trailer since the cattle aren't going as long of distance and the haul bill will be much less than that of cattle heading several hundred miles to a feedlot.

The WEIGHT variable is a solid testament to the price-slide theory outlined in Chapter Three. Weight was negatively correlated with price and statistically significant to the 99% confidence level in each of the eight models. With this variable, there appears to be somewhat of a trend as the negative price slide lowers as weight increases. The negative affect of weight on price generally declined through each of the first seven models. The last model did appear to reverse this trend, but keep in mind that this model had the fewest observations as well as the largest weight dispersion of any in the study.

CASHCORN was significant to at least the 95% confidence level in each of the eight models. Also notice how from the 500lb category up, the negative affect of a change in corn price on the price of feeder cattle seems to increase with weight. This counters previous literature that states that the impact of a change in corn price is even greater for lightweight calves than their heavier counterparts [Meyer 2003, p. 3]. It isn't apparent exactly why such discrepancy exists between previous literature and this model. Perhaps one issue worth noting is the time period concerned in this study. Increasing consumer demands for beef and tight supplies of fed cattle have made the highest feeder cattle prices ever recorded in history. These high prices coupled with international trade issues lead to large swings in feeder cattle prices that weren't necessarily based on historical market drivers such as corn price.

One variable that was trending and significant throughout the eight models was the DFLIVE variable, which was positive to the 99% confidence level in each of the eight models. The affect of live cattle futures on feeder cattle prices steadily declined as weight increased, from a parameter estimate of 2.21 in the first model to one that was 1.13 in the final model. This trend stands to reason because, in general, the heavier cattle are when they are sold as feeder cattle, the less additional pounds they will gain in a feedlot. As they get closer and closer to slaughter weight, the live cattle futures price should get closer and closer to their current value. This goes back to the price slide. The live cattle futures contract represents a 1250lb animal. Based on the price slide, the price per pound will be higher for a 500lb animal than a 1250lb animal. The same is true for the changes in price. A change in the price of fed cattle expectations will be met by a proportionately larger change in the price of feeder cattle, based on this price slide. As an animal nears that 1250lb mark, the change in its price should approach a mirror image of the change in fed cattle price expectations. As you can see from the parameter estimate of 1.13 for the heavy calves, this theory proves correct in this study.

Another theory of feeder cattle prices is that heifers are less efficient gainers than their steer counterparts, making their cost of gain higher and their relative price lower. As one might expect, with fewer pounds of gain left, this margin between the price of steers and heifers should narrow since they bring approximately the same price when sold as fed cattle. DHEIFER illustrates this theory as the margin steadily narrows in all but the first and last regressions. The first equation, as noted, has a lot of variability and relatively low explanatory power and there were no heifers in the heaviest model. Other than in these two models, the margin between heifers and steers narrows from -\$10.98/cwt. in the 400 to 499lb model to -\$4.74/cwt. in the 900 to 999lb model.

The four variables DBLK, DBBWF, DCHAR, and DCHARBLK shed light on some interesting facts in the market for feeder cattle. Notice that in most regressions DBLK, DBBWF, and DCHARBLK have a positive parameter estimate and are statistically significant from the intercept, which is their “mixed” counterparts. In recent years, the promotion and increased sales of Angus Beef have lead to the premium offered to fed cattle that qualify as Certified Angus Beef. Since Angus cattle are often identified by their black hide color, the premium for fed cattle is based on hide color and marbling. Cattle listed as black, bbwf, or Charolais / black have a greater chance of earning this premium as fed cattle. For this reason, lots with black cattle will often receive a premium over those that do not have black cattle, as this study has shown. Even though the intercept lots, which are classified as “mixed” may contain some black cattle, in most cases they will contain less black hided animals than those listed as Charolais / black, which is why these lots received a positive parameter estimate in five of the eight regressions. Notice that those listed as Charolais only received a statistically significant positive parameter estimate in one of the eight regressions. Basically, these cattle received a price that was statistically no different from their “mixed” counterparts in the majority of this study.

The variable DHOLST was significant to the 99% confidence level in all eight models. The negative parameter estimate in each of the models reiterates previous literature that suggests feeder cattle with dairy influence will receive significant discounts in the marketplace. There appears to be somewhat of a trend within these parameter estimates. The first model, which addresses the lightest calves in the study showed the largest discount for Holsteins. The eighth model, which addresses the heaviest cattle, had the smallest discount associated with Holsteins. It seems the lightweight calves (225 to 399lbs) were discounted nearly $24/cwt., then the discount leveled off to approximately $17/cwt. for calves weighing 400 to 799lbs. The margin between Holstein price and their native counterparts then steadily declined over the next three weight groups to an approximate discount of only $12/cwt. for the heaviest calves, which is about half the discount that was noted in the lighter calves.

This apparent trend makes intuitive sense when one considers why Holsteins receive a price discount in the first place. Two of the main reasons why Holsteins are discounted are the facts that they are less efficient gainers in the feedlot and their dressing percentage is typically 6-8% lower than native steers at slaughter [Grant et al., p. 1]. The fact that their dressing percentage is lower will cause Holsteins to receive discounted prices until they are slaughtered. However, the portion of the discount based on lower feed efficiency should be much like that of native heifers. The heavier they get, the lower this discount, because there are less pounds to gain, which would imply less increased feeding cost based on this lower feed efficiency. So, just as the discount for heifers decreased with weight, one would expect the margin between the price of Holstein steers and their native counterparts to also decrease as weight increases.

The three variables intended to capture differences in market locations had mixed results in the eight models. DKYTN was significant in each of the models in which it was included. With confidence, one can assume that lots of cattle sold at the Kentucky Tennessee Livestock Market in Guthrie, Kentucky are likely to bring approximately $3.00 to $4.00/cwt. less than if they had been sold at Blue Grass Stockyards. As mentioned previously, the fact that this market is an in-weigh location as opposed to the other three which are all out-weigh markets, was likely a driving factor for the statistically significant price differences. Since this study covered a limited number of markets, absolute conclusions as to why the discrepancy in price exists aren't possible.

The other two market location variables were DOWEN and DPARIS which, for the most part, weren't statistically significant from the intercept. The model showed that they were not stronger markets than Blue Grass Stockyards, and if anything, feeder cattle prices at Producers Owenton and Producers Paris could be a little softer at times. However, even in the regressions showing a statistically significant difference in price, the discrepancy was less than $1/cwt. and such a negligible difference could be a product of different sale dates at each of the three markets.

CPH-45 sales have long been promoted as offering Kentucky producers a chance to capture market premiums from pre-conditioning cattle. This study confirms that CPH-45 cattle indeed receive a premium compared to cattle sold through traditional auction markets. The CPH-45 observations used in these regressions were held at Blue Grass Stockyards and Producers Paris, so the premium was not a product of market location. Another important note to remember is that this study only included lots of 20 or more head, so the relative premium displayed through the DCPH variable is not a product of mere lot size but more of added value for pre-conditioning.

Pre-conditioned calves typically make the adjustment to the feedlot with less sickness and death loss than those calves that haven't been pre-conditioned. These regressions showed that there was statistically significant premium for CPH-45 calves weighing 400 to 699lbs. Since heavier cattle (700lbs and up) aren't as likely to get sick when shipped to a feedlot, the premium in CPH-45 sales has typically been in the lighter weight calves. These results confirmed that theory as the premium was highest for the 400 to 499lb regression and declined over the next two weight groups until DCPH wasn't statistically significant in the 700 to 799lb regression.

The only unexpected result relating to the DCPH variable was that the lightest calves (225 to 399lbs) wasn't statistically significant and even had a negative parameter estimate. This could be due to the fact that cattle that have been weaned a minimum of 45 days would be expected to be heavier than 399lbs. Buyers could have taken the fact that these cattle were less than 400lbs as an indicator of poor performance and lowered their bids accordingly. For whatever reason, these cattle unexpectedly didn't receive the price premium of the heavier counterparts.

The SEASON variable obviously had some issues as it tried to capture seasonality trends within the market for the lighter calves (225 to 699lbs). However it was successful and significant in the next four models. It seems that although this variable was adjusted to fit each weight group, it didn't accurately reflect seasonal price trends within the light-weight feeder cattle market. Since the explanatory power was relatively higher for the four heavier-weight regressions than the four lighter-weight regressions, the statistical significance of the SEASON variable likely had increased the explanatory power of the models in which it was effective.

As one can see, when examined individually, certain trends of how price is affected differently by selected variables as weight changes become apparent. Table 5.9 shows the regression results in a format that allows easier comparison of how the parameter estimates and/or statistical significance of each explanatory variable changed as the weight groups changed.

**Table 5.9 Selected Variables & Their Corresponding Parameter Estimates**

| | HEAD | WEIGHT | CASHCORN | DFLIVE | DHEIFER |
|---|---|---|---|---|---|
| 225-399lbs | 0.0056 | -0.0941*** | -5.2549*** | 2.2130*** | -10.2390*** |
| 400-499lbs | 0.0073 | -0.0614*** | -2.9988** | 2.0993*** | -10.9770*** |
| 500-599lbs | 0.0290*** | -0.0621*** | -2.5588** | 1.7628*** | -9.6664*** |
| 600-699lbs | 0.0233*** | -0.0362*** | -3.4649*** | 1.6650*** | -7.4561*** |
| 700-799lbs | 0.0219*** | -0.0355*** | -3.9789*** | 1.5961*** | -6.2661*** |
| 800-899lbs | 0.0168*** | -0.0333*** | -4.1350*** | 1.4006*** | -6.0213*** |
| 900-999lbs | 0.0181*** | -0.0307*** | -4.3826*** | 1.4094*** | -4.7436*** |
| 1000-1236lbs | 0.0482*** | -0.0521*** | -6.5804** | 1.1299*** | N/A |

**Table 5.9 (Continued)**

**Selected Variables & Their Corresponding Parameter Estimates**

| | DBLK | DBBWF | DCHAR | DCHARBLK | DHOLST |
|---|---|---|---|---|---|
| 225-399lbs | 2.7773** | 2.0162 | -0.93697 | -6.3141 | -23.8140*** |
| 400-499lbs | 2.5496*** | 2.1878*** | -0.09357 | 1.5996 | -17.1073*** |
| 500-599lbs | 2.9920*** | 2.6485*** | 0.7136* | 1.7839*** | -17.0700*** |
| 600-699lbs | 1.9037*** | 2.0464*** | 0.2084 | 1.1344*** | -16.9749*** |
| 700-799lbs | 1.2307*** | 1.6808*** | -0.1414 | 1.2829*** | -17.0609*** |
| 800-899lbs | 1.8213*** | 1.9911*** | 0.2838 | 1.0461*** | -14.5940*** |
| 900-999lbs | 2.0225*** | 2.3968*** | 0.5453 | 0.9405*** | -13.1647*** |
| 1000-1236lbs | 2.0208 | 4.0504* | -2.1933 | -0.4915 | -12.1748*** |

**Table 5.9 (Continued)**

**Selected Variables & Their Corresponding Parameter Estimates**

| | DOWEN | DPARIS | DKYTN | DCPH | SEASON |
|---|---|---|---|---|---|
| 225-399lbs | 3.1622 | 4.2188 | -5.2674* | -4.0894 | 1.4783 |
| 400-499lbs | -0.3904 | -0.1804 | -2.1337*** | 5.9299*** | -1.0912 |
| 500-599lbs | -0.6617 | -0.7086 | -4.3095*** | 3.5694*** | -0.0616 |
| 600-699lbs | 0.0107 | -0.9851*** | -3.3693*** | 1.6169*** | -0.7598 |
| 700-799lbs | -0.7272** | 0.0297 | -3.9278*** | -0.6373 | 2.8879*** |
| 800-899lbs | -0.7108** | -0.41213* | -4.3131*** | -1.0382 | 6.4559*** |
| 900-999lbs | 0.6961 | 1.1922* | N/A | N/A | 4.2269*** |
| 1000-1236lbs | 2.9590 | 0.4848 | N/A | N/A | 6.1311* |

# CHAPTER SIX
# FEEDER CATTLE PRICE PREDICTION MODEL

## Introduction

In order to develop the grazing decision tool, one must first have some sort of price prediction model. To accurately choose which management practice(s) maximize returns over variable costs, an expected selling price must be included. Depending on how prices change as the grazing season progresses and the cattle gain additional weight, different strategies may be the "best" choice. This chapter is devoted to the explanation of the feeder cattle price prediction model which will be used in the Grazing Management Decision Tool.

The market for feeder cattle has been referred to as a perfectly competitive market, where the forces of supply and demand determine an equilibrium price [Canada Agriculture, p. 1]. As discussed previously, the supply of feeder cattle available each year is a function of breeding herd capacities. Demand for feeders is a derived demand based on expectations and current economic conditions within the cattle feeding and backgrounding industries. Since this demand is based upon the slaughter cattle market as well as other inputs in the cattle feeding industry, the feeder cattle market is often more volatile than the slaughter cattle market [Canada Agriculture, p. 1].

With any perfectly competitive industry, prices will be bid up or down until economic profit is zero. In the example of feeder cattle markets, feedlots bid prices up when cattle feeding becomes profitable until profitability drops back to zero. On the contrary, when cattle feeders are experiencing losses, they tend to lower their bids for feeder cattle until the losses are eliminated. Based on this perfectly competitive assumption, the "average" feedlot would never experience long run profits or losses. However, "average" feedlots have yet to be discovered, so more efficient operations garner profits and expand while less efficient operations face losses and are eventually forced to shut down. The transition between times of profits and losses also allows for the industry to get "out of line" with equilibrium prices that result in extended profits or losses for cattle feeders [Canada Agriculture, p. 1].

Overall though, prices will revert back to an equilibrium level reflecting zero economic profits from cattle feeding. Since feeder prices are the only controllable input price for feedlots, these prices are the ones that will adjust based on cost of gain expectations and slaughter cattle price expectations. Cost of gain and slaughter cattle prices are controlled by other market factors that feedlot operators can't control [Canada Agriculture, p.1]. Hence, bids for feeder cattle will adjust accordingly when the latter two fluctuate.

## The Prediction Model

Following the perfectly competitive industry assumption, feeder cattle prices should be at a level that reflects zero economic profit from cattle feeding. Since slaughter price expectations and cost of gain are the two factors affecting this level of economic profit, this prediction model is based solely on these two factors. The simple formula relating feedlot demand to feeder cattle prices is:

**FP = SPe + (SW-FW) * (SPe-CG)/FW**

**Where:**

FP = Feeder Cattle Price ($/cwt)

SPe = Slaughter Price Expectation ($/cwt)

SW = Slaughter Weight

FW = Feeder Cattle Weight

CG = Expected Cost of Gain ($/cwt)

Using this formula, consider a scenario where the expected slaughter price is $85/cwt, expected cost of gain for the industry is $50/cwt, and the average slaughter weight is 1250lbs. Based on the formula, the price for a 600lb steer calf could be predicted as shown:

$85 + (1250-600) * ($85-$50) / 600 = $122.92/cwt

As you can see, this formula is an ever-changing break-even calculation for the cattle feeding industry as a whole. Based on historical data, this model has been proven to be an accurate price predictor [Pugh, p.4]. It is important to remember however, that short term variances in supply and unexpected changes in demand can cause the predicted price to differ significantly from the actual price received at the point of sale.

**Expected Slaughter Price**

Although accurate in theory, the predicted price that is formulated through this model is only as valid as the estimates it is based upon. The most important of these is slaughter price expectation. Since slaughter price expectations are a direct reflection on the value of fed cattle, feedlots will adjust their bids significantly in light of changing expectations for future slaughter cattle prices.

Feeder cattle prices have historically been more volatile than fed cattle prices. Since feeder cattle have fewer pounds over which to distribute the expected revenue change stemming from a change in fed cattle price expectations, there is a proportionately larger shift in their price per cwt. In accordance with this theory, the expected response to a change in fed cattle price expectations increases as feeder cattle weights decrease [Pugh, p.5]. This theory held in the regression model on Kentucky feeder cattle prices. As Table 5.9A shows, the parameter estimates decreased for DFLIVE variable as the weight of the feeder cattle increased.

As with any price expectation, fed cattle price expectations are always subject to change as supply and demand factors in the market for beef vary. The agriculture industry uses futures markets to determine global price expectations. These prices are used to determine what prices to pay customers as well as what price to charge customers. Consider the fact that the futures market contains almost an immeasurable number of participants speculating, all of which are speculating or hedging on future price expectations and it is clear to see why futures market prices, however accurate they may turn out to be, are perceived as the industry's best estimate of what future cash prices will be [Stasko, p.49].

Based on this perception, the using of a deferred Live Cattle futures price would seem to be the most appropriate, as well as, the simplest way to estimate what the future slaughter price will be. The Chicago Mercantile Exchange offers live cattle futures contracts representing six months out of the year. These months are February, April, June, August, October, and December. Based on the weight of a group of feeder cattle, one can estimate which deferred Live Cattle futures contract most appropriately represents the expected fed cattle price to use in the prediction model.

Based on Kansas State University feedlot data on nearly 2.75 million cattle dating from 1992 to 2005, average daily gain in a feedlot is approximately 3.3lbs/day and average slaughter weight is 1247lbs. Using these averages, one can calculate a rough estimate of how long a certain group of cattle will remain in a feedlot until they are slaughtered. By choosing the appropriate slaughter date, the corresponding live cattle futures contract can be selected as a predictor of the fed cattle price estimate.

For simplistic purposes, assume a 1250lb slaughter weight with an average daily gain of 3lbs/day. Although the 3lbs/day is a little lower than the average generated from the Kansas State data, it should be sufficient considering the fact that feeder cattle sold in Kentucky are likely to shrink 5-7% while they are hauled to the feedlot. This lower gain estimate also allows for the fact that some of the lighter weight cattle sold in Kentucky will be backgrounded before they are shipped to a feedlot. During this backgrounding phase, average daily gains on forage-based rations will likely be lower than those expected from the higher concentrate rations in a feedlot.

Based on these assumptions, the formula for deriving the approximate days to slaughter for feeder cattle would be:

**D = (1250 – FW) / 3**

**Where:**

D = Days to Slaughter

FW = Feeder Cattle Weight

In order to make this formula more "user-friendly" in choosing the appropriate deferred live cattle futures contract, D should be divided by 30 to derive the number of months to slaughter rather than days. The complete formula would then be:

**M = (1250 – FW) / 3 / 30**

**Where:**

M = Months to Slaughter

FW = Feeder Cattle Weight

As mentioned previously, live cattle futures contracts are only available for six months out of the year. Of course, cattle will be slaughtered in all 12 months; therefore each contract month represents two months of fed cattle price expectations. The

February contract price will be used for cattle expected to be slaughtered in January as well as February and the April contract price will used for both March and April expectations, and so forth.

Consider a 750lb steer sold on April 15th. Using the above formula the correct deferred live cattle futures contract can be selected as follows:

(1250 – 750) / 3 / 30 = 5.55 months

April 15th + 5.55 months = October

Although not exact, this estimate is close enough to sufficiently choose a contract month from which a fed cattle price expectation can be derived. Since the expected slaughter date falls in October, the current October Live Cattle futures contract price will be used as the fed cattle price expectation for this particular prediction model.

**Cost of Gain**

Along with the fed cattle price expectation, this prediction model also depends on the expected cost of gain. Although not as significant as the expected fed cattle price when determining feeder cattle prices, cost of gain is an important factor that must not be overlooked. Changes in cost of gain expectations offer an explanation for why feeder cattle prices are not always in line with fed cattle price expectations. As these cost expectations increase (decrease) feedlots are forced to lower (raise) their bids for feeder cattle in order to account for the change in feed cost [Canada Agriculture, p.3].

Cost of gain expectations become even more significant when estimating the price of lighter weight feeder cattle. The cost of gain expectations applies to a larger amount of gained weight for lighter cattle when compared to their heavier counterparts. Therefore, it is logical to expect variations in cost of gain expectations to have a more significant impact on the price of lighter cattle than that of heavier ones [Canada Agriculture, p. 3].

The regression on Kentucky feeder cattle prices attempted to capture this cost of gain effect by using a cash corn price variable. Since corn makes up a significant portion of feedlot rations in the U.S. feedlot industry, this variable seemed to be a logical choice for capturing the cost of gain effect on feeder cattle prices. Although the CASHCORN parameter estimates were negative, as one would expect, for each of the eight models, no obvious trend of decreased affects on price as weight increased was present. As you can see in Table 5.9A, these parameter estimates varied between the weight groups in no obvious pattern and the heaviest cattle seemed to be affected the most by a change in the price of corn. Although the model performed well as a whole, it seems that this attempt to capture cost of gain and its relative affect on price was only partially successful.

Although there are different methods to estimate cost of gain based on feed and other input costs such as interest and yardage, this model will use a cost of gain estimate that has already been calculated. As you can see from Figure 2.1, a significant portion of the U.S. cattle feeding sector is located in the Panhandle region. For this model a projected break-even chart for Panhandle feedlots will be used as the expected cost of gain reference. The website, www.agcenter.com, posts updated benchmarks/projections reflecting current market conditions and expectations for feedlots within the Panhandle region.

Remember that even if these projections turn out to be incorrect, since they are a reflection of what feedlot operators in a significant cattle feeding region feel will be the cost of gain for placed steers, they will serve the purpose of this model. In predicting feeder cattle prices, the emphasis lies on what those in the feedlot industry expect fed cattle prices to do and what they expect their cost of gain will be. Any variation in input costs or fed cattle prices that occurs after the purchase of the feeder cattle is what generates profits or losses for the feedlot, assuming that the price of feeder cattle was bid up (down) to a point where expected economic profits (losses) were zero at the point of purchase.

**Prediction Model – Example**

Now that all of the parts to the prediction model are understood, consider the following example:

• Date: April 1st

• Current Weight: 625lbs

• Expected Sale Date: July 1st

• Expected Sale Weight: 800lbs

• Expected Slaughter Weight: 1250lbs

• Expected Average Daily Gain: 3lbs

(1250 – 800) / 3 / 30 = 5 months

• Expected Slaughter Date: December 1st

• December Live Cattle Futures: $84.50/cwt.

• Panhandle Projected Cost of Gain: $49/cwt.

$84.50 + (1250lbs – 800lbs) * ($84.50/cwt. - $49/cwt.) / 800lbs = $104.47/cwt.

Based on these input and output projections as well as the zero economic profit assumption which forms the prediction model, 800lb feeder cattle should bring approximately $104/cwt.

**Prediction Model – Test**

In order to test the forecasting accuracy, a Theil's inequality coefficient was used. The formula for the Theil's inequality coefiicient is as follows [Pindyck and Rubinfeld, p. 340]:

$$U = \frac{\sqrt{\frac{1}{n}\sum(X_i - Y_i)^2}}{\sqrt{\frac{1}{n}\sum X_i^2} + \sqrt{\frac{1}{n}\sum Y_i^2}}$$

The numerator of this formula is simply the root mean squared error, but the denominator is scaled so that the U will always equal some value between 0 and 1. If the forecasting model is a perfect fit, then U = 0. If however, the model has absolutely no predictive power, then U = 1.

This break-even model, although rather simple, returned a relatively strong Theil's U result. Using a sample from the data collected and used in this research, U was less than 0.10 in each of the eight weight groups. Only in the two lightest weight groups (225 to 399lbs and 400 to 499lbs), was U greater than 0.01. Since this forecasting model is based on a deferred Live Cattle futures price, one would expect it to have lower accuracy for lighter cattle that are farther from slaughter than their heavier counterparts. However, even in the lightweight models, U was small enough to merit using such a forecasting model for the Grazing Management Decision Tool.

In a separate Theil's U test, parameter estimates from the regressions discussed in Chapter Five were used to develop a forecasting model. The original hypothesis was that this type of forecasting model might be far greater than the simple break-even model, based on the fact that it includes more variables and is based on actual Kentucky feeder cattle price data. Using the same sample from the data set that was used to test the break-even model, each of the regression based forecasts for feeder cattle weighing over 399lbs returned only a minutely smaller U. In fact in the 1000 to 1236lb weight group, the break-even prediction performed slightly better. Based on these results, it was decided that although slightly more accurate, the added complexity of the regression based prediction model made it inappropriate for the Grazing Management Decision Tool.

This prediction model will be used to project a price months into the future using current market forecasts. Forecasts are likely change and the actual price will undoubtedly differ from the predicted price in most instances. The decision tool is designed to offer producers a way to make informed management decisions based on current price forecasts. Adding complexity to such a tool could curb usage by producers, and since forecasts are apt to change over the course of the grazing season anyways, such added complexity for what might be a slightly more accurate forecast would only hinder the overall effectiveness for Kentucky producers.

# CHAPTER SEVEN
# GRAZING MANAGEMENT DECISION TOOL

## Introduction

Using the price prediction model outlined in Chapter Six, a grazing decision tool was constructed to enable producers to evaluate the profitability potential from various summer grazing programs. The Grazing Management Decision Tool uses expected monthly average daily gains over the summer grazing season to estimate weight gain for steers in a summer grazing program. With the use of the price prediction model to calculate expected returns and grazing budgets to estimate costs, this decision tool allows producers to calculate the expected return over variable costs from different grazing scenarios.

The initial hypothesis is that many producers may be able to increase profitability by altering grazing strategies. Such alterations might be shortening the grazing season and selling earlier or using supplemental feeding to increase weight gain. By using this decision tool, producers can use current market outlooks to evaluate different grazing scenarios before making the investment.

## Overview

This decision tool is designed to simulate different summer grazing strategies so that producers can make profit maximizing decisions based on current market outlooks. The market outlook portion of this decision tool is generated using a feeder cattle price prediction model which is based on deferred Live Cattle futures prices. The model assumes a 1250 pound slaughter weight with an average daily gain of 3 pounds per day after the feeder cattle are sold to find the corresponding Live Cattle futures contract which best estimates the slaughter price expectation for a particular group of feeder cattle. Using this Live Cattle futures price and expected feedlot cost of gain, the prediction model determines an estimate of what feedlots will be willing to pay for a certain group of feeder cattle. Note: This prediction model is based on the expected price for Medium #1 and Medium and Large #1 feeder steers.

Historical Kentucky data collected over various grazing trials was used to formulate expected monthly average daily gains (ADGs) a producer might expect from grazing stockers on primarily fescue pasture. Factors such as weather conditions cause grazing performance to differ from year to year, and these are average expectations based on several years of field trials. So, over a "typical" Kentucky grazing season, the monthly rates of gain used in this model are what a producer might expect. If producers feel that they have more accurate gain estimations than these defaults, they can adjust the model to more accurately reflect their operation. Table 7.1 lists the default monthly rates of gains from pasture used in the model:

**Table 7.1 Expected Monthly Average Daily Gains**

| Month | Expected ADG |
|---|---|
| April | 2.74lbs |
| May | 1.86lbs |
| June | 1.03lbs |
| July | 0.60lbs |
| August | 0.78lbs |
| September | 0.63lbs |
| October | 0.96lbs |

This decision tool will use the inputted number of days on pasture in each month to calculate the number of pounds gained during the respective grazing season. This number will be added to the in-weight which producers must input to calculate an out-weight and expected price per cwt. The model also allows for producers to use supplemental feeding to increase their rate of gain during any point in the grazing season. The amount of supplemental feed per day is based on a percentage of initial body weight, which users can change. Users must also input an expected feed to gain conversion rate on an as-fed basis for whichever supplement they use. This model uses a default setting at which soyhulls are fed at the rate of 1% of initial body weight per day with a partial conversion efficiency at which 8 pounds of soyhulls is equal to 1 pound of gain [Vanzant, p. 20].

The model also accounts for expected variable costs incurred during the grazing season using University of Kentucky grazing budgets [Isaacs et al., p. 1] These budgets account for all variable costs producers are expected to incur and adjust accordingly as the producer changes the length of the simulated grazing season and / or incorporates supplemental feeding. Again the model is based on some default prices as estimated by the University of Kentucky. If a producer feels that these costs do not accurately reflect the cost structure of his or her operation, any or all of the costs may be changed to better reflect an individual's own grazing operation.

Using the expected variable costs and predicted returns, this model generates an expected return over variable cost for each scenario the producer inputs. Users can alter the length of the grazing season and try supplementation to see if expected returns over variable costs can be increased. This model combines historical gain data with current market outlooks to develop a profitability prediction. Anyone familiar with livestock markets knows that they can change dramatically in a relatively short period of time. However, the use of such a decision tool allows producers to evaluate different grazing strategies and scenarios based on current forecasts. If forecasts change or weather factors cause expected rates of gain to deviate, the user can adjust the model so that it portrays a more accurate reflection of potential profitability.

## User Guide

Included Below is the User Guide which is included with the Grazing Management Decision Tool. This User Guide is intended to guide users through the decision tool which is in Microsoft Excel.

**1.)** To begin using the decision tool, click on the Decision Tool tab located at the bottom of the page.

**2.)** In order to keep the prediction model current, Live Cattle futures prices and expected feedlot cost of gain have to be updated. The futures prices are listed on the Chicago Mercantile Exchange website which can be accessed by clicking the link like the one displayed below.

**Delayed Futures and Options Quotes**

This link will be located near the bottom of the page.

Then fill in each of the orange boxes indicating the futures contract price for each of seven contract months listed. The order of the months and the years for each will also have to be changed as time progresses. The contract currently listed as June '05 will eventually need to be changed to August '05 and so forth as the near contracts expire and others are added.

**3.)** Then click on the Ag Center link similar to the one shown below to find a projected feedlot cost of gain estimate.

**The Ag Center**

Once you go to this website, click on the Benchmarks link in the upper left portion of the screen. Then scroll down to a table like the one shown below.

## Projected Break-even for a Typical Panhandle Steer Purchase

| | | |
|---|---|---|
| Cost of 750# steers del. feedyards | 115 cwt | $862.50 |
| Cost of gain for 500# | 49 cwt | $245.00 |
| Interest on 75% feed and cattle cost | 5.75%* | $16.36 |
| Break-even on 1250# steers | 89.9 cwt | $1,123.86 |
| October Live Cattle | 86.1 cwt | $1,076.25 |
| Profit/(Loss) per head | | ($47.61) |

The cost of gain estimate is located in the middle column on the second row (it is highlighted in the above example). In this case it would be $49 per cwt. of gain. Input this number in the orange box below the Ag Center link.

**4.)** The model is now updated and ready for your production information. The blue cells are input cells where information about your simulated scenario must be entered. Go back to the top and input the date cattle will be purchased and / or turned out to pasture, their initial weight, price per cwt., and the number of head in the blue cells in the column labeled Pasture. Notice the model copies these numbers to the column labeled Pasture & Supplement. This is done so that users can examine the differences in profit between pasture alone and pasture with some supplemental feeding to increase weight gain.

**5.)** Enter the expected sale date in either or both of the two columns with blue cells. Users don't have to use the Pasture & Supplement portion of the decision tool, but it may be interesting to evaluate both together. In order for the model to calculate ADG over the grazing period, users must enter in how many days of each month the cattle will be on pasture. This can be done on the right side in the blue boxes in the Pasture column and in the Pasture & Supplement column (Note: the cattle do not have to receive supplemental feeding every day they are on pasture, perhaps they could be supplemented for only one month instead of the entire grazing season). If the Pasture and Supplement column is used, the choice of supplement, amount per head per day, and partial conversion must be entered. The model is set with a default supplement choice of a soyhull ration amounting to 1% of initial body weight per day with a partial conversion efficiency of 8 pounds of soyhulls to each pound of gain. These can be modified to better reflect the user's own operation. The monthly estimated ADGs are based on several grazing trials conducted by the University of Kentucky [Johns]. These estimates are based on primarily fescue pasture. If users feel that they have a better estimate of what their cattle will gain on their pastures, these estimates can also be modified to match their own operation. This can be done by simply entering the new ADG expectations in each of the blue cells below the monthly expected ADGs.

**6.)** Once the numbers have been entered by the corresponding months on the right-hand side, the model will calculate an expected sale weight. The model will also calculate an expected slaughter date based on this sale weight. Scroll down to the red boxes where Expected Slaughter Date for both the Pasture and Pasture & Supplement columns is listed (Note: only one will be listed if users only entered the previous information for one). Based on these expected slaughter date, enter the corresponding Live Cattle futures price in the blue cells below each date. Remember that each contract month applies to that month and the previous month. So for a March '06 slaughter date the user would put the April '06 Live Cattle futures price in the corresponding blue cell.

**7.)** If the above steps were followed correctly, the model should have projected a sale price and calculated Return Over Variable Costs on a per head and total basis in the green boxes. Costs are calculated using grazing budgets. Users can modify these budgets by changing the numbers in blue to better reflect costs incurred in their operation. These can be accessed by clicking on the Graze Budget and Supplement Budget tabs at the bottom of the page. Changing costs in the Graze Budget only changes the costs simulated in the Pasture column of the decision tool and costs changed in the Supplement Budget will only affect the Pasture & Supplement column. To try other scenarios, repeat steps 4-6.

**Decision Tool Simulation**

In order to demonstrate what output users could expect to receive from the Grazing Management Decision Tool, a simulation has been included. For purposes of this simulation, assume that a producer was evaluating the following grazing scenario:

Cattle Purchased: May 1st
Purchase Weight: 500 lbs
Purchase Price: $130/cwt.
Number of Head: 75
Expected Sale Date: October 1st

This simulation will include two scenarios. The first of which will be cattle on pasture with no supplement. Using the price prediction model outlined in Chapter Six and the default expected ADGs included in the decision tool, the cattle in this first scenario would gain 149lbs over this grazing season and sell for $118/cwt. weighing 649lbs on October 1st. Based on these projections and the cost estimates included in the model, the model predictions are as follows:

Gross Returns Per Head: $770
Estimated Variable Costs: $757
Estimated ROVC (per head): $13
Total ROVC: $948

The expected net returns above variable costs shown on the previous page were from pasture alone with no additional supplement. The second part of the simulation will assume the cattle receive one percent of their initial body weight in soyhulls each day. This will increase the rate of gain, but it will also increase the variable costs per head. At this increased rate of gain, the model predicted these cattle to weigh 744lbs on October 1st and sell for $110/cwt. Following the same initial assumptions from the first scenario, the expected costs and returns from the second scenario are as follows.

Gross Returns Per Head: $816
Estimated Variable Costs: $800
Estimated ROVC (per head): $16
Total ROVC: $1205

Based on these expectations from the Grazing Management Decision Tool, the producer could then evaluate whether the additional investment in labor to feed the cattle soyhulls each day, is worth the expected increase in net returns. Different producers are likely to make different management decisions based on these expectations. Those that aren't equipped to handle storing the soyhulls or feeding them may choose pasture alone. Others may already have the infrastructure in place to provide supplemental feeding at some cost less than the increase in expected returns. In this case they would likely choose to provide supplemental feeding throughout the grazing season, as in the second scenario. This decision tool provides producers with expectations that will hopefully enable them to make well-informed management decisions within their grazing program. It is merely an expectation based on current forecasts that are always subject to change, but it at least gives them some projection based on what the market is telling them today. If the market changes tomorrow, then it can easily be changed to reflect the new outlook. Included below is a link to the Grazing Management Decision Tool.

Grazing Management Decision Tool

# CHAPTER EIGHT
# CONCLUSIONS AND IMPLICATIONS

## Conclusions

This thesis included two separate yet directly related parts in the feeder cattle price analysis and the decision tool which is focused on grazing management and profitability projections. The econometric analysis of Kentucky feeder cattle prices revealed several important findings which were highlighted in Chapter Five. Since the decision tool segment of this thesis has yet to be put into practice by producers, there are more future implications to discuss concerning it as opposed to conclusions.

Though Kentucky has relatively little cattle finishing, as noted previously, it has a well established role as a feeder cattle supplier to cattle finishing sectors across the United States. The econometric analysis revealed many interesting findings as to what characteristics affect the price producers receive for their feeder cattle at auction. With such a large data set (over 7,000 observations) the explanatory power was relatively large for most of the eight models.

Perhaps the most interesting findings from the econometric analysis of Kentucky feeder cattle prices were how these price relationships varied between the eight weight groups. As Table 5.9 illustrates, there were apparent trends in how these selected variables influenced price as the weight of these feeder cattle increased. For example, the relative discount for heifers and Holsteins declined as the weight of feeder cattle increased. The original hypothesis was that due to their less efficient weight gain, they would receive discounts relative to the native steers, which were the intercept in this model. Following this hypothesis, one would expect the relative discount to decrease as they gain weight, since their decreased weight gain efficiency would be less of a factor affecting feedlot profitability when they enter a finishing program with less weight to gain before slaughter. The relative discounts for heifers decreased from approximately \$10/cwt. to less than \$5/cwt. as they progressed from the lighter weight groups to the heavier ones. The discount for Holsteins decreased from nearly \$24/cwt. in the light-weight model to slightly more than \$12/cwt. in the heaviest model.

The dummy variable included to capture calves sold through a CPH (Certified Pre-Conditioned for Health) sale also revealed some interesting findings. CPH sales have long been promoted as a means for Kentucky producers to increase the net return from their calf-crop by pre-conditioning their calves and capturing this health premium. The CPH sale format also allows small producers to capture the lot size premium by commingling their cattle with similar calves from other producers to form larger uniform lots than they would have previously been able to offer. In this analysis, CPH cattle received a premium of nearly $6/cwt., $3.50/cwt. and $1.50/cwt. for cattle weighing 400 to 499lbs, 500 to 599lbs, and 600 to 699lbs respectively. One could hypothesize that a substantial portion of this premium is for the health program that CPH calves receive as opposed to only their lot size, since this study only included lots of 20 or more head.

This model also included four different auction markets across the state of Kentucky. Three of the four showed no significant difference in price for most of the eight weight groups. However, the Kentucky Tennessee Livestock Market showed significant discounts ranging from approximately $2/cwt. to over $5/cwt. in each of the six models in which it was included. At first glance there seems to be an opportunity for arbitrage here since these markets are only a few hours apart. However, further investigation revealed that this particular market is an in-weigh market as opposed to the other three which are out-weigh markets. The basic difference between the two being one market weighs the cattle as they are received and the other markets weigh the cattle as they are sold. This could undoubtedly lead to a substantial difference in price since cattle shrink while they are standing in the yards excreting waste. Since the Kentucky Tennessee Livestock Market weighs cattle upon delivery, the buyers adjust their bids to reflect the fact that these cattle now weigh less than they did at delivery due to waste excretion from the time they were delivered until they are sold. In an out-weigh market this shrinkage between the delivery and sale isn't a factor since the cattle are purchased according to the pounds their weight when they are sold. In fact, the greater shrinkage these cattle experience while waiting to sale, the less a factor shrinkage will be when they are shipped to a feedlot or backgrounding operation since some of it has already occurred before they were weighed and purchased.

Overall, the models addressing these eight weight groups performed rather well with each revealing some noteworthy findings. However, in future studies, perhaps the models designed to capture price relationships within the market for lighter calves should include different variables than those designed for their heavier counterparts. It seemed that as weight increased, the explanatory power and number of significant variables rose in these models. For example, using a cash corn price as opposed to a corn futures price may not be appropriate for the lighter calves. In many cases, these calves are likely to go through a backgrounding operation where forages will make up a significant portion of feeding rations as opposed to the high concentrate rations found in the cattle finishing sector. This fact could have lead to the issue of the CASHCORN variable not having more of an impact on price in the heavier calves than it did on their lighter counterparts. Previous literature suggests just the opposite [Meyer 2003, p. 3], and the fact that the current price of corn isn't as important to cattle that are months away from a feedlot could account for a portion of these conflicting results.

Obviously there were some issues with how the SEASON variable captured seasonality trends within the market for lighter calves. Even though the approach to capturing this impact worked in the heavier models, the overall results could possibly benefit from choosing a different method for the lighter models. In fact, previous studies suggest that seasonal differences in price are larger in the market for lighter calves than they in those of heavier cattle [Meyer 2003, p. 8].

Although some variables performed better than others, the eight models together reveal several price relationships and trends within the Kentucky feeder cattle market. Chapter Five includes a more in-depth analysis of each of the models individually as well as an overview of how the results compared across weight groups.

## Implications

The price analysis portion of this study has many future implications for backgrounders and cow-calf producers alike within the state. By noting price relationships between breeds and genders of feeder cattle, they can make informed management decisions within their herd and/or calf purchases to increase profitability. For instance, by looking at the premium they can expect from black steers as opposed to mixed steers, producers can estimate at what relative discount mixed calves will become relatively more profitable than their black counterparts. The same is true for cow-calf operators who are buying heifers, bulls, or cows to expand their herd. Most producers probably have a good perception of what brings a premium or discount, but one might hypothesize that the actual size of the relative premium or discount for a particular group of calves isn't always known. This type of research sheds additional light on that issue and will hopefully provide useful insight for cattle producers across the state.

There is an immense amount of opportunity for applied research from the dataset that was gathered for this research. With over 7,000 sale lots of Kentucky feeder cattle in a database, the possibilities are endless. It would also be interesting to continue expanding this database over the next several years to compile price data from a complete cattle cycle. There could then be separate analysis run over different periods in the cycle to see how selected characteristics may affect price differently. For example, in an expansion phase, the price of heifers may be bid up to a point where their relative discount to steers is lower than what was shown in this particular analysis. It would also be interesting to compare this load lot data to an average sale price for that weight group at each particular stockyard. It's no secret that groups of 20 or more head bring a premium when compared to singles and small groups, but such a study might shed light on the actual size of this premium.

This dataset could also be used to calculate an expected basis for 20 head or more lots of Kentucky feeder cattle. The initial hypothesis would be that Kentucky cattle face a negative basis due to the added transportation to cattle finishing areas. However, the "load lot" premium seems to overcome this in some situations and Kentucky feeder cattle sold in uniform load lots may actually face a positive basis. Basis has been calculated using average stockyard prices which include all the cattle sold, but an analysis that focused strictly on larger groups may produce a different result.

Like the price analysis portion of this study, the Grazing Management Decision Tool also comes with many future implications. This decision tool offers Kentucky cattle producers a means of evaluating different grazing strategies before the investment is made. It seems that all too often, producers turn the cattle out to pasture and leave them there until the forage source has faded and then they sell the cattle and evaluate the grazing season to see if it was profitable. In some years this may have been the most profitable choice. In others there may have been a possibility to incorporate supplemental feeding and increase profitability. Still, in other years, the most profitable decision may have been to sell the cattle at an earlier date.

The decision tool is designed to include current market forecasts as well as expected grazing performance data. Although everything is an estimation or expectation that is subject to change, the value comes from combining all of these expectations to offer producers a relatively simple way to simulate various scenarios in an attempt to increase the profitability of their grazing operation. Once producers become familiar with this decision tool, they will hopefully be able to simulate numerous scenarios in just a few minutes.

There is also an opportunity to expand the capabilities of the decision tool. Currently the default average daily gains are based primarily on cattle grazing endophyte-infected fescue pastures and the supplementation default gains are based only on a soyhull ration. With some modification, the decision tool could allow producers to choose between different forages, each of which would have their own default gain expectations. There could also be other supplement choices, each with expected gain data included. As producers begin using the decision tool and become acquainted with it, such additions may prove useful. With such additions, it would prove useful to make this more of a cross-disciplinary effort by getting additional insight from nutritionists and forage specialists.

There is also an opportunity to make additions to the model to allow for varying stocking rates. Many producers may choose to sell part of the calves early in the season as forage availability begins to diminish. It is possible to analyze such decisions with the current setup of the decision tool, but it isn't as user-friendly as using a scenario where all of the calves are sold at once.

The decision tool currently is set up to cover seven months of summer grazing (April – October). It could be modified so that it is a twelve month decision tool. This could be achieved by including gain expectations from winter rations and stockpiled forages. Again the different ration possibilities are numerous, including everything from feeding a hay and soyhull ration to grazing standing corn with some form of protein supplement. Such modifications would undoubtedly require cross-disciplinary efforts to ensure the accuracy of gain expectations.

Although it would add to the complexity of the decision tool, incorporating the findings from the price analysis portion of this study into the price prediction model might be a worthwhile consideration. The prediction model would still use the deferred Live Cattle futures price but would include the other variables from the price analysis as opposed to just the futures price and expected cost of gain. Producers would have to enter more data concerning the breed and gender of their herd, but the price prediction would reflect all of these characteristics as opposed to producers having to adjust the price prediction. For instance, this would increase the accuracy of the decision tool for a producer who is turning Holsteins out to pasture. The way it currently is set up, producers have to make this adjustment manually if they choose to vary their price expectation from the original price prediction.

As with any such decision tool, modifications and additions like the ones mentioned could make the model more complex and less user-friendly. Perhaps the best method for deciding which modifications to pursue would be from a demand standpoint. If there is a demand from producers to add to the decision tool so that it does a better job addressing particular backgrounding scenarios they face, then such modifications should be pursued. If however, most producers feel as though increasing the complexity would hurt the effectiveness and usefulness of such a decision, then perhaps it is best left the way it is. The model was created with the intention of offering assistance to Kentucky cattlemen, and should be adjusted and modified to ensure that this goal is continuously met.

## REFERENCES


Anderson, John D. and James N. Trapp. "The Dynamics of Feeder Cattle Market Responses to Corn Price Change." Journal of Agricultural and Applied Economics. 32,3 (December 2000):493-505.

Ash, M.S. Animal Feed Compendium. United States Department of Agriculture. Economic Research Service. Ag Econ Report No. 656. Washington, DC: 1992

Bailey, DeeVon, and Lyle N. Holmgren. Price Slides for Feeder Cattle. BCH-8470, University of Wisconsin-Extension, Cooperative Extension.

Belsley, D., E. Kuh, and R. Welsh. Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. New York: John Wiley and Sons, 1980.

Burdine, Kenneth H. and John T. Johns. Pre-conditioning Feeder Calves: A CPH-45 Case Study. AEC 2003-03, University of Kentucky, 2003.

Canada, Alberta Government, Agriculture, Food and Rural Development. Predicting Feeder Cattle Prices. Government Printing Department, 2001.

Chicago Mercantile Exchange. Introduction to Livestock and Meat Fundamentals. Chicago, 2002.

Dhuyvetter, Kevin C., and Ted C Schroeder. "Price-Weight Relationships for Feeder Cattle." Canadian Journal of Agricultural Economics. 48 (2000):299-310.

Dhuyvetter, Kevin C., Ted Schroeder, and Walt Prevatt. The Impact of Corn and Fed Cattle Prices on Feeder Cattle Price Slides. Kansas State University Agr. Exp. Sta. and Cooperative Extension Service. MF-2504. April 2001.

Fieser, B.G., E.S. Vanzant, and L.J. Driedger. "Evaluation of Corn and Soybean Hull Supplements on Performance of Stocker Cattle Grazing Endophyte-Infected Fescue." 2002 Beef Research Report. pp. 18 – 20, PR-463, University of Kentucky Agricultural Experiment Station.

Florida Agricultural Statistics Service. U.S. Department of Agriculture. "Florida Cattle and Calf Inventory." January 2004.

Grant, Rick, Rick Stock, and Terry Mader. "Feeding and Managing Holstein Steers". Cooperative Extension Institute of Agriculture and Natural Resources. University of Nebraska-Lincoln. G93-1177-A. August 1993.

Green, William H., Econometric Analysis, Fifth Edition. Upper Saddle River, N.J.: Pearson Education, Inc., 2003.

Gujarati, Damodar, Basic Econometrics. New York, N.Y.: McGraw-Hill, Inc., 1978.

Isaacs, Steve, Stephanie Goode, Richard Trimble, Lee Meyer, Kenneth Burdine, and Terry Hutchens. Livestock Enterprise Budgets for Kentucky. University of Kentucky, July 2004.

Johns, John. Extension Beef Specialist. University of Kentucky. Personal Interview. May 17, 2005.

Kay, Ronald D. and William M. Edwards, Farm Management, Fourth Edition. Boston, M.A.: The McGraw-Hill Companies, 1999

Kuhl, Gerry "Focus on Feedlots." Kansas State University. January 2005.

Meyer, A. Lee "Introduction to Key Beef Cattle Marketing Concepts." August 2003.

Meyer, A. Lee "Marketing Beef Cattle." The Kentucky Beef Book. pp. 10-1 – 10-5, ID-108, University of Kentucky.

Meyer, A. Lee and John T. Johns. "Cattle Grazing Programs – 1988." 1988 Beef Cattle Facts. Pp. 1 – 3, No. 1, University of Kentucky Cooperative Extension Service.

National Cattlemen's Beef Association, Cattlemen's Beef Board, Beef Industry Fact Sheet.

Peel, Derrell S. Stocker Cattle: Shock Absorber for the Beef Industry. Dept. Agr. Econ. Visions, Oklahoma State University, 2000.

Pindyck, Robert S. and Daniel L. Rubinfeld. Economic Models & Economic Forecasts. New York.: McGraw-Hill, Inc., 1991

Pugh, G. "The Economics of feeder cattle and calf pricing in North America." Canadian Farm Economics 20 (1986): 3-7.

Sartwell III, James D., et. al., Buying and Selling Feeder Cattle – The Impact of Selected Characteristics on Feeder Cattle Prices. Dept. Agr. Econ. MF-2162, Kansas State University, 1996.

Smith, S.C., D.R. Gill, T.R. Evicks, and J. Prawl. Effect of Selected Characteristics on the Sale Price of Feeder Cattle in Eastern Oklahoma: 1997 & 1999 Summary. Dept. Animal Sciences, Oklahoma State University, 2000.

Stasko, Gary, F. Marketing Grain and Livestock. Ames, Iowa: Iowa State University Press, 1997.

Tomek, William, and Kenneth Robinson. Agricultural Product Prices. Ithaca, N.Y.: Cornell University Press, 1981.

U.S. Department of Agriculture. Cattle: Background. Briefing Room, ERS. July 2004a.

U.S. Department of Agriculture. Cow-calf Production Costs and Returns per Bredcow, 2002-2003 1/. ERS, Oct. 2004b.

Vanzant, E.S. "Increasing Level of Soybean Hulls for Stocker Steers Grazing Endophyte-Infected Fescue." 2003 Research and Extension Beef Reports. pp. 19 – 21, SR-2004-2, University of Kentucky Agricultural Experiment Station.

# VITA

## Roger Wayne Eldridge

**Birthplace** – Frankfort, Kentucky

**Birthdate** – December 6, 1982

### EDUCATION

Midway College - Midway, Kentucky
Attained credit in various business and general education courses
Earned 51 hours - G.P.A. 4.0
Pursued this coursework in the evening program while attending UK fulltime

University of Kentucky - Lexington, Kentucky
Bachelor of Science in Agriculture – Summa Cum Laude
Major: Agricultural Economics
GPA: Overall 3.96, Agricultural Economics: 4.0
Pursuing Master of Science in Agriculture
Expected Graduation: August 2005

Skills: WordPerfect 8.1, Microsoft Office: Excel, Word, Access, and PowerPoint

### EXPERIENCE

Perkins Farms - Frankfort, KY
*Laborer, 2000 - Present*
- Work on family operated 1000 acre beef cattle and tobacco operation
- Annually help raise 42 acres of tobacco, 750 head of feeder steers
- Maintain pasture and hay fields
- Manage migrant laborers
- Check beef cattle progress and performance
- Monitor beef cattle market situations and offer advice to owners

University of Kentucky - Lexington, KY
*Teaching Assistant, 2003 - 2004*
- Teaching Assistant for Dr. Carl Dillon's Agriculture Management Principles course
- Graded assignments and tests and recorded grades in a spreadsheet
- Assisted students using Microsoft Excel to complete assignments in weekly lab sessions
- Provided additional tutoring for students as needed

University of Kentucky - Lexington, KY
*Research Assistant, Spring 2004*
- Part time position working under the VATM (Value Added Target Marketing) grant
- Recruit producers and county agents to participate in the VATM program
- Record carcass data in database

Berea College – Berea, KY

*Adjunct Professor – Fall 2004*

- Teaching Farm Resource Management in the Department of Agriculture and Natural Resources
- Course emphasized the linkages between the physical production systems and the economic and business systems used in the food and fiber industries. In addition, the social aspects of management and decision making were addressed. Particular emphasis was placed on organization and use of resources in a farm business.

University of Kentucky - Lexington, KY

*Extension Associate – Livestock Marketing, 2004 - Present*

- Staff position working under the VATM (Value Added Target Marketing) grant
- Recruit producers and county agents to participate in the VATM program
- Record carcass data in database and distribute individual reports to Kentucky producers
- Offer advice to Kentucky beef cattle producers
- Monitor current market situations and outlook
- Work in conjunction with other beef extension team members on various projects

## HONORS/LEADERSHIP

- College of Agriculture Dean's List every semester
- Scholarships: Edwin C. Gamble, Dairy Farmers of America, Sam R. & Katherine Ewing, Kentucky Farm Bureau, Franklin County Farm Bureau, Franklin County Homemakers, Paul Gray Memorial, Agribusiness Association of Kentucky
- Agribusiness Club – Career Dinner Coordinator
- Alpha Lambda Delta Honor Society
- Phi Sigma Theta National Honor Society
- Franklin County Cattlemen's Association – Board Member

## PROFESSIONAL PUBLICATIONS

Burdine, Kenneth H., R.W. Eldridge, and Richard Trimble. "The Economics of Renovating Pastures with Clover". Ext 2005-04. May, 2005.

Burdine, Kenneth H., Greg Schwab, R.W. Eldridge, and Richard Trimble. "The Economics of Pasture Fertilization". Ext 2005-06. May, 2005.

Eldridge, R.W., Kenneth H. Burdine, and Richard Trimble. "The Economics of Rotational Grazing". Ext 2005-02. February, 2005.