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Effects of Differences in Video and Traditional Markets on Feeder Cattle Prices

Damon Eric Drinnon
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Damon Eric Drinnon entitled "Effects of Differences in Video and Traditional Markets on Feeder Cattle Prices." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Dan L. McLemore, Major Professor

We have read this thesis and recommend its acceptance:

Emmit Rawls, Kim Jensen

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Effects of Differences in Video and Traditional Markets on Feeder Cattle Prices

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Damon Eric Drinnon
December 2009

Abstract

Few decisions are more important to feeder cattle producers than how to market their product. This study uses the hedonic pricing model to show which method of marketing results in higher prices (traditional auctions or video board sales) and which characteristics of cattle, conditions of sale, and market conditions result in price premiums and discounts.

The two equations used were estimated by ordinary least squares in the SAS Reg procedure with 3131 observations over the 1996-2007 period. Model I (47 independent variables) was developed to estimate implicit values of various animal attributes, conditions of sale, and market conditions on the Tennessee Livestock Producers (TLP) video board sale. The dependent variable was sale price for each lot. Model II (36 independent variables) specified the ratio of TLP sale price to Tennessee auction market average price as a function of various animal attributes and conditions of sale.

Lot characteristics that had significant positive implicit prices included: steers, larger lots, medium and large frame number 1 muscling, existence of a health program, animals penned the night before weighing, higher live cattle futures prices, and the fall season. Lot characteristics that had significant negative implicit prices included: mixed gender, fleshiness, higher weights, larger weight range, Charolais cross, longer distance to feedlot area, higher corn prices, and the spring season.

TLP sale price exceeded Tennessee auction average price for similar cattle by 9 percent on average over the 12 years. The amount by which TLP price exceeded auction price was significantly positively affected by number of head in the lot, indication that animals were PVP certified, longer distance from farm to weigh point, allowance of pencil shrink, and allowing buyers to choose a load from a larger group of animals. The price difference was significantly

negatively affected by the fact that the lot was of mixed gender, weight range for the lot was wide, the lot contained a larger percentage of animals that were not black or black baldy, animals showed substantial “ear”, animals had been fed supplement or were “home raised”, and location of animals was farther from typical feedlot areas.

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Chapter I

Introduction

The beef cattle industry plays an important role in both United States agriculture and the United States economy as a whole. The industry also has a larger global impact. According to the United States Department of Agriculture's Economic Research Service (ERS) Overview section of the Cattle Briefing Room page, "The United States has the largest fed-cattle industry in the world, and is the world's largest producer of beef; the majority of beef produced and exported from the United States consists of grain-finished, high-value cuts." Because of the country's large grain supply and abundance of grasslands, the United States is able to produce high quality beef (USDA, ERS – Briefing Room - Cattle: Overview). These two factors contributed to the country becoming a world leader in the beef industry.

According to the National Cattlemen's Beef Association (2009), the production of beef cattle represents the largest single segment of American agriculture with more than one million participating businesses, farms and ranches. This statement is supported by 2007 data from the United States Department of Agriculture's Economic Research Service Newsroom, specifically the United States Beef and Cattle Industry Background Statistics section. The value of United States cattle and calf production for 2007 totaled $36.0 billion, while the retail equivalent value of the entire United States beef industry for 2007 was $74 billion (USDA, ERS – Newsroom). According to Cattle Fax – April 2009, the January 1, 2009, cattle report showed that all cattle and calves in the U.S. totaled 94.5 million head; of those, 31.7 million were beef cows.

According to data compiled from the National Cattlemen's Beef Association (NCBA) the demand for beef products has increased 22 percent since 1998. In 2005, the per capita

consumption of beef was 64.7 pounds, while the consumption of chicken was 60.3 pounds (NCBA, 2009). In 2007, consumers spent an average of $241 per person on beef in supermarkets and restaurants, which results in roughly $74 billion in retail sales (USDA, ERS – Newsroom).

The United States beef cattle industry is divided into two major production sectors: cow-calf and cattle feeding operations (USDA, ERS – Briefing Room – Cattle: Background). Cow-calf operations produce cattle or beef by breeding cows and producing calves for sale. The calves are then sold to the next phase of the industry, feeding operations. These consist of either stocker operations or feedlots. The primary product of commercial cow-calf operations is a 6-10 month old calf weighing between 400 and 650lbs. The average beef cow herd in the U.S. is 40 head. Operations with 100 or more beef cows comprise just 9% of all beef operations but possess 51% of the beef cow inventory (USDA, ERS – Briefing Room – Cattle: Background). Those operations with 40 head or fewer usually include multi-enterprise operations or operators with off-farm employment (USDA, ERS – Briefing Room – Cattle: Background).

Cattle feeding operations encompass both stocker operations and feedlots. According to Anderson et al. the Mississippi State University Extension August 2004 "Stocker Cents" article in *Cattle Business in Mississippi*, "stocker cattle are generally considered young, lightweight calves developed primarily on forage-based diets until they reach a desired weight." Stocker operations involve growing light-weight calves, usually about 400-500lbs, to a desired heavier weight, about 700-800lbs. This change occurs in a 100-200 day stockering period, which averaged 145 days in the Mississippi State University study (Anderson et al., 2004).

Feedlots are institutions that intensively feed concentrates (grains) to feeder cattle. Animals exiting the feedlot for slaughter are usually produced weighing 1100-1400lbs. According to the United States Department of Agriculture's Economic Research Service Cattle

Background section of the Briefing Room, feedlots are primarily concentrated in the Great Plains, but they are also present in other areas of the United States: Corn Belt, Southwest, and Pacific Northwest. In a feedlot, animals are fed an average of 140 days; however, the time the animals are fed may vary from 90 days to 300 days (USDA, ERS – Briefing Room – Cattle: Background). The average gain for animals while at the feedlot ranges from 2.5 to 4 lbs per day (USDA, ERS – Briefing Room – Cattle: Background). In order to maintain significant gain in heavier weight animals, rations of 70-90% grain and protein concentrates are used (USDA, ERS – Briefing Room – Cattle: Background).

Feedlots with less than 1,000 head one-time capacity comprise the vast majority of feedlots in the United States. Feedlots with capacities greater than 1000 head make up less than 5% of all feedlots, but they market 80-90% of fed cattle in the United States. Feedlots with 32,000 head or more one-time capacity market 40% of fed cattle in the United States (USDA, ERS – Briefing Room – Cattle: Background).

The beef cattle industry is also vital to Tennessee's agriculture as well as the state's economy. In 2007 Tennessee ranked 9th in the nation for beef cow numbers, 1.2 million, and 15th in total cattle, 2.13 million head valued at 1.68 billion dollars (USDA, NASS). Tennessee exceeds all states east of the Mississippi River except for Kentucky in number of cattle (Neel); only Texas, Missouri, and Oklahoma have more cow-calf operations than Tennessee. According to the United States Department of Agriculture's National Agricultural Statistics Service (NASS) 53 percent of the 79,000 farms in Tennessee have beef cattle. In addition, 51% of all cattle in Tennessee are beef cattle (Neel). These numbers result in the beef cattle industry being the largest single source of agricultural income for Tennessee. The 2007 cash receipts from the sale

of cattle and calves totaled $582 million, which comprised 22.5% of Tennessee's total agricultural income (Neel).

The production and sale of feeder cattle is the most important element in the Tennessee beef industry. Economists report, according to the National Cattlemen's Beef Association, that every dollar made in cattle sales is multiplied or turned about four or four and a half times. This would result in the state's cattle industry generating $2.6 billion in economic activity. Tennessee's beef industry is based primarily on producing and marketing feeder cattle. "Feeder cattle production starts with cow-calf operations which make up 88 percent of the state's beef operations while the remaining 10 percent are backgrounding or stockering operations" (Neel). Tennessee annually markets more than 750,000 feeder calves to backgrounding operations and feedlots, primarily in the Midwest and High Plains areas of the country (USDA, NASS).

Problem

There are many decisions and questions that face cow-calf producers. However, few are as important as when, where, and how to market or sell their animals. When choosing a method of marketing, producers consider several factors such as: distance to market, market practices, convenience, and sale dates, but they are primarily concerned with the net sale price of their animals. There are various ways in which producers are able to market animals; however, for the purposes of this study, the focus will be on traditional local weekly auction markets throughout Tennessee and non-traditional auctions, specifically the Tennessee Livestock Producers (TLP) Lower Middle Tennessee Cattle Association Video Board Sale held in Columbia, TN.

Traditional auction markets have evolved to operate in a distinct manner when compared to other marketing methods. Animals sold at these locations are predominantly local due to the

fact that they have to be hauled to the sale site, which creates a logistical and geographical limitation on the animals that are marketed through the sale. Because the producers must haul the animals to market, it is more difficult for them to "no-sale" their animals, they must incur the cost of hauling their animals back to the farm if the price is unsatisfactory. Buyers must also be physically present in order to make bids at the sale. The buyers do not have any previous knowledge of what kind or types of animals will be at the sale. There is very little to no information that is communicated between sellers and buyers about the cattle being sold; therefore, the buyers have no background information on the cattle. Buyers must assess the cattle solely by what they physically see while the cattle are in the sale ring. At these weekly auctions no "official" grading occurs before the animals are sold. Also, these weekly auctions usually sell animals individually or a few head at a time which increases costs per head to buyers, because they purchase or put together truckloads of cattle, which consist of 48,000 to 50,000 lbs.

Non-traditional auctions, as represented by the TLP Video Board Sale, operate in quite a different manner. Sale lots are much larger, consisting mainly of load lots of cattle. In these types of auctions, the animals are not physically present. This decreases the transaction costs because sellers do not incur the cost of hauling animals to the auction site to be marketed. Some sellers, however, may haul their animals to a desired meeting point such as a local auction market to weigh and load their animals onto the buyer's truck. This occurs at a later date after the transaction has transpired. It is also not necessary for buyers to be physically present. Buyers are able to telecommute or place their bids by phone since the auction is broadcast live over the internet. This improved access for buyers may result in a larger number of buyers participating in the sale. The lack of a physical presence of animals is replaced by an extensive amount of background information relating to the cattle being sold. A video representation of each lot of

cattle being sold is usually made two or more weeks before the auction date. Also, a catalog of information on each sale lot is printed in advance of the auction date. Information contained in the catalog includes number, weights, grade, breed, sex, health treatments, nutritional background, weighing conditions, price slides, etc. Instead of having to assess the cattle and bid simultaneously, buyers have a week or two prior to the auction to view both the detailed catalog description and internet video of the lots of cattle.

The advancement of technology has allowed producers the opportunity to choose among different marketing methods. These methods may potentially decrease the amount of risk involved and increase the probability for a higher net sale price received for cattle. Other studies exist on the development of different marketing methods for feeder cattle through advancements in technology (Blank et al. 2006; Turner, Dykes, and McKissick 1991; Bailey, Brorsen, and Peterson 1991). Bailey states in his 1991 article "A Comparison of Video Cattle Auction and Regional Market Prices" that "economic theory suggests that video auction prices may indeed be higher than traditional markets" (465). Video or electronic markets may enable the market to operate more efficiently by reducing transaction costs, resulting in increased prices received by sellers and/or decreased costs to buyers. Research also shows that, in an auction atmosphere, the larger the buyer base, the more competition exists between buyers, which results in a potentially higher sale price (Pate, J., 2005). Therefore, sellers or producers attempt to find the auctions with the largest number of buyers present to improve their chances of receiving a higher sale price for their animals. Non-traditional auctions such as the TLP video board sale allow the opportunity for a national buyer base resulting in the probability of an increased number of buyers participating in the sale.

There is little published information available regarding which method of marketing yields the highest net sale price when comparing traditional and non-traditional markets for feeder cattle in Tennessee. Knowledge of the differences in sales prices would be beneficial to producers, enabling them to make better decisions among different methods of marketing.

With the introduction of electronic and video auctions, producers have the ability to market their animals under specific programs and certifications because they are able to communicate (what is thought to be reliable) information about the animals to potential buyers. This availability of information creates a major difference between video sales and traditional auction markets. In a traditional auction atmosphere, there is an unequal distribution of knowledge about the animals between buyers and sellers. Sellers know about the history, management, health, and perhaps, genetics of the animals, whereas buyers only know what they can see as animals pass through the sale ring. This imbalance of knowledge represents asymmetry of information. Chymis looked specifically at the problem of revaccination due to asymmetric information. Chymis attempted to "present a simple model to show that if buyers do not know and cannot verify whether sellers have vaccinated their animals then they may consider revaccination" (79). When applied to traditional versus non-traditional marketing methods, this leaves open an opportunity for a price premium for increased knowledge or information. Therefore, it is plausible that an increase in information could result in higher prices for quality animals (Chymis).

If increased information has the potential to increase sale price for higher quality cattle, the question of what information producers should include when selling their animals arises. What are the effects on sale price of communicating various types of information? Characteristics of animals, other than grade, weight, and sex, might include genetic background,

health treatments, nutritional regime, source verification, and others. Conditions-of-sale, characteristics such as price slide, pencil shrink, and weighing conditions might be included. It is the purpose of this study to discover which characteristics elicit price premiums for lots of feeder cattle on the TLP Video Board Sale.

Previous research suggests that certain characteristics possessed by groups of cattle cause a price premium while others cause a discount. Preconditioning, health certifications, and age and source verification are examples of characteristics that have been studied (Ward, Lusk, and Dutton 2008; Bulut and Lawrence 2006; Abidoye and Lawrence 2006). However, research also indicates that the premiums paid for these characteristics are obtained only when the animals are marketed through certain channels such as 'graded feeder calf sales' or 'special calf sales' where this information is communicated to buyers (Dhuyvetter 2004). This study will attempt to show if there is a price difference between the two types of markets included in the study and whether that price difference can be attributed to the various physical characteristics of the animals or the various conditions of sale on the TLP Video Board Sale. The knowledge obtained from this research will enable producers to develop improved marketing strategies for the animals in their operations.

Producers desire the highest possible price for their product, especially if they have taken extra steps in managing their animals. This may include items such as health programs, certifications, implants, and supplements. Producers want to ensure that their efforts toward better management will not go unrewarded. The sale price of their animals should reflect the value to the buyer of their effort in management; therefore, their animals should bring a price premium. This is why the decision of where and how to market one's animals is so important to the producer.

Literature Review

The importance of the different characteristics or bundles of characteristics possessed by the cattle or the lot of animals being marketed through either sales channel has been discussed. The idea that cattle are made up of different inputs or characteristics that have varying values to the subsequent owners may be viewed in an hedonic framework. Merriam-Webster defines hedonic as literally meaning of or relating to pleasure and hedonism as the doctrine that pleasure or happiness is the sole or chief good in life. Hedonics attempts to convey the idea that the pleasure or happiness a buyer derives from a good depends on the attributes that good embodies. Hedonics means of or relating to pleasure, but when coupled with the economic concept of utility it can be used to derive the amount of pleasure or utility one receives from a good or product, in this case feeder cattle (Merriam-Webster). It is this collection of embodied characteristics that the gives the good or product utility.

There have been a number of efforts to apply the hedonic framework to agriculture, especially in the beef cattle sector (Ladd and Martin 1976; Buccola 1980). Hedonics have been used to study the characteristics that give utility to goods and, in the beef cattle sector, price premiums (discounts) for feeder cattle (Bailey and Peterson 1991; Faminow and Gum 1986; Schroeder 1988). However, little research has dealt simultaneously with the physical characteristics of the animal, weighing conditions and practices, market conditions, and value added programs, all of which could possibly affect the value of the lot of cattle being marketed. By including these characteristics in a hedonic model, it will be possible to analyze the impact that each characteristic, trait, or practice has on the sale price of an animal or lot of animals.

A brief review of literature will help to provide a basis from which to understand how hedonics can be applied in valuing beef cattle. The literature supporting the concept of hedonic

pricing spans four decades, from the mid 1960's to the present. Lancaster first introduced the idea of hedonic pricing in his 1966 journal article "A New Approach to Consumer Theory" where he states that it is the characteristics of a good that give the good utility, not just the good itself (132,134). This suggests that the value of a particular good is really the sum of the values of the individual characteristics that make up that good. In the case of feeder cattle, the value of a particular pen of feeder cattle is based on the sum of the values of the cattle, lot, and market characteristics. In other words, cattle buyers are buying separate attributes such as: breed, sex, weight, flesh, frame, lot size, days to delivery, shrink, and terms of trade such as weighing conditions as opposed to the whole animal (Feuz et al.).

Rosen's 1974 article continues to refine and build upon Lancaster's original idea of hedonic pricing. Rosen, however, departs from Lancaster on the assumption of indivisibility, in which he suggests that all packages cannot be united and sellers cannot repackage existing products. He also proposes that a single good is able to possess bundles of characteristics. In this line of thinking, Rosen suggests that optimality is achieved by purchasing the brand offering the desired combination of characteristics.

Ladd and Martin's 1976 article was the first research study to relate the concept of hedonics to agriculture, which was done by viewing an input of production as a collection of characteristics. Thus, the value of a feeder animal may be viewed as the values of the collection of characteristics of the animal to the cattle feeding sector.

While Ladd and Martin were the first to relate hedonics to agriculture, Buccola was the first to apply the idea of hedonic pricing to the beef cattle sector. Buccola attempted to explain price differences in feeder cattle value specifically by weight and sex. He found that break-even

price analysis can be used successfully to understand market price differentials between different lots of feeder cattle possessing different characteristics.

Faminow and Gum expand upon Buccola's work by discussing price differences for Arizona feeder cattle in response to price and lot size and a price and weight relationship between steers and heifers. Faminow and Gum believed the model used in their study could be a "useful method of summarizing information to farmers about current market conditions" (162). The intent of their research was to aid the producer in making marketing decisions.

Instead of focusing on just a few traits as previous research had done, Schroeder et al. examined a variety of physical characteristics in relation to the demand for Kansas feeder cattle. The models used in the study enabled Schroeder to incorporate several factors which stratify the data helping to capture the preference of the buyer.

Turner's 1991 article analyzed cattle characteristics and market conditions on three different Georgia teleauctions and examined the fundamental differences between traditional markets and electronic markets. This was the first electronic market study conducted concerning feeder cattle. Turner mentioned the increased flow of information along with pencil shrink and hauling factors in his examination of this particular type of market. Turner's findings show that an increased number of buyers results in an increase in price.

Turner, Dykes, and McKissick's results were confirmed in Bailey and Peterson's 1991 market study where they compared traditional and non-traditional markets to examine the price relationship between the two types of markets. Superior Livestock Auction Company's satellite video marketing method was used as the non-traditional market. One way to test the adequacy of information within a market is to compare price in different markets. The result of the research

supported Turner, Dykes, and McKissick's findings that an increase in information increases net sales price even with a national market such as Superior.

Instead of examining the trait itself, Sy et al. attempted to determine the preference for traits among three different types of Canadian cattle producers: seed stock, cow-calf, and feeders. Their objective was to systematically evaluate the preferences that different segments of the beef cattle system attach to the characteristics of cattle. Sy et al. declared that for cattle breeders to maximize profit they must select animals with traits that are desirable to producers and final consumers. Sy et al.'s findings suggest that different types of producers do not value characteristics the same due to the nature of their businesses.

Brorsen et al. take a slightly different avenue and focus on price slides which have a direct correlation with weight. Weight is arguably the most important characteristic in determining feeder cattle value. A price slide specifies the rate at which the contract price will be reduced when the delivered weight is greater than the estimated average at sale (291). Because feeder cattle weight is critical in determining price, understanding the workings of the price slide is important in analyzing the market price for feeder cattle. Due to the existence of asymmetric information between buyers and sellers Brorsen believes, "contracts need to be structured to provide sellers with an incentive to accurately represent their estimates of average delivery weights" (291). Brorsen et al.'s findings suggest, "larger price slides or lower weight tolerances should be encouraged" (307).

Lawrence and Yeboah took a path similar to that of Brorsen et al. by examining "source verification" as a process that could add value to the animal instead of a particular inherent animal characteristic. They found that the traditional market did not reward the producer's effort for quality cattle, such as source verification (SV) programs. Therefore, to receive a price

premium, the SV animals needed to be marketed through 'special sales' such as graded sales. They could not confidently conclude that the premium was paid solely for SV rather than the entire Iowa-Missouri Beef Improvement Organization (IMBIO) Source Verification program.

Another research paper that focuses on cattle characteristics and also uses the hedonic pricing method is Ouma, Abdulai, and Drucker's work, "Measuring Heterogeneous Preferences for Cattle Traits Among Cattle-Keeping Households in East Africa." This work relates closely to Sy et al.'s study in that it focuses on farmers' preferences in terms of the utility they receive from various cattle traits. However, Ouma, Abdulai, and Drucker attempted to derive the economic values for cattle traits in East Africa (Kenya and Ethiopia) using the choice model approach. The research attempted to explain why there is a difference in traits desired by farmers and traits that are valuable in the product market system.

The most recent article that utilizes hedonics in the beef sector is Ward, Lusk, and Dutton's work on valuing attributes of retail beef products. Ward, Lusk, and Dutton attempt to "identify the value consumers place on observable characteristics of fresh beef products," by viewing retail beef products as multi-attribute or bundled goods (364). These characteristics included quality indicators such as product type, packaging type, specialty labels and store type. Ward concluded that most of the variables used in the study influenced retail beef prices or the value consumers placed on those observable characteristics.

Objective

The application of hedonic methodology to analyze feeder cattle prices on video board sales or to estimate differences between types of markets in Tennessee. The purpose of this study is to help fill that void. This project has four main objectives: 1) to provide estimates of the price

effects of various types of information that are provided by the sellers participating in board sales, 2) to provide estimates of the effects on sale price of various conditions of sale specified by sellers participating in board sales, 3) to provide estimates of the price differences between video board sales and traditional weekly auction markets for feeder cattle in Tennessee, and 4) to identify the sources of the price differences between the two market types.

Chapter II

Methods

Conceptual Framework

This study utilizes one main concept, the hedonic pricing model. The framework for the hedonic pricing model is based on the idea that it is the characteristics of a good that give the good utility (Lancaster). Each good can be viewed as a bundle of characteristics each of which has utility. The good derives its utility based on the amount of each characteristic contained in the good and the amount of utility associated with each unit of the characteristic. The concept can be extended to goods that are purchased as inputs for further production (Ladd and Martin). This idea applies to feeder cattle that are purchased for the different traits they possess that can be used in further developing the animals for eventual slaughter.

Hedonic pricing analysis typically utilizes multiple regression to estimate the effect of product attributes on the product's price. The dependent variable in the regression is the product's price, while predictors or independent variables measure the presence and extent of different product attributes. For example, a specific sex, grade, weight, breed, health program, feed price and fed cattle futures price translates into a feeder cattle price.

The price of a good depends on the characteristics that make up the good (internal characteristics) and the outside characteristics (external factors) that have an influence on the good, such as market conditions and other input and output prices. Traits can be singular, but more often than not they are 'bundled'. This means that a good can possess more than one trait; goods are able to have more than one set of traits (Rosen). This concept can be applied to all goods. Buccola was the first to apply hedonics to beef cattle. A beef animal is made up of numerous inputs and characteristics and it is these characteristics, or lack thereof, that give the

animal its value. The buyer is purchasing not only the physical attributes of the animal, but also the management practices that were applied to the animal. Physical traits of the animal may be obvious: gender, weight, muscling, frame size, etc; however, management traits are not as easily observed. These may include health programs applied to the animal, implants, vaccinations, weaning date, injection locations, genetic background, and prior feeding regime.

When animals are sold at the traditional local auction barn, buyers are bidding on what they see of the animal, which are only the obvious physical traits. There is a lack of reliable background information communicated on the cattle to the buyer. This asymmetry of information exists due to the nature of the traditional auctions.

Graded sales, and more recently, video sales have begun to take the steps necessary to counteract the problem of asymmetric information. These types of sales provide the needed background information that cannot be gathered by physically viewing the animal. Markets evolve to capture potential opportunities. The fundamentals of capitalism suggest that when a niche presents itself, an entity takes the risk and enters the market to take advantage of that opportunity; thus the development of non-traditional 'special' sales.

This study, under the framework of the hedonic pricing model, will show which method of marketing results in higher prices for the seller while showing which traits or characteristics of the cattle and conditions of sale garner a price premium. This information would give Tennessee producers, those producers who market through the TLP video board sale, or those who participate in graded or other special sales in Tennessee the knowledge of how to better manage and market their animals to receive higher prices.

Basic Model of Attributes Influencing Price on TLP Sale (Model I)

The market for feeder cattle determines prices through the interaction of supply and demand (Schroeder et al. 1988). The demand for specific lots of feeder cattle will be influenced by several different traits and characteristics of the animals along with market conditions and the conditions of sale for those lots. This suggests, according to both Schroeder et al. and Buccola, that feeder cattle prices should be a function of the physical characteristics (C) of cattle in the lot and the market conditions (M) associated with that particular sale. V represents the value of each specific trait, while R is the price effect of the respective market condition. Schroeder et al.'s equation is as follows:

1) $$\text{Price}_{it} = \sum_{k} V_{ikt} C_{ikt} + \sum_{h} R_{ht} M_{ht}$$

where i refers to the lot of cattle, k refers to specific animal trait, h refers to market influence and *t* represents the transaction date. The following equation borrows from Schroeder et al.'s model but includes a summation term specifying the conditions of sale for the particular lot of animals being sold:

2) $$P_{it} = \sum_{j} V_{jt} C_{ij} + \sum_{k} W_{kt} S_{ik} + \sum_{h} R_{h} M_{ht} + \varepsilon_i$$

where:

P_{it} refers to sale price of the i^{th} lot in time period t in dollars per hundredweight,

V_{jt} refers to value of the j^{th} characteristic in time period t,

C_{ij} refers to the level of the j^{th} characteristic in lot i,

W_{kt} refers to the price effect of the k^{th} condition of sale in time t,

S_{ik} refers to the level of the k^{th} condition of sale for the i^{th} lot,

R_h refers to the price effect of market condition h,

M_{ht} represents the level of market condition h in time period t, and

ε_i represents the random error term.

As indicated in equation 2, the independent variables involved in this study can be grouped into three categories: animal characteristics, conditions of sale, and market conditions associated with that particular sale. The following is a brief description of the variables and their hypothesized signs (Table 1 lists the name, description, and hypothesized sign of each variable).

Animal Characteristics

Animal characteristics variables represent attributes that are either inherent in the animals or embodied in the animals by the seller. Characteristics of importance are those that affect value to the buyer.

Gender

Gender is a dummy variable and specifies whether the lot is made up of steers (value = 1) or heifers (value = 0). Bulls were not included because in-tact bulls are not typically sold in special video or graded sales. It was hypothesized that this variable would have a positive sign because steers are more efficient than heifers in feeding programs.

Mixed Lot

Mixed lot is a dummy variable that specifies whether the lot contains one gender (value = 0) (steer or heifer) or a mixture of both genders in the same lot (value = 1). The mixed lots of steers and heifers would actually be priced as two separate lots during the auction; however they would be sold together meaning that both 'lots' must be loaded at the same time. This was

usually done by the seller in order to put together a truckload of animals. It was hypothesized that this variable would have a negative sign because buyers prefer lots and loads with as much uniformity as possible.

Lot Size

Lot size (number of animals in the lot) was hypothesized to have a positive sign because more animals in a lot mean fewer lots are needed to comprise a truckload. The natural logarithm of number of head was used because a linear form was not believed to correctly represent the relationship between number of head and price. A linear representation would imply that the increase in price as number of head increased from two to four would be the same as when the number of head increased from 62 to 64. The natural logarithm results in a non-linear relationship in which price per hundredweight increases at a decreasing rate.

Frame Size and Muscle Score

The frame and muscle set of variables consists of three proportion variables that indicate the percentage of animals of each United States Department of Agriculture (USDA) frame and muscle scoring group in each lot. The Medium and Large number 1 muscling category was used as the base or reference category. It was hypothesized that all of the other variables, Medium and Large number 2's, Medium and Large number 3's, and Small number 1's would have negative signs because they are typically less efficient in producing value in the feedlot than are larger framed, heavier muscled cattle.

Flesh

Flesh was a continuous variable based on the scale with which the USDA measures flesh or fat cover, a scale that ranges from 1 to 10. The amount of flesh or fat cover an animal showed was hypothesized to have a negative effect on price because flesh lessens the animal's propensity to gain weight efficiently and flesh or fat is not as valuable as muscle and frame in the feedlot or other stages of the production process.

Weight

Weight of a feeder animal typically has a negative effect on price per hundredweight. However, the relationship is nonlinear with price decreasing at a decreasing rate as weight increases. The weight variable was entered as the reciprocal of weight and the sign was hypothesized to be positive. The reciprocal provides the appropriate functional form while using only a single degree of freedom.

Weight Range

The range of animal weight in the lot is calculated as the weight of the heaviest animal less the weight of the lightest animal. The weight range sign was hypothesized to be negative because the wider the weight range the less uniform that lot is. This would result in a lower price for the lot.

Breed

Breeds are represented by a set of proportion variables that indicate the percentage of animals of each breed that make up the lot. The black and black baldy category is omitted because it was used as the base or reference. It was hypothesized that all other breeds: red and

red baldy, Charolais cross, Hereford, Simmental cross, and other breed category would possess a negative sign when compared to the reference category due to the desirability of black-hided animals for efficiency in the feedlot and expected carcass value.

Ear Coefficient

Typically Brahman cattle are discounted because of insufficient marbling at slaughter and for their tendency to become sick during fall and winter months because of the heat loss through their ears. Northern feedlots usually do not prefer Brahman influenced cattle for this reason. Brahman breeding was represented by a continuous variable consisting of a decimal showing the percent of "ear" or percent of Brahman breeding present in the lot. This percent was calculated by taking the percent of "ear" that the animals showed and multiplying it by the percent of animals in the lot that showed ear. It was hypothesized that this variable would have a negative sign. The increased amount of ear is an indication that there is an increased Brahman influence in the cattle.

Health Program

The health program variable is a dummy variable with a value of 1 if the cattle were subjected to a health management program and 0 otherwise. The hypothesized sign for this variable was positive because the application of a health program shows that steps have been taken to help improve the animals' health. Health program does not represent a single particular program, but rather the assurance that some specific health management protocol was applied.

Horns

Horns is a dummy variable for the presence of animals with horns in the lot (1 indicates horns and 0 indicates no horns). It was hypothesized that the presence of horns would have a negative effect on price due to the fact that animals with horns might injure other animals in the feedlot and dehorning heavier weight animals causes increased stress and hinders the animal's daily gain.

Pinkeye

The pinkeye variable is a dummy variable, 0 indicating no presence of scaring from pinkeye and 1 indicating scaring from pinkeye. Pinkeye was hypothesized to have a negative sign because it could indicate blindness in that eye and loss of efficiency in the feedlot.

Supplement

The supplement variable is a dummy variable showing whether the lot of animals was exposed to any form of supplemental (protein concentrates) feeding besides forage (grass and hay). The value of the variable is 1 if supplement was fed and 0 if it was not. The hypothesized sign for this variable was positive because animals fed concentrates are already able to eat from a feed bunk and require less adjustment once they reach the feedlot.

Implant

The implant variable is a dummy variable with a value of 1 if the animals have been implanted and 0 if they have not. An implant is a growth hormone implanted in the animal to encourage growth. It was hypothesized that this sign would be positive because the existence of an active implant would encourage more rapid growth.

Home Raised

The home raised variable is a dummy variable with a value of 1 if the animals were born and raised on the seller's farm and 0 otherwise. The sign was hypothesized to be positive because these animals have probably not been exposed to a number of various different pathogens/diseases and may be healthier.

Beef Quality Assurance

The Beef Quality Assurance (BQA) variable is a dummy variable with a value of 1 if the producer marketing the animals has BQA certification and 0 if the producer does not have the certification. It was hypothesized that this variable would have a positive sign because if the seller is BQA certified the animals have been under the care of a producer who has been trained to use best practices in managing feeder animals.

Process Verified Program

The PVP variable is a dummy variable with a value of 1 if the cattle were grown in a Process Verified Program and 0 otherwise. It was hypothesized that this variable would have a positive sign. PVP verification at this time in Tennessee typically means the animals are verified as to age and source. This allows the animals to be exported to countries that require age and source verification.

EID Tags

The electronic identification (EID) tags variable is a dummy variable with a value of 1 if the animals have electronic identification tags or 0 if the animals do not. It was hypothesized that

this variable would have a positive sign because these animals could be traced electronically back to a specific producer.

Conditions of Sale

Conditions of sale variables represent merchandising methods specified by the seller intended to affect the desirability of the cattle. Some conditions may be encouraged or promoted by the marketing agency.

Weighing Conditions

Weighing conditions for cattle were represented by a set of two dummy variables. Potential options for weighing conditions consisted of the animals being weighed on the truck at a commercial truck scale, on the ground at the farm, or on the ground at some location away from the farm. Each option is represented by a dummy variable that assumes a value of 1 if it applies and 0 otherwise. However, the category of "weighed on the ground at some location away from the farm" is used as the omitted category because it was most common in the data set. When cattle are weighed on the ground away from the farm, they must first be loaded onto a truck, hauled, and unloaded to be weighed. This process involves substantial animal weight shrink. As a result, the price for animals weighed on the ground away from the farm should be higher than for animals weighed by the other two methods. Therefore, it was hypothesized that the coefficients for weighed on the ground at the farm and weighed on the truck would be negative.

Miles Hauled to Weigh

The miles hauled variable is a continuous variable. It represents the distance in miles from the farm (where the animals were loaded if weighed away from the farm) to the point where they were weighed. Thus, this variable is zero if animals are weighed on the farm and greater than zero if animals are weighed by either of the other two methods. It was hypothesized that this variable would have a positive sign because the longer the animals are hauled, the more the animals shrink.

Net Distance

Cattle sold on the TLP sale are at a variety of locations scattered across Tennessee, Western North Carolina, Northern Alabama, Northern Georgia and Southwest Virginia. Cattle located to the east and south are farther from typical feedlot destinations. Net distance is a continuous variable representing the distance the animals were likely hauled from the farm to the feedlot measured in miles. The actual destination of the cattle could not be determined from sale records. Therefore, for the purpose of this study, Garden City, Kansas, was used as the base destination for all cattle sold. This destination was chosen by judgment to represent the variety of actual destinations to calculate net distance. It was hypothesized that this variable would have a negative sign because the farther the animals are hauled the greater the transportation cost. Therefore, the farther the animals are from the feedlot the less the buyer can afford to pay for them.

Price Slide

Price slide is a price discount allowed by the seller if the actual sale weight is a given number of pounds over the estimated weight specified in the sale catalog. It is expressed in cents

per pound. It was hypothesized that this variable would have a positive sign because the greater the price slide the greater the price discount and the higher the price the buyer would be willing to offer.

Weight Tolerance

Weight tolerance is used in conjunction with the price slide. The weight tolerance is the number of pounds actual weight may exceed the estimated weight before the price slide takes effect (usually about 10 lbs.). It was hypothesized that this variable would have a negative sign because the greater the weight tolerance the more actual weight may exceed estimated weight before the price slide (discount) is applied.

Pencil Shrink

Pencil shrink is a percentage of animal weight that is subtracted from actual weight that allows for shrinkage of the animals during transportation and handling. It was represented as a continuous variable that may or may not be allowed by the seller. A larger pencil shrink results in a lower pay weight, other things equal. It was hypothesized that this variable would have a positive sign.

Heavy End

The heavy end variable is a dummy variable that takes on a value of 1 when the seller specifies that the buyer must take the heaviest animals from a large lot to make a 48,000 to 50,000 pound truckload. It was hypothesized that this variable would possess a negative sign because buyers would rather have the option to take lighter weight animals than heavier animals.

Buyer's Choice

The buyer's choice variable is also a dummy variable that takes on a value of 1 when buyers have the option to choose whichever animals they want to take to fill a truckload from a larger group of animals. It was hypothesized that this variable would have a positive sign.

Handling (Before Weighing)

The handling (before weighing) set of variables represents the method by which the animals were gathered for loading and/or weighing. Three methods were indicated in the data set: driven by foot, driven on horseback, and driven on all-terrain vehicle (ATV). Each is represented as a dummy variable. If no information was included in the catalog, all three variables were assigned a 0 value. It was hypothesized that the driven-by-foot variable would have a negative sign, while the driven-by-horses and ATV variables would have positive signs because driving the animals by foot would be less stressful while driving by horses or ATV's would be more stressful. Increased stress on the animals would translate into more shrink resulting in a lower pay weight.

Penned

The penned set of variables represents the various times animals may be gathered and penned. Two times are indicated in the data: penned the night before or penned the morning of transfer. Also, in many cases, sellers provided no information. Penned the morning of transfer was used as the base or reference variable because it was the most common situation. Both no information and penned the night before were hypothesized to have negative signs because by penning the morning of weighing and loading the animals would not have had time to eat and drink and would probably weigh less, other things equal.

Lot Type

The lot set of variables represents the conditions in the lot where the animals are gathered or penned for transfer (weighing/loading). Three options exist: dry lots, lots with hay and water, and lots with feed and water. Also, some sellers provide no information on the lot condition. The dry lot variable was used as the base or reference variable and the other two conditions and sales for which sellers gave no information were hypothesized to have negative signs because animals do not have access to food or water in a dry lot.

Market Conditions

Variables representing conditions in the beef cattle complex/market clearly influence overall price level for feeder cattle. In addition, this may influence the effects of various animal characteristics on animal price.

Corn Futures Price

The corn futures price ($/bu.) variable is a continuous variable that represents the future value of corn for the nearby contract month on the date the TLP sale takes place. Because corn is a major input cost for cattle feeding, it was hypothesized that this variable would have a negative effect on the price of feeder cattle.

Live Cattle Futures Price

The live cattle futures price ($/cwt.) variable is a continuous variable that represents the future value of finished live cattle for the nearby contract month on the date the TLP sale takes place. It was hypothesized that this variable would have a positive effect on the price of feeder cattle.

Weight-by-Corn Price Interaction

As corn prices decline, the price discount for heavier weight feeder cattle increases and as corn prices increase, discounts for weight decrease. This factor was accounted for by including a weight-by-corn price interaction variable. The weight-by-corn price interaction variable is a continuous variable that was constructed by multiplying the estimated average weight of animals (lbs.) in the lot by the nearby corn futures price ($/bu.). It was hypothesized that this variable would have a positive sign because as corn prices increase, heavier feeder cattle are discounted less and vice versa. With high corn prices and high cost of gain, feedlots prefer to purchase heavier weight animals than to place weight on those animals in the feedlot.

Weight-by-Live Cattle Price Interaction

Assuming that the cost of weight gain in the feedlot is constant, the discount for heavier feeder cattle increases as live cattle price increases because buyers of feeder cattle (feedlots) will prefer lighter weight cattle because the margin of placing weight on cattle is greater. The weight-by-live cattle price interaction variable is a continuous variable that was calculated by multiplying the estimated average weight of the lot (lbs.) by the nearby live cattle futures price ($/cwt.). It was hypothesized that this variable would have a negative sign. Ultimately, all other things held constant (corn prices), as live cattle prices increase, it becomes more profitable for feedlots to purchase light weight animals and place weight on those animals which increases the weight discount (Adams et al.).

Weight-by-Season Interaction

The set of two weight-by-season interaction variables are continuous variables that are designed to account for the fact that heavier weight cattle are discounted less in the fall and more

in the spring (McLemore, Rawls, and Wells). The spring variable takes on the value of the estimated average weight of the lot during spring (February, March, April, and May), while the fall variable takes on the value of the estimated average weight of the lot during fall (August, September, October, and November). Both spring and fall variables are 0 otherwise. The seasonal price pattern for lighter weight (400 to 600 lbs.) cattle in Tennessee (lower in the fall and higher in the spring) is well-documented (Rawls). This pattern is consistent with the large numbers of freshly-weaned feeder cattle that come to market in the fall due to the predominance of winter-spring calving seasons and the slump in forage production anticipated for winter. In the spring, light cattle are in heavy demand to utilize spring forage growth. The majority of cattle on the TLP sale are heavier. Heavier cattle (yearlings, 600 to 800 lbs.) are less plentiful in the fall and are not in strong demand for spring grazing due to their size. So, the seasonal price pattern for lighter feeder cattle is different from that for heavier feeder cattle. As a result, the hypothesized sign of the weight-by-spring variable is negative while the hypothesized sign for the weight-by-fall variable is positive.

Model of Price Differences between TLP and Traditional Auctions (Model II)

Knowing which animal characteristics and conditions of sale add value to the lot of animals and which ones discount those lots is vital information for producers. However, knowing whether the TLP video sale produces higher prices on average than traditional auction markets within Tennessee would allow producers to make marketing decisions that would enable them to receive higher prices for their product. The model described in this section will show the differences in prices for similar cattle sold on the TLP video board sale and traditional auction markets in Tennessee in the same time period as a function of the various animal characteristics

and conditions of sale associated with each TLP lot. This model will provide estimates of how animal characteristics and conditions of sale affect the difference in prices on the two types of markets. The model that expresses this relationship is:

3) $$D_{it} = \sum_{j} V_{jt} C_{ij} + \sum_{k} W_{kt} S_{ik} + \varepsilon_i$$

The symbols are the same as those defined earlier in equation (2), except that the term representing sale price, (P_{it}), is replaced and market conditions, $\Sigma R_h M_{ht}$, is deleted. In this equation, sale price is replaced by D_{it} which refers to the ratio between the sale price on the TLP video board sale for the i^{th} lot and the average price for cattle of the same gender, grade and weight on Tennessee's traditional auction markets in time period t. The market condition summation term, $\Sigma R_h M_{ht}$, was deleted from this equation because the general market conditions will be the same for both the video board sale and the traditional auction in the t^{th} time period; therefore it should have no effect on the price ratio. In addition, the animal characteristics, $C_{ij,}$ in equation (3) will not include those physical animal characteristics that are accounted for in the weekly reports of the traditional auction market data: weight, frame size, muscle score, and sex because they are common to the price observations on both markets.

Data

The two types of markets chosen for this study were referred to earlier as traditional and non-traditional markets due to the manner in which they conduct transactions. Traditional markets are those local auction markets where sellers physically bring each animal they want to sell and buyers competitively bid on the animals as the animals move through the auction ring

(Pate, J., 2005). Animals typically are sold individually or in small groups (McLemore, Rawls, and Wells).

Non-traditional markets are those that differ in some significant way from the traditional markets. In this study, the difference lies in the primary media with which the auction is held, attending in person with cattle present versus viewing over the internet, satellite, cable television, or catalog. The additional information available to buyers from the video and catalog in advance of the sale and the larger sale lots represent major motivations for buyers to pay more for cattle on the video sale.

Non-traditional markets were represented by the Lower Middle Tennessee Cattle Association Video Board Sale that is conducted by the Tennessee Livestock Producers (TLP) organization. These particular auctions take place in Columbia, Tennessee, on the first Friday of each month except for February and July, which for Tennessee and the Southeast are months that usually hold extreme weather. Also there are usually fewer or lighter volumes of cattle being marketed during these months. The data set from the TLP video sales spans 12 years, from 1996-2007. There were 3131 usable observations on lots of cattle sold during the period.

The data from the TLP video board sales were obtained from the sale catalogs for each sale. The sale price information from the TLP sales was recorded by an Extension Farm Management Specialist present at each sale.

The information provided in the catalogs of this non-traditional sale gives a detailed account of the lot of cattle that the seller is making available for sale. This allows buyers information on the background of a potential lot of animals they may purchase, which is a considerable increase in the amount of information above that available at a traditional auction. This additional information describes the attributes of the animals such as gender and breed and

various management practices and weighing conditions. All of these pieces of information, according to previous research, (McLemore, Rawls, and Wells 1993; Lalman and Ward 2003; and Dhuyvetter 2004) possess the potential to influence the price buyers are willing to pay for a lot of cattle.

This study's comparison between traditional and nontraditional markets uses the Tennessee auction market average price for the particular week of the TLP sale as a basis from which to make the comparison. The traditional markets are represented by the weekly state average price for feeder cattle on 11 traditional auctions across Tennessee obtained from the National Agricultural Statistics Service office in Nashville. Prices were available for 1996 through 2007 to match the TLP video sale data. Prices are quoted in dollars per hundredweight by frame, muscling, weight and gender. This establishes a set of prices for the traditional market, which allows this study to measure the difference between the traditional auction and the non-traditional TLP market.

This study will not only focus on comparing the two types of markets, but will also examine the price effects of various traits of the animals and different characteristics of the terms or conditions of sale. These results should reveal which characteristics and conditions add to or reduce the difference between the TLP and traditional markets. A study of this nature has not been conducted in Tennessee using this type of detailed information that covers more than a decade of observations, analyzing a considerable number of various cattle characteristics and market conditions. The futures prices data used in this study were obtained from the Chicago Mercantile Exchange (CME).

Analysis

This research utilized Statistical Analysis System (SAS) software for the statistical analysis of two different equations (Model I and Model II) to accomplish the goals of the study. These two equations were estimated using ordinary least squares with the Reg procedure in SAS. Descriptive statistics for variables included in the study can be found in Table 2.

Model I

As discussed earlier, model I (equation 2) was developed to estimate the implicit values of the various animal attributes and conditions of sale on the TLP video board sale. The dependent variable was the sale price ($/cwt.) for each lot sold over the 12-year period. In order to eliminate or reduce the effects of changes in the general level of cattle prices over the period, the raw price was divided by the annual average of the raw price for each year. This procedure transformed the raw price into an index which should be comparable over the entire period for which data were collected. With the use of this indexed dependent variable, the estimated coefficients from the equation become the implicit effects of the particular independent variables on the index. These effects should be interpreted as percentage changes in the raw prices on the TLP sale.

Model II

The purpose of model II (equation 3) was to estimate the average price difference between the TLP sale and the Tennessee auction market average and to estimate the effects of information on various animal attributes and conditions of sale on the price difference. The dependent variable was the ratio of the raw price for a lot sold on the TLP sale to the auction market average price for the state in the same week for cattle of the same gender, weight, frame

and muscling. Because most of the lots of cattle sold on the TLP sale were mixed as to frame and muscle scores, the prices from the state auction market average were weighted by the percentage of animals in each grade classification in the TLP lot. For example, if the TLP lot consisted of 90 percent medium and large number 1 cattle and 10 percent medium and large number 2 cattle, the auction market average price for medium and large number 1's was multiplied by 0.9 and the price for medium and large number 2's was multiplied by 0.1 to comprise the auction market average price. This procedure should result in a more accurate comparison of the prices between the two markets by making the prices for the two types of markets more comparable.

Multicollinearity

Both models estimated in the study contain a relatively large number of independent variables (47 variables for model I and 36 variables for model II). This large number of regressors raises the likelihood that multicollinearity will be a serious problem in the estimation of regression coefficients. For each equation, the optional tests for multicollinearity available in the Reg procedure in SAS were utilized. Tests on each equation will be discussed in the Results section of the thesis. However, overall, problems detected were relatively minor.

Chapter III

Results

Two models were utilized to accomplish the goals of this study. The first (model I) specified the sale price on the TLP video board sale as a function of the various animal characteristics, conditions of sale, and market conditions associated with each transaction. Estimation of the parameters of this model will yield the implicit market values of each of the independent variables on the TLP sale. In order to remove the effects of annual variations in price levels from the analysis, each TLP sale price was indexed by dividing it by the annual average TLP sale price.

The second model (model II) specified the ratio of the TLP video board sale price to the traditional weekly auction market average price for the state as a function of a smaller set of animal characteristics and conditions of sale associated with each transaction. Estimation of the parameters of this second model will yield the effects of each of the independent variables on the TLP video board sale price relative to the traditional auction market average price for similar cattle during the week of the TLP sale. Estimated parameters from model II may be interpreted as measures of the contributions of each of the independent variables to the difference between the prices on the two types of markets. That is, a positive sign on an independent variable implies that an increase in the variable value increases the TLP price relative to the auction market average price.

The parameters of both models were estimated using ordinary least squares regression. The results are presented in the sections that follow. Slightly less than half of the coefficients on the independent variables in the two equations were statistically significant at the .05 level or higher. Overall, the results of the estimations were consistent with hypotheses about the signs of

the independent variables. However, there were several variables with signs that contradicted stated hypotheses and seemed to contradict conventional wisdom. Explanations for these signs are somewhat difficult.

Model I

Table 3 gives the variable names, parameter estimates, standard errors, level of significance, and variance inflation factors for variables included in model I. Estimation of model I included 3131 observations and 47 independent variables. The resulting R-square was .4822. The F value for the regression was 61.07, significant at the .0001 level. Specific results related to each product attribute are discussed in turn.

Animal Characteristics

Animal characteristics variables represent attributes that are either inherent in the animals or embodied in the animals by the seller. Characteristics of importance are those that affect value to the buyer.

Gender

As expected, the gender of the lot proved to be a significant variable in explaining price. The estimated parameter on the gender variable was significantly different from 0 at the .01 level of significance. Steers showed a price premium over heifers of 7.67 percent per hundredweight. These results are supported by previous research from Barham and Troxel and Lawrence and Yeboah that found heifers were discounted in relation to steers and this was statistically significant at the .01 level. Signs, significance, and coefficients were similar to those obtained by McLemore, Rawls, and Wells. and Turner, McKissick, and Dykes.

Mixed Lots

Selling cattle in mixed lots, containing both steers and heifers, proved to be a less desirable method of marketing animals because those lots received a lower sale price. The mixed lot variable was significant at the .01 level with those lots being discounted 1.47 percent per hundredweight. These results contradict the findings of Bailey and Peterson who found that, "no significant difference in price was found between lots that were sorted and unsorted by sex at the video auction" (1991).

Lot Size

Lot size as represented by the natural logarithm of number of head in the lot was, as expected, significant at the .01 level and positive. As the number of head increases, the sale price per hundredweight increases at a decreasing rate. For example, with an estimated coefficient of .0156, an increase in lot size from 10 to 20 head would increase price per hundredweight by 1.08 percent, while an increase from 30 to 40 head would increase price by .45 percent, and an increase from 50 to 60 head would increase price by only .28 percent. The findings of this research agree with previous research such as Barham and Troxel in that "a financial advantage (exists) for marketing calves in groups as opposed to marketing them as individuals" (3436). Lawrence and Yeboah go a step further by stating that, "buyers generally prefer larger lot sizes that can fill either a truckload or half a truckload, and they may bid higher for larger lot sizes" (126). The signs and significance were similar to the findings of Turner, Dykes and McKissick, Faminow and Gum, McLemore, Rawls, and Wells and Schroeder et al.

Frame Size and Muscle Score

The frame size and muscling score variables all proved to be highly significant and have negative signs when compared to the base or reference variable of Medium and Large number 1's, as hypothesized. Medium and Large number 3's and Small number 2's carried much larger discounts, 17.01 and 18.09 percent per hundredweight, respectively, than did Medium and Large number 2's at 6.99 percent. This shows a buyer's preference for larger framed heavily muscled animals. The Medium and Large number 2's and Small number 1's were significant at the .01 level while the Medium and Large number 3's were significant at the .05 level. These findings are similar to those of Schroeder et al., Barham and Troxel, and McLemore, Rawls, and Wells.

Flesh

The flesh variable (scale of 1 to 10 with higher numbers indicating more flesh) was also highly significant at the .01 level and negative as hypothesized. The more flesh an animal showed the more it was discounted (1.39 percent per unit of flesh score) because the more flesh an animal possesses the lower its efficiency in gaining weight. In other words, buyers would rather purchase muscle and skeleton than fat. This is supported by previous research from Schroeder et al. and Barham and Troxel who found that "buyers tend to prefer cattle that are slightly thin, hoping to take advantage of compensatory gain" (3439).

Weight

The estimated weight variable represented by the reciprocal of estimated weight was, as expected, positive and significant at the .01 level. The effect of weight on price was consistent with previous research in that as weight increases price decreases at a decreasing rate. For example, an increase in an animal's weight from 400 to 500 pounds would decrease price per

hundredweight by 6.1 percent, while an increase from 500 to 600 pounds would decrease price by 4.1 percent, and an increase from 600 to 700 would decrease price by 2.9 percent. These results show that as weight increases price decreases at a decreasing rate. Schroeder et al.'s. findings showed that weight had a nonlinear impact on feeder cattle prices and as a general rule, price declined as weight increased (75). This is supported by the findings of McLemore, Rawls, and Wells. Bulut and Lawrence found that as weight increases price decreases but at a decreasing rate. This is the reasoning behind this study's use of the reciprocal of estimated weight. Weight and weight squared results in a parabola whereas the reciprocal is a hyperbola. The parabola will eventually turn back up (decreases, then at some point increases) whereas the hyperbola approaches/decreases asymptotically. There is no evidence that the price weight relationship would change or turn and increase at some reasonable heavier weight. Also, use of the reciprocal conserves degrees of freedom and lessens the multicollinearity problem.

Weight range was highly significant at the .01 level and had a negative sign as hypothesized indicating a discount of 0.01 percent per hundredweight for each pound increase in weight range. The weight range variable was negative because the wider the weight range the greater the discount on the lot. A wider weight range usually signals less uniformity in the lot which results in a discounted price.

Breed

All breeds proved to have negative signs when compared to the black and black baldy base; however, only one of the five being compared was statistically significant. That variable was the Charolais cross category which was significant at the .01 level with a price discount of 1.50 percent per hundredweight. The results of this study disagree with those of Barham and

Troxel, Brown and Morgan, and Smith, Gill and Bess in that all showed black hided animals to hold a price premium over other breeds. In the current study only Charolais cross showed significantly lower prices.

The ear coefficient, indicating the degree of Brahman influence, carried the hypothesized negative sign. However, it was not statistically significant at the .05 level.

Health

The health of an animal is of the utmost importance to both producers and buyers alike. A sick animal incurs treatment costs and still may die. The application of a health program of some type was significant at the .05 level and held a price premium of 1.42 percent per hundredweight. The results of a price premium for a health program agree with those of Bailey who indicated "buyers should be willing to pay a higher price for healthy cattle than for severely stressed cattle" (466).

Pinkeye was not statistically significant, but it had a positive sign, opposite to the hypothesized sign. Again, there is not an obvious reason for animals with pinkeye scarring to elicit a price premium.

Management

There are a number of different management and marketing practices that individual producers may apply to their operation. This section of the study focused on supplemental feeding, hormone implants, home raised animals and animals with horns. None of these variables proved to be statistically significant. Though not statistically significant, supplement possessed an unexpected negative sign. This contradicted the expected hypothesized sign. However, the counterintuitive sign may be logical. Buyers of feeder cattle purchase an animal (or lot of

animals) based on that animal's or lot's propensity to gain. If the animal has already been placed on some form of protein supplement at some point in its life, that animals' propensity to further gain has been decreased. In other words, with an animal that has been supplemented, the buyer is placing a lower bid on that lot because the efficiency of weight gain in the feedlot will be lower. It is also probable that supplemented animals could possibly possess more flesh than those lots that were not supplemented. This would also explain the negative sign.

Home raised animals were hypothesized to have a positive sign; however, the results suggest otherwise although the coefficient is not statistically significant. The negative sign may be due to those animals' seclusion or lack of contact with other animals throughout their existence. Therefore, they are not 'tough' or thrifty in the sense that they have not been exposed to pathogens outside their herd. This contradicts the idea of F.M. Pate that cattle bought directly from the farm tend to fewer health problems than cattle sold at regional auctions.

Horns possessed a positive sign which was contradictory to that hypothesized, but it was not statistically significant. No explanation could be given to explain why horns could have a positive influence on price.

Certification and Verification

Certifications and verification programs are a means for producers to market and differentiate their product. BQA certification, EID tags, and PVP verification were examined in this study. None of these variables were statistically significant. Both EID tags and PVP variables were positive, as hypothesized. The lack of statistical significance was rather surprising in view of the recent emphasis on for animal identification and source verification stemming from the bovine spongiform encephalopathy (BSE) scare.

The BQA certification variable showed a negative sign which was different from the hypothesized sign. BQA certification's negative sign may result from the greater possibility that producers who are BQA certified would also incorporate some type of supplemental feeding into their program.

Conditions of Sale

Conditions of sale variables represent merchandising methods specified by the seller intended to affect the desirability of the cattle. Some conditions may be encouraged or promoted by the marketing agency.

Weighing Conditions

With weight being the major factor in valuing cattle, producers may be concerned with conditions relating to how their animals are weighed because those conditions affect pay weight. None of the weighing condition variables evaluated in this study were statistically significant at the .05 level. Animals were weighed either on the ground at the farm, on the ground away from the farm, or on the truck. Both weighed on the ground at the farm and weighed on the truck had negative signs, as hypothesized, when compared to on the ground away from the farm. This was hypothesized to be the case because buyers would prefer animals to be weighed on the ground away from the farm. This would mean the animals were handled twice, causing more stress resulting in increased shrinkage.

The miles hauled variable (distance the animals are hauled before they are weighed) was not significant. However, it did possess a positive sign as hypothesized, meaning the further the animals were hauled the greater the price premium due to the amount of shrink that the animals experienced.

Net Distance

The net distance variable (distance from farm to feedlot or destination) was significant at the .01 level and possessed a negative sign as hypothesized. This variable indicated a price discount of 0.003 percent per hundredweight per mile. The farther the animals are located away from the feedlots, the higher the transportation costs, resulting in a lower sale price.

Weighing

Price slide and weight tolerance are merchandising tools that are used extensively in making a lot of feeder cattle more attractive to buyers. Price slide (negative sign) and weight tolerance (positive sign) were both significant at the .01 level. However, their signs did not match the hypothesized signs. This result is counter to logic and is unexplained.

Pencil Shrink

The percentage pencil shrink allowed by the seller was not statistically significant in affecting price. The coefficient showed the hypothesized positive sign.

Stipulations

Sellers may place stipulations in the catalogs that pertain to the animals the buyer must take or choose from a group. Some sellers require buyers to take the heaviest animals from a group first in order to make a load; this is referred to as ‘off the heavy end’. Other sellers allow the buyer to choose which animals they would like to take; this is referred to as ‘buyer’s choice’. The base used here is the assumption that the buyer takes all of the animals in the groups. Neither of these variables proved to be significant, but their signs matched the hypothesized signs. The heavy end variable was negative, while the buyer’s choice was positive.

Handling (Before Weighing)

Before the animals are weighed and loaded they must be handled or driven together and penned in some type of lot or holding area. Depending on the preference of the producer, animals may be driven by foot, on horses or on all-terrain vehicles (ATV). None of these variables were statistically significant. However, the foot and ATV categories were as hypothesized negative and positive, respectively, compared to the omitted "no information" category. If they were driven by foot or by horse the sign was negative because this usually implies a low impact handling method. The horses category was less negative than the foot category indicating a slightly more stressful method. Using an ATV tends to agitate the animals more causing more stress.

Penned

The amount of time the animals are penned or held before weighing and/or loading also has an impact on shrink and sale price. The information in the catalogs categorizes cattle as either penned the morning of pick up or the night before, and if there is no mention, it was categorized as "no information" in the data set. Penned the morning of was used as the base because of its prevalence in the data set. The "no information" variable was not significant, but penned the night before was highly significant at the .01 level and had a positive sign. This sign was contradictory to the hypothesized sign. This variable held a 2.01 percent per hundredweight price premium. The rationale for this discrepancy may be that these animals are shrunk slightly more due to limited access to feed and water or stressed from being held in unfamiliar surroundings.

Lot Type

The catalog describes the way in which the animals are held by categorizing them as kept in a dry lot, in a lot with hay and water, in a lot with feed and water, or no information. The dry lot category was used as the base or reference variable because it was the most common category in the data set. None of these variables were statistically significant; however, each variable's sign coincided with the hypothesized signs, negative. This is consistent with conventional wisdom. Animals held in a dry lot do not have access to feed or water and tend to shrink. The other categories have the potential to cause the animals to become full.

Market Conditions

Variables representing conditions in the beef cattle complex/market clearly influence overall price level for feeder cattle. In addition, this may also influence the effects of various animal characteristics on animal price.

Futures Prices

Futures prices for both corn and live cattle proved to be highly significant at the .01 level. Corn futures possessed a strongly negative relationship as hypothesized with a discount of 20.58 percent per dollar increase in corn prices due to the direct relationship with cost of weight gain. This result is consistent with the research from Kansas State that showed increases in corn futures to reduce feeder cattle prices by $36.56 per hundredweight (Dhuyvetter, Prevatt, and Schroeder). As corn prices increase so does the feedlot's cost of gain because corn is the main energy source for feeding cattle.

Live cattle futures showed a positive effect as hypothesized, carrying a price premium of 1.12 percent per dollar increase in futures. This effect reflects feedlots' anticipation of an opportunity to profit from the higher live cattle futures prices.

Weight-by-Futures Price

Two interaction terms were used to show the effect of the relationship between feeder cattle prices and 1) estimated weight and corn futures prices and 2) estimated weight and live cattle futures prices. The weight-by-corn interaction was hypothesized to be positive because when corn prices increase, the discount on weight is lessened. Feedlots are able to purchase weight relatively cheaper when corn prices are higher than they can place weight on the animal at the feedlot. Thus, sale price increases as the interaction term increases. This variable was significant at the .01 level and carries a positive price effect of .02 percent per hundredweight. That is, when the weight-by-corn interaction term increases by one unit, feeder cattle prices increase by .02 percent.

The weight-by-live cattle futures interaction term was hypothesized to be negative. When live cattle prices increase, the discount on weight increases. The variable was significant at the .01 level and carried a negative sign. With fixed corn prices, as live cattle prices increase, the weight discount increases because it becomes more profitable for the feedlot to place weight on the animal than to buy it. Feedlots are able to increase their net revenue by purchasing lighter weight animals and feeding them out due to the low cost of gain compared to final product price.

Weight-by-Season

Two interaction terms were used to show the price effect of the relationship between weight and season; these included weight-by-spring and weight-by-fall interaction terms. It was

hypothesized that cattle marketed in the spring would have a negative sign and cattle sold in the fall would have a positive sign. The results of the regression showed that cattle marketed in the spring had a negative sign and cattle sold in the fall had a positive sign. Both variables were significant at the .01 level. The weight-by-spring variable held a price discount of 0.004 percent per hundredweight for cattle sold in February, March, April, and May. That is, for each one pound increase in weight for animals sold during the 'spring' months, there is a price discount of 0.004 percent per hundredweight. The weight-by-fall variable held a price premium of 0.002 percent per hundredweight for cattle sold in August, September, October, and November. That is, for each pound increase in weight for animals sold during the 'winter' months, there is a price premium of 0.002 percent per hundredweight. This result seems to contradict the conventional seasonal pattern of higher feeder cattle prices in the spring and lower prices in the fall for lighter weight cattle (Rawls). The seasonal price pattern for lighter weight cattle on traditional auction markets is based on: a) the existence of heavy runs of winter and spring-born calves that weigh 400-600 lbs. in the fall, resulting in lower prices, and b) the development of grass growth in the spring, resulting in higher demand and higher prices for light cattle suitable for grazing. The TLP sale is dominated by heavier cattle (600-800 lbs.) that are not plentiful in the fall, resulting in higher prices, and that are not ideally suited for grazing in the spring, resulting in lower prices. In addition, the value of weight is greater going into winter months when feed is more expensive and less going into the spring months when feed is less expensive. The results of this study are consistent with the fact that heavier weights are discounted less in the fall and more in the spring given the predominant negative relationship between weight and price per hundredweight.

Multicollinearity in Model I

When a regression equation has a large number of variables, such as this one (47), multicollinearity usually tends to be problematic. The variance inflation factor (vif) and collinearity diagnostics (collin) in SAS were used to test for multicollinearity. The tests revealed five variables whose variance inflation factors were high. According to Judge et al. the general rule is variance inflation factors greater than 5 may be of concern (869). Those five variables were: reciprocal of estimated weight, corn futures price, live cattle futures price, weight-by-corn futures interaction, and weight-by-live cattle futures interaction. However, all five of these variables are statistically significant at the .01 level. Variance inflation factors for all variables in model I are given in Table 3. These five variables were, by design, unavoidably correlated with one another. Therefore all five were maintained in the model.

Model II

Table 4 gives the variable names, parameter estimates, standard errors, levels of significance and variance inflation factors for variables included in model II. Estimation of model II included 3131 observations and 36 independent variables. The resulting R-square was 0.2906. Specific results related to each product attribute are discussed in turn.

The mean of the ratio of the prices on the TLP video board sale to prices for comparable cattle on the traditional weekly auction markets was 1.09422. This result may be interpreted to mean that prices on the TLP sale were 9 percent higher, on average, than prices on the traditional auctions for similar cattle during the 1996 through 2007 period. The sources of, or reasons for, this price difference are not clearly understood. One of the objectives of this study is to estimate

the effects of various animal and lot attributes and conditions of sale on that price difference. The following discussions reveal the results of the study related to this objective.

Animal Characteristics

Animal characteristics variables represent attributes that are either inherent in the animals or embodied in the animals by the seller. Characteristics of importance are those that affect value to the buyer.

Mixed Lot

Selling cattle in mixed lots, containing both steers and heifers, proved to be a less than desirable method of marketing animals. The mixed lot variable was negative, as hypothesized, and significant at the .01 level. A mixed lot on the TLP sale reduced the amount by which the TLP price exceeded the weekly auction price by 0.03 percent.

Lot Size

The coefficient on the natural log of number of head was positive, as hypothesized, and significant at the .01 level. As the natural log of number of head increases by 1 the ratio of TLP price to auction price increases by 2.21 percent. For example, as lot size changes from 5 head to 50 head, there is a 5.09 percent increase in the price ratio.

Weight Range

The weight range variable was significant at the .01 level and negative as hypothesized. A 1 pound increase in weight range reduces the amount TLP price exceeds the auction price by .01 percent. The wider the weight range the greater the discount on the lot. A wider weight range usually signals less uniformity in the lot which results in a discounted price.

Flesh

Flesh was not statistically significant but had the hypothesized negative sign. As the amount of flesh increases, the amount the TLP price exceeds the auction price would be reduced.

Breed

All breeds were significant except for the "other breed" category when compared to the reference category of black and black baldy. They all possessed the negative hypothesized sign. Red and red baldy, Charolais cross, and Simmental cross were all significant at the .01 level. These three breeds reduce the amount TLP price exceeds the auction price by 3.99, 2.17, and 4.93 percent, respectively, while the Hereford category was significant at the .05 level with a reduction of 4.44 percent. These results agree with those of Barham, Brown and Morgan, and Smith, Gill, and Bess in that all showed black hided animals to hold a price premium over other breeds of feeder cattle due to the desirability of black-hided animals for efficiency in the feedlot and expected carcass value.

The ear coefficient proved to be significant at the .01 level and had a negative sign as hypothesized. The coefficient indicates that if one-half of the cattle in the lot had one-quarter Brahman breeding, the ratio of TLP price to auction price would be reduced by 1.74 percent (.5x.25x13.94)

Health

The health program variable was not statistically significant; however, it did have the hypothesized positive sign. This finding is consistent with the idea that a health program's benefit is primarily to the producer and not the feedlot. Due to the low cost of vaccination per head, most feedlots vaccinate every animal as it enters the feedlot. Therefore, the appearance or

presence of a health program is not of primary importance to the buyers. However, it does benefit the seller in that it allows them to market more animals due to a potentially decreased death loss.

Management

Management practices vary depending on the operation and producer. The supplement, home raised and PVP variables were significant at the .01 level. The supplement and home raised signs were negative which contradicted the hypothesized signs, but they were consistent with the results for model I. The explanation is the same as for model I. The supplement and home raised variables reduce the amount TLP exceeds the auction price by 0.79 and 1.26 percent, respectively. The PVP variable was positive as hypothesized and increased the amount TLP exceeds the auction price by 2.41 percent. The implant, BQA, and EID tags variables were not significant.

The horns and pinkeye variables were significant at the .01 and .05 levels, respectively. However, they both had the opposite of the hypothesized signs. No explanation is available for the positive signs.

Conditions of Sale

Conditions of sale variables represent merchandising methods specified by the seller intended to affect the desirability of the cattle. Some conditions may be encouraged or promoted by the marketing agency.

Weighing Conditions

Both weighing on the truck and on the ground at the farm were not statistically significant. However, they carried the hypothesized negative signs when compared to the reference category of weighing the cattle on the ground away from the farm.

The miles hauled variable was significant at the .05 level. Miles hauled had a positive sign, as hypothesized, resulting in the variable increasing the amount by which TLP exceeds the auction price by 0.02 percent per mile hauled before weighing.

Pencil shrink was significant at the .01 level and had a positive sign as hypothesized. The coefficient of 0.7478 means that a 3 percent pencil shrink would increase the price ratio by 2.24 percent. Because the 2.24 percent increase in price is less than the 3 percent pencil shrink, the producer would not recoup pencil shrink. The seller actually loses money by allowing the pencil shrink.

The price slide variable was significant at the .05 level with a negative sign which contradicted the hypothesized sign. No explanation is available. Weight tolerance was not significant, but carried the counterintuitive positive sign.

Net Distance

Net distance had a negative sign, as hypothesized, reducing the amount TLP exceeds the auction price by 0.004 percent per mile from the representative feedlot. The net distance variable was significant at the .01 level.

Stipulations

The heavy end variable was positive and not significant. The buyer's choice variable was significant at the .05 level and had a positive sign, as hypothesized. If the seller allows the buyer

to choose a load from among a larger group of animals, TLP exceeds the auction price by 0.83 percent. Buyers will pay a small price premium if they are allowed to choose which animals they want from a larger group.

Handling, Penned, Lot Type

None of the lot type variables were significant; however, they did possess the hypothesized signs. All were negative compared to the dry lot reference variable.

Neither of the penned variables were significant when compared to the reference variable of penned the morning of loading and weighing. Penned the night before carried a negative sign, as hypothesized, but the no information category held an unexpected positive sign.

None of the handling variables were significant. The driven-by-ATV category held an unexpected negative sign with no logical explanation. The other two handling (before weighing) variables (foot and horses) held the hypothesized signs.

Multicollinearity in Model II

When a regression equation has large number of variables, such as this one (35), multicollinearity may be problematic. The variance inflation factor (vif) and collinearity diagnostics (collin) in SAS were used to test for multicollinearity. The variance inflation factors are represented in Table 4. The tests revealed that there were no variables whose variance inflation factors were above 5. There were no major multicollinearity problems in model II.

Chapter IV

Summary, Conclusions, and Implications

Summary

Feeder cattle producers are faced with a variety of decisions while managing an operation, but few are as important as deciding where and how to market their animals/product. Producers have the ability to choose the desired method for marketing their animals. This study focuses on traditional weekly Tennessee auctions and non-traditional auctions, specifically the TLP video board sales. There is little published information regarding which marketing method yields the highest sale price. Producers want the net sales price to reflect their efforts in management. The results of this study should help producers in choosing which marketing method best suits their operation. The four objectives of this study were: 1) to provide estimates of the price effects of various types of information that are provided by the sellers participating in video board sales, 2) to provide estimates of the effects on sale price of various conditions of sale specified by sellers participating in board sales, 3) to provide estimates of the price differences between video board sales and traditional weekly auction markets for feeder cattle in Tennessee, and 4) to identify the sources of the price differences between the two market types.

In order to accomplish the objectives of this study, two hedonic regressions were estimated using data for 1996 to 2007 from the Tennessee Livestock Producers video board sales and the weekly Tennessee auction price average. Model I specified the sale price on the TLP video board sale as a function of the various animal characteristics, conditions of sale, and market conditions associated with each transaction. Estimation of the parameters of this model yields the implicit market values of each of the independent variables on the TLP sale.

Model II specified the ratio of the TLP video board sale price to the traditional weekly auction market average price for the state as a function of a smaller set of animal characteristics and conditions of sale associated with each transaction. Estimation of the parameters of model II yields the effects of each independent variable on the TLP video board sale price relative to the traditional auction market average price for similar cattle during the week of the TLP sale.

These models were estimated using ordinary least squares regression analysis, specifically the Reg procedure in SAS. Estimation of each model utilized 3131 observations that were collected over a twelve-year period. The results for model I indicated that the 47 independent variables accounted for 48 percent of the variation in the dependent variable. The 36 independent variables used in model II accounted for 29 percent of the variation in the dependent variable. F tests for both models indicated that they were highly significant at the .01 level. T tests were performed on the estimated coefficients for each of the independent variables.

Conclusions

It was believed, before this study that animals marketed through non-traditional auction markets such as the TLP video board sale would garner higher prices when compared to traditional auction markets. This study found that the amount the TLP sale price exceeded the auction price for similar cattle was 9 percent on average. While the result coincides with what was previously thought, the difference was larger than expected.

The results of this study found several variables that confirmed conventional wisdom and were supported by previous research. Those variables involving weight (estimated weight and weight range) confirmed conventional wisdom as to the effect of weight on price. For example, from Model I, as the weight for feeder cattle increases, price decreases at a decreasing rate.

Weight range was another variable whose estimated coefficients were in support of conventional wisdom in both models. The wider the weight range the greater the discount in price due to decreased uniformity in the lot.

Out of the many variables utilized in this study, a few results stood out and required further consideration. In both models I and II, the other breed category was not significant. This was interesting considering that in model II all of the breed categories were statistically significant and negative when compared to the black and black baldy base. Other breed was not statistically significant though it did have a negative sign. This study did not include dairy breeds in the other breed category; therefore, it is primarily a category of other beef breeds. This may be the underlying reason for the other breed category not being statistically significant.

The insignificance of the horns and pinkeye variables in model I was rather surprising. The same variables were both significant and positive in model II. These characteristics are usually thought to be indicators of the quality and management of the cattle, thus resulting in a price discount for their presence. Due to the amount of information that is available on the lots being sold, buyers may view these two characteristics as less important than other traits and characteristics of the lot. This may explain the results of model I where both variables were not statistically significant.

Another variable whose results were unexpected was PVP. PVP was surprisingly not statistically significant in model I; however, it did have the correct hypothesized positive sign. PVP was highly significant and positive in model II. It was believed that PVP would have a significant influence on the TLP price because of the verification's ability to expand the market for those cattle, qualifying them for export to certain markets, such as Japan. However, this did not prove to be the case in model I.

The BQA and EID variables were similar to PVP in that it was believed that these variables would possess a significant price premium. However, the findings of this research indicated that neither BQA nor EID had a significant effect on price.

In model II, pencil shrink was significant and positive as hypothesized. However, when a 3 percent pencil shrink is applied to a lot of animals there is only a 2.24 percent price premium received by the producer. The application of a pencil shrink actually results in a revenue reduction because the price premium is not large enough to pay for the pencil shrink allowance. This may also explain why pencil shrink was not statistically significant in model I.

Health program was significant at the .05 level in model I, but not significant in model II. The results of this study regarding the presence of a health program were consistent with beliefs that a health program is primarily beneficial for the producer and not necessarily the feedlot. A health program allows the producer to market more animals at higher weights due to decreased death loss and increased weight gain.

The mixed lot variable was negative and statistically significant at the .01 level in both models. These results imply that buyers prefer single gender lots as opposed to lots containing both steers and heifers. This could stem from feedlots having to sort more often because of the difference of weight gain between steers and heifers. Steers finish (gain weight) at a faster pace than do heifers. This relates back to the issue of uniformity in the lot.

While stress was not a variable examined in this study, it served as an important factor in describing and explaining results, specifically how the amount of stress cattle experience affects weight and potentially sale price. It was interesting to see the perceived role that stress played in this study in the penned, lot type, and handled (before weighing) variables. The results of these variable categories focused primarily on the amount of stress the animals experienced while

being handled and penned in a lot before being weighed. Before this study, the influence of stress did not seem to be a vital component of these two marketing methods. Upon further consideration, stress relates to, and influences (shrink) which directly affects weight and weight is a characteristic in the marketing of feeder cattle. Therefore, it could be assumed that since stress relates to weight, it should play an important role in marketing feeder cattle. The effect of stress had a greater influence on how the animals were handled, penned, and the type of lot they were kept in than did other factors such as length of time with the penned variable and method in both the handled and lot type variables.

Lot size appears to be the obvious variable that helps to explain the price difference between prices on traditional and non-traditional auction markets. Traditional auctions market animals a few head at a time, whereas non-traditional auctions sell load lots at time. This enables buyers to fill their orders with less work and cost, purchasing load lots as opposed to a few head at a time.

Because the variables used in model II account for less than 30 percent of the variation in the dependent variable, there clearly are other factors that influence this price difference which are not accounted for in this study. It could be speculated that those variables not included in this study may explain some or possibly most of the remainder of the variation. A portion of variation may be completely random. Ease of buyer presence, decreased transaction costs, and accessibility of lot information beforehand are just a few variables that were not included in this study that may help explain the remainder. The nature of the non-traditional auction does not require buyers to be physically present at the auction. They may place bids from anywhere in the country. This allows for the possibility of a larger (national) buyer base; whereas traditional auctions require the buyer to be there in person to place bids. Non-traditional auctions permit

decreased transaction costs for both buyers and sellers. Buyers do not have to load out animals the day of the sale; they are able to arrange a day and time to pick up the animals from the seller's farm or chosen location. Buyers also have access to information on the cattle/lots being sold that is not available to buyers in the traditional auction setting. Buyers on non-traditional sales also know the identity of the producer which may instill more confidence in cattle quality. Buyers have the ability to view the video of the lots being sold along with the information contained in the sale catalogs. This is different from the traditional auctions where buyers must assess the lot as it walks into the sale ring. The non-traditional auction allows buyers more time to assess the lots they may be interested in purchasing. More time and increased information may result in a better decision.

Implications

The result of model I's analysis implies that feeder cattle characteristics, conditions of sale and market conditions influence sale price at non-traditional auction markets such as the TLP video board sale examined in this study. The result of model II's analysis implies that feeder cattle characteristics and conditions of sale can be used to explain some of the price difference between traditional and non-traditional auction markets.

The findings of this study benefit those involved in the marketing sector of the feeder cattle industry, specifically buyers and sellers. Producers in Tennessee receive the largest benefit due to the geographical focus this study; however, producers in the Southeast as well as those across the U.S. may be able to apply these results to their specific situation, enabling them to better market their product and manage their operations.

The results of model I should enable producers who utilize non-traditional marketing methods to make better decisions in managing their animals and adding value to their product. The results of this study show which characteristics garner price premiums and which characteristics carry a price discount on a lot of feeder cattle. The results of model II should better equip producers, especially those in Tennessee, in their decision of choosing which marketing method better suits their situation.

The insignificance of the EID variable in both models could possibly change at some point in the future. The idea of rewarding producers for the ability to trace and identify the source of their animals has become a focus of interest recently due in part to outbreaks of diseases such as BSE. Traits or characteristics such as PVP and EID could, in the future, garner considerable price premiums for their ability to identify and trace specific animals to their origin.

As a suggestion for further research, model I could be expanded to include additional variables such as seller identification enabling one to examine whether there is any price premium/discount related to the reputation of the producer/seller. Other variables not included in this study could be included to explain more of the variation, such as those mentioned earlier: ease of buyer presence, decreased transaction costs, and accessibility of lot information beforehand. Another action that could be taken to further this research would be to expand the data set to include more recent data (years 2008 and 2009 up to the present) this would add observations to more recent characteristics, such as PVP, giving a better representation of the effects of such characteristics.

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Appendix

Table 1. Definition and Hypothesized Signs of Variables Used in Models I and II.

Variable/Characteristic	Hypothesized Sign	Description
Model I Dependent Variable: Annual Price Index		Indexed prices of cattle sold on the TLP video sales
Model II Dependent Variable: Price Ratio		Price ratio of TLP sale price to traditional auction price
Gender	+	1 – If steer; 0 – if heifer.
Mixed Lot	-	1 – If a lot of animals that contains both steers and heifers; 0 – otherwise.
Lot Size: Natural Log of Head	+	The natural logarithm of the number of head of cattle in the lot.
Frame and Muscle: M&L #2	-	Description of cattle skeletal size and muscling. Percent of the lot that is M&L #2 (expressed as a decimal). Medium and Large framed animals that are narrow throughout.
Frame and Muscle: S #1	-	Description of cattle skeletal size and muscling. Percent of the lot that is S #1 (expressed as a decimal). Small framed animals that are slightly thick.
Frame and Muscle: M&L #3	-	Description of cattle skeletal size and muscling. Percent of the lot that is M&L #3 (expressed as a decimal). Medium and Large framed animals that are narrower than #2.
Flesh	-	The body condition score or amount of flesh on the animal (1-10). Medium fleshed animals fall between the scores of 3 and 5
Reciprocal of Estimated Weight	+	The inverse or one over the estimated average weight of the lot of animals in lbs.
Weight Range	-	The weight of the heaviest animal less the weight of the lightest animal in the lot (lbs.).
Breed: Red and Red Baldy	-	Proportion (decimal) of the animals in the lot that are Red and Red Baldy.
Breed: Charolais Cross	-	Proportion (decimal) of the animals in the lot that are Charolais Cross.
Breed: Hereford	-	Proportion (decimal) of the animals in the lot that are Hereford.
Breed: Simmental Cross	-	Proportion (decimal) of the animals in the lot that are Simmental Cross.
Breed: Other Breed	-	Proportion (decimal) of the animals in the lot that are other beef breeds and crosses not designated in the study.

Table 1. Cont.

Variable/Characteristic	Hypothesized Sign	Description
Ear Coefficient	-	Percent of Brahman breeding in various animals in the lot multiplied times the percent of animals showing Brahman breeding.
Health Program	+	1 – If a health program was indicated in the sale catalog, 0 – otherwise.
Horns	-	Percentage (decimal) of the lot possessing horns.
Pinkeye	-	Percentage (decimal) of the lot possessing pinkeye scars.
Supplement	+	1 – Fed some type of supplemental feed; 0 – otherwise.
Implants	+	1 – Implanted with a growth implant; 0 – otherwise.
Home Raised	+	1 – Animals are bred and raised on a single farm; 0 – otherwise.
PVP	+	1 – Highest level of certification for age and source verification; 0 – otherwise.
BQA	+	1 – Beef Quality Assurance: Management Practices Certification; 0 – otherwise.
EID Tags	+	1 – Registered electronic animal identification number tag visible; 0 – otherwise.
Weighing Conditions: Ground at Farm	-	1 – If the animals were weighed on the ground at the farm; 0 – otherwise.
Weighing Conditions: Truck	-	1 – If the animals were weighed on the truck; 0 – otherwise.
Miles Hauled to Weigh	+	Miles hauled from farm to weigh point (miles).
Net Distance	-	The distance (miles) the animals are hauled from the pick-up point to the assumed destination – Garden City, Kansas.
Price Slide	+	Animal is discounted if it is heavier than the estimated weight plus tolerance (cents per pound).
Weight Tolerance	-	The amount (lbs) allowed above the estimated weight before the slide takes effect.
Pencil Shrink	+	A percentage (decimal) of animal weight that is subtracted from actual weight to allow for shrinkage of the animals during transportation and handling.

Table 1. Cont.

Variable/Characteristic	Hypothesized Sign	Description
Heavy End	-	1 – If buyers must choose heaviest animals to construct a load (48,000 to 50,000lbs); 0 – otherwise.
Buyer's Choice	+	1 – If buyers have the option to choose any animals they desire from a group of cattle; 0 – otherwise.
Handling: Driven-by-Foot	-	1 – If the animals were driven by foot; 0 – otherwise.
Handling: Driven-by-Horses	+	1 – If the animals were driven by horses; 0 – otherwise.
Handling: Driven-by-ATV	+	1 – If the animals were driven by ATV's; 0 – otherwise.
Penned: No Information	-	1 – If there was no indication as to when the animals were gathered and penned before loading; 0 – otherwise.
Penned: Night Before	-	1 – If animals gathered and penned the night before loading; 0 – otherwise.
Lot Type: No Information	-	1 – If there was no information provided as to the type of lot the animals were held in; 0 – otherwise.
Lot Type: Hay and Water	-	1 – If the animals were placed in a lot with access to hay and water; 0 – otherwise.
Lot Type: Feed and Water	-	1 – If the animals were placed in a lot with access to feed and water; 0 – otherwise.
Corn Futures Price	-	The nearby contract price of corn futures ($/bu.).
Live Cattle Futures Price	+	The nearby contract price of live cattle futures ($/cwt).
Weight-by-Corn Price	+	Interaction term: Animal weight in lbs. multiplied by and Corn futures price in ($/bu).
Weight-by-Live Cattle Price	-	Interaction term: Animal weight in lbs. multiplied by Live Cattle futures price in ($/cwt).
Weight-by-Spring	-	1 – If animals were sold during the months of Feb., Mar., Apr., or May; 0 – otherwise.
Weight-by-Fall	+	1 – If animals were sold during the months of Aug., Sept., Oct., or Nov; 0 – otherwise.

Table 2. Descriptive Statistics for Variables Included in the Regressions (n = 3131)

Variable/Characteristic	Mean	Standard Deviation	Minimum	Maximum
Model I Dependent Variable: Annual Price Index	1.000	0.0824	0.746	1.306
Model II Dependent Variable: Price Ratio	1.0942	0.0546	0.873	1.386
Gender	0.608	0.488	0.0	1.0
Mixed Lot	0.134	0.341	0.0	1.0
Lot Size: Natural Log of Head	3.992	0.567	1.609	5.991
Frame and Muscle: M&L #2	0.154	0.106	0.0	0.850
Frame and Muscle: S #1	0.0143	0.0299	0.0	0.300
Frame and Muscle: M&L #3	0.00261	0.0213	0.0	0.500
Flesh	5.0664	0.568	2.0	7.0
Reciprocal of Estimated Weight	0.00139	0.000227	0.000976	0.00267
Weight Range	170.0386	57.876	40.0	500.0
Breed: Red and Red Baldy	0.103	0.142	0.0	1.0
Breed: Charolais Cross	0.245	0.258	0.0	1.0
Breed: Hereford	0.0201	0.0684	0.0	0.950
Breed: Simmental Cross	0.0136	0.0775	0.0	1.0
Breed: Other Breed	0.00614	0.0369	0.0	0.830
Ear Coefficient	0.0178	0.0326	0.0	0.250
Health Program	0.0351	0.184	0.0	1.0
Horns	0.0155	0.0388	0.0	0.650
Pinkeye	0.00532	0.0177	0.0	0.300
Supplement	0.780	0.414	0.0	1.0
Implants	0.551	0.497	0.0	1.0
Home Raised	0.409	0.492	0.0	1.0
PVP	0.0153	0.123	0.0	1.0
BQA	0.155	0.362	0.0	1.0
EID Tags	0.0105	0.102	0.0	1.0
Weighing Conditions: Ground at Farm	0.0661	0.249	0.0	1.0
Weighing Conditions: Truck	0.225	0.418	0.0	1.0
Miles Hauled to Weigh	16.429	12.725	0.0	70.0
Net Distance	1009.400	148.257	97.38	1309.64
Price Slide	0.0410	0.0170	0.0	0.10

Table 2. Cont.

Variable/Characteristic	Means	Standard Deviations	Minimum	Maximum
Weight Tolerance	18.103	8.867	0.0	25.00
Pencil Shrink	0.00917	0.00833	0.0	0.05
Heavy End	0.302	0.459	0.0	1.0
Buyer's Choice	0.0642	0.245	0.0	1.0
Handling: Driven-by-Foot	0.0105	0.102	0.0	1.0
Handling: Driven-by-Horses	0.00894	0.0942	0.0	1.0
Handling: Driven-by-ATV	0.000958	0.0309	0.0	1.0
Penned: No Information	0.0125	0.111	0.0	1.0
Penned: Night Before	0.0597	0.237	0.0	1.0
Lot Type: No Information	0.376	0.485	0.0	1.0
Lot Type: Hay and Water	0.0418	0.200	0.0	1.0
Lot Type: Feed and Water	0.000319	0.0179	0.0	1.0
Corn Futures Price	2.585	0.602	1.908	4.823
Live Cattle Futures Price	77.5012	10.649	61.80	100.40
Weight-by-Corn Price	1899.81	519.839	804.00	3978.56
Weight-by-Live Cattle Price	57191.77	12511.21	25762.50	94382.50
Weight-by-Spring	175.315	311.820	0.0	975.00
Weight-by-Fall	375.0303	380.143	0.0	1025.00

Table 3. Model I OLS Regression Results: Parameter Estimates, Standard Errors, and Variance Inflation Factors.

Variable/Characteristic	Parameter Estimate	Standard Error	Variance Inflation Factor
Gender	0.0767**	0.00265	1.463
Mixed Lot	-0.0147**	0.00394	1.585
Lot Size: Natural Log of Head	0.0156**	0.00272	2.0784
Frame and Muscle: M&L #2	-0.0700**	0.0136	1.855
Frame and Muscle: S #1	-0.181**	0.0397	1.234
Frame and Muscle: M&L #3	-0.170**	0.0562	1.257
Flesh	-0.0139**	0.00238	1.596
Reciprocal of Estimated Weight	122.968**	21.113	19.849
Weight Range	-0.000105**	0.0000247	1.783
Breed: Red and Red Baldy	-0.0115	0.00844	1.259
Breed: Charolais Cross	-0.0150**	0.00465	1.270
Breed: Hereford	-0.0133	0.0165	1.109
Breed: Simmental Cross	-0.0226	0.0145	1.100
Breed: Other Breed	-0.0365	0.0296	1.0523
Ear Coefficient	-0.0424	0.0383	1.363
Health Program	0.0142*	0.00688	1.407
Horns	0.0155	0.0294	1.137
Pinkeye	0.0247	0.0614	1.0454
Supplement	-0.00265	0.00292	1.282
Implants	0.00224	0.00238	1.300
Home Raised	-0.00178	0.00312	2.055
PVP	0.00113	0.0102	1.362
BQA	-0.00366	0.00356	1.451
EID Tags	0.00568	0.0119	1.302
Weighing Conditions: Ground at Farm	-0.00908	0.00532	1.530
Weighing Conditions: Truck	-0.00388	0.00394	2.367
Miles Hauled to Weigh	0.0000276	0.000109	1.673
Net Distance	-0.0000279**	0.0000106	2.141
Price Slide	-1.0593**	0.114	3.285
Weight Tolerance	0.00110**	0.000188	2.428
Pencil Shrink	0.244	0.226	3.095

* indicates significantly different form zero at the .05 level

** indicates significantly different from zero at the .01 level

Table 3. Cont.

Variable/Characteristic	Parameter Estimate	Standard Error	Variance Inflation Factor
Heavy End	-0.00256	0.00299	1.647
Buyer's Choice	0.000950	0.00466	1.144
Handling: Driven-by-Foot	-0.00633	0.0128	1.497
Handling: Driven-by-Horses	-0.00488	0.0118	1.0816
Handling: Driven-by-ATV	0.0513	0.0357	1.0710
Penned: No Information	0.00130	0.0106	1.213
Penned: Night Before	0.0201**	0.00536	1.412
Lot Type: No Information	-0.00430	0.00235	1.136
Lot Type: Hay and Water	-0.0120	0.00637	1.423
Lot Type: Feed and Water	-0.0805	0.0605	1.0241
Corn Futures Price	-0.206**	0.0142	63.688
Live Cattle Futures Price	0.0112**	0.000601	35.889
Weight-by-Corn Price	0.000240**	0.0000189	84.701
Weight-by-Live Cattle Price	-0.0000108**	0.000000754	77.958
Weight-by-Spring	-0.0000357**	0.00000440	1.648
Weight-by-Fall	0.0000249**	0.00000371	1.739

* indicates significantly different form zero at the .05 level

** indicates significantly different from zero at the .01 level

Table 4. Model II OLS Regression Results: Parameter Estimates, Standard Errors, and Variance Inflation Factors.

Variable/Characteristic	Parameter Estimate	Standard Error	Variance Inflation Factor
Mixed Lot	-0.0292**	0.00292	1.453
Lot Size: Natural Log of Head	0.0221**	0.00208	2.0297
Flesh	-0.00202	0.00153	1.102
Weight Range	-0.000111**	0.0000179	1.571
Breed: Red and Red Baldy	-0.0399**	0.00633	1.185
Breed: Charolais Cross	-0.0217**	0.00354	1.226
Breed: Hereford	-0.0444**	0.0126	1.0882
Breed: Simmental Cross	-0.0493**	0.0110	1.0702
Breed: Other Breed	-0.0274	0.0228	1.0401
Ear Coefficient	-0.139**	0.0285	1.265
Health Program	0.00604	0.00530	1.392
Horns	0.0502*	0.0226	1.120
Pinkeye	0.128**	0.0474	1.037
Supplement	-0.00791**	0.00214	1.153
Implant	0.000655	0.00175	1.109
Home Raised	-0.0126**	0.00218	1.674
PVP	0.0241**	0.00770	1.307
BQA	-0.000173	0.00269	1.388
EID Tags	0.00249	0.00919	1.288
Weighing Conditions: Ground Farm	-0.00499	0.00407	1.498
Weighing Conditions: Truck	-0.00572	0.00302	2.329
Miles Hauled to Weigh	0.000179*	0.0000832	1.638
Net Distance	-0.0000381**	0.00000806	2.0897
Price Slide	-0.138*	0.0636	1.700
Weight Tolerance	0.000138	0.000114	1.501
Pencil Shrink	0.748**	0.174	3.0618
Heavy End	0.00245	0.00228	1.603
Buyers Choice	0.00826*	0.00360	1.140
Handling: Driven-by-Foot	-0.0147	0.00986	1.484
Handling: Driven-by-Horse	0.0126	0.00908	1.0690
Handling: Driven-by-ATV	-0.0268	0.0276	1.0637
Penned: No Information	0.00919	0.00817	1.202
Penned: Night Before	-0.000336	0.00412	1.396
Lot Type: No Information	-0.00129	0.00180	1.111
Lot Type: Hay and Water	-0.00224	0.00490	1.405
Lot Type: Feed and Water	-0.0785	0.0466	1.0153

* indicates significantly different form zero at the .05 level

** indicates significantly different from zero at the .01 level

Vita

Damon Eric Drinnon was born in Whitesburg, Tennessee on October, 28, 1984, to Donnie and Vickie Drinnon. He graduated from Cherokee High School in May, 2003. He then attended Maryville College where he obtained a B.A. degree in Business and Organizational Management with minors in Economics and Accounting in May, 2007. Later, he attended the University of Tennessee, Knoxville, where he earned a M.S. degree in Agricultural Economics in August, 2009.