MARKET VALUE, FEEDLOT PERFORMANCE, AND PROFITABILITY OF A PRECONDITIONED CALF

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This thesis has been divided into two essays with a joint conclusion chapter. The first essay deals with a market and price study on the value of a preconditioned feeder calf. The second essay deals with a performance and profitability advantages of preconditioned calves. Both essays deal with preconditioned calves.

Preconditioning includes the management practices implemented at the ranch to improve health and nutrition of calves, thus adding value to feeder calves. Preconditioning has been gaining much more attention the past few years due to value-added and quality beef assurance programs. There has been much more attention paid to cattle health during the finishing process brought about by the results of the Texas A&M ranch to rail studies. These studies found that cattle performance and profitability is greatly affected by their health during the feeding process. Texas A&M then developed the VAC-45 (value added calf- 45 day weaning period) program based on these studies. They established from previous studies that if cattle were weaned, vaccinated, and backgrounded for forty-five days before shipment, it helped improve cattle health during the feedlot phase of production. There appears to be an asymmetry problem in the information on preconditioned calves. The cow-calf producers may not be aware of the added feedlot performance and carcass value of preconditioning or the feedlot is not willing to pay a premium for this added value.

The first essay is a study on how the market values a preconditioned calf sold in a special preconditioned feeder calf sale. Groups like the Missouri Farms Alliance (MFA) Health Track Program, Oklahoma Cattlemen's Association's (OCA) Oklahoma Quality Beef Network (OQBN), Pfizer and Emerge Interactive are sponsoring sales of preconditioned calves. The sales are expected to generate premiums for preconditioned calves over traditional livestock auction calves. The first data set for this essay consists of sales conducted in Joplin, Missouri from December 1997 to March 2001. The second data set consists of one regular weekly auction and two preconditioned calf sales held on three consecutive days. This second data set has more detailed description on feeder cattle lot characteristics such as breed, horns, frame size, muscling, fill, condition, uniformity, and health. Then a comparison is made between the enhanced returns of a preconditioned calf if any over calves weaned and directly shipped from the cow-calf producer.

The second essay is a study to determine if there is enhanced performance and profitability to feeding preconditioned calves over calves of other backgrounds. This data were collected from closeout sheets of a commercial feedlot owned by Friona Industries L.P. in the Texas Panhandle. Comparisons were made based on background, origin, and weight. The different backgrounds consist of preconditioned, grazing, low risk, and high risk cattle. There will be models to measure performance differences of death loss, cost of gain, average daily gain, feed conversion, and medicine costs. Then there is a profitability comparison of different backgrounds, given costs to determine if preconditioned calves are more profitable and by how much. This profitability comparison is used to determine the true value of feeding preconditioned calves.

The results from both essays will then be used to determine joint implications for conclusions regarding marketing and performance. A comparison will be made between the market value from the first essay and the feedlot performance and profitability study (second essay) to determine if the market is truly valuing preconditioning.

II. Market Value of Preconditioned Calves

Introduction

To add value to a product, a person must meet or exceed the expectation of the purchaser. This has led to the use of value based marketing techniques in the beef industry. Much discussion in recent years is on ways to improve the efficiency and add value to beef production. One way to improve efficiency is to maintain the health of calves through the feedyard stage of production. Preconditioning includes management practices implemented at the ranch to improve health and nutritional standing in order to minimize stress and lower costs. Costs to the industry for the treatment of sick calves annually are $35 per head or $70 million total (Lalman and Smith). King found that preconditioned cattle sold through Superior Livestock auctions received a premium of $3.33 per hundredweight compared with cattle not preconditioned. Another advantage of most preconditioning programs is that they commingle calves from different producers to produce more uniform lots of calves. Preconditioning calves is not a new management tool for producers to add value but it has been gaining more attention in the past few years because of value-added beef quality assurance programs.

Currently, the question is, does market value of preconditioned calves cover added production costs? Buyers of feeder calves could have a problem with trust in a preconditioning program, to the extent that, have these animals actually been treated? Preconditioning programs must prioritize establishing a reputation through performance in order to earn buyer trust. For these preconditioning programs, trust and integrity become one of the main goals. There also seems to be a problem with inefficient information in the market chain. Producers may not be aware of the added value of preconditioning. It could also be that buyers are unaware of the value added by preconditioning or are not willing to pay producers the value preconditioned calves are worth.

How can producers who precondition their calves overcome information and market inefficiency, to receive a premium price for their cattle? It is important to find out which factors affect premium the most and how to increase efficiency of the market. Information on the added value of preconditioning programs needs to be shared among different levels of the beef production chain. With this added information producers can make better decisions regarding preconditioning their calves and buyers can better match price with value.

Objectives

The main objective of this study is to increase the efficiency of feeder cattle markets in terms of valuing preconditioned cattle.

Specific objectives are

1) Determine the premium buyers pay for preconditioned calves
2) Determine whether or not the added revenue from preconditioning calves exceeds the added costs of production.

Literature Review

This study will attempt to describe the effects that preconditioning has on feeder calf prices and the market value for a preconditioned calf. Preconditioning can be defined as management practices by the cow-calf producer before placement in the feed yard to improve immune system and nutrition while minimizing stress (Lalman and Smith). Preconditioning includes the development of the immune system, dehorning, castration, and training calves to eat. Preconditioning can most basically be described as a management practice that enhances the value of feeder calves. Much of the literature deals with feeder cattle price differentials and what effect they have on price. Also an area that needs to be examined is what impact preconditioning has for a cow-calf producer.

Feeder Cattle Price Differentials

Feeder cattle price determination has been historically concentrated on market supply and demand situations. Price discovery also includes given characteristics for a given lot of cattle. Many different cattle characteristics that lead to feeder cattle price differentials are reviewed. Buccola (1980) found that cattle markets discriminate on the basis of weight, age, and gender. Other factors affecting feeder cattle prices are buyer behavior, given supply and demand for different types of feeder cattle, and the confidence that a buyer has in the cattle and seller. Finally how preconditioning effects price premiums for a given lot of feeder cattle is reviewed.

Price discovery of feeder cattle is affected by many interaction factors. Price differentials in feeder cattle should reflect supply and demand for lots of cattle given different weight and grade categories (Marsh). Also price premiums and discounts for different lots of feeder cattle should reflect demand for a given lot's traits such as gender, weight, number of head, breed, health, grade, and condition (Schroeder et. al.1988).

Weight Effect

There have been many studies focusing on the effect of weight and age on the price differentials for feeder cattle. One of the earliest studies by Buccola (1980) used break-even analysis to study the long run price relationships of feeder cattle. It was found that higher feed cost had an inverse relationship with the price of feeder cattle and higher anticipated live cattle price had a positive effect. As feed costs increased, the price of feeder cattle decreased. Also having a direct relationship to higher feed cost was the demand for yearling cattle compared to calves (Buccola 1980; Marsh; Faminow and Gum). With increased feed costs, demand for yearlings increases because of less weight gain needed to reach finish or harvest weights. But if there was a perceived future price increase for live cattle then demand for lightweight calves would increase relative to yearling cattle given lower feed costs (Buccola 1980; Marsh; Faminow and Gum). The reason for higher demand for calves relative to yearlings was due to the fact it was cheaper to add weight than it is to buy it. For example, if cost of gain was cheaper relative to prices for yearling cattle then demand for calves would increase.

Higher cost of gain should serve to diminish the difference in feeder cattle prices between steers and heifers as weight increases due to a shorter finishing period for heifers (Buccola 1980). Faminow and Gum used a nonlinear relationship of weight, using a quadratic term to model price. That is to say the price of feeder cattle typically decreases at a decreasing rate with higher weights. Results in Arizona markets found the marginal value of feeder cattle to sharply decline after 450 pounds. These results were consistent with those by Schroeder et al. 1988; Lambert et al.; and Turner, McKissick, and Dykes In a study of auction markets in Eastern Oklahoma and Oklahoma City it was found that prices for feeder cattle drastically decreased after the 500-599 pound weight range when compared to a base weight range of 300-399 pound range (Smith et al.). Many studies show the greatest demand for feeder cattle to be from the lightweight to the mid weight range group. This would represent the most profitable range of cattle due to biological finish of beef cattle.

Gender Effect

There have been many price differential studies on the difference in feeder cattle prices between steers, heifers, and bulls. In many cases buyers of feeder cattle will pay higher prices for steers when compared to heifers and bulls. There have been several studies that have discovered discounted prices for heifers and bulls (Turner, Dykes, and McKissick; Lambert et al.; and Smith et al.). Lower prices received for bulls are associated with the added stress and lower performance of newly castrated animals (after purchasing bulls) and because lower prices are associated with bullock beef compared to beef from steers (if not castrated). Heifer discounts compared to steers are based on lower average daily gain, lower feed efficiency, and unexpected pregnancies (Smith et al.). Much of the discounts for heifers could be due to the fact that many animals are lower quality, because higher quality heifers are kept as herd replacements (Turner, Dykes, and McKissick; Lambert et al.; and Smith et al.). Faminow and Gum found that a positive long-run outlook for live cattle prices could cause the demand for lightweight heifers as replacements to be reduced.

Lot Size and Uniformity Effects

Many buyers of feeder cattle prefer multiple head lots that are uniform. Buyers usually pay premiums for multiple head, uniform lots because of the ease of filling orders for specified groups of cattle. There have been multiple studies, which have found that multiple head uniform lots command a premium with respect to smaller or single head lots. Research has found that premiums were paid for uniform lots that facilitate filling a truckload (Faminow and Gum; Schroeder et al. 1988; Smith et al.). In most studies the optimal lot size was found to 46 to 60 head. Faminow and Gum found a discount of $3 per hundredweight for lot sizes less than ten head in Arizona auction markets. Two studies found significantly different results than the above studies. Turner, Dykes, and McKissick found the optimal lot size ranged from 143 to 276; this larger number could be attributed to the fact this study was based on teleauctions in Georgia with larger producers. Troxel et al. found that in Arkansas the price for single lots was not significantly different than prices for lots of six or more. One reason for this result could be because of smaller operators with smaller cowherds and poor management decisions. The study by Smith et al. used binary variables to describe lot size and found multiple head lots generated a premium over single head lots with the largest premiums being for lots greater then ten head.

Health, Horns, Condition, and Fill Effects

Results from a survey of cattle feeders with a one-time capacity of 1.8 million head discovered that health was the most important feeder cattle trait (Northcutt et al.). Of all characteristics, health often has the most profound effect on price. Lower prices are offered for sick cattle because of higher probability being chronically sick and having lower performance. Therefore cattle with health problems brought significant discounts compared to healthy cattle. Examples of discounts were: for sick cattle $11.47 to $28.96 per hundredweight, cattle with dead hair and mud $.97 to $10.70 per hundredweight, stale cattle $0.02 to $11.58 per hundredweight, lame cattle or with lumps $10.51 to $27.40 per hundredweight, and cattle with bad eyes $4.27 to $12.50 per hundredweight (Smith et al.; Schroeder et al. 1988; Troxel et al.). Results were found from studies in Kansas, Arkansas, and Oklahoma auction markets. These characteristics represent added cost of production for feedlot managers and potential discounts at harvest.

Cattle with horns normally receive discounts when compared to polled cattle. Some reasons for these discounts are increased use of bunk space and carcass bruises. Discounts for horned cattle were found to be \$0.42 to \$3.42 per cwt. (Smith et al.; Schroeder et al. 1988; Troxel et al.). There has been greater attention paid to the removal of horns because the 1995 Beef Quality Assurance Audit found a significant increase in carcass bruise damage compared to the 1991 audit (Troxel et al.).

Condition of cattle can have a significant effect on the price of feeder cattle. But these discounts can vary based upon the season and age of cattle. Schroeder et al. (1988) found that fleshy cattle discounts declined for Kansas auctions in the fall. Thin and very thin cattle were significantly discounted compared to spring sales, and fat or fleshy cattle discounts were less for yearlings then calves. The Smith et al. study in Oklahoma found discounts to be less for fleshy cattle in the spring than the fall for steers or heifers. Discounts increased for thin and very thin steers in the spring but discounts for thin and very thin heifers decreased. Fat or fleshy cattle discounts decreased in the spring for all cattle. Troxel et al. discovered that thin cattle generated premiums, while very thin, fleshy, and fat cattle received discounts compared to cattle in average condition.

The fill of feeder cattle can have an impact on the price of feeder cattle at auction markets. Feeder cattle of moderate fill are preferred because the market is not willing to pay for weight represented by gut fill. In Oklahoma it was found that cattle classified as tanked and gaunt received large discounts, with shrunk and full cattle receiving smaller discounts compared to cattle with an average fill (Smith et al.). Schroeder et al. (1988) found full and tanked cattle from feeder cattle auctions in Kansas received discounts relative to cattle of average fill but the discount was lower in the fall. In Arkansas, gaunt and shrunk cattle received a higher price then cattle with an average fill, while tanked and full cattle received considerable discounts (Troxel et al.).

Muscling, Frame, and Breed Effects

Cattle frame and muscle score can be used as determinants for a feeder calf's finishing weight and biological production level to a desired quality or yield grade. Cattle described as being small framed were discounted heavily compared to large and medium frame cattle (Lambert et al.; Schroeder et al. 1988; Smith et al.; Troxel et al.; Turner, Dykes, and McKissick). Muscle thickness also had a significant impact on the price of feeder cattle. Heavily muscled cattle received higher prices than medium and light muscled cattle (Lambert et al.; Schroeder et al. 1988; Smith et al.; Troxel et al.; Turner, Dykes, and McKissick). Greatest discounts were found to be for light muscled cattle, which in most cases is typical of dairy breeds. In most cases, the highest demand is for large frame, heavily muscled feeder cattle. This advantage for larger, heavily muscled cattle can be attributed to higher gains and a more efficient biological production cycle to finish to choice grade.

Breed of cattle can be important in determining feeder cattle price based upon breed attributes. The market will tend to value feeder cattle based upon anticipated performance for a given breed of cattle. Through crossbreeding, producers can take advantage of breed interactions to produce a better feeder calf. In Kansas, discounts were found for Angus, other English crosses such as shorthorn crosses, Brahman, and Longhorns when compared to Hereford cattle. Exotics such Simmental and charolais crosses and motley-faced cattle such as black and red baldy cattle generated small premiums compared to Herefords (Schroeder et al. 1988). Lambert et al. found Angus and dairy cattle generated discounts while exotics generated premiums compared to Herefords. In Georgia teleauctions, Angus cattle generated premiums but dairy and exotic cattle were discounted (Turner, Dykes, and McKissick). Smith et al. found in Oklahoma that black exotics, other exotics, and motley-faced cattle generated premiums compared to Angus. Hereford, Brahman, dairy, Longhorn, and mixed lots were discounted compared to Angus. These differences in premiums and discounts could be explained by different areas in which the cattle were sold due to demand for breeds due to climate and length of study.

Preconditioning Effects

What must be noted is that preconditioned feeder cattle are affected by the same price differentials as most cattle with a few exceptions. Preconditioned cattle in many cases will be sold at heavier weights than wean-and-ship calves so this should be considered when deciding the timing of marketing. Gender should only affect heifers since all bulls are required to be castrated before they are sold. The commingling of similar cattle into larger, more uniform lots by preconditioning programs should generate higher prices based on previous studies (Lawrence and Yeboha). Sickness should not be a large problem for preconditioned cattle due to cattle being previously weaned and vaccinated (Lalman and Smith). Most programs require dehorning of calves, which enhances feeder cattle prices. Producers should be cautious with their nutrition program so that steers are not too fleshy. Since preconditioned cattle are already on feed there should not be as large a problem with shrunk, gaunt, or tanked calves. Preconditioned calves will still be affected by the same premiums and discounts for muscling, frame size, or breed because preconditioning cannot change genetic traits. In a study by King of Superior Livestock Auctions for Pfizer found premiums of $3.33 per hundredweight for preconditioned calves.

Buyer Behavior

Most buyers of calves are purchasing cattle for either placement in the feedyard or for grazing pastures as stockers. Most buyers demand homogenous lots of cattle (Buccola 1982). Buyers purchase cattle according to level of risk in filling orders for customers. Risk adverse buyers may be persuaded to offer their reservation price early in the auction to ensure they purchase the quality and amount of cattle they require. This could be due to economies of scale and large fixed costs of cattle feeders. Feeder buyers set their reservation price based on the physical attributes of a lot of feeder cattle along with forecasts of live cattle price and corn price (Marsh). Less risk adverse buyers will not offer their full reservation price early but instead will offer what they expect average price to be later in the auction. Therefore, sale lots of feeder cattle sold early and late in an auction tend to have distorted price signals from buyers. That is, buyers fill their demand for homogenous lots in the order of their risk aversion, therefore creating a downward trend in price during the auction (Buccola 1982). By doing this, buyers are successful in discriminating against themselves. That is to say a buyer could pay a higher price for homogenous lots of feeder cattle if purchased during the start of the auction as opposed to later in the auction. In many cases, sellers will be able to extract some economic rent from buyers during the early section of an auction. In Kansas, it was found during feeder cattle auctions, cattle in the second and third quarter brought a premium attributed to greater number of buyers (Schroeder et al. 1988). Cattle sold in the first half of a sale may produce windfall gains over cattle sold later.

Effects on Cow-calf Producers

Most cow-calf producers do not precondition their calves, in part because the benefits of those cattle are not being communicated through the marketing chain. The cow-calf producer pays the cost of preconditioning but many of the benefits are believed to be received by the feedlot. Information failure or asymmetry exists regarding the benefits of preconditioning (Nyamusika et al.). The costs of preconditioning for the producer range from $35 to $60 per head (Cravey). The benefits to the feeder are that preconditioned cattle have been shown to have less treatment costs for sick calves, lower death loss, better-feed conversion, and lower cost of gain. An alternative for the rancher is to retain ownership of the calves where the goal of the program now is in their favor (Lusby and Barnes).

Another marketing alternative for a producer is to participate in a certified preconditioning program that offers special auctions of just these type cattle. There are many types of certified programs that allow smaller producers to come together and pool cattle of like quality and size in order to attract more buyers and a price premium. The pooling of feeder calves into larger lots will be more effective in producing greater profits than regular auctions. In Iowa, it was found that the pooling of source verified calves according sex, class, and average weight produced premiums of $0.96 to $2.14 per hundredweight (Lawrence and Yeboah). However, this premium would not be enough to cover the costs of production for preconditioning by the rancher. A preconditioning program held special auctions each October in Lincoln County, Oklahoma from 1982 to 1987. The premiums for these auctions ranged from $4.24 to $8.75 per hundredweight for steers and $2.76 to $8.63 per hundredweight for heifers compared with the weighted average price of feeder calves in the Oklahoma City Stockyards (Lalman and Smith). The preconditioned calf auction was showing improved price premiums each year but participation in the program fell off as the feeder cattle market improved.

One problem faced by most preconditioning programs and auctions is that producers either expect or have been led to expect large price premiums for their cattle that are not present at first. Producers enrolling in these programs must expect the price premium to be low the first few years as the program builds a reputation (Stough). The program must be given time to develop a reputation with buyers. Buyers of these cattle offer premiums for what they feel is the quality of the cattle, and the confidence they have that producers treated the animals according to the specified program (Lawrence and Yeboah).

The reputation of a seller is important only in markets that have inefficient information (Turner, McKissick, and Dykes). It was found in a study of teleauctions in Georgia that producers start to earn a reputation after the first auction. Reputations, good or bad, could generate either premiums or discounts respectively. The more information given to the buyer about cattle quality, the less that reputation had an effect on the sale price of feeder cattle (Turner, McKissick, and Dykes). After a reputation has been established, producer identification can help a buyer have some idea of cattle quality. What producers who enroll in these preconditioning programs must remember in the first few years is that it takes time to build a trusting relationship with feeder buyers. When they do, then the premiums will likely develop.

Overall, one generally assured effect of preconditioning is that costs are lowered for the feedyard because animals are healthier. This becomes more important with value-based marketing, a direction toward which the industry is moving. However, in order to receive a premium, producers must first build a reputation with buyers.

Conceptual Framework

There has been much discussion in the beef industry the past few years over ways to added value to beef cattle. Price reflects the demand for a sale lot of preconditioned cattle given the available supply (Schroeder et al. 1988). The market price (*P*) of a lot of preconditioned cattle (*i*) at time (*t*) given cattle (*k*) and lot characteristics(*C*) and (*h*) and market forces (*M*) could be conceptualized as:

(1) $$P_{it} = \sum_{k} V_{ikt} C_{ikt} + \sum_{h} R_{ht} M_{ht}$$

where *P, C, M, i, t, k,* and *h* are defined above (Schroeder et al. 1988; Buccola 1980; Turner, Dykes, McKissick). Coefficients V and R represent the value of each trait and the impact of various market forces.

The market value for preconditioned cattle can be affected significantly by a buyer's confidence in the seller or the preconditioning program. Buyers of preconditioned cattle must have confidence in the quality of cattle they buy. There is presence of moral hazard, and in fact, producers have an incentive to lie. Some producers could be free riders if they have entered into a program but not truly followed the protocol set forth by the program. For a program to be successful, it must monitor producers to ensure those participating follow the program protocol. Also the program must punish producers who are not following program specifications.

There is believed to be information inefficiency on source and process verification of calves. In order to overcome this problem, each specific preconditioning program must make sure producers are following guidelines and requirements. The reputation of the seller i.e. sponsoring organization, is at stake to ensure these cattle have been preconditioned properly. Without confidence in sellers, the buyer for preconditioned cattle may not be willing to pay a premium for cattle. It could be both difficult and costly to verify that preconditioning has taken place. The market will start to put more value on preconditioned cattle as buyers gain more confidence in preconditioned cattle and the seller's reputation.

Feedyards must also send more accurate market signals for improved performance of preconditioned cattle in the form of higher prices to increase market efficiency. It is expected that the true value of preconditioning is greater than the marginal revenue for a preconditioned calf for cow-calf producers. Expected benefits of preconditioning are lower cost of gain, less morbidity, and lower death loss during the feedlot phase of production. Efficient information exchange on enhanced revenues and lower production costs provided by preconditioning are needed to improve market value of preconditioning. Also the added revenue due to a group of uniform calves that will perform similarly during the feeding process is not known. This improved information could be used by alliances to show the benefit of preconditioning and increase enrollment in preconditioning programs, thereby helping to produce better beef products for consumers. For cow-calf producers to participate in such a program, there must be an incentive through higher market prices to encourage participation in preconditioning programs.

Preconditioning does not overcome poor genetics of inferior performing animals. Producers must know the quality of cattle they are producing. Preconditioning cannot change breed and physical characteristics of cattle attributed to genetics. Therefore factors such as small frame score, thin muscling, and perceived inferior breeds of cattle will still be discounted. Just because calves are enrolled in a preconditioning program does not change the way the market will value their genetically inherited characteristics. These programs are striving to produce an all-round higher quality product for consumers.

It is hypothesized that the lower production costs for the feedyard due to preconditioning are not being incorporated in the premium that markets are returning for preconditioning. Many preconditioning alliances hold special sales for preconditioned cattle. An example is the sale held monthly from October to March in Joplin, Missouri by two different preconditioning programs. For producers to enroll cattle in these sales, cattle must first be process verified by a representative of the sponsoring organization. The uniformity of cattle in lots and lot size could affect the price. The way cattle are pooled together can also directly contribute to the price by producing more uniform, similar performing lots of calves.

This research will find out how producers can overcome these market inefficiencies to receive a premium relative to added benefits for feedyard production due to preconditioning. This leads to the following hypothesis which is tested in this research:

Feeder cattle markets are inefficient in valuing preconditioned cattle, thus the premiums do not cover the added production costs to the producer and do not reflect the true value preconditioning adds.

Procedures

This research determined if the premium buyers pay for preconditioned calves through special preconditioned sales is adequate to cover the added producer costs of production for preconditioning. Buyers and sellers were notified of preconditioned sale dates prior to the sale and special sales were held independently of regular monthly sales. Also smaller producer's cattle were pooled together into larger lots to produce a more uniform group. Data from preconditioned sales was compared to regular sales to determine if the premiums are covering the added costs of production due to the preconditioning of cattle. This research will utilize two hedonic price analysis models. That is to say that the price of a given lot is based upon the perceived type of lot and quality attributes of cattle (Chvosta, Rucker, and Watts).

Time Series Data

The first equation to be estimated is

$$
\begin{aligned}
P_{it} = {} & \alpha + B_1 Head_{it} + B_2 Head_{it}^2 + B_3 AvgWt_{it} \\
& + B_4 AvgWt_{it}^2 + \sum_{j=1}^{2} B_{5j}\, St_{ijt} + \sum_{j=1}^{2} B_{6j}\, Sx_{ijt} + \sum_{j=1}^{22} B_{7j}\, Mo_{ijt} Yr_{ijt} \\
& + \sum_{j=1}^{4} B_{8j} Class_{ijt} + \sum_{j=1}^{4} B_{9j} Condition_{ijt} + e_{it}
\end{aligned} \tag{2}
$$

where i=1,..., N denotes the transactions for each sale type, and t=1,...,T_i denotes the month and year the sale took place. The model in equation 2 utilizes the time series data set. The description of the variables used in equation 2 can be found in table 2.

The model cannot be estimated by ordinary least squares as shown in equation (2). The model in equation (2) will be solved using the reg procedure in SAS (SAS Institute). There must be one variable from each set of dummy variables (sale type, sex, month-and-year interaction, class, and quality) dropped to properly estimate the model.

Table 3 lists the frequency of the independent dummy variables. The variables that are dropped will be denoted in subsequent tables as the base variables for comparison.

The dependent variable in equation (2) is the price per hundredweight of each lot. Independent variables are those that are expected to have an influence on the sale lot price. The number of head per lot (*Head*) is expected to have a positive relationship on average price. As the number of head increases prices increase at an increasing rate. A quadratic term ($Head^2$) is used for the curvature of the relationship of head per lot on price. The Head and $Head^2$ are used to explain the effect of pooling like cattle within a given lot (Lawrence and Yeboha). The average weight of a lot (*AvgWt*) is used to describe what effect average weight of a lot has on price and is expected to have a negative relationship. As average weight increases, it is expected that the price will decrease at a decreasing rate. This is due to the nonlinear relationship that weight has on the price. A quadratic term ($AvgWt^2$) is used to correct the curvature of price-average weight relationship due to the nonlinear relationship of weight and price (Faminow and Gum).

The sale type dummy variable (*St*) is used to represent the different sale types. The preconditioned sale variable is used to measure the premium received for preconditioned calves. The special sale variable is of primary interest in this model.

Another dummy variable (*Sx*) is used to find the influence of sex on a given lot. It is expected to represent the discount price of heifers when compared to steers.

A dummy interaction term between month and year (*MoYr*) is used to find the relationship month and year have on the price of preconditioned calves. An interaction term was used to measure the combined effect for each month for the different years.

This relationship should represent the trend and seasonality in the feeder cattle market. The base year was assigned to the first month and year of the data set. Month and year interaction variables are used due to seasonal placement of feeder calves and also help to show the price trend in the data (Schroeder et al. 1993).

Two dummy variables are used to describe physical characteristics of a given lot of calves for both types of sales. The first of the two is used to describe the frame score and muscling of a given lot (*Class*) represented by the four different frame scores. Another classification variable (*Condition*) is used to describe the condition differences between lots. The categories of the quality variables are normal, thin, fancy, and fleshy.

Sequential Data Set

The second equation to be estimated is

$$
\begin{aligned}
P_{it} = & \propto + B_1 Head_{it1} - B_2 Head_{it}^2 - B_3 AvgWt_{it} + B_4 AvgWt_{it}^2 \\
& + \sum_{j=1}^{3} B_{6j} Sale_{ijt} + \sum_{j=1}^{3} B_{7j} Sex_{ijt} + \sum_{j=1}^{10} B_{8j} Breed_{ijt} + \sum_{j=1}^{4} B_{9j} Horns_{ijt} \\
& + \sum_{j=1}^{4} B_{10j} Frame_{ijt} + \sum_{j=1}^{3} B_{11j} Muscle_{ijt} + \sum_{j=1}^{6} B_{12j} Fill_{ijt} + \sum_{j=1}^{5} B_{13j} Cond_{ijt} \\
& + \sum_{j=1}^{6} B_{14j} Health_{ijt} + \sum_{j=1}^{2} B_{15j} Uniform_{it} + e_{it}
\end{aligned} \tag{3}
$$

where i=1,…, N denotes the transactions for each sale type, and t=1,…,T_i denotes the days on which the sale took place. The model in equation 3 utilizes the sequential sale data set. The description of the variables used in equation (3) can be found in Table 4. This model in equation (3) is also a hedonic pricing model similar to the first model but has added lot characteristics. The model in equation (3) cannot be estimated utilizing ordinary least squares as presented in (3). The model in equation (3) will be solved using the reg procedure in SAS. In order for the model to find a solution, one variable from each group (sale, sex, breed, horns, frame, muscle, fill, condition, health, and uniform) must be dropped and serve as a base. Base variables will be consistent with past studies done by Schroeder et al. (1988) and Smith et al. The base variables will be denoted in subsequent tables. Frequency the independent variables can be found in table 5.

The dependent variable in (3) is price per cwt. for each lot of feeder calves sold through the auction market. Independent variables of (3) are those that are expected to influence price. The variables for lot size (*Head* and $Head^2$) and lot weight (*AvgWt* and $AvgWt^2$) will have the same relationship as the lot size and weight variables in equation (2). This model also has a classification variable (*Uniform*) to describe whether the lot is uniform or not. There is a group of three dummy variables for sale type (*Sale*) used to describe the difference between preconditioned and non-preconditioned calves. There are two variables to represent two different preconditioning programs. The first preconditioned calf sale (Precon1) is expected to generate a higher premium due to that it has only one vaccination and backgrounding protocol for the program.

The next variables are dummy variables (*Sex*) used to describe the price difference between steers, bulls, and heifers. There is a group of classification variables (*Health*) used to describe the health of a lot of feeder calves. These variables are important for this study since preconditioning increases the immune system and produces healthier calves (Lalman and Smith). Another group of dummy variables (*Horns*) is used to describe the presence of horns in a lot of feeder calves. The dummy variables (*Cond*) are used for the description of the physical appearance of a lot of feeder calves. Variables (*Fill*) are used for the amount of gut fill a lot of cattle have. There are category variables (*Muscle*) to describe the thickness of muscling for a lot of calves. Another group of variables (*Frame*) used to describe the frame score of a lot. There also a set of dummy variables (*Breed*) to describe the breed differences for a lot of calves.

To determine if the cost of production is covered by the premium received as opposed to non-preconditioned calf, a comparison will be made between profits (revenues less variable costs) from a non-preconditioned calf to profit for a preconditioned calf. The cost information being used for these equations is based on Gill's Texas A&M Vac-45 budget of the Vac 45 trials, OSU enterprise budgets, personal interviews and the Cowman spreadsheet by Dewald and Lalman.

Equation (4) is used to find the gross revenue of a non-preconditioned calf. It is

$$(4) \qquad \prod_{nonvac} = WW_{nonvac} * [P_{vonvac}(WW_{nonvac})]$$

where Π_{nonvac} is profit for a non-preconditioned calf. WW_{nonvac} is weaning weight of a calf after shrink. $P_{vonvac}(WW_{nonvac})$ is price per cwt. for a non-preconditioned calf as a function of weaning weight forty-five days prior to the preconditioned calf auction. Pay weight will be considered the average weight of the non-preconditioned calf after a standard shrink percentage at least forty-five days prior to the preconditioned calf auction. The price is the price per cwt. of non-preconditioned calves.

Equation (5) is used to find the profit of a preconditioned calf. It is

$$(5) \quad \prod_{vac} = SW_{vac} * [P_{vac}(SW_{vac}) + PP_{vac}] - [HC_{vac} + NC_{vac} + LC_{vac} + MC_{vac} + DL_{vac} + CI_{vac}]$$

where Π_{vac} is profit for a preconditioned calf. SW_{vac} is sale weight of a calf after shrink. Sale weight is weaning weight plus added weight gain of the calf due to a forty-five day preconditioning period. Previous studies have found gain during the preconditioning period of 1.5 to 2.0 pounds per day (Lusby and Barnes; Lusby and Thedford; Lalman et al.). $P_{vac}(SW_{vac})$ is the market price per cwt. for a preconditioned calf as a function of sale weight. PP_{vac} is price premium for the preconditioned calf. Price premiums will be based on the two preconditioned calf sale variables in equation (3). HC_{vac} is associated health cost of preconditioning, which consists of two rounds of vaccination, worming, and antibiotics. NC_{vac} is nutritional costs of preconditioning and includes weaning ration to be fed and hay or forage costs. LC_{vac} is labor cost during the weaning period for processing and feeding. MC is marketing cost of the preconditioned calf. DL_{vac} is the associated death loss for newly weaned calves. CI_{vac} is the cattle interest costs for the added costs of preconditioning and opportunity costs of retaining calves for forty-five days. All costs will be calculated on a per head basis.

A comparison was, then, made between profit of a non-preconditioned calf (Π_{nonvac}) and preconditioned calf (Π_{vac}). This comparison is between retaining calves and preconditioning them for forty-five days as opposed to the more traditional practice of selling calves directly after weaning. This comparison will determine if there is a profit advantage from preconditioning.

Results

The models developed for this study are used to represent the price of preconditioned feeder cattle relative to non-preconditioned feeders. In the first model estimated for equation (2) the price for cattle is found with respect to a regular sale, number 1, normal flesh steers, sold in December 1997, given the average weight and lot size. The second model is estimated by equation (3) where price is found relative to a uniform lot of healthy angus steers sold during the regular weekly auction with large frame, heavily muscled, average fill and condition. Finally, using budgets and price information based on the results from equation (3) it is determined whether or not the preconditioning premium is covering the added costs of production.

Time Series Data

The results for equation (2) are found in Table 6. The model had some statistical problems, which were believed to be attributed to the aggregation of sale data. The model had an adjusted R^2 of 0.942, considered quite high. The model is explaining most of the variation in price considering that it is missing breed identification for calves since this data is the aggregated market reports published by the Missouri market reporter's office of USDA.

The Breusch-Pagan, Glejser, and Harvey tests were used to test for heteroskedasticity and all resulted in the rejection of the null hypothesis of homoskedasticity. Therefore to alleviate the problem of heteroskedasticity Harvey's procedure was used to create weights for the Feasible Generalized Least Squares (FGLS) in table 6 (Greene). The test for autocorrelation were found to be in the inconclusive range.

<u>Preconditioning</u>

Over the four years of the data period, preconditioned calves produced a premium of $2.59 per hundredweight when compared to their non-preconditioned counterparts (table 6). It should be noted that the preconditioned price is based upon two different preconditioned programs that are separated in the sequential sale data. Of the two programs one has very strict protocol on procedures to use and the second program has different modifications of the vaccination and feeding program. Therefore this could explain the low price premium for preconditioning in this data set compared with the sequential data (discussed later) and by King.

Lot Characteristics

Heifer lots brought a significant discount of $10.21 per hundredweight when compared to lots of steers. Sale lots of #1-2 large and medium muscle and frame scores were discounted from $5.05 to $9.92 per hundredweight compared to lots of heavier muscled and larger frame feeder calves. Feeder cattle classified as thin and fancy generated premiums of $4.60 and $4.54 per hundredweight while fleshy cattle were discounted $6.53. It could be determined then that buyers of feeder cattle prefer large frame, heavily muscled steers that have a thin or fancy appearance.

Month and Year

Figure 5.1. Effect of Time on Feeder Calf Prices

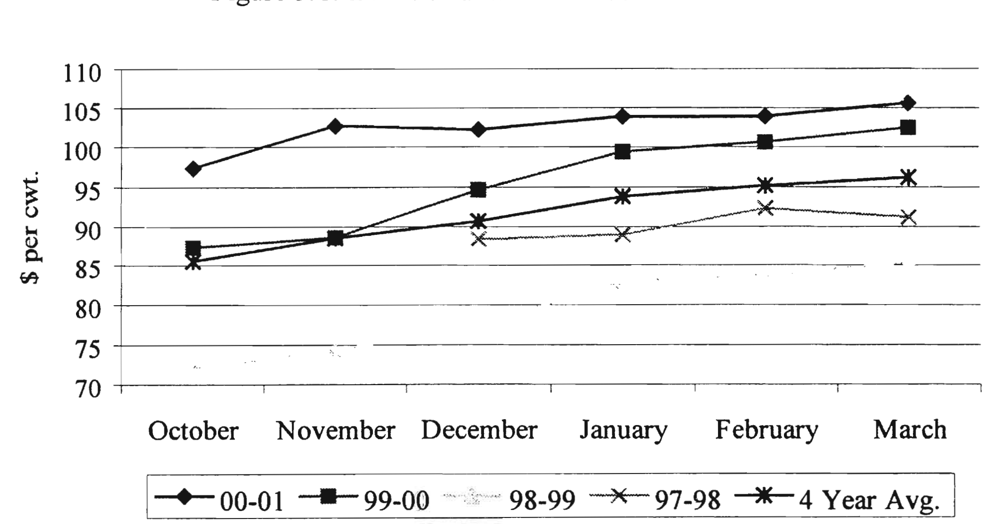


Figure 5.1 represents the effect that time has on the price per cwt. for feeder cattle during the time of the data. The base month and year (denoted in Table 6) is December 1997. The price shown is for both preconditioned and non-preconditioned feeder calves during the specified period. Compared to December 1997, the four-year average of

prices as increasing from October to March. Lowest prices are during the second year (1998-1999) while the highest prices are in the fourth year (00-01).

Lot Size and Weight

The variables representative of lot size (*Head*) had some unexpected results as it had a negative value, which is normally not the expected results in previous studies and was not significant (Faminow and Gum; Schroeder et al.; Turner, Dykes, and McKissick). However some of the explanation could be attributed to the aggregation of the data i.e., these are not actual lots but aggregation of lots of like cattle within fifty-pound weight variation among the lots. Note that the average lot size for this data set is 118 head (table 1) whereas in the sequential data set average lot size was 9 head (table 2). The quadratic term for lot size ($Head^2$) had the expected sign but again was not significant.

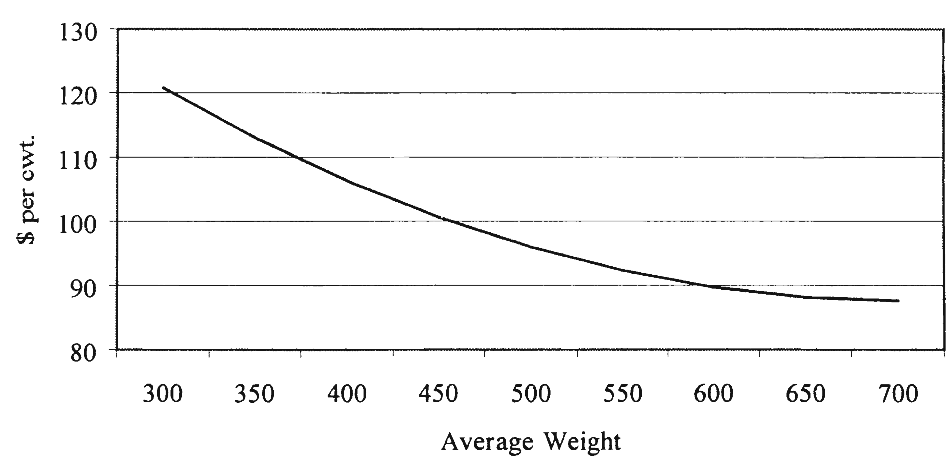
The variables used to describe lot weight ($AvgWt$, $AvgWt^2$) had the correct signs as expected and as in previous research and were significant (Faminow and Gum; Schroeder et al.; Turner, Dykes, and McKissick).

Sequential Sale Data

Results for equation (3) are found in Table 7, and a comparison with other feeder cattle price differential studies is shown in Table 8. Results for the current study in table 9 are in the column labeled Avent. The model from equation (3) had an adjusted R^2 of 0.720. This model explained less of the variation in price despite having more information about the lots of feeder cattle. Note that the standard deviation of price in the time series was bout $13.68 per hundredweight over a four-year period. For the sequential data set, the standard deviation was nearly as large for price $12.26 per hundredweight (table 2) even though sale covered three consecutive days. Breusch-Pagan, Glejser, and Harvey tests are used to test for heteroskedasticity and rejected the null hypothesis of homoskedasticity. Harvey's procedure was used to produce the weights for FGLS estimates of equation (3) reported in table 7 (Greene). Parameter residuals that were found to be outliers were not removed because they dealt with single head lots of very sick cattle or cattle with impairments that resulted in low prices.

<u>Lot Weight</u>

Figure 5.2. Effect of Weight on Price



The data analyzed was limited to a weight range from 300 to 700 pounds. Lot weight had a negative influence on price while the quadratic term had a positive influence. The results were as expected and represent the nonlinear relationship between weight and price. Prices per hundredweight were highest at 300 pounds and the price sharply decreased, then price leveled off from 575 to 700 pounds. So it could be said there was little difference in price between lots of feeder cattle with average weights between 575 and 700 pounds. These estimates were compared with other studies in table 8. The estimates in this study seem to be consistent with previous studies, which used a nonlinear relationship to model price and for cattle sold in late fall (Lambert et al., Schroeder et al. 1988, Smith et al., Turner et al. Marsh, Faminow and Gum). Figure 5.2 represents the effect that weight has on a lot of feeder cattle sold during the three sequential sales.

Gender

Prices were discounted $7.02 per hundredweight for heifers when compared to steers. These discounts were consistent with previous studies shown in table 8. This discount could be attributed to higher quality heifers being retained by owners as herd replacements. The discount for bulls when compared to steers is $4.52 per hundredweight. Bulls are discounted due to the added stress and lower performance due to later castration. This discount is consistent with work by Troxel et al. and Smith et al. for bulls.

Uniformity and Lot Size

Figure 5.3. Effect of Lot Size on Price per cwt.

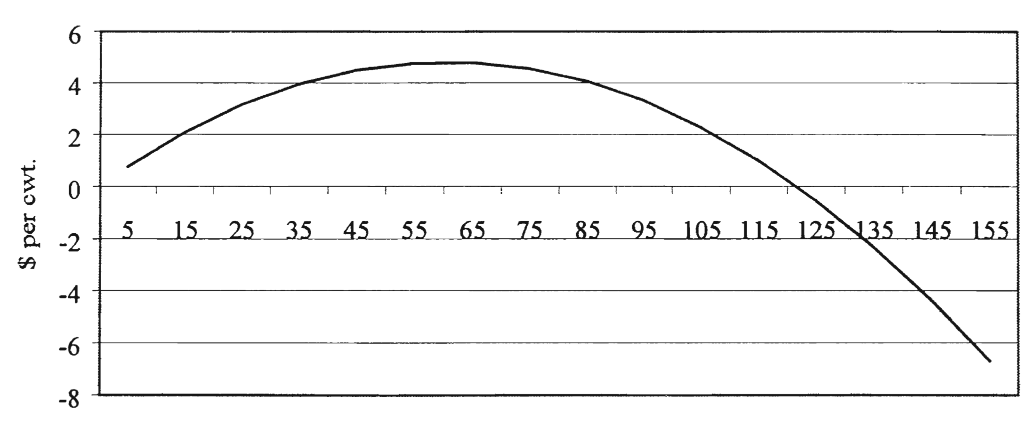


Figure 5.3 represents the effect of lot size on price per hundredweight. Lots that were classified as not uniform were discounted $0.87 per hundredweight. The results for uniformity were in line with previous studies in table 8. Lot size had a positive effect on

price that is as lot size increased price increased at an increasing rate. The quadratic term for the lot, size variable had the correct sign and significance. The most preferred lot sizes for this data set are 55 to 65 head. Other studies found the preferred lot size to be 45 to 60.

Health, Horns, Condition, and Fill

Cattle classified as healthy are used as the base variable for comparison. Lots of cattle with dead hair and mud were not significant but discounted $9.45 per hundredweight. This discount is in line with Troxel et al. but is greater than in the studies by Schroeder et al. 1988, and Smith et al. for dead hair and mud. Sick cattle were discounted $13.88 per hundredweight; this was a lower estimate then for sick cattle sold in the fall for previous studies. Part of this low estimate could be due to only three lots being classified as sick. Cattle with bad eyes were discounted up to $20.87 per hundredweight, considerably higher then previous studies. Lame cattle or cattle with lumps were severely discounted by $41.33 per hundredweight. Feeder cattle buyers in Joplin during these particular sales more heavily discounted animals with physical impairments than for sickness.

Lots of cattle with horns were discounted $1.01 per hundredweight but were not significant. The results for cattle with horns were consistent with studies by Troxel et al., and Schroeder et al. 1988, but were considerably less then a study by Smith et al. (Table 8). Cattle described as dehorned generated a premium of $1.28 per hundredweight but were not significant. While lots of mixed horn cattle were discounted $6.14 per hundredweight, which was considerably different than results found by Schroeder et al. 1988, which found mixed results.

Cattle of average condition were the base category for comparisons of lot condition. The variable for very thin cattle had to be dropped because of only one observation that caused a multicollinearity problem during the weighting process. Thin cattle were discounted $0.55 per hundredweight, but were not significant. This was a surprising result given past studies that found large, significant discounts in the fall for thin cattle. Cattle described as fleshy were discounted $0.60 per hundredweight, which is consistent with results for previous studies of cattle sold in the fall. The lower discount for fleshy cattle could be due to the fact that the cattle were sold in the fall and a large number were preconditioned cattle. Cattle classified as fat were discounted $3.91 per hundredweight but the coefficient was not significant.

Lots of normal fill were the basis of comparison for fill. Shrunk cattle and full cattle generated discounts of $0.35 and $0.24 per hundredweight respectively. Neither the shrunk or full variables were found to be significant.

Muscling, Frame, and Breed

Lots of feeder cattle with heavy muscle score are used as the base variable. Cattle with a medium and light muscle score were discounted $1.54 and $8.82 per hundredweight respectively. The results of muscle score are compared in Table 8. The parameter estimate for medium muscled cattle was lower than results found by Troxel et al. and Schroeder et al. 1988 but is consistent with results found by Smith et al. Discounts for light muscled cattle were consistent with previous studies.

Cattle with large frame scores are used as the basis of comparison. Lots with a frame score of upper medium, lower medium, and small are discounted $1.46, $5.94, and $42.57 per hundredweight respectively. The results for upper medium frame cattle are consistent with previous studies in Table 8. Lower medium and small framed cattle in this study were discounted more than in previous work.

Lots of Angus cattle are the base group for breed comparison. Hereford and white face cattle received discounts of $2.96 and $0.65 per hundredweight. Cattle with less than one-quarter Brahman and more than one-quarter Brahman were discounted $4.67 and $11.05 per hundredweight respectively. Lots of black exotics and other exotics generated premiums of $0.46 and $0.49. Dairy, Longhorn, and mixed breed lots were discounted $9.48, $7.14, and $1.79. The only breeds found to be significant were Hereford, less than one quarter Brahman, dairy, Longhorn, and mixed breeds.

Preconditioning

Figure 5.4. Preconditioning Premiums

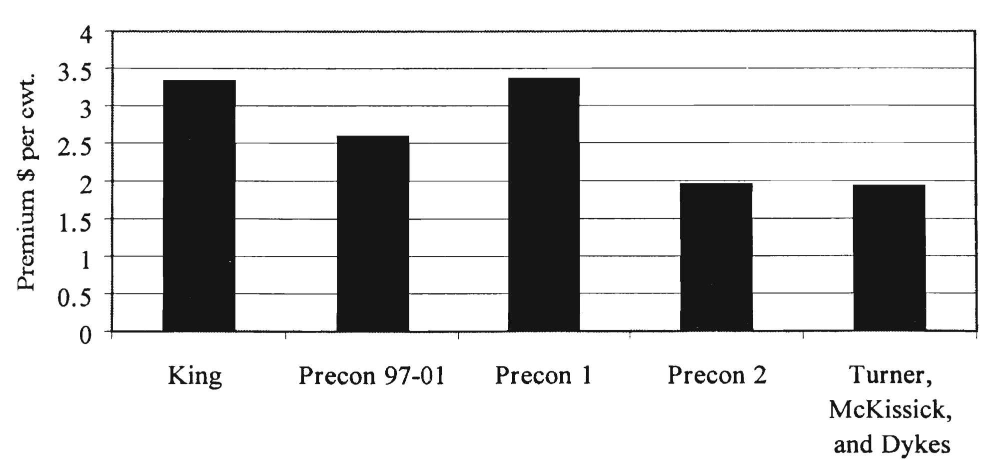


Figure 5.4 is a comparison of previous results on premiums for preconditioning (King; Turner, McKissick, and Dykes) compared to the results of this study. The price premium from the time series data over a four-year period (1997-01) was $2.59 per hundredweight. What should be noted is that the precondition premium is representative of two different sales and programs. The first program (Precon 1) only has one protocol requiring a forty-five day weaning period that requires calves be vaccinated twice,

dehorned, wormed, bulls castrated, and a back-grounding nutritional program. The second program (Precon 2) has many different weaning and vaccination protocols that can be followed. For example the first preconditioning program generated a premium in the sequential data set of $3.36 per hundredweight for steers and heifers when compared to the regular weekly auction. The second program generated premiums of $1.96 per hundredweight premiums when compared to the regular weekly auction for steers and heifers. The lower premium for the second program could be attributed to the numerous different vaccination and weaning guidelines. For example the vac 34 program just requires vaccination 3 to 4 weeks before shipment. Both results are consistent with other previous results represented in figure 5.4.

Spreadsheet Comparison

The results for equation (4) can be found in table 9. The price data for equation (4) are from the average of regular weekly auctions for steers for October 17, and 24, 2000 at Joplin regional stockyards in Joplin, Missouri. The average was taken because the weaning date for calves sold in the preconditioned calf program was in the middle of the two auctions (Mo. Dept. of Ag). Sale weight is the weight of calves after a 4% shrink. The price used is $99.09 per hundredweight for steers; and heifers are discounted $7.02. Gross revenue per head for steers and heifers is $460.43 and $415.21 respectively.

Results for equation (5) are in table 9. The price at marketing is the average price from sequential data of $94.35 and $87.33 per hundredweight respectively for steers and heifers. Recall the sale dates were December 4, 5, and 6, 2000. The final price for preconditioned calves is the price at marketing less a discount for increased flesh and the added premium for preconditioning program. A flesh discount is included due to the apparent added flesh due to the forty-five day feeding program. The gross revenue for preconditioned steers and heifers is $546.28 and $494.20 per head. Cattle interest represents interest and opportunity costs of preconditioning and is based upon the bank prime loan rate (Federal Reserve Board). Costs due to preconditioning are in table 9 and outlined in detail in table 10. Total costs for steers and heifers are $64.44 and $63.69.

A comparison is then made between the gross revenue from traditional marketing and gross revenue from preconditioned cattle. The return for preconditioned steers and heifers less traditional marketing and preconditioning costs is $21.41 and $15.30 per head. Steers are more profitable than heifers but both are more profitable than traditional marketing. The value of preconditioned calves will be further examined in the conclusion after a comparison of preconditioned and non-preconditioned calves based on feedyard performance and price differences.

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Table 1. Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Time Series Data Summary Statistics.[a]				
Head	118.254	125.583	4.000	877.000
Weight	514.968	99.534	300.000	694.000
Price	88.338	13.676	57.000	137.320
Sequential Sale Data Summary Statistics[b]				
Head	9.134	13.397	1.000	158.000
Weight	520.491	96.519	300.000	699.000
Price	94.355	12.262	2.000	139.000

[a] 1333 observations
[b] 1249 observations

Table 2. Model (2) Variable Definitions and Expected Signs.

Dependent Variable	Variable Definition
P_{it}	j^{it} transaction price ($/cwt) for calves in sale t

Independent Variable	Variable Definition	Expected Sign
St_{ijt}	Zero-one dummy variable for type of sale, j=1-2, 1=Regular, 2=Preconditioned; Base = Regular	+
Sx_{ijt}	Zero-one dummy variable for the sex of a lot of cattle, j=1-2, 1=Steers, 2=Heifers, Base=Steers	-
$Head_{it}$	Total number of head in a lot	+
$Head^2_{it}$	Quadratic term for number of head in a lot	-
$AvgWt_{it}$	Average weight of a lot of cattle.	-
$AvgWt^2_{it}$	Quadratic term for average weight	+
Mo_jYr_{ijt}	Zero-one dummy variable for months October to March (Mo1-Mo6) and years 1997-98 to2000-01 (Yr1-Yr4), j=1-6; Base=Mo3Yr1	+/-
$Class_{ijt}$	Zero-one dummy variable for lot frame score, j=1-4, 1=No. 1 Med & Lg, 2= No. 1-2 Med & Lg No. 1 Med & Lg, 3=No. 1 Med, 4= No. 2 Med & Lg; Base= No. 1 Med & Lg	-
$Condition_{ijt}$	Zero-one dummy variable for condition of the lot j=1-4, 1=normal, 2=thin, 3=fancy, 4=fleshy; Base=Normal	+/-

Table 3. Model (2) Frequency Distribution.

Variable	Frequency	Percent
Sale Type		
Sale Type 1	677	50.79
Sale Type 2	656	49.21
Sex		
Steers	753	56.49
Heifers	580	43.51
Frame and Muscling		
No. 1 Med & Lg	1044	78.32
No. 1-2 Med & Lg	206	15.45
No. 1 Med	52	3.90
No. 2 Med & Lg	31	2.33
Month and Year		
Mo 3 Year 1	43	3.23
Mo 4 Year 1	42	3.15
Mo 5 Year 1	36	2.70
Mo 6 Year 1	47	3.53
Mo 1 Year 2	46	3.45
Mo 2 Year 2	82	6.15
Mo 3 Year 2	40	3.00
Mo 4 Year 2	72	5.40
Mo 5 Year 2	72	5.40
Mo 6 Year 2	79	5.93
Mo 1 Year 3	48	3.60
Mo 2 Year 3	36	2.70
Mo 3 Year 3	46	3.45
Mo 4 Year 3	73	5.48
Mo 5 Year 3	76	5.70
Mo 6 Year 3	39	2.93
Mo 1 Year 4	56	4.20
Mo 2 Year 4	72	5.40
Mo 3 Year 4	103	7.73
Mo 4 Year 4	123	9.23
Mo 5 Year 4	63	4.73
Mo 6 Year 4	39	2.93
Lot Quality		
Normal	1143	85.75
Thin	31	2.33
Fancy	103	7.73
Fleshy	56	4.20

Table 4. Model (3) Variable Definitions and Expected Signs.

Dependent Variable	Variable Definition
P_{it}	ith transaction price ($/cwt) for a lot of preconditioned calves in sale t

Independent Variable	Variable Definition	Expected Sign
$Head_{it}$	Total number of head in a lot	+
$Head^2_{it}$	Quadratic term for head	-
$AvgWt_{it}$	The average weight of a lot of cattle	-
$AvgWt^2_{it}$	Quadratic term for average weight	+
$Sale_{ijt}$	Zero-1 dummy variable for the sale type, j=1-3, 1=Regular, 2=precon1, 3=precon2; Base=Regular	
Sex_{ijt}	Zero-one dummy variable for sex of cattle, j=1-3, j=steer, 2=bull, 3=heifer; Base=steer	-
$Breed_{ijt}$	Zero-one dummary variable for breed of a lot of cattle, j=1-10, 1=Hereford, 2=Angus, 3=Whiteface, 4=Black Exotics, 5=Other Exotics, 6=Less than ¼ Brahman, 7=More than ¼ Brahman, 8=Dairy, 9=Longhorn, 10=Mixed Breed; Base=Angus	+/-
$Horns_{ijt}$	Zero-one dummy varable for the presence of horns in a lot of cattle, j-1-4, 1=Polled, 2=Horns, 3=Dehorned, 4=Mixed Horns; Base=Polled	
$Frame_{ijt}$	Zero-one dummy variable for frame size of cattle, j=1-4; 1=Large, 2=Upper Medium, 3=Lower Medium, 4=Small; Base=Large	-
$Muscle_{ijt}$	Zero-one dummy variable for muscle thickness, j=1-3; 1=Heavy, 2=Medium, 3=Light; Base=Heavy	-
$Fill_{ijt}$	Zero-1 dummy variable for fill of cattle j=1-5; 1=Gaunt, 2=Shrink, 3=Average, 4=Full, 5=Tanked; Base=Average	-
$Condition_{ijt}$	Zero-one dummy variable for condition of cattle; j=1-5; 1=Thin, 2=Very thin, 3=Average condition, 4=Fleshy, 5=Fat; Base-Average condition	+/-
$Health_{ijt}$	Zero-one dummy variable for health of cattle, j=1-6; 1=Healthy, 2=dead Hair or Mud, 3=Stale, 4=Sick, 5=Bad Eye, 6=Lame or Lump; Base=Healthy	-
$Uniform_{ijt}$	Zero-one dummy variable for uniformity of a lot, j=1-2; 1=Uniform, 2=Non-uniform; Base=Uniform	-

Table 5. Model (3). Frequency Distribution.

Variable	Frequency	Percent
Sale Type		
Public	586	46.92
Precon 1	307	24.58
Precon 2	356	28.50
Sex		
Steer	675	54.04
Heifer	535	42.83
Bull	39	3.12
Breed		
White Face	67	5.36
Herford	15	1.20
Angus	273	21.86
Black Exotics	48	3.84
Other Exotics	537	42.99
Less than ¼ Brahman	119	9.53
More than ¼ Brahman	2	0.16
Dairy	28	2.24
Longhorn	10	0.80
Mixed Breed	150	12.01
Horns		
Polled	1182	94.64
Horns	57	4.56
Dehorned	5	0.40
Mixed Horns	5	0.40
Frame		
Large	763	61.09
Upper Medium	431	34.51
Lower Medium	52	4.16
Small	3	0.24
Muscle		
Heavy	964	77.18
Medium	253	20.26
Lite	32	2.56
Fill		
Shrunk	118	9.45
Average Fill	858	68.69
Full	273	21.86

Table 5. Model (3). Frequency Distribution. (continued)

Variable	Frequency	Percent
Condition		
Very thin	1	0.08
Thin	120	9.61
Average	831	66.53
Fleshy	293	23.46
Fat	4	0.32
Uniformity		
Uniform	1213	97.12
Non-uniform	36	2.88
Health		
Healthy	1231	98.56
Dead Hair and Mud	2	0.16
Sick	3	0.24
Bad Eye	5	0.40
Lame or Lump	8	0.64

where i=1,…,N denotes each different lot, and t=1,…,T_i denotes the time cattle were placed in the feedlot. The description of variables used in equation (3) can be found in table 5.

The dependent variable in equation (3) is the cost of gain ($ per cwt) of a lot. As placement weight (*Pwt*) and calf flesh (*Flesh*) increase, each is expected to cause a lower cost of gain. Inbound shrink (*Shrink*) and medicine cost (*Med*) are expected to increase the cost of gain, especially due to the effect sickness has on animal performance. Higher average daily gain (*ADG*) of a lot causes cost of gain to decrease while an increase in conversion (*Conv*) will increase cost of gain. Days on feed (*DOF*) is expected to increase cost of gain. Sex of lot (*Sex*) is expected to be positive as it is expected heifers will have a higher cost of gain then steers. The placement month (*Mthin*), placement year (*Yrin*), origin (*Origin*), lot breed (*Breed*), and lot quality (*Quality*) could have an increasing or decreasing effect on cost of gain. The background of a lot (*Back*) is expected to have an increasing effect on cost of gain because research shows healthier calves demonstrated lower costs of gain.

The third equation to be estimated is

$$\begin{aligned}(4)\qquad ADG_{it} = {} & \alpha + B_1 Pwt_{it} + B_2 Flesh_{it} - B_3 Shrink_{it} - B_4 Med_{it} - B_5 Conv_{it} \\ & + B_6 DOF_{it} + B_7 Gain_{it} - \sum_{j=1}^{2} B_{8j}\, Sex_{ijt} + \sum_{j=1}^{6} B_{9j}\, Mthin_{ijt} + \sum_{j=1}^{3} B_{10j}\, Yrin_{ijt} \\ & + \sum_{j=1}^{6} B_{11j} Origin_{ijt} + \sum_{j=1}^{4} B_{12j} Breed_{ijt} + \sum_{j=1}^{2} B_{13j} Quality_{ijt} - \sum_{j=1}^{7} B_{14j} Back_{ijt} + e_{it}\end{aligned}$$

where i=1,…,N denotes each different lot, and t=1,…,T_i denotes the time cattle were placed in the feedlot. The description of variables used in equation (4) can be found in table 6.

Table 6. Model (2) Parameter Estimates. (continued)

Independent Variable	Parameter Estimate
Mo 5 Year 2	-1.618***
	(-2.39)
Mo 6 Year 2	0.124
	(0.20)
Mo 1 Year 3	2.083**
	(2.80)
Mo 2 Year 3	3.369***
	(4.49)
Mo 3 Year 3	9.330***
	(14.36)
Mo 4 Year 3	14.102***
	(22.81)
Mo 5 Year 3	15.344***
	(22.42)
Mo 6 Year 3	17.15***
	(24.53)
Mo 1 Year 4	12.055***
	(18.56)
Mo 2 Year 4	17.398***
	(22.63)
Mo 3 Year 4	16.907***
	(27.08)
Mo 4 Year 4	18.624***
	(30.07)
Mo 5 Year 4	18.631***
	(29.73)
Mo 6 Year 4	20.358***
	(18.39)
Head	-.001
	(-0.64)
$Head^2$	$-9.150x10^{-7}$
	(-0.24)
Weight	-0.096***
	(-7.79)
$Weight^2$	$2.501x10^{-5}$**
	(2.15)
Adjusted R^2	0.942
RMSE	1.838
Observations	1333

[a] Numbers in parenthesis are values of calculated t-statistics.
Significance levels are *** = 0.01, ** = 0.05, and * = 0.10

Table 7. Model (3) Parameter Estimates.

	Independent Variable	Parameter Estimate
	Intercept	188.200*** (41.05)[a]
Lot Size		
	Head	0.158*** (8.79)
	$Head^2$	-0.001*** (-5.39)
Lot Weight		
	Weight	-0.288*** (-17.04)
	$Weight^2$	0.205×10^{-3}*** (13.33)
Sale Type		
	Public	Base
	Precon 1	3.357*** (11.22)
	Precon 2	1.955*** (6.37)
Lot Gender		
	Steer	Base
	Heifer	-7.021*** (-29.44)
	Bull	-4.523*** (-4.88)
Breed		
	Angus	Base
	Hereford	-2.962** (-2.28)
	White Face	-0.651 (-1.10)
	Black Exotic	0.462 (0.66)
	Other Exotic	-0.486 (-1.57)

Table 7. Model (3) Parameter Estimates (continued).

Independent Variable		Parameter Estimate
	Less than ¼ Brahman	-4.666*** (-7.91)
	More than ¼ Brahman	-11.052 (-0.87)
	Dairy	-9.479*** (-4.03)
	Longhorn	-7.138** (-2.74)
	Mixed Breed	-1.788*** (-4.54)
Horns		
	Polled	Base
	Horns	-1.010 (-1.51)
	Dehorned	1.276 (0.81)
	Mixed Horns	-6.142** (-2.00)
Frame		
	Upper Medium	Base
	Large	1.460*** (4.69)
	Lower Medium	-4.481*** (-4.17)
	Small	-41.113* (-1.77)
Muscle		
	Medium	Base
	Lite	-7.276*** (-2.78)
	Heavy	1.541*** (3.59)

Table 7. Model (3) Parameter Estimates (continued).

Fill		
	Average Fill	Base
	Shrunk	-0.346
		(-0.63)
	Full	-0.235
		(-0.79)
Condition		
	Average Condition	Base
	Thin	-0.554
		(-0.86)
	Fleshy	-0.598**
		(-2.08)
	Fat	-3.913
		(-0.99)
Lot Uniformity		
	Uniform	Base
	Non-Uniform	-0.867*
		(-1.82)
Health		
	Healthy	Base
	Dead Hair and Mud	-9.447
		(1.36)
	Sick	-13.877*
		(-1.82)
	Bad Eye	-20.872***
		(-4.07)
	Lame or Lump	-41.334***
		(-3.83)
	Adjusted R^2	0.7204
	RMSE	1.973
	Observations	1249

[a] Numbers in parentheses are values of calculated t-statistics.
Significance levels are *** = 0.01, ** = 0.05, and * = 0.10.

Table 8. Comparison of Different Price Differential Studies.

Characteristics	Avent	Troxel et al.	Turner, Dykes, and McKissick	Schroeder et al. 1988	Smith et al.
Lot Size & Weight					
Head	0.158		.13 to .54	.131 to .282	
Head^2	-0.001		-.24x10^{-5} to .19x10^{-3}	-.001 to .003	
Weight	-0.288			-0.41 to .103	
Weight^2	0.205x10			-.003x10^{-3} to .003x10^{-2}	
Sex					
Heifer	-7.021	-10.95	base		-7.43 to –10.56
Bull	-4.523	-4.63			-2.24 to –3.56
Steers	base	base	4.488 to 6.805		base
Breed					
Hereford	-2.962	-10.34[a]	.036 to .676[b]	base	-3.22 to –8.37
White Face	-.651	1.23		-.188 to .605	.07 to .85
Less than ¼ Brahman	-4.666	-1.96	-1.12 to .979.	-612 to –1.758	-1.91 to 1.43
More than ¼ Brahman	-11.052	-1.32	(Brahman)	-3.287 to –7.058	-6.11 to –1.91
Black Exotic	.462	N/A	-3.008 to 0.566	.061 to 1.045	.93 to 3.64
Other Exotic	.486	N/A	(Exotic)	(Exotic)	.95 to 2.98
Dairy	-9.479	N/A	-10.678	-7.349 to –10.10	-24.95 to –13.75
Longhorn	-7.138	-19.19		-4.561 to –6.975	-14.41 to –26.82
Mixed Breeds	-1.788	N/A	.315 to .886	--.095 to .110	-1.83 to 1.76
Angus	base	-.38	-.016 to .651	-.946 to –1.744	base

Table 8. Comparison of Different Price Differential Studies (Continued).

Characteristics	Avent	Troxel et al.	Turner, Dykes, and McKissick	Schroeder et al. 1988	Smith et al.
Horns					
Polled	base	base		base	base
Horns	-1.01	-1.49		-.418 to –840	-3.42
Dehorned	1.276	base		base	
Mixed Horns	-6.142			-.285 to .445	
Frame					
Large	base	base	-.499 to -.051	base	base
Upper Medium	-1.460	-.96	(Medium to Large)	-.748 to .552	-1.33
Lower Medium	-5.941	Medium		-1.976 to –2.519	-3.40
Small	-42.573	-19.53	-6.4481	-1.808 to –4.109	-18.86
Muscle					
Heavy	base	base	0.371 to 2.77	base	base
Medium	-1.541	-4.72		-4.728 to –2.398	-9.37 to -.670
Light	-8.817	-13.40		-14.792 to –4.388	-26.48 to –8.06
Fill					
Average Fill	base	base		base	base
Shrunk	-.346	2.21		-1.242 to 1.43	-2.53 to –1.78
Full	-.235	-4.73		-4.062 to 3.357	-4.37 to –2.59

Table 8. Comparison of Different Price Differential Studies (Continued).

Characteristics	Avent	Troxel et al.	Turner, Dykes, and McKissick	Schroeder et al. 1988	Smith et al.
Average Condition	base	base		base	base
Thin	-.554	2.40		-1.131 to -.215	-4.37 to –2.59
Fleshy	-.598	-1.87		-2.051 to 1.738	-2.56 to -.390
Fat	-3.913	-4.69		-3.149 to 3.009	-11.37 to –5.04
Uniformity					
Uniform	base			base	base
Non-uniform	-.867			-.583 to -.018	-2.35 to .60
Health					
Healthy	base	base		base	base
Dead Hair & Mud	-9.447	-10.70		-1.332 to -.971	-3.15 to –1.40
Sick	-13.877	-25.80		-21.345 to –11.469	-28.96 to –16.50
Bad Eye	-20.872	-12.50		-10.033 to –4.271	-14.08 to –7.60
Lame or Lump	-41.334	-27.40		-19.141 to –10.514	-21.58 to –18.11
Adjusted R^2	0.720		0.89 to 0.97	0.71 to 0.74	
RMSE	1.973		1.72 to 3.57	3.31 to 5.14	
Observations	1,244		89 to 619	2,172 to 5,574	11,135 to 15,473

Table 9.[a] Preconditioning and Traditional Comparison.

	Steers[b]	Heifers[c]
Traditional Management Alternative		
Ranch (marketing) weight (lbs.)	484.02	469.77
Shrink (%)	4	4
Sale weight (lbs.)	464.66	450.98
Price ($/cwt.)	99.09	92.07
Gross revenue ($/head)	**$ 460.43**	**$ 415.21**
Preconditioning Management Alternative		
Weaning weight (lbs.)	484.02	469.77
Weaning period	45.00	45.00
ADG (lbs./day)	2.00	2.00
Ranch (marketing) weight (lbs.)	574.02	559.77
Shrink (%)	2	2
Sale weight (lbs.)	562.54	548.57
Weaning day price from traditional alternative ($/cwt.)	99.09	92.07
Price at marketing	94.35	87.34
Price change from weaning to marketing ($/cwt.)	(4.74)	(4.74)
Price slide for increased weight ($/cwt.)	(0.00)	(0.00)
Price discount for increased flesh ($/cwt.)	(0.60)	(0.60)
Preconditioning premium ($/cwt.)	3.36	3.36
Final price ($/cwt.)	97.11	90.09
Gross revenue ($/head)	**$ 546.28**	**$ 494.20**
Preconditioning Management Costs ($/head)		
Cattle interest	4.52	4.12
Health supplies and medicine	8.00	8.00
Death loss	2.30	2.08
Labor and equipment	6.00	6.00
Feed, hay, and pasture	35.00	35.00
Additional marketing costs (tags, commission, etc.)	5.00	5.00
Total cost	**$ 60.82**	**$ 60.20**
Traditional and Preconditioning Comparison		
Traditional gross revenue	460.43	415.21
Network gross revenue	546.28	494.20
Increased revenue	85.85	78.99
Less preconditioning costs	61.05	61.05
Net return from preconditioning program	**$ 25.02**	**$ 18.79**

[a] Numbers based on Gill and Lalman
[b] compared to a uniform lot of healthy angus steers with an upper medium frame, heavy muscled, average
fill, and condition.
[c] represents the discount for heifers compared to steers of $7.02 per cwt..

Table 10. Description of Preconditioning Costs.

	$ Per head
[a]Vaccines and Medicine	
First Round (2-4 weeks prior to or at weaning)	
7-way blackleg (50 doses at $12)	0.24
Haemophilus somnus (50 doses at $8.81)	0.18
IBR, BVD, PI_3, BRSV, and Pasteurella hemolytica (50 doses at $110)	2.20
Penicillin (500 ml at $24.60)	0.60
Pour-on wormer (50 doses at $207)	4.14
Second Round (at weaning or 2-3 weeks after weaning)	
7-way blackleg (50 doses at $12)	0.24
Haemophilus somnus (50 doses at $8.81)	0.18
IBR, BVD, PI_3, and BRSV (50 doses at $81.50)	1.63
Total	9.41
Nutritional Costs	
[b]Weaning Ration (14% protein at $180 per ton)	7.56
[c]High quality Bermuda grass hay ($55 per ton)	3.85
[b]Protein cube supplement (20% protein at $215 per ton	13.33
[c]Pasture ($10 per month)	11.00
Total	35.74

[a]Hi-Pro Animal Health Oklahoma City, Oklahoma
[b]Foust Feeds Amarillo, Texas
[c]Interview with Roger Sahs based on Oklahoma State University Enterprise Budgets

III. Performance and Profitability of Preconditioned Calves

Cattle feeding is a multi-billion dollar industry in the United States. It is also a highly competitive, narrow margin business (Cattle Fax). Cattle feeders utilize feeder cattle and feedstuffs to produce an end product of beef. Feedlots compete in input markets for feeder cattle and feedstuffs and in an output market to sell fed cattle into a highly concentrated processing industry with a relatively fixed weekly capacity (Lawrence, Wang, and Loy). Feedlot mangers must also manage production uncertainty associated with animal performance due to weather, genetics, and health. As value based marketing of cattle on carcass performance increases, animal performance will become increasingly important. Results from a survey of cattle feeders with a one-time capacity of 1.8 million head discovered that health was the most important feeder cattle trait (Northcutt et al.). The factor most affecting feedlot profits after fed cattle and feeder cattle prices is cost of gain, which is directly related to cattle performance (Schroeder et al. 1993). Costs to the feedlot for the treatment of sick calves are annually $35 per head or $70 million total (Lalman and Smith). One way to improve the efficiency of feeder cattle is to maintain health during the finishing process. An option to this problem is the purchase of preconditioned feeder calves. Benefits to the feedlot are that preconditioned cattle are believed to have lower treatment costs, lower death loss, better-feed conversion, and lower cost of gain.

The question then arises are premiums paid for preconditioned cattle in the range to make it profitable for cattle feeders. Feedlot operators could also precondition their own lightweight calves purchased from the sale barn that present a high risk for sickness and associated higher cost of gain. Cow-calf producers pay the costs of preconditioning but benefits are received by the feedlot causing information inefficiency through the marketing chain (Nyamusika et al.). Better pricing signals must be sent through the marketing chain to properly value preconditioning in order in encourage preconditioning be performed on the ranch.

Objectives

The main objective of this study is to determine if preconditioned feeder cattle are more productive then other types of feeder cattle.

Specific objectives are

1. Determine if preconditioned calves have improved feedlot and carcass performance over non-preconditioned calves.
2. Determine if preconditioned calves are more profitable.
3. Determine if feedlot buyers properly value preconditioned calves.

Literature Review

This study will attempt to identify factors that affect cattle feeding profitability and performance. Most of the comparison will be between preconditioned feeder calves versus calves purchased through auctions and directly from ranch grazing program. This literature review will attempt to identify results of previous research focused on health and how it affects performance and profitability of cattle finishing.

Factors Affecting Cattle Feeding Profitability

There have been several studies to investigate the factors that affect cattle finishing profitability. In these studies, the few select factors that have been found to affect profitability are price (fed and feeder), cattle performance, and carcass characteristics. This study will attempt to identify these characteristics and how they affect profits.

In most studies, the factor having the largest effect on profit is fed cattle price (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). In many cases fed cattle price explained the largest part of profit variation. This is due to the fact fed cattle price is a principle component of revenue. Also, fed cattle price becomes more important as placement weight increases (Lawrence, Wang, and Loy). This is due to the fact that heavier placement weight means the animal will be fed to heavier weights to reach the target performance (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al. 1993). In most studies, feeder cattle purchase price had the second largest impact on profit variation (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). Feeder price can have the largest impact on profit at higher placement weights (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). Feeder cattle price is the primary uncertainty in cattle feeding (Schroeder et al. 1993). At lighter placement weights, corn prices, feed efficiency, and interest rates gain in importance due to the longer feeding period (Lawrence, Wang, and Loy). As placement weight increases, feeder cattle cost increases while interest and feed cost will decrease (Langemeier, Schroeder, And Mintert). In feedlots located in the Midwest, heifers were $12.30 less profitable then steers (Lawrence, Wang, and Low).

The influence of average daily gain on profitability increased with placement weight, indicating the importance of rate of gain at heavier placement weights (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al. 1993). The greater influence of average daily gain is due to the higher energy diets of heavier placed cattle (Lawrence, Wang, and Loy; and Schroeder et al. 1993). In each of the above studies, increased average daily gain led to increased profitability. The greater importance of increased average daily gain is to reduce feeder interest cost and lower the cost of gain (Langemier, Schroeder, and Mintert). In most of the previous studies, corn price is used as a proxy for cost of gain (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al. 1993). In previous studies, the influence of corn price was reduced with increased placement weight. This is because cost of gain is expected to be lower with greater placement weights. An increase in corn prices was found to decrease feedlot profitability (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al. 1993). Schroeder et al. 1993 found feed conversion improved by approximately 10% since the early 1980's, which could be attributed to improved technology, health programs, and improved management practices. Feed conversion was found to be higher for cattle placed from October to December and lower for cattle placed in February through May (Schroeder et al. 1993). Increased feed conversion resulted in higher cost of gain, lower average daily gains, and decreased profits (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993).

Effect of Health on Performance and Profitability

Results from a survey of cattle feeders with a one-time capacity of 1.8 million head indicated that health was the most important feeder cattle trait (Northcutt et al.). Bovine respiratory disease is estimated to have cost the industry nearly $624 million in 1991 alone (Gardner et al.1999). Morbidity was found to be dependent on immunity as 98% of non-vaccinated cattle became infected compared to 20% of vaccinated calves

(Nyamusika et al.). A study by Gardner et al. 1996 found medical costs to have the largest influence on profitability of all performance traits.

The Texas A&M Ranch to Rail program found that the treatment of sick feeder calves from 1992 through 2000 costs from $20.76 to $37.90 per head and added $4.15 to $7.58 per hundredweight to the cost of gain (Smith). Calves that were not treated gained 0.09 to 0.39 more per day than claves treated once and 0.40 to 1.21 greater gain per day than calves treated more then once (Smith). The Gardner et al. 1999 study found more then 14 pounds reduced weight gain for each day that calves were held in hospital pens. The factor most affecting feeder profits after fed cattle and feeder cattle prices is cost of gain, which is directly related to cattle performance (Schroeder et al. 1993). There is a direct relationship between the performance of feeder cattle and their health during the feeding process.

Nyamusika et al. found that through the use of vaccination and treatment for sickness the return to vaccination was $44 per head. A study by Friona Industries compared 1166 non-preconditioned calves with 1180 preconditioned calves. The benefit of the preconditioned calves was found to be $11.04 per hundredweight or $60.72 per head (Cravey). Healthy calves in the Texas A&M ranch to rail program had returns of $61.23 per head while sick cattle realized losses of $31.97 per head (McNeill). Gardner et al. 1999 found cattle with no lung lesions returned $732 per head while cattle with inactive lung lesions returned $72.22 less than cattle with no lesions and cattle with active lung lesions $75.88 less than cattle without lesions. Carcass value was found to be reduced by $4 per head for cattle treated once and $15 per head for cattle treated twice or more compared with calves not treated (Stovall et al.)

As the industry moves towards grid pricing, keeping cattle healthier becomes more important. The biggest finding the Texas A&M ranch to rail study found was the impact health had on the ability of cattle to express their genetic potential and the cost of sick cattle due to carcass performance (McNeill). When calves become sick during the feedlot phase of production, the percent Choice grade carcasses was reduced by 7 to 19% (Smith). In a study by Stovall et al. it was found that heifers treated once yielded 6.8% fewer Choice carcasses and if treated twice or more yielded 25.1% fewer Choice carcasses than those not treated. Cattle with inactive lung lesions yielded 8.1% fewer Select carcasses and 9.4% more Standard carcasses then steers without lesions, while cattle without lesions yielded 19.6% more Select and 24.7% fewer Standard carcasses than calves with active lung lesions (Gardner et al. 1999).

Pricing Methods

The inability to accurately measure beef quality and pricing cattle in a way that does not reflect value differences between animals are two problems facing the beef industry. Cattle feeders pointed out that cattle are priced on averages and that higher quality cattle receive the same price as lower quality cattle (Schroeder et al. 1998). Feuz, Fausti, and Wagner found that producers who were producing leaner, higher quality carcasses were not being rewarded with a premium while those producing inferior carcasses were not penalized by discounts. Producers who are producing higher quality cattle are subsidizing inferior quality cattle by an estimated $35 per head (Schroeder, and Graff). To improve quality there must be price incentives present for producers and processors to meet consumer needs when production decisions are being made (Schroeder et al. 1998).

Feuz, Fausti, and Wagner did a study focused on four different pricing methods live-weight basis, dressed-weight, grade-and-yield, and a value based marketing approach. Their result found as one moved from live weight to the value added marketing approach the more information became valuable and pricing accuracy improved. The amount of information directly affects the degree of risk associated with a buyer's pricing decision. Profits also increased with the movement from live weight to value based marketing (Feuz, Fausti, and Wagner). As a buyer's price discrimination increases, so does the seller's price variability (Feuz, Fausti, and Wagner). Schroeder and Graff performed a study on grid pricing of fed cattle by packers. Grid pricing of cattle resulted in the largest variability and discrimination in terms of pricing signals. If cattle were sorted and sold under the optimum marketing strategy, the value of information is $15 per head higher for selecting live selling over carcass weight selling, $18 per head more using carcass weight selling over the grid, and $35 per head greater for selling on the grid over live weight selling (Schroeder and Graff).

Conceptual Framework

There have been many questions in recent years on how to improve cattle performance and therefore profitability. One alternative to improve performance and profitability is by maintaining the health of cattle through the feeding process. The Texas A&M Ranch to Rail program demonstrated how large an effect poor health can have by limiting cattle from reaching their genetic potential (McNeill). By limiting cattle's potential due to sickness, cattle could have higher cost of gain, lower carcass qualities, and resulting lower prices. An alternative to improve cattle performance due to health is through the purchase of preconditioned calves.

Cattle feeding profitability can be described as:

(1) $$Profit = f\,(IP,\ PERF,\ SP)$$

where profit is a function of input prices (IP), performance factors (PF), and sale prices (SP) (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al. 1993). Input prices are feeder cattle price, which is dependent on weight, cost of gain, and interest cost associated with cattle feeding. Performance factors are average daily gain, feed conversion, days on feed, and medicine costs. The selling price is the fed cattle price, which, is dependent on selling weight, and carcass attributes.

To establish the value of preconditioned calves over calves described as sick, a survey was sent to feedlot mangers of Texas Cattle Feeders Association (TCFA) member feedlots. A copy of the survey can be found in the appendix. A preconditioned feeder calf is expected to generate premiums at the feeder calf level as was found to be the case in the first essay and study by King. Are premiums paid warranted given the added value to the feedlot or are the input costs just being increased? Feeder cattle purchase price will be dependent upon weight and other market factors such as expected cost of gain and expected live cattle price. From the respondents of the TCFA survey, the average premium placed on preconditioned feeder cattle was $5.25 per hundredweight (Table 1).

Feeder cattle price was found to be the second most important factor for determining profitability in previous research (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). Interest rates will add to return variability depending on feeder cattle purchase costs, feed costs, and how cattle feeding costs are financed.

Cost of gain is expected to have a large impact on profitability when affected by sickness. In studies by McNeill of the ranch to rail data, it was found that cost of gain for a sick animal was increased $9.28 per hundredweight more compared to healthy calves. Many feedlot managers use the price of high-energy grains such as corn as a proxy for anticipated cost of gain. If corn price is expected to increase, therefore adding to input costs and reducing profit, feedlot managers will try to place animals at higher weights because it is more cost effective to purchase rather then add weight.

Average daily gain (ADG) has a substantial impact on profitability. The health of feeder calves is expected to affect ADG. In the results from the TCFA survey, ADG is expected to be reduced by 0.37 pounds per day for sick animals. The results of the ranch to rail studies showed a reduced ADG of 0.18 pounds per day for sick animals (McNeill). Conversions for sick cattle are expected to be 0.56 greater i.e. an increase is a pound of feed per each pound of weight gain than healthy cattle from the TCFA survey. Increased conversion rates and lower ADG will lower profitability by adding to days on feed thereby increasing cost of gain.

Fed cattle price for cattle in previous studies was found to have the largest impact on feedlot profitability (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). This is because the fed cattle price for a given weight represents revenue for the cattle. Higher weights should generate added revenue but could also result in carcass discounts due to heavy carcass. The expected fed cattle price will also be a determining factor for the feeder calf purchase price. If fed cattle prices are expected to increase, then feedlot buyers will have a higher demand for lightweight cattle because it may be cheaper to add weight than to purchase it.

It is hypothesized that preconditioned cattle will have higher profitability due to increased performance and lower production costs from improved health. If there are differences in performance and costs for preconditioned calves but no differences in profit compared to unhealthy calves it can be concluded that feeder order buyers are efficient (i.e. sufficient premiums for preconditioned calves) in their valuing of preconditioned cattle.

Data

Survey Data

The first data set used was developed from the TCFA survey, a copy of which is located in the appendix. This survey was sent out to 89 feedlot managers and asked to distinguish the differences between preconditioned calves and non-preconditioned calves and what effect it had on health and performance. The categories about which managers were questioned included percent sick, percent dead, ADG, feed conversion, percent choice and percent outs, Managers were also asked for their opinion how much of a premium (if any) should preconditioned calves receive. Also managers were asked how preconditioned calf programs could be improved to better serve the feedlot industry. Summary statistics for this data can be found in table 1.

Feedlot Performance and Profitability Data

Data were collected from a commercial feedlot in the Texas Panhandle. Since it could not be distinguished which lots of preconditioned calves came from preconditioning programs or from backgrounding yards, it was decided that cattle placed in the 500 to 699 pound range would be collected. This was thought to give the greatest representation of preconditioned calf programs and lots for comparison. The other backgrounds of calves collected for comparison were cattle off grass, and sale barn low and high risk calves. Pen data collected were from pens placed from October to March to more closely match the market study (see essay one) and it was thought this would represent the lots with the most preconditioned program calves. The data were collected from feedyard closeout sheets between June 2000 to September 2001. Summary statistics for this data set can be found in table 2 for continuous variables and frequency distributions for classification variables can be found in table 3.

Procedures

This research will attempt to determine if there is a performance and profit difference between calf backgrounds. The survey data were analyzed using analysis of variance (ANOVA). A paired t-test was used to determine if there was any significant perceived difference between preconditioned and non-preconditioned calves for the performance variables. Also the surveys were summarized to find the premium managers feel preconditioned calves are worth. This data will aid in determining in what ways preconditioned calf programs can better help feedlots.

The feedlot closeout data set was used to compare different performance categories and profitability. The Least Squares (LS) means and GLM procedures in SAS was used to analyze the data (SAS Institute). LS means was used because it takes into account unbalanced comparison groups. All regression models were hedonic type models. Performance and profitability model results were based upon lot characteristics and qualities. All models cannot be analyzed using ordinary least squares as shown in the equations. Instead there must be one of the dummy variables dropped in each of the categories for sex placement month, placement year, origin, breed, background, and cattle

The dependent variable in equation (4) is the average daily gain of a lot. As placement weight (*Pwt*) increases and calf flesh (*Flesh*) decreases expected average daily gain increases. Inbound shrink (*Shrink*) and medicine cost (*Med*) are expected to decrease average daily gain due to the effect sickness has on animal performance. As conversion (*Conv*) decreases it is expected to increase average daily gain as animals become more efficient. Days on feed (*DOF*) and total pounds of gain (*Gain*) could have a positive or negative effect on average daily gain depending on length of feeding and amount of total gain.. The sex of lot (*Sex*) is expected to have a negative effect as heifers are thought to have lower average daily gains then steers. Placement month (*Mthin*), placement year (*Yrin*), origin (*Origin*), lot breed (*Breed*), and lot quality (*Quality*) could increase or decrease average daily gain. The background of a lot (*Back*) is expected to affect average daily gain. Research shows preconditioned calves demonstrated greater average daily gain than non-preconditioned calves (Cravey, McNeill).

The fourth equation to be estimated is

$$
\begin{aligned}
Conv_{it} = {} & \alpha - B_1 Pwt_{it} - B_2 Flesh_{it} + B_3 Shrink_{it} + B_4 Med_{it} - B_5 ADG_{it} \\
& - B_6 DOF_{it} - B_7 Gain_{it} + \sum_{j=1}^{2} B_{8j} Sex_{ijt} + \sum_{j=1}^{6} B_{9j} Mthin_{ijt} + \sum_{j=1}^{3} B_{10j} Yrin_{ijt} \\
& + \sum_{j=1}^{6} B_{11j} Origin_{ijt} + \sum_{j=1}^{4} B_{12j} Breed_{ijt} + \sum_{j=1}^{2} B_{13j} Quality_{ijt} + \sum_{j=1}^{7} B_{14j} Back_{ijt} + e_{it}
\end{aligned}
\tag{5}
$$

where i=1,…,N denotes each different lot, and t=1,…,T_i denotes the time cattle were placed in the feedlot. The description of variables used in equation (5) can be found in table 7.

The dependent variable in equation (5) is the conversion or feed efficiency of a lot. As placement weight (*Pwt*) and calf flesh (*Flesh*) increase, conversion is expected to decrease. Inbound shrink (*Shrink*) and medicine cost (*Med*) are expected to increase the feed conversion of animals due to the effect sickness has on animal performance. As the average daily gain (*ADG*) of a lot increases, conversion decreases or feed efficiency increases. Days on feed (*DOF*) are expected to decrease conversion rates as animals are on feed longer. The sex of lot (*Sex*) for heifers will have greater conversion rates then steers. Placement month (*Mthin*), placement year (*Yrin*), origin (*Origin*), lot breed (*Breed*), and lot quality (*Quality*) could have a mixed effect on conversion. The background of a lot (*Back*) is expected to affect feed conversion. Research shows preconditioned calves have lower conversion rates.

The fifth equation to be estimated is

$$
\begin{aligned}
(6)\qquad Med_{it} = {} & \alpha - B_1 Pwt_{it} - B_2 Flesh_{it} + B_3 Shrink_{it} - B_4 ADG_{it} - B_5 Conv_{it} \\
& + B_6 DOF_{it} + B_7 Dead\%_{it} + \sum_{j=1}^{2} B_{8j}\, Sex_{ijt} + \sum_{j=1}^{6} B_{9j}\, Mthin_{ijt} + \sum_{j=1}^{3} B_{10j}\, Yrin_{ijt} \\
& + \sum_{j=1}^{6} B_{11j} Origin_{ijt} + \sum_{j=1}^{4} B_{12j} Breed_{ijt} + \sum_{j=1}^{2} B_{13j} Quality_{ijt} + \sum_{j=1}^{7} B_{14j} Back_{ijt} + e_{it}
\end{aligned}
$$

where i=1,…,N denotes each different lot, and t=1,…,T_i denotes the time cattle were placed in the feedlot. The description of variables used in equation (6) can be found in table 8.

The dependent variable in equation (6) is the medicine cost per hundredweight. As placement weight (*Pwt*) and calf flesh (*Flesh*) increase they are expected to decrease medicine costs. It is expected that heavier animals or animals with more flesh will have less problems with sickness. An increase in inbound shrink (*Shrink*) is expected to increase medicine cost . As average daily gain (*ADG*) increasing should decrease medicine costs. As conversion (*Conv*) increases it is expected to increase medicine costs due poor efficiency. Days on feed (*DOF*) is expected to increase medicine because it reflects that sick animals are on feed longer. Higher death loss percentage (*Death%*)

should be associated with increased medicine costs due to increased sickness. The sex of lot (*Sex*), placement month (*Mthin*), placement year (*Yrin*), origin (*Origin*), lot breed (*Breed*), and lot quality (*Quality*) could have a mixed effect on conversion. The background of a lot (*Back*) is expected to affect medicine costs. Improved health of preconditioned calves should lower medicine costs.

The last equation to be estimated is *Profit*

$$
\begin{aligned}
P_{it} = {} & \alpha - B_1 Pwt_{it} + B_2 Flesh_{it} - B_3 Shrink_{it} + B_4 ADG_{it} - B_5 Conv_{it} - B_6 DOF_{it} \\
& - B_7 Dead\%_{it} - B_8 Med_{it} - B_9 FC_{it} - B_9 Misc_{it} - B_{10} FP_{it} + B_{11} TCFA_{it} \\
(7) \quad & + B_{12}\%PCH_{it} + B_{13}\%YG1-2_{it} + \sum_{j=1}^{2} B_{14j}\, Sex_{ijt} + \sum_{j=1}^{6} B_{15j}\, Mthin_{ijt} + \sum_{j=1}^{3} B_{16j}\, Yrin_{ijt} \\
& + \sum_{j=1}^{6} B_{17j} Origin_{ijt} + \sum_{j=1}^{4} B_{18j} Breed_{ijt} + \sum_{j=1}^{2} B_{19j} Quality_{ijt} + \sum_{j=1}^{7} B_{20j} Back_{ijt} + e_{it}
\end{aligned}
$$

where i=1,…,N denotes each different lot, and t=1,…,T_i denotes the time cattle were placed in the feedlot. The description of variables used in equation (7) can be found in table 9.

The dependent variable, profit per head, is an accounting measure and is defined as

$$(8) \qquad P_{it} = (LP_{it} \text{ x } Alwt_{it}) - (FP_{it} \text{ x } Pwt_{it}) - (Med_{it} + FC_{it} + Misc_{it} + Int_{it})$$

The selling price per hundredweight (*LP*) is based on carcass performance and multiplied times average live weight (*Alwt*) per hundredweight to generate gross revenue. Feeder price per hundredweight (*FP*) times placement weight (*Pwt*) per hundredweight is the purchase cost of the feeder animal. Production costs are as follows: medicine costs per head (*Med*), feed cost per head (*FC*), miscellaneous (*Misc*) cost per head, which consists of processing, hospital costs, yardage and cattle interest expense (*Int*). Interest on cost of gain and feeder purchase cost and is based upon the bank prime loan rate (Federal Reserve Board).

As placement weight (*Pwt*) increases it is expected to reduce profit due to its effect on increased purchase cost. The calf flesh score (*Flesh*) should increase expected profit due to the discount for fleshy feeder cattle. An increase in inbound shrink (*Shrink*) is expected to decrease profitability. The average daily gain (*ADG*) should have an increased effect on profitability due to higher gains and less days on feed. Feed efficiency (*Conv*) is expected to have a negative effect on feedlot profitability. Higher conversion leads to less efficiency and therefore increased feeding period. Death loss percentage (*Death%*) decreases profitability due to loss of cattle. Days on feed (*DOF*) is expected to decrease profitability because of increased production costs when animals are on feed longer. Feed costs (*FC*) are expected to decrease profitability due to higher ration costs. Miscellaneous costs (*Misc*) are expected to decrease profits. The price of feeder cattle (*FP*) is expected to decrease profits when feeder price increases due to increased input costs. A higher fed cattle cash price (*TCFA*) is expected to be associated with increase profitability. A higher percentage of Choice and higher (*%PCH*) should earn premiums and increase profits. Yield grade 1 to 2 (*YG1-2*) are expected to generate premiums, also increasing profitability. The sex of lot (*Sex*) is expected have a negative effect due to lower returns for heifers. Placement month (*Mthin*), placement year, origin (*Origin*), and lot breed (*Breed*) should have mixed effects on profits. Lot quality (*Quality*) is expected to decrease profits because of lower quality of number 1.5 cattle compared to number 1 cattle. The background of a lot (*Back*) are expected to have an increasing effect on profitability due to improved health and performance of preconditioned calves.

Least squares means were used to make comparisons within categories for sex, placement month, placement year, origin, breed, background, and frame. Simple means were used to compare across closeout data versus the TCFA survey and the ranch to rail results.

Results

TCFA Survey

As mentioned above, a survey was mailed to TCFA member feedlot managers to establish what they felt the benefits were to preconditioning and how programs could be improved. The results for ANOVA (Analysis of Variance) procedure and a paired t-test can be found in table 1. A majority of the managers responded that the best improvement that could be made on preconditioned calves would be to sort out all chronically sick or non-performing animals prior to sale or shipment to the feedyard and sell them separately. Next feedyard mangers noted that better records be kept on calf vaccinations and nutrition. Finally mangers expressed that cow-calf producers work more closely with the feedyard on protocols for their vaccination and nutrition programs.

Performance and Profitability

This research attempted to identify the difference in performance and profitability of preconditioned calves over other cattle backgrounds. The basis for comparison is a sale lot pen of preconditioned, number 1 exotic crossbred mix steers from Oklahoma, placed in October of 1999. All comparisons were made to this lot for various performance and profitability measures. The Breusch-Pagan, Glejser, and Harvey tests were used to test for heteroskedasticity for all models and all resulted in a failure to reject the null hypothesis of homoskedasticity. A Kolmogorov-Smirov and Anderson-Darling test for normality were performed on all models and all failed to reject the null hypothesis of normally distributed errors. All models also passed the specification test of the first and second movements.

Death Loss

Results for equation (2) can be found in table 10. The model from equation (2) had an adjusted R^2 of 0.537. This model explained less of the variation in death loss despite having a wide range of information. There were very few variables that were found to have a significant effect on dead loss and many had incorrect signs.

The variable for heifers was not found to significantly affect dead loss. Similarly, placement months were not found to have a significant effect in comparison to October. The only origin variable found to affect dead loss compared to Oklahoma was Central Texas. Quality did not have a significant effect on death loss. The breeds that had an effect on death loss were cross bred Brahman and Okie crossbred mix which were found to reduce death loss.

Sale barn high risk calves were found to have a negative effect on dead loss compared to preconditioned cattle and had an LS mean that was significantly different from preconditioned calves (table 20). This was an unexpected since it was thought high risk calves would increase death loss.

Increased, shrink was found to significantly increase death loss. Also as medicine cost increased, overall death loss increased. It seems there may be a problem with the classification variables or some variables were not available in this data set to help explain death loss.

Cost of Gain

The results for equation (3) can be found in table 11. Model (3) had an adjusted R^2 of 0.849. This model explained much of the variation in cost of gain given the relative amount of information.

Heifers had a greater cost of gain then steers. LS means were found to be significantly different between steers and heifers (table16). Cost of gain for cattle placed in November and December were lower then for cattle placed in October. Cost of gain was also higher for cattle placed in January and steadily increased through March placements. However, LS means were not found to be significantly different between January, February, March, or October, but these were found to be significantly different from November, and December. The LS means results indicated considerably lower cost of gain for cattle placed in January, February, March, compared to October, November, and December. Parameter estimates for cattle placed in 2000, and 2001 had significantly higher cost of gain then cattle placed in 1999 (table 11). The LS means results for cost of gain in table 18 found significant differences between all three placement years with cost of gain increasing from 1999 to 2001.

There were only two origins found to have a significant effect on cost of gain. Cattle originating from the Texas Panhandle had higher cost of gain while cattle originating from Central Texas had lower costs (table 11) compared with Oklahoma. The LS mean results for cost of gain found significant differences between cattle originating from the Texas Panhandle from all other origins with higher associated costs (table 19). There was no significant effect or difference by quality on cost of gain for number 1.5 cattle compared to number 1 cattle. Crossbred Brahman was the only breed found to have a significant impact on higher cost of gain. There were no significant differences between LS means for breed groups (table 21).

Sale barn low risk cattle had lower cost of gain compared to preconditioned calves while high risk cattle had considerably higher costs, and grass cattle had somewhat increased cost (table 11). The LS Means results in table 20 found a significant difference between preconditioned and high risk cattle with greater cost for high risk calves. Placement weight, conversion, and medicine cost were found to significantly increase cost of gain. Higher average daily gains resulted in lower cost of gain.

<u>Average Daily Gain</u>

Results for equation (4) can be found in table 12. The model in equation (4) had an adjusted R^2 of 0.933. There was large portion of variation in this model explained by the available information.

The heifer parameter estimate was not significant nor were LS means significantly different from steers. Placement month was not significant or different across placement months. For placement year, the estimate for 2001 was significant and greater then 1999. LS means were significantly different for 2001 compared to 1999 and 2000 (table 18). The parameter estimate for Missouri was the only significant origin variable and was found to increase average daily gain (table12). LS means results for origin did not find a significant difference between origins (table 19). Cattle quality did not significantly affect daily gain. Okie exotic crossbred mix cattle were found to significantly increase average daily gain.

The high risk calves parameter estimate was found to be significant and positively affect average daily gain (table 12). This was an unexpected result but could have to do with fewer observations for high risk cattle. Placement weight estimate was significant and found to increase average daily gain as weight increases. Total weight gained during the feeding period was also found to increase average daily gain. As conversion increased it decreased average daily gain as did days on feed. Medicine cost was found to decrease average daily gain, which was expected due to lower performance of sick calves.

Conversion

The results for the model in equation (5) can be found in table 13. Model in equation (5) had an adjusted R^2 of 0.862. The model explained much of the variation of conversion with the given information.

The estimate for heifers was not found to be significantly different, (table 13) nor was the LS means significantly different from steers (table 16). Parameter estimates for January, February, and March had increased conversions over October (table 13). LS means in table 18 for conversion were found to be different between months with the highest conversion rate in October. The estimates for placement year 2000 and 2001 were significant and found to be increasing over both years. The LS means were significantly different with the highest conversion in 2001. There were no estimates for origin found to be significant. Cattle classified as number 1.5 were not significantly different from number 1s. No significant differences were found between breeds. For background, low risk calves had significantly lower conversion while grass and high risk calves had increased conversion rates.

Placement weight was significant and as weight increased it was found to increase conversion rates. Flesh and shrink were not found to significantly affect conversion.

Increased average daily gain was associated with decreased feed conversion. This result could be expected because higher daily gains are related to lower conversion. As total weight gained during feeding process increased, it was found to increase feed conversion rates.

Medicine

The results for equation (6) can be found in table 14. The model for (6) had an Adjusted R^2 of 0.842. A large portion of the variation in the model was explaining the variation. There were just a few variables that explained most of the variation.

The heifers variable was not found to be significantly different from steers. January is the only month variable found to be significant and to have lower medicine costs then October. Placement year was not significant in explaining medicine costs. Calves from Missouri and Central Texas were significant and found to have increased medicine costs. LS Means in table 19 the only significant difference was found to be cattle from South and Central Texas with the highest medicine costs being found for calves originating from Central Texas. For breed, cattle of crossbred Brahman, Okie English mix, and Okie crossbred mix were significant and all had increased medicine costs. Low risk calves and grass cattle had slightly increased medicine costs compared to preconditioned calves. High risk calves had higher medicine costs compared with preconditioned calves as was expected (table 14). The LS Means results found medicine costs for high risk calves to be significantly different and higher than all other backgrounds. Higher medicine costs were expected for all backgrounds other than preconditioned calves due to their increased immunity.

Death loss was found to be significant and increase medicine costs as death loss increased. Placement weight decreased medicine costs as it increased. Flesh, shrink, average daily gain, and conversion were not found to be significant. As days on feed increased, medicine costs were reduced. It was previously thought that days on feed would increase medicine costs due longer feeding period of unhealthy calves.

Profitability

Results for equation (7) on profitability can be found in table 15. The model had an adjusted R^2 of 0.868. This model explained a large amount of the variation in profitability with available information. But as in previous research, the variability in profits is explained by few variables.

Parameter estimate for heifers was significant with heifers earning $12.48 per head less then steers. A significant difference was found in LS means between steers and heifers. Heifers had losses of $10.46 per head while steers returned $2.02 per head. There were not any placement months found to be significant. LS means in table 17 showed no significant difference in profits between placement months. Placement year was not significant with all years showing losses. For cattle origin only cattle originating from Central Texas were significant with lower profits of $18.20. Breed classification of a lot was not found to be significant. Background was not found to significantly affect profit, which was an unexpected result. Low and high risk cattle had higher returns then preconditioned calves. Grass cattle had lower profits compared to preconditioning.

Average daily gain was found to increase profits as it increased which was consistent with previous research. Feed conversion was also found to increase profits as cattle became inefficient. This did not follow with previous research which found increased feed conversion to decrease profit. This could be caused by correlations between cost of gain and conversion of sale barn cattle. As days on feed increased, it was found to increase profits. This was not expected but again could be attributed to longer feeding periods for sale barn cattle. Increased medicine costs were found to decrease profits by $7.05 per head. Death loss variable was dropped because it had a t-value of zero and caused medicine not to be significant and have the wrong sign. Feed costs were found to decrease profits by $6.54 per head as feed costs increased by $1 per hundredweight. Increased feeder cattle price and placement weight were found to reduce profit by $5.71 and $0.11 per head respectively. Live cattle cash price reported by the TCFA was found to increase profitability by $9.36 per head as cash price increased. An increase in the Percent choice and yield grades 1 and 2 increased profits by $0.74 and $0.47 per head respectively.

The simple means of the closeout data were used to compared to the TCFA survey and the ranch to rail studies in table 22. The results for the closeout data were consistent with those found from the TCFA survey and the ranch to rail.

The death loss was found to be 4.85% for high risk cattle, the results from the survey and ranch to rail were 4.27%, and 3.4% respectively. This shows that the closeout data is consistent with managers perception and previous work concerning death loss of cattle classified as sick. The mean death loss for preconditioned cattle in the closeout data is 0.99, which was the lowest for all backgrounds. The result for preconditioned is in range with the TCFA survey (1.5%) and the ranch to rail (0.5%).

Mean for average daily gain (2.87) is highest for preconditioned cattle which was expected. The result for preconditioned average daily gain is in the range of the survey

(2.94) and ranch to rail (2.96). Sick cattle had a mean average daily gain of 2.40 which was expected due to decreased performance of sick cattle. The mean for high risk cattle average daily gain was consistent with non-preconditioned cattle from the TCFA survey (2.57) but lower then ranch to rail result (2.78).

The mean for percent choice (44.31%) was lower then the survey results (50.43%) but higher then ranch to rail (39%). Precondition percent choice was considerably lower then for low risk (53.18%) and grass (49.12%) background cattle. The percent choice for high risk cattle (34.65%) was considerably lower than all other backgrounds, but is consistent with the survey (35.78%) and higher than the ranch to rail (29%).

The difference in feeder price between preconditioned and high risk cattle is $5.14 per hundredweight. The premium from the survey valued preconditioned cattle at $5.25 per hundredweight. Days on feed were around thirty-seven days longer for high risk cattle when compared to preconditioned. Medicine costs for high risk cattle are $3.59 per hundredweight higher then preconditioned cattle. Cost of gain is $4.32 per hundredweight greater for high risk compared to preconditioned cattle. The higher cost of gain for high risk cattle can be attributed to lower performance due to sickness. Interest charges were also higher for high risk cattle. This should be expected due to high risk cattle having higher cost of gain and longer days on feed.

The live price for low risk, high risk, grass, and preconditioned cattle is $69.92, $72.41, $70.29, and $71.25 per hundredweight respectively. Prices for the different backgrounds were not expected to be greatest for high risk cattle. The average live weight of low risk, high risk, grass, and preconditioned were found to be 1146, 1189, 1132, and1158 pounds respectively. Net profit for cattle were found to be a loss of

$0.0009 per head for low risk, a profit of $49.99 per head for high risk, a $17.45 loss for grass, and $0.08 per head profit for preconditioned.

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Table 1. TCFA Survey Results and Summary Statistics

Category	N	Mean	Standard Deviations	Minimum	Maximum	t Statistic	P-value
<u>% Sick</u>						6.723	2.45 E-06
Preconditioned	17	9.235	6.4	1.5	25		
Non Preconditioned	17	36.441	18.641	12.5	70		
<u>% Dead</u>						8.130	3.5. E-07
Preconditioned	16	1.500	0.816	0.5	3		
Non Preconditioned	16	4.269	1.886	2	10		
<u>ADG</u>						5.550	2.78 E-5
Preconditioned	16	2.941	0.337	2.35	3.6		
Non Preconditioned	16	2.572	0.375	1.7	3.3		
<u>Conversion</u>						3.988	6.47 E-4
Preconditioned	15	6.317	0.768	5.5	8.25		
Non Preconditioned	15	6.877	1.1	5	9		

Table 1. TCFA Survey Results and Summary Statistics (continued)

Category	N	Mean	Standard Deviations	Minimum	Maximum	t Statistic	P-value
% Choice						6.008	1.2 E-5
Preconditioned	16	50.438	11.877	20	65		
Non Preconditioned	16	35.781	12.836	0	55		
% Outs						4.496	2.51 E-4
Preconditioned	15	2.467	1.797	0	6		
Non Preconditioned	15	6.867	5.194	2	20		
Price Premium $/cwt	17						
Precon		5.25	2.470	0	10		

Table 3. Frequency Distribution

Variable	Frequency	Percent
Sex		
Steer	75	45.45
Heifer	90	54.55
Placement Month		
October	30	18.18
November	38	23.03
December	26	15.76
January	18	10.91
February	26	15.76
March	26	15.76
Placement Year		
1999	18	10.91
2000	90	54.55
2001	57	34.55
Origin		
Missouri	18	10.91
Oklahoma	53	32.12
Texas Panhandle	8	4.85
South Texas	58	35.15
East Texas	21	12.73
Central Texas	7	4.24
Frame		
Number 1	47	28.48
Number 1.5	118	71.52
Breed		
Cross Bred Brahman	27	16.36
Okie English	8	4.85
Exotic Continental	5	3.03
Okie Exotic Mix	46	27.88
Okie Crossbred Mix	10	6.06
Exotic Okie Mix	18	10.91
Exotic Crossbred Mix	51	30.91
Background		
Preconditioned	69	41.82
Sale Barn Low Risk	10	6.06
Sale Barn High Risk	10	6.06
Grass	76	46.06

Table 4. Model (2) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
Dead $\%_{it}$	ith death percentage for a lot of cattle in sale t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle in a lot	-
$Flesh_{it}$	Average Flesh score of a lot of cattle	-
$Shrink_{it}$	Inbound shrink percentage of cattle in a lot	+
Med_{it}	Medicine cost ($/cwt) for a lot of cattle	+
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	+/-
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
$Origin_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	+
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1= Number 1, 2- Number1.5; Base = 1 cattle	-
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-

Table 5. Model (3) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
COG_{it}	ith cost of gain ($/cwt) for a lot of cattle in time t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle in a lot	-
$Flesh_{it}$	Average flesh score of a lot of cattle	-
$Shrink_{it}$	Inbound shrink percentage of cattle in a lot	+
Med_{it}	Medicine cost ($/cwt) for a lot of cattle	+
ADG_{it}	Average daily gain (lbs/day) of a lot of cattle	-
$Conv_{it}$	Average feed conversion (lbs of feed/lbs of gain) of a lot of cattle	+
DOF_{it}	Days that a lot of cattle are in the feedyard	+
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	+
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
$Origin_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	+
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1=Number 1, 2- Number 1.5; Base = Number 1	+/-

Table 6. Model (4) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
ADG_{it}	ith average daily gain (lbs/day) for a lot of cattle in time t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle in a lot	-
$Flesh_{it}$	Average flesh score of a lot of cattle	-
$Shrink_{it}$	Inbound shrink percentage of cattle in a lot	+
Med_{it}	Medicine cost ($/cwt) for a lot of cattle	+
$Conv_{it}$	Average feed conversion (lbs of feed/lbs of gain) of a lot of cattle	+
DOF_{it}	Days that a lot of cattle are in the feedyard	+
$Gain_{it}$	Average weight gain of a lot of cattle	+/-
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	+/-
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
$Origin_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	+
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1=Number 1, 2- Number 1.5; Base = Number 1	-

Table 7. Model (5) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
$CONV_{it}$	ith feed conversion (lbs of feed/lbs of gain) for a lot of cattle in time t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle in a lot	-
$Flesh_{it}$	Average flesh score of a lot of cattle	-
$Shrink_{it}$	Inbound shrink percentage of cattle in a lot	+
Med_{it}	Medicine cost ($/cwt) for a lot of cattle	+
ADG_{it}	Average daily gain (lbs/day) of a lot of cattle	-
DOF_{it}	Days that a lot of cattle are in the feedyard	-
$Gain_{it}$	Average weight gain of a lot of cattle	-
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	+
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
$Origin_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	+
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1=Number 1, 2- Number 1.5; Base = Number 1	+

Table 8. Model (6) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
Med_{it}	ith medicine cost ($/cwt) for a lot of cattle in time t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle	-
$Flesh_{it}$	Flesh score of a lot of cattle	-
$Shrink_{it}$	Inbound shrink percentage of cattle	+
ADG_{it}	Average daily gain (lbs/day) of a lot of cattle	-
$Conv_{it}$	Feed conversion (lbs of feed/lbs of gain) of a lot of cattle	-
DOF_{it}	Days that a lot of cattle are in the feedyard	+
Dead $\%_{it}$	Percentage of dead cattle in a lot	+
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	+/-
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
Origin $_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	+
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1=Number 1, 2- Number 1.5; Base = Number 1	+/-

Table 9. Model (7) Variable Definitions and Expected Signs

Dependent Variables	Variable Definition	Expected Sign
P_{it}	ith profit ($/head) of a lot of cattle in time t	

Independent Variables	Variable Definition	Expected Sign
PWT_{it}	Average placement weight of cattle in a lot	-
$Flesh_{it}$	Average flesh score of a lot of cattle	+
$Shrink_{it}$	Inbound shrink percentage of cattle in a lot	-
ADG_{it}	Average daily gain (lbs/day) of a lot of cattle	+
DOF_{it}	Days that a lot of cattle are in the feedyard	-
$Conv_{it}$	Average feed conversion (lbs of feed/lbs of gain) of a lot of cattle	-
$Dead\ \%_{it}$	Percentage of dead cattle in a lot	-
Med_{it}	Medicine cost ($/cwt) for a lot of cattle	-
FC_{it}	Feed Cost ($/cwt.) for a lot of cattle	-
$Misc_{it}$	Miscellanous costs ($/cwt.) of a lot of cattle	-
FP_{it}	Feeder purchase price ($/cwt.)	-
$TCFA_{it}$	TCFA cash price ($/cwt)	+
$\%PCH_{it}$	Percent choice and great carcass of a lot of cattle	+
$\%YG1\text{-}2_{it}$	Yield Grade 1-2 percentage of a lot of cattle	+
Sex_{ijt}	Zero-one dummy variable for the sex of a lot, j-1-2, 1 Steers; 2=Heifer; Base=Steers	-
$Mthin_{ijt}$	Zero-one dummy variable for placement month of a lot of cattle, j=1-6, 1=Oct., 2=Nov., 3=Dec., 4=Jan., 5=Feb., 6=Mar.; Base = Oct.	+/-
$Yrin_{ijt}$	Zero-one dummy variable for placement year of a lot of cattle, j=1-3, 1=1999. 2=2000, 3=2001; base = 1999.	+/-
$Origin_{ijt}$	Zero-one dummy variable for origin of a lot of cattle, j=1-6, 1-Missouri, 2=Oklahoma, 3=Texas Panhandle, 4=East Texas, 5=South Texas, 6=Central Texas; Base = Oklahoma	+/-
$Breed_{ijt}$	Zero-one dummy variable for breed classification of cattle; j=1-7, 1=Crossbred Brahman, 2=Okie English, 3=Exotic Continental, 4=Okie Exotic Mix, 5=Okie Crossbred Mix, 6=Exotic Okie Mix, 7=Exotic Crossbred Mix; Base = Exotic Crossbred Mix	+/-
$Back_{ijt}$	Zero-one dummy variable for background of a lot of cattle, j=1-4, 1=Sale Barn Low Risk; 2=Sale Barn High Risk, 3=Preconditioned, 4=Grass; Base = Preconditioned	-
$Quality_{ijt}$	Zero-one dummy variable for lot quality score, j=1-2; 1=Number 1, 2- Number 1.5; Base = Number 1	-

Table 10. Model (2) Parameter Estimates for Death %

Independent Variable	Parameter Estimate
Intercept	4.312** (1.95)[a]
Steer	Base
Heifer	0.137 (0.51)
October	Base
November	0.466 (1.12)
December	0.399 (0.90)
January	-0.0005 (-0.00)
February	-0.256 (-0.49)
March	0.530 (0.96)
1999	Base
2000	0.379 (0.77)
2001	0.786 (0.256)
PWT	-0.00414 (-1.26)
Oklahoma	Base
Missouri	-0.554 (-0.95)
Texas Panhandle	-0.077 (-0.11)
South Texas	-0.480 (-1.0)
East Texas	-0.730 (-1.27)
Central Texas	-1.540** (-2.02)

Table 10. Model (2) Parameter Estimates for Death % (continued)

Independent Variable	Parameter Estimate
Number 1	Base
Number 1.5	0.080 (0.25)
Exotic Crossbred Mix	Base
Cross Bred Brahman	-0.632* (-1.62)
Okie English	0.210 (0.29)
Exotic Continental	-0.228 (-0.30)
Okie English Mix	-0.718 (-1.53)
Okie Crossbred Mix	-1.201** (2.07)
Exotic Okie Mix	-0.211 (-0.45)
Sale Barn Low Risk	-0.825 (-1.30)
Sale Barn High Risk	-2.911*** (-2.74)
Preconditioned	Base
Grass	-0.222 (-0.64)
Flesh	-0.035 (-0.12)
Shrink	0.226** (1.94)
Med	2.222*** (9.80)
Adjusted R^2	0.537
RMSE	1.507
Observations	165

[a] Numbers in parantheses are values of calculated t-statistics.
Significance levels are ***=0.01, **=0.05, and *=0/10.

Table 11. Model (3) Parameter Estimates for COG

Independent Variable	Parameter Estimate
Intercept	6.022 (0.77)[a]
Steer	Base
Heifer	1.800*** (4.38)
October	Base
November	-0.006 (-0.01)
December	-0.046 (-0.10)
January	1.354* (1.77)
February	1.759*** (2.92)
March	2.506*** (4.13)
1999	Base
2000	2.937*** (5.20)
2001	4.911*** (5.63)
PWT	0.017*** (3.86)
Oklahoma	Base
Missouri	-0.189 (-0.29)
Texas Panhandle	1.377* (1.82)
South Texas	-0.367 (-0.75)
East Texas	0.246 (0.39)
Central Texas	-1.440* (-1.73)
Number 1	Base

Table 11. Model (3) Parameter Estimates for COG (continued)

Independent Variable	Parameter Estimate
Number 1.5	-0.342
	(-1.00)
Exotic Crossbred Mix	Base
Crossbred Brahman	0.961**
	(2.27)
Okie English	-0.194
	(-0.25)
Exotic Continental	-0.101
	(-0.12)
Okie Exotic Mix	0.588
	(1.19)
Okie Crossbred Mix	0.958
	(1.56)
Exotic Okie Mix	0.100
	(0.20)
Preconditioned	Base
Sale Barn Low Risk	-1.192*
	(-1.76)
Sale Barn High Risk	6.248***
	(5.55)
Grass	0.718**
	(1.96)
Flesh	0.141
	(0.46)
Shrink	0.267**
	(2.09)
ADG	-2.066**
	(-1.91)
Conv	4.33***
	96.29)
DOF	0.018
	(1.45)
Med	0.935***
	(3.56)
Adjusted R^2	0.849
RMSE	1.587
Observations	165

[a]Numbers in parentheses are values of calculated t-statistics.
Significance levels are ***=0.01. **=0.05, and *=0.10.

Table 12. Model (4) Parameter Estimates for ADG

Independent Variables	Parameter Estimate
Intercept	3.807*** (12.60)[a]
Steer	Base
Heifer	-0.244 (-1.05)
October	Base
November	0.012 (0.50)
December	0.032 (1.22)
January	0.045 (1.09)
February	0.047 (1.43)
March	0.029 (0.89)
1999	Base
2000	0.023 (0.73)
2001	0.111** (2.35)
PWT	0.001*** (5.23)
Oklahoma	Base
Missouri	0.091*** (2.65)
Texas Panhandle	0.037 (0.90)
South Texas	0.018 (0.69)
East Texas	0.038 (1.10)
Central Texas	0.012 (0.25)
Number 1	Base

Table 12. Model (4) Parameter Estimates for ADG (continued)

Independent Variables	Parameter Estimate
Number 1.5	-0.005
	(-0.27)
Exotic Crossbred Mix	Base
Crossbred Brahman	0.036
	(1.55)
Okie English	-0.011
	(-0.28)
Exotic Continental	-0.052
	(-1.16)
Okie Exotic Mix	0.032
	(1.18)
Okie Crossbred Mix	0.070**
	(2.09)
Exotic Okie Mix	0.021
	(0.77)
Preconditioned	Base
Sale Barn Low Risk	-0.033
	(-0.88)
Sale Barn High Risk	0.145**
	(2.35)
Grass	0.014
	(0.71)
Flesh	-0.001
	(-0.07)
Shrink	0.001
	(0.20)
Gain	0.009***
	(12.36)
Conv	-0.301***
	(-10.55)
DOF	-0.008***
	(-9.98)
Med	-0.054***
	(-3.76)
Adjusted R^2	0.933
RMSE	0.086
Observations	165

[a]Numbers in parentheses are values of calculated t-statistics.
Significance level are ***-0.01. **=0.05, and *=0.10.

Table 13. Model (5) Parameter Estimates for Feed Conversion

Independent Variables	Parameter Estimate
Intercept	8.841***
	(3.74)[a]
Steer	Base
Heifer	0.049
	(0.94)
October	Base
November	0.047
	(0.88)
December	0.055
	(0.94)
January	0.324***
	(3.65)
February	0.225***
	(3.17)
March	0.224***
	(3.27)
1999	Base
2000	0.260***
	(3.88)
2001	0.620***
	(6.66)
PWT	0.003***
	(5.44)
Oklahoma	Base
Missouri	0.099
	(1.26)
Texas Panhandle	0.136
	(1.48)
South Texas	-0.031
	(-0.52)
East Texas	0.038
	(0.49)
Central Texas	0.003
	(0.02)
Number 1	Base

Table 13. Model (5) Parameter Estimates for Feed Conversion (Continued)

Independent Variables	Parameter Estimate
Number 1.5	-0.010
	(-0.23)
Exotic Crossbred Mix	Base
Crossbred Brahman	-0.047
	(-0.90)
Okie English	-0.062
	(-0.65)
Exotic Continental	-0.113
	(-1.14)
Okie Exotic Mix	0.011
	(0.19)
Okie Crossbred Mix	0.063
	(0.83)
Exotic Okie Mix	0.018
	(0.30)
Preconditioned	Base
Sale Barn Low Risk	-0.138*
	(-1.68)
Sale Barn High Risk	0.057
	(0.41)
Grass	0.040
	(0.90)
Flesh	-0.052
	(-1.40)
Shrink	0.003
	(0.16)
ADG	-1.506***
	(-10.55)
Gain	0.002***
	(2.72)
DOF	-0.006***
	(-2.89)
Med	0.016
	(0.47)
Adjusted R^2	0.862
RMSE	0.194
Observations	165

[a]Numbers in parentheses are values of calculated t-statistics.
Significance level are ***-0.01. **=0.05, and *=0.10.

Table 14. Model (6) Parameter Estimates for Medicine

Independent Variables	Parameter Estimate
Intercept	-1.175
	(-0.57)[a]
Dead%	0.189***
	(8.44)
Steer	Base
Heifer	-0.055
	(-0.49)
October	Base
November	-0.047
	(-0.40)
December	0.009
	(0.07)
January	-0.361*
	(-1.79)
February	0.009
	(0.06)
March	-0.017
	(-0.10)
1999	Base
2000	-0.077
	(-0.51)
2001	-0.119
	(-0.51)
PWT	-0.005***
	(-4.17)
Oklahoma	Base
Missouri	0.385**
	(2.29)
Texas Panhandle	-0.026
	(-0.13)
South Texas	-0.140
	(-1.08)
East Texas	-0.018
	(-0.11)
Central Texas	0.473**
	(2.15)

Table 14. Model (6) Parameter Estimates for Medicine (Continued)

Independent Variables	Parameter Estimate
Number 1	Base
Number 1.5	0.036 (0.40)
Exotic Crossbred Mix	Base
Crossbred Brahman	0.235** (2.12)
Okie English	-0.073 (-0.35)
Exotic Continental	0.032 (0.15)
Okie Exotic Mix	0.221* (1.68)
Okie Crossbred Mix	0.388*** (2.38)
Exotic Okie Mix	0.179 (1.37)
Preconditioned	Base
Sale Barn Low Risk	0.319* (1.79)
Sale Barn High Risk	2.646*** (13.00)
Grass	0.212** (2.20)
Flesh	-0.088 (-1.10)
Shrink	0.023 (0.68)
ADG	-0.442 (-1.55)
Conv	-0.279 (-1.43)
DOF	-0.008*** (-2.56)
Adjusted R^2	0.842
RMSE	0.422
Observations	165

[a]Numbers in parentheses are values of calculated t-statistics.
Significance level are ***-0.01. **=0.05, and *=0.10.

Table 15. Model (7) Parameter Estimates for Profit

Independent Variables	Parameter Estimate
Intercept	-369.094** (-2.19)[a]
Steer	Base
Heifer	-12.475* (-1.73)
October	Base
November	3.373 (0.56)
December	8.621 (1.23)
January	9.928 (0.60)
February	16.576 (1.25)
March	10.257 (0.84)
1999	Base
2000	-9.401 (-0.79)
2001	-0.766 (-0.04)
Oklahoma	Base
Missouri	5.388 (0.65)
Texas Panhandle	1.161 (0.12)
South Texas	4.456 (0.70)
East Texas	6.770 (0.83)
Central Texas	-18.204* (-1.67)
Number 1	Base
Number 1.5	-4.325 (-0.97)

Table 15. Model (7) Parameter Estimates for Profit (Continued)

Independent Variables	Parameter Estimate
Exotic Crossbred Mix	Base
Crossbred Brahman	3.225 (0.56)
Okie English	-13.959 (-1.37)
Exotic Continental	-1.707 (0.16)
Okie Exotic Mix	2.440 (0.36)
Okie Crossbred Mix	-10.297 (-1.26)
Exotic Okie Mix	6.086 (0.96)
Preconditioned	Base
Sale Barn Low Risk	6.786 (0.77)
Sale Barn High Risk	3.955 (0.24)
Grass	-3.416 (-0.70)
Flesh	5.282 (1.34)
Shrink	-2.635 (-1.56)
ADG	57.528*** (3.88)
Conv	26.009*** (2.59)
DOF	0.874*** (4.60)
Med	-7.046* (-1.77)
FC	-6.539*** (-5.86)
Misc	0.624 (0.11)
FP	-5.708*** (-9.64)

Table 16. LS Means for Sex and Quality

Cattle Trait	Sex		Quality	
	Steers	Heifers	Number 1	Number 1.5
% Dead	0.628	0.770	0.655	0.743
Standard Error	0.411	0.411	0.407	0.433
COG ($/cwt)	48.105[a]	50.034[b]	49.193	48.946
Standard Error	0.463	0.4489	0.429	0.452
ADG (lbs/day)	2.807	2.783	2.798	2.793
Standard Error	0.025	0.025	0.024	0.025
Conversion (lbs/gain)	6.393	6.457	6.424	6.426
Standard Error	0.056	0.056	0.052	0.055
Medicine ($/cwt.)	1.142	1.06	1.093	1.115
Standard Error	0.112	0.116	0.105	0.111
Profit ($/head)	2.024[a]	-10.46[b]	-2.049	-6.389
Standard Error	6.662	7.462	6.274	6.683

[a,b] Means in the same row for the same item with a different superscript letter differ (P>.05).

Table 17. LS Means for Placement Month

Cattle Trait	Month: January	February	March	October	November	December
% Dead	0.494	0.970	0.901	0.517	0.254	1.035
Standard Error	0.487	0.424	0.458	0.527	0.466	0.483
COG ($/cwt)	47.732[a]	47.85[a]	47.79[a]	49.445[a]	49.708[b]	50.421[b]
Standard Error	0.550	0.472	0.534	0.626	0.514	0.510
ADG (lbs/day)	2.772	2.784	2.804	2.817	2.819	2.801
Standard Error	0.030	0.026	0.029	0.034	0.028	0.028
Conversion (lbs/gain)	6.235[a]	6.297[ac]	6.302[a]	6.598[bd]	6.483[bcd]	6.483[bcd]
Standard Error	0.064	0.056	0.064	0.076	0.063	0.063
Medicine ($/cwt.)	1.243	1.178	1.237	0.828	1.218	1.198
Standard Error	0.133	0.113	0.129	0.168	0.126	0.124
Profit ($/head)	-10.902	-7.515	-2.241	-1.414	5.339	-0.901
Standard Error	10.879	11.60	13.101	14.327	10.326	8.109

[a,b,c,d] Means in the same row with a different superscript letter differ (P>.05)

Table 18. LS Means for Placement Year

Cattle Trait		Year	
	1999	2000	2001
% Dead	0.315	0.684	1.099
Standard Error	0.598	0.391	0.491
COG ($/cwt)	46.462^{a}	49.316^{b}	51.430^{c}
Standard Error	0.681	0.418	0.557
ADG (lbs/day)	2.751^{a}	2.774^{a}	2.861^{b}
Standard Error	0.038	0.023	0.030
Conversion (lbs/gain)	6.138^{a}	6.384^{b}	6.755^{c}
Standard Error	0.080	0.050	0.063
Medicine ($/cwt.)	1.168	1.104	1.039
Standard Error	0.173	0.101	0.146
Profit ($/head)	-0.692	-10.217	-1.749
Standard Error	13.410	6.034	12.030

^{a,b,c} Means in the same row with a different superscript letter differ ($P>.05$)

Table 19. LS Means for Origin

Cattle Trait	Missouri	Oklahoma	Texas Panhandle	South Texas	East Texas	Central Texas
% Dead	0.710	1.266	1.178	0.781	0.541	0.282
Standard Error	0.629	0.444	0.691	0.423	0.581	0.763
COG ($/cwt)	48.938^{ab}	49.181^{ab}	50.459^{a}	48.736^{ab}	49.461^{ab}	47.641^{ab}
Standard Error	0.682	0.477	0.725	0.454	0.613	0.812
ADG (lbs/day)	2.854	2.762	2.780	2.781	2.800	2.774
Standard Error	0.037	0.026	0.040	0.025	0.034	0.040
Conversion (lbs/gain)	6.483	6.391	6.513	6.351	6.433	6.382
Standard Error	0.083	0.058	0.089	0.055	0.075	0.099
Medicine ($/cwt.)	1.376^{ab}	0.985^{ab}	0.973^{ab}	0.857^{ab}	0.961^{ab}	1.468^{a}
Standard Error	0.167	0.121	0.191	0.118	0.160	0.206
Profit ($/head)	1.261	-4.151	-2.974	0.316	2.593	-22.361
Standard Error	9.087	6.614	10.040	6.530	8.949	11.219

^{a,b,c} Means in the same row with a different superscript letter differ (P>.05)

Table 20. LS Means for Different Background

Cattle Trait	Sale Barn Low Risk	Sale Barn High Risk	Preconditioned	Grass
% Dead	0.875[ab]	-1.250[a]	1.698[b]	1.474[ab]
Standard Error	0.648	0.995	0.423	0.411
COG ($/cwt)	46.551[a]	53.519[b]	47.754[ac]	48.454[c]
Standard Error	0.686	1.051	0.444	0.432
ADG (lbs/day)	2.731	2.909	2.763	2.778
Standard Error	0.037	0.058	0.024	0.0238
Conversion (lbs/gain)	6.314	6.449	6.451	6.489
Standard Error	0.083	0.132	0.054	0.053
Medicine ($/cwt.)	0.614[a]	2.996[b]	0.296[a]	0.509[a]
Standard Error	0.183	0.191	0.117	0.116
Profit ($/head)	0.706	-2.013	-6.087	-9.483
Standard Error	9.769	15.482	6.617	6.221

[a,b,c] Means in the same row with a different superscript letter differ (P>.05)

Table 21. LS Means for Breed

Cattle Trait	Crossbred Brahman	Okie English	English Continental	Okie Exotic Mix	Okie Crossbred Mix	Exotic Okie Mix	Exotic Crossbred Mix
% Dead	0.468	1.306	0.871	0.374	0.105	0.887	1.093
Standard Error	0.511	0.704	0.783	0.479	0.641	0.524	0.401
COG ($/cwt)	49.730	48.534	48.663	49.284	49.699	48.870	48.704
Standard Error	0.541	0.741	0.830	0.503	0.672	0.549	0.421
ADG (lbs/day)	2.818	2.770	2.730	2.814	2.851	2.802	2.782
Standard Error	0.030	0.041	0.046	0.028	0.037	0.030	0.023
Conversion (lbs/gain)	6.401	6.382	6.335	6.450	6.506	6.465	6.439
Standard Error	0.067	0.090.	0.101	0.062	0.083	0.067	0.051
Medicine ($/cwt.)	1.193	0.894	0.993	1.189	1.348	1.138	0.970
Standard Error	0.134	0.195	0.218	0.125	0.171	0.138	0.106
Profit ($/head)	1.027	-16.134	-3.928	0.255	-12.475	3.893	-2.173
Standard Error	7.864	10.229	11.478	7.208	9.384	7.687	6.017

Table 22. Comparison of Simple Means to TCFA Survey and Ranch to Rail

	Low Risk Sale Barn[a]	High Risk Sale Barn[a]	Grass[a]	Precondition[a]	Non Precondition[b]	Precondition[b]	Sick[c]	Healthy[c]
Death %	1.73	4.85	1.34	0.99	4.27	1.5	3.4	0.5
ADG (lbs/day)	2.81	2.40	2.75	2.87	2.57	2.94	2.78	2.96
Conversion (lbs/gain)	6.35	6.78	6.55	6.33	6.87	6.31		
% Choice	53.18	34.65	49.12	44.31	35.78	50.43	29	39
% Outs	0.41	0.90	1.15	1.13	6.86	2.46		
Feeder Price ($/cwt)	85.32	82.35	89.30	87.49		5.25[d]		
Days on Feed	177.4	227.8	189.35	190.9				
Feed Costs ($/cwt)	43.09	44.62	46.52	44.95				
Medicine ($/cwt)	0.63	3.94	0.35	0.21			31.33[e]	0[e]
Cost of Gain ($/cwt)	46.59	51.97	49.47	47.65			65.96	56.68
Interest Expense ($/head)	34.89	44.58	38.58	32.90				

Table 22. Comparison of Simple Means to TCFA Survey and Ranch to Rail

	Low Risk Sale Barn[a]	High Risk Sale Barn[a]	Grass[a]	Precondition[a]	Non Precondition[b]	Precondition[b]	Sick[c]	Healthy[c]
Placement Weight (lbs)	624	570	598	602				
Live Price ($/cwt)	69.92	72.41	70.29	71.25				
TCFA Cash Price ($/cwt)	69.20	72.15	70.85	70.23				
Live Weight (lbs)	1146	1189	1132	1158				
Revenue ($/head)	803.68	861.03	816.92	825.47				
Profit (without Feeder Cost)	531.51	519.27	516.85	530.34				
Net Profit/Loss ($/head)	(0.0009)	49.99	(17.45)	0.08				

[a] Avent
[b] TCFA Survey
[c] McNeill Ranch to Rail
[d] Premium from TCFA Survey for preconditioned calves
[e] Medicine cost per head

IV. Conclusions

This conclusions section is a joint conclusion from the two essays. There is a comparison between the two essays and how the market value is affected by feedlot performance. It is hypothesized in the first essay that the market was not truly rewarding producers who precondition their calves. In the second essay the hypothesis was that preconditioned calves had improved performance and profitability given previous work (Cravey).

The market in Joplin over the four year period valued preconditioned calves at $2.59 per hundredweight higher (Figure 5.4, essay one) than preconditioned calves. Over the four year period, it could be concluded that buyers preferred preconditioned, large frame, heavily muscled steers with a thin or fancy appearance. In the sequential sale data it could be concluded that buyers prefer a uniform lot of 55 to 65 head of healthy, large frame, heavily muscled preconditioned Angus steers in average condition. This was consistent with previous studies on lot size (Faminow and Gum; Schroeder et al. 1988; Smith et al.). Discounts for heifers was found to be in range with other studies in feeder cattle price differentials (Turner, Dykes, and McKissick; Lambert et al.; and Smith et al.) Breed was not found to be as an important factor as in previous studies. Price was more influenced by health and physical attributes. Thin cattle received a premium over the four year period and had smaller discount in the fall then previous studies. It could be concluded that buyers in this market do not discount thin cattle as much as previous work. Fleshy cattle were not discounted as much as previously which is thought to be attributed to the larger number of preconditioned calves.

The premium for preconditioned calves was found to be higher for the program with one protocol ($3.36 per hundredweight) than the program with three protocols ($1.96) in the sequential sale data. But over 86% of the observations followed the same protocol as the first program, therefore it could be concluded that buyers have greater confidence in the first program. The lower price over the four years for preconditioning could be attributed to the fact there was two different programs for preconditioned calf sales are grouped together. It appears that the program with the single protocol of vaccination and weaning generated higher returns than the other program. Buyers seem to put higher value on this program. The premiums for preconditioned calves from the sequential data set for the first program were consistent with results by King.

Also there was a difference in feeder cattle prices paid by the feedlot from the closeout data. Feedlot order buyers paid $5.14 per hundredweight higher for preconditioned cattle over high risk cattle and $2.17 per hundredweight higher for low risk cattle. With the overall premium for preconditioned cattle being $3.66 per hundredweight over sale barn cattle. It should be noted though that cattle classified as preconditioned could not be separated into cattle that were preconditioned on the ranch and those from preconditioning or backgrounding lots. The premium is consistent with results from the survey. Managers responding to the survey placed a higher value on preconditioned cattle and noted a performance difference between preconditioned and non-preconditioned feeder cattle. Therefore it can be concluded that feedlot operations place a higher value on preconditioned calves. A problem with the survey was that managers were not asked about the profitability differences between preconditioned and non-preconditioned feeder cattle.

The results from the feedlot performance and profitability study gave mixed results compared to what was previously thought. There were differences in performance measures but not significance differences in profits. There is thought to be a problem with how cattle were classified by the feedlot into backgrounds of low risk, high risk, grass, and preconditioned. This is because different order buyer who purchased the cattle classified cattle, so there could be different perceptions in the way cattle should be classified. The cattle breed classification was not found to cause any significant difference in cattle in most models.

The model for death percentage had the incorrect signs compared to what was anticipated. The fact that high risk cattle had a negative effect compared to preconditioned cattle and negative LS Mean was unexpected. This result was not expected because the simple means (table 22, essay 2) showed high risk cattle to have a death loss of 4.85% compared to 0.99% for preconditioned cattle, also respondents to the survey expressed a higher death loss for non-preconditioned cattle and a study by Cravey showed a greater death percentage for non-preconditioned cattle. Also shrink and medicine costs were found to increase death loss which are factors attributed to non-preconditioned cattle. It is thought that there was a variable missing from the model to explain death percentage. It might have improved the model to know the percentage of cattle that became sick. Another factor of interest might have been the number of cattle pulled for health treatments, retreated cattle and days cattle were in the hospital pens. Another factor could have been the smaller number of high risk cattle compared to other backgrounds.

Cost of gain had some unexpected results. Sale barn low risk cattle had lower cost of gain compared to preconditioned cattle. There could a problem with how cattle were classified because there is no prior knowledge on what vaccinations or what other factors might affect performance. High risk steers were found to have higher cost of gain ($6.25 per hundredweight) compared to preconditioned cattle, this could be attributed to sickness and lower performance. The lower cost of gain for preconditioned calves was consistent with the work by Cravey. Average daily gain did not have the appropriate signs for high risk cattle compared to preconditioned cattle. This could be attributed to the small number of observations for comparison. The results for medicine costs were as expected. All groups compared to preconditioned cattle had increased medicine costs as was previously thought due the improved health of preconditioned cattle. High risk cattle had medicine cost that were $2.65 per hundredweight compared to preconditioned cattle. The higher cost for sick cattle was consistent with results by Cravey and McNeill.

The profit results were not as expected. Some factors that were not included in the data might have affected profit. The number of sick cattle, pulls, and cattle retreated. The month and year did not have much effect on profit. The origin and breed of cattle did not affect profitability. The results for different backgrounds were not as expected. Sale barn cattle were found to be more profitable then preconditioned cattle. In comparing simple means, high risk cattle were profitable, preconditioned cattle showed little profit, while low risk and grass cattle had negative returns. This was surprising due to the fact that high risk cattle had higher production costs and lower performance. High risk cattle had higher cost of gain ($6.25 per hundredweight) and medicine cost ($2.65 per hundredweight) compared to preconditioned cattle. High risk cattle had substantially lower percentage choice carcasses but had fewer outs. The profitability results were unexpected because in studies by Cravey, Gardner et al., and McNeill found healthy cattle to be substantially more profitable then sick cattle.

The factors affecting cattle feeding profits were found to be in line with previous research with a few exceptions (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). As feed conversion increased it was found to increase profits. This could be due to the fact sale barn high risk were most profitable and had the highest conversion rates. When prices were examined, it was found that high risk cattle had the highest price ($72.41 per hundredweight) and the highest live weight (1189 pounds) therefore having the highest revenue. All prices were based on carcass performance and converted back to a live price by the feedyard. There is no knowledge on what types of grids were used and what the premiums and discounts were. These prices were based on cattle shipped to the packing plant. Cattle that were poor performers may have been sorted off and either sold or likely transferred to different pens. This would affect the profitability of lots because poorer performing cattle were not included in the price and carcass data. This could have contributed to the higher profitability of the high risk cattle.

Previous research has found that fed cattle price and feeder cattle price are the two largest factors effecting cattle feeding profitability (Lawrence, Wang, and Loy; Langemier, Schroeder, and Mintert; Schroeder et al.1993). Therefore it seems to make sense that high risk cattle were most profitable given they had the lowest feeder purchase price and highest fed cattle price. It should be noted that lower performing animals may not have been included in the final fed cattle price. Since there was not found to be any significant difference in profit between preconditioned cattle and other backgrounds, the conclusion could be drawn that this market was efficient in the purchase price paid for feeder cattle give the data. In table 22 (essay 2) returns were looked at without feeder cattle purchase price to represent retained ownership. Profit was calculated based on cost of gain and interest expense. Interest expense did account for feeder calf value to account for the opportunity costs of selling cattle as feeders and not retaining ownership. Preconditioned cattle returned $11.07 and $13.52 more per head than high risk and grass cattle, respectively, but returned $1.17 per head less then low risk cattle.

Based on this study the best way to determine the profitability of feeding preconditioned calves would be through an experiment or trial based on a group of preconditioned and comparable sale barn or weaned calves. Through the use of an experiment, cattle could be followed to overcome some of the data shortcomings of this study. For example the market study was just based on cattle sold in Joplin, Missouri while cattle in the feedlot data came from many different origins. Classification on the background of cattle could be improved through an experiment. Also there would be some advantage to calves that were grouped together as they were described in the market study as opposed to not knowing whether the cattle were preconditioned in a preconditioning feedyard or at the place of origin. As there has been development of many of these types of preconditioning programs, this should assist in the availability of data for further research if cattle could be tracked from weaning to harvest. Another step that could be taken is to survey producers who are participating in preconditioned calf programs to find details of their operations. This could be used to establish the added price needed for producers to participate in the program.

September 2001

Dear Feedlot Manager:

As part of research on the value of preconditioning programs, we are seeking your input. This survey should take only ten minutes to complete. We are interested in feedlot managers' opinion regarding various aspects of preconditioning programs. Your best estimates are needed, checking records is not necessary.

This survey is part of a masters degree thesis at Oklahoma State University. Your cooperation and thoughts are greatly appreciated. Participation is totally voluntary. Your identity and survey response will be kept confidential to the best of our ability. Results will be shown as aggregated responses from all managers surveyed.

If you have any questions or concerns you may contact:
Dr. Clem Ward (Professor) at (405)-744-9821 or by email at ceward@okstate.edu.
R. Keith Avent (Graduate Assistant) at (405)-744-5547 or by email at avent@okstate.edu.

Thank you for your cooperation in this research project.

Sincerely,

Clement E. Ward
Professor and
Extension Economist

Preconditioning Survey

In your best judgement ...

1. What health advantages in the feedlot result from preconditioning calves compared with non-preconditioned calves?
   Preconditioned calves _______ % sick _______ % dead
   Non-preconditioned calves _______ % sick _______ % dead

2. What feedlot performance advantages result from preconditioning calves compared with non-preconditioned calves?
   Preconditioned calves _______ ADG _______ Conversion
   Non-preconditioned calves _______ ADG _______ Conversion

3. What carcass performance advantages result from preconditioning calves compared with non-preconditioned calves? Assume genetically equal calves at birth.
   Preconditioned calves _______ % Choice or better _______ % Outs
   Non-preconditioned calves _______ % Choice or better _______ % Outs

4. What is the market value (premium) for preconditioned calves? _______ $/cwt. (500 lb. calf)

5. What could current preconditioning programs do to better serve feedlots than what they are currently doing? ____
   ____
   ____

6. Would your feedlot be interested in providing closeout and carcass data to help identify the true value of preconditioning programs in cattle feeding?
   ______ I would consider cooperating _______ No, I am not interested

Please return the completed survey to:

Clement Ward
Department of Agricultural Economics
515 AH, OSU
Stillwater, OK 74078

THANK YOU.

Oklahoma State University
Institutional Review Board

Protocol Expires: 7/29/02

Date: Monday, July 30, 2001 IRB Application No AG022

Proposal Title: MARKET VALUE OF VALUE ADDED CALF

Principal
Investigator(s):

Clement E. Ward
513 Ag Hall
Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

Oklahoma State University Institutional Review Board

Protocol Expires: 7/29/02

Date : Monday, September 24, 2001

IRB Application No AG022

Proposal Title: MARKET VALUE OF VALUE ADDED CALF

Principal Investigator(s) :

Clement E. Ward
513 Ag Hall
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s) : Approved **Modification**

Please note that the protocol expires on the following date which is one year from the date of the approval of the original protocol:

Protocol Expires: 7/29/02

Signature : Carol Olson

Carol Olson, Director of University Research Compliance

Monday, September 24, 2001
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA 2

Roy Keith Avent

Candidate for the Degree of

Master of Science

Thesis: MARKET VALUE, FEEDLOT PERFORMANCE, AND PROFITABILITY OF A PRECONDITIONED CALF

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Amarillo, Texas On June 19, 1976, the son of Jack and Patricia Avent.

Education: Graduated from Pampa High School, Pampa, Texas in May 1994; received Bachelor of Science degree in Agribusiness from West Texas A&M University, Canyon, Texas in December 1999. Completed the requirements for the Master of Science degree with a major in Agricultural Economics at Oklahoma State University in August 2002.

Experience: Sales Representative, Foust Feeds, January 1997 to August 2000; Graduate Research Assistant, Department of Agricultural Economics, Oklahoma State University, August 2000 to May 2002.

Professional Memberships: Southern Agricultural Economics Association