VALUE-BASED FED CATTLE MARKETING: A COMPARISON OF LIVE WEIGHT VERSUS GRID PRICING SYSTEMS

By

MICHELLE BESHEAR

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1995

Submitted to the faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May 1997

VALUE-BASED FED CATTLE MARKETING: A

COMPARISON OF LIVE WEIGHT VERSUS

GRID PRICING SYSTEMS

Thesis approved:

James N. Trapp

Thesis Advisor

Darrell S. Peel

Helen Dolezal

Thomas C. Collins

Dean of Graduate College

ACKNOWLEDGEMENTS

First, I would like to extend my gratitude and appreciation to my advisor, Dr. James Trapp for his guidance, encouragment, amd invaluable knowledge throughout my graduate career. Enormous thanks also go to my committee members, Dr. Derrell Peel and Dr. Glen Dolezal for all of their assistance and knowledge. My deepest appreciation for all of the assistance, advice and teasing are expressed to Dr. Clement Ward and Dr. Stephen Koontz. I have truly been fortunate to work with such a wonderful and knowledgeable group of individuals.

Secondly, I would like to express my sincerest thanks to my wonderful friends that have been there to help me keep my sanity as I journeyed through the masters programs. To Michelle, Sheila, Lynn, Sherri, and Brian, thanks for always listening and assuring me that things would be OK.

Finally, I owe a tremendous amount to my family who have supported thoroughout my life. I would like to thank my parents, David and Nita; my brothers, Bryan and Cleo; and my grandparents, Lela Mae Beshear and Lucille Williams for always believing in me. I would like to dedicate my work to the memory of my grandpa, Andy Beshear. I know that he would be of proud of my accomplishments.

TABLE OF CONTENTS

Chapter	Page
1. Introduction	1
Problem Statement	2
Hypotheses	4
Objectives	4
Organization of thesis	5
2. Literature Review	6
Introduction	6
Studies of Carcass-based Pricing Systems	6
Price Discovery and Pricing Efficiency	12
3. Theory and Procedures	21
Introduction	21
Theorectical Framework	22
Seasonal Carcass Price Patterns	23
Grid Versus Live Weight Pricing	26
Hypothesis Tests	30
4. Results	41
Introduction	41
Seasonal Carcass Price Patterns	41
Grid Versus Live Weight Pricing	44
Hypothesis testing and Implications	50
5. Summary and Conclusions	74
Summary and Conclusions of Study	74
Limitations and Research Opportunities	76
BIBLIOGRAPHY	78

LIST OF TABLES

Table Page

1. OSU Boxed Beef Calculator Input Example 33

2. Boxed Beef Calculator Price Table Example 34

3. Boxed Beef Calculator Cut-out Values for Yield Grades 1, 2, and 3 35

4. Slaughter Steer Market Price Example 36

5. Premiums and Discounts Used in Pricing Grid 37

6. Format for Hypothesis Tests 38

7. Summary of Price Spreads For Yield Grades 1 - 3 52

8. Comparison of Live Versus Grid Pricing for CCDS 53

9. Summary of Feedlot X Live Versus Grid Values 54

10. Standard Deviation of Values for Feedlot X 55

11. Maximum and Minimum Values for Feedlot X 56

12. Feedlot X Pen Values With Prices Held Constant 57

13. Weighted Average Pen Distribution By Yield Grade 58

14. Weighted Average Pen Distribution By Quality Grade 59

15. Pen Distribution by Quality and Yield Grade for Feedlot X 60

LIST OF FIGURES

Figure Page

1. Distribution of Yield Grades 39

2. Distribution of Quality Grades 40

3. Choice Y2 Seasonality 61

4. Select Y2 Seasonality 62

5. Choice Y1-Y2 Spread 63

6. Choice Y1-Y3 Spread 64

7. Choice Y2-Y3 Spread 65

8. Select Y1-Y2 Spread 66

9. Select Y1-Y3 Spread 67

10. Select Y2-Y3 Spread 68

11. Choice-Select Spread 69

12. Grid Versus Live Pricing With Quality Held Constant 70

13. TX/OK Monthly Average Fed Steer Price 1988-1997 71

14. TX/OK Weekly Average Fed Steer Price 1993 72

15. TX/OK Weekly Average Fed Steer Price 1993 73

Chapter 1

Introduction

In recent years, the beef industry has seen its share of the market for retail meat decrease; while poultry and pork have increased their market shares. A major factor impacting the shift in consumer expenditures away from beef is believed to be caused by the price competitiveness of pork and poultry (Barkema and Drabenstott). Another factor impacting consumer expenditure on beef is concern over the quality aspect of beef versus other meats. Many industry leaders contend that considerable changes must be made within the beef industry if beef is to compete with poultry and pork (Purcell, and Barkema and Drabenstott). As the poultry and pork industries continually improve on their product quality and value, the beef industry must find ways to improve its price and quality competitiveness. Current pricing inefficiencies in the fed cattle market may be a factor contributing to beef's lack of price competitiveness with other meats.

Value-based marketing is a concept that may advance the beef industry in price and quality competitiveness. Value-based marketing is a pricing alternative on which cattle will be bought on a carcass basis rather than the commonly used average live weight basis. With a carcass value-based marketing system, premiums are paid for cattle with desirable carcass characteristics and discounts are incurred by cattle with undesirable carcass characteristics. A few producers in the industry are selling cattle on a carcass basis with the price being determined by a packer formula or "pricing grid". Grid pricing is a carcass-based pricing method where U.S. Choice Yield

Grade 3 (Choice Y3) is typically used as the base price with other quality and yield grades priced at premiums and discounts to the base price (McClelland). Thus, the "pricing grid" arises where a 4 by 5 matrix or "grid" of prices is determined with one dimension reflecting quality grade and the other yield grade. Generally, premiums are paid for Prime carcasses, and Yield Grade 1 (Y1) and 2 (Y2) carcasses. Discounts are applied to carcasses which are non-conformers to packer boxed beef fabrication specifications, such as Standard, Yield Grade 4 (Y4), Yield Grade 5 (Y5), dark cutters, advanced maturity carcasses or carcasses weighing more than 950 or less than 550 pounds. A grid pricing system is fairly complex and requires the reporting of prices in a timely manner in order to obtain the base price, quality and yield grade spreads, and volume traded.

Problem Statement

Today's consumers want a lean, consistent cut of beef at a competitive price. The current beef pricing system is not fully communicating these desires to producers. The current marketing system for beef stimulates excess fat production by placing the same value on trimmable fat as edible lean (National Cattlemen's Association). Any time a pricing system fails to communicate consumer demand to producers, the system is inefficient and needs to be changed. However; the pricing system should be changed only if the benefits of the change will compensate for the costs of the change. The belief within the industry is that a better marketing system would better enable the industry meet consumers' demands. It would accomplish this by rewarding cattlemen for producing cattle with desirable slaughter characteristics and penalizing

those who produce cattle with less desirable slaughter characteristics. Grid pricing is believed by many in the industry to be designed to enhance price discovery and help communication among the phases of the beef industry (Fitzgerald and Stolle).

The concept of carcass-based marketing has received much attention within the beef industry in recent years; however, few studies have been conducted to analyze the feasibility of such a pricing system. One advantage of a carcass-based pricing system is that carcass quality does not have to be estimated as in live cattle bidding. Uncertainty about quality generally leads to inefficiency or increased costs in marketing. Pricing accuracy improves at the carcass level where quality and yield grades are actually assigned in the industry. However, carcass beef is not the final consumer product. The most ideal pricing system in theory would be one that priced cattle based on retail prices of the products produced; the next most ideal pricing system being one based on wholesale meat products, i.e., boxed beef subprimals. However, such pricing systems are difficult to implement because the technology does not exist to retain animal source identity for individual cuts/boxes of beef. Thus, pricing beef based on boxed beef prices while desirable from a marketing efficiency perspective appears to have technical problems. These problems may be resolvable with the use of various "grid pricing" systems. Such systems would predict boxed beef subprimal yields based on carcass weight and grades for different carcasses and then value carcasses/animals based on these predictions and boxed beef subprimal prices. This study will analyze the use of one specific formula-based "grid pricing" system.

Hypotheses

The study maintains three specific hypotheses. The first hypothesis is that beef carcass prices based on the formula used will exhibit a seasonal pattern. The second hypothesis is that formula-based grid pricing values individual cattle significantly different than live weight pricing. The differences in values calculated from the two pricing systems will be tested to determine if the mean difference in values is significant. The third hypothesis is that formula-based grid pricing will exhibit greater variation of animal values within pens, due to variation in quality; however, the study further hypothesizes that variation across pens will not be significantly different between the two pricing systems.

Objectives

The general objective of the study is to provide a comparison of the traditional method of marketing fed cattle ("cash" or live weight basis) with one alternative formula-based carcass grid pricing system. There are three specific objectives of the study.

1. To determine the seasonal price patterns for beef carcasses by yield and quality grade.
2. To determine the variance in individual animal values for both live weight and grid pricing methods on over 100 pens of cattle.
3. To determine the difference between the theoretical grid value of the cattle in each pen with the estimated live value of the cattle.

Organization of the thesis

Chapter 2 will summarize literature related to the study. Literature in the areas of seasonality of beef, price discovery and pricing efficiency in the fed cattle industry, and alternative pricing methods for fed cattle will be reviewed. Chapter 3 describes the theory, data, and methodology used to derive the theoretical carcass prices. This chapter will also outline how the values of the animals for the two pricing systems were calculated. Chapter 4 presents the results of this study. Chapter 5 will briefly summarize the study and discuss conclusions drawn from the results.

Chapter 2

Literature Review

Introduction

Past research in the area of fed cattle pricing has focused mainly on the need for a more efficient pricing system and the role of price discovery in the industry. Relatively few studies have been conducted to analyze increased pricing efficiency or the economic feasibility of changing to an alternative pricing system such as value-based pricing. The focus of this study is a comparison of live weight pricing with an alternative pricing system for fed cattle. This literature review will focus on the limited amount of previous research related to carcass-value based pricing and provide an overview of the literature pertaining to price discovery and the industry's need for increased pricing efficiency.

Studies of Carcass-Based Pricing Systems

Hayenga et al. evaluated carcass merit pricing in the pork industry in the early 1980s. At the time of the study, consumer surveys indicated that fat/health concerns were the primary reasons for the lack of pork consumption. However, pork producers felt that monetary incentives to produce leaner hogs were inadequate. In an effort to combat problems on both sides of the industry, the authors of the study in conjunction with the U.S. Department of Agriculture, evaluated 185 market hogs to determine alternative grading and pricing procedures for pork carcasses.

The hogs included in the study varied in body type and weight, and were slaughtered in four different weight groups ranging from 200 to 290 pounds. Carcass

value per hundredweight (cwt) was calculated by taking the weights of wholesale cuts, fat, lean trim, and bone, then multiplying these by average market prices in the Yellow Sheet. The carcass total dollar value was then divided by the carcass weight expressed per hundredweight to determine carcass value per hundredweight. Based on this carcass value per cwt. and easily measured carcass characteristics, statistical relationships were estimated. The study indicated that a backfat measurement and hot carcass weight explained 79 percent of variation in carcass value per cwt. A muscling score index (thin, moderate, thick) based on a USDA indexing system was also used to explain variation in carcass quality. Although, muscling is a fairly subjective trait it was included to prevent thin hogs with inadequate muscling from receiving undeserved premiums. In order to determine a premium/discount schedule, carcass value per cwt. was regressed against dummy variables for backfat, carcass weight and muscling score. The regression yielded a premium/discount matrix for meatpackers to price pork. This resulting premium/discount matrix is similar to the grid used to develop the alternative pricing system in this study.

Hayenga et al. concluded that meat packers could use their own cut-out data and prices received for various wholesale products to determine premiums and discounts associated with changes in carcass weight, backfat, and muscling. The three variables accounted for 79 percent of the variation in carcass total dollar value and could be readily recorded in most packing plants with rapid chain speeds. By using this grading system to base evaluation and pricing, meatpackers could reduce the variability among carcasses. Communication of the premium/discount matrix to producers would likely

enhance producer acceptance of a carcass merit pricing system.

Although this study is related to the pricing of hogs and the pork industry, the beef industry is currently facing many of the challenges that the pork industry has been able to overcome. Furthermore, in order for beef to regain its retail dominance, it is important for the beef industry to better understand how competing meats have changed to meet consumer demands. Gaining producer acceptance is also important to help the beef industry to implement alternative pricing systems.

Fausti and Feuz conducted a study on the types of risk associated with buying cattle and the factor price disparity that results. The theory of factor price disparity can be defined as the price difference that a processor is willing to pay for inputs without knowing the inputs contribution to the final product. Previous studies have addressed the price differentials between marketing alternatives and the issue of informational risk. The focus of the study is on informational risk and the inherent price risk of a competitive market. Empirical analysis is used to support the theory of factor price disparity. The evidence shows that the theory is consistent with other research that concluded buyers apply a risk premium associated with the marketing alternative used to price cattle.

A short-run model using two marketing methods was used to evaluate the theory of factor price disparity. The two marketing methods were selected based on their informational conditions. The live weight marketing method is used as the incomplete information alternative and dressed grade and yield system is used as the full information marketing alternative. The dressed grade and yield method is similar to a grid pricing

system; however, price is determined only by the quality grade of the animal and its carcass weight or dressed yield (dressing percentage) ignoring carcass size, and other carcass defects. The model assumes that buyers purchase cattle through both marketing methods. The incomplete information condition implies that there is uncertainty in the total product.

The conclusions of the model results indicate packer purchasing decisions in the absence of market failure, generates factor price disparity. Factor price disparity asserts that a risk neutral firm will pay less for an input with uncertainty of its "total product" in a market than it will pay for an input when its contribution to production is certain. The empirical results provides strong evidence that price differentials exist between different marketing alternatives for slaughter cattle. While previous studies have discussed the issue of informational risk on pricing in the fed cattle market; this study provides a framework for the analysis of the impact of informational risk in the fed cattle market. Fausti and Feuz's study provides evidence of the impact of informational risk on pricing in the beef industry to support the theory that packers consider risk of uncertain quality when pricing cattle on a live weight basis. By using an alternative pricing system, such as grid pricing, in which more information is known, the risk is decreased and pricing efficiency should improve.

Feuz, Fausti and Wagner analyze the efficiency of four marketing methods for pricing fed cattle. The methods examined were: live weight pricing, dressed weight basis, dressed weight and yield basis, and a value-based marketing approach. The marketing methods were evaluated in terms of pricing efficiency, mean profit levels,

degree of price differentiation, and production factors and/or quality variables that have the greatest influence on profit.

Profits were calculated for each marketing method based on 340 steers as part of the South Dakota retained ownership demonstration project. Variables having the greatest impact on profit were determined and these carcass characteristics and production variables that impacted profit varied among alternative marketing methods. Variables considered in the study include quality grade and yield grade, dressing percentage, fat thickness over the 12th rib, and feedlot variables such as average daily gain, total cost of gain, and total days on feed.

The study concludes that producers are responding to and being rewarded for feedlot characteristics rather than carcass characteristics. However, carcass characteristics more effectively reflect consumer preferences to producers. Therefore, the current marketing system in the industry is not effectively communicating consumer demands to producers. The authors conclude that for a value-based marketing method to be successful, the risk aversive behavior of the market participants must be considered. Paired difference tests of the mean differences between marketing alternatives were conducted. The results of the tests indicated that live weight pricing was the least profitable method and that dressed weight pricing was the most profitable. However, there was not a significant difference in the profits from the dressed weight and carcass-based pricing methods. The carcass-based pricing method had the greatest variance. This result supports the hypothesis of the study that carcass-based pricing will result in greater variation than live weight pricing.

Although, the study evaluates several marketing methods, including live weight basis pricing and carcass-based pricing, the results are based on pens of five head of cattle. This represents a relatively small sample from which to perform convincing statistical analysis. Given the perceived variability of animal values yielded from carcass-based pricing system, larger pen sizes are needed to adequately determine if the variability is due to variations in quality within or among the pens. Also, the small pen sizes are not typical of the industry.

Faminow, de Matos and Richmond studied the Canadian beef industry to determine errors in pricing slaughter steers and heifers. The study collected data based on 270 high quality steer and heifer carcasses cut out to the same commercial specifications for comparison with the cattle's live weight price. The value of the meat from the carcasses was evaluated on a carcass weight equivalent, with the live weight price adjusted to carcass equivalent by dividing through by the dressing percentage.

The carcasses were separated into weight groups based on their hot carcass weight. The weight groups were based on three industry standard weight groups: 550 to 650, 650 to 750, and 750 to 850 pounds. The carcasses were then compared by gender, heifers versus steers for purchase value and carcass value. Profits based on yield grade, cattle gender, and weight group were also calculated.

The study concluded that prices for steers tend to be high relative to the value of their meat yields, while heifers appear to be discounted when purchased, yet their carcasses tend to have high meat yield values. Secondly, live weight prices tend to be independent of final yield grade, and meat yields are closely related to yield grade. This

implies that price signals based on animal quality are not clearly communicated to cattle producers. A final conclusion of the study is that heavier heifers tend to be discounted when purchased, although their carcasses tend to have higher meat value yields.

This study supports the argument that pricing fed cattle on a live weight basis leads to errors and inefficiency in the industry. The key reason for the variation in live weight pricing and carcass meat values is the uncertainty in estimating yields and other carcass characteristics on a live weight basis. A better pricing system is needed for the industry to pass on price signals to producers for the type of beef that is demanded by today's consumers.

Price Discovery and Pricing Efficiency

The necessity for increased pricing efficiency in the beef industry has been addressed as the key for the future success of the beef industry by many industry participants. Barkema and Drabenstott state that the future success of the beef industry depends on the industry's ability to make beef more price competitive with other meats and to deliver the quality that consumers are demanding. Their study states that several factors, including lifestyle changes and the rising price of beef relative to other meats have contributed to the recent decline in beef consumption. They conclude that empirical evidence indicates that the relative price of beef compared to other meats has been the primary factor affecting beef consumption rather than lifestyle changes. They also state that the relative price of beef and lifestyle factors will continue to impact the industry.

Purcell's study of the importance of pricing and grading issues in the beef industry also focuses on the future of the beef industry. Purcell states that in order for

the beef industry to maintain its current open exchange structure and avoid a completely integrated industry, pricing efficiency in the beef industry must improve. The study relates the importance of grades to pricing efficiency. The current grading system is not identifying the high-value animals and pricing those animals at a premium. Purcell states that this is not likely to change until the industry moves away from pricing cattle on a live weight basis. The study addresses the need for a carcass-based pricing system, and also outlines some of the obstacles that may hinder the implementation of such a pricing system. Potential remedies for some of the obstacles facing a carcass-based pricing system include: a) technology to identify value without compromising slaughtering efficiency; and b) a progressive move towards a less adversarial relationship between producer and packers. Purcell concludes that economic forces will prevail to determine how the industry will evolve in the future. The study identifies industry consolidation, the continuing struggle between meat sectors for market share, and the growing realization that the consumer will ultimately determine quality/value are potential dominant forces shaping the future of the industry.

McCoy and Sarhan provide a broad overview of the markets for livestock and meat. The section pertaining to the types of livestock markets and marketing compares the direct marketing system for live animals with a carcass grade and weight marketing system. A previous study (1980) of carcass-based marketing systems for cattle and hogs was cited. Advantages and obstacles of implementing such a marketing system were discussed from both the packer and producer perspective. A survey of both packers and producers identified several obstacles and benefits of using a carcass-based pricing

system.

The majority of the obstacles facing a carcass-based pricing system from a producer's standpoint were related to lack of trust in the packers. Obstacles identified by producers included: the need to commit to a sale before the value is determined, delay in payment, inability to compare prices, and lack of confidence in accuracy of grading at the plant. Packers identified the following factors as obstacles of using a carcass-based pricing system: maintaining carcass identity during slaughter, difficulty in computing carcass value and payment, additional grading costs. Despite the numerous obstacles listed by participants from both sides of the market, both producers and packers believed that carcass-based marketing has potential benefits. Producers agreed that carcass-based pricing makes payments fairer and increases net returns. With the carcass-based pricing system, producers gain beneficial information for production practices and are rewarded for producing high quality animals. The carcass-based pricing system benefits packers by aiding in quality control, and by reducing the risk of overvaluing an individual animal. The carcass-based pricing system study discussed in McCoy and Sarhan's book is somewhat dated. The potential obstacles listed in the study such as maintaining carcass identity during slaughter and the difficulty in computing carcass value and payment have been resolved to some extent by technological and market advancements. However, the issue of the lack of trust and the relationship between producers and packers is an issue that hinders the advancement of carcass-based pricing at present. Purcell indicates that a move towards a less adversial relationship between packers and producers is needed for carcass-based pricing to be successful.

Ward discusses a variety of concerns and issues related to livestock-meat pricing and price reporting. The most pertinent areas of the study are the sections in which the price discovery process and the importance of price reporting to the fed cattle market are assessed. Pricing methods studied include: live weight, dressed weight, dressed weight and grade, formula pricing, and forward contract pricing. The "house formulas" discussed in the study are similar to the concept of a carcass-based pricing system. Each pricing method requires a varying amount of cattle characteristics that buyers must estimate and the amount and type of risk assumed by the producer. As pricing methods move from live weight, to dressed weight, to dressed grade and yield, pricing accuracy improves. Differences in pricing affects the level of competition among cattle buyers.

Ward also emphasizes the importance of accurate and timely meat price reporting to livestock pricing issues. Packers use reported carcass prices to estimate and negotiate prices. Reported carcass prices are also used in forward contracting cattle. Accurate and timely price reporting is also vital to the success of formula or grid pricing. Structural changes in the meatpacking industry, changes in price reporting and their impact on live cattle prices are discussed.

The study provides a detailed perspective of several pricing methods providing varying levels of information about the individual animal. The most dominant pricing method was live weight pricing followed by dressed weight pricing. The remaining pricing methods were not widely used at the time of the study. Dressed weight and grade pricing was not prevalent, although it provided more information and increased pricing accuracy. The current situation in the industry is similar to Ward's findings.

Although several alternative marketing methods offer more information and greater pricing efficiency, most cattle bought today are priced on a live weight basis.

Unnevehr and Bard address the inefficiency of the current beef pricing system from the consumers' perspective. The study used the National Beef Market Basket Survey to determine consumer preferences for fat characteristics in different beef cuts. The results of the study imply that consumers are willing to pay for a reduction in external fat on beef table cuts, and that consumers place a positive value for marbling in steaks and negative value for marbling in most other beef table cuts. Currently, external fat is being trimmed at the packing, food service and retail level, which is more costly to the beef industry than producing carcasses with less external fat. Cattle producers are not responding to retail price signals because they are receiving no incentive from packers to do so. Boxed beef is priced on the industry standard of one-inch trim for external fat. Under this standard, beef carcasses that receive a yield grade 4 are discounted, but yield grade 3 carcasses receive no significant discounts. Yield grade 1 and 2 carcasses are receiving no price premium for having less external fat.

The study concludes that the current pricing system in the beef industry is failing to pass incentives from the retail level to the producer. Producers have no incentive to reduce external fat unless premiums are received for yield grade 1 and 2 carcasses. Unnevehr and Bard stated that the market's failure to transmit price signals from the consumer to the producer is due to problems with the pricing system and not the grading system. The grading system is identifying carcasses that better meet the consumers' preferences, yet these animals receive no premium under the current pricing system to

encourage continued production of this animal type. The use of grid pricing is believed to provide the necessary incentives to produce the animals with desirable characteristics. The authors also point out that improving quality could have important benefits to the industry by reducing negative attributes associated with beef which leads to decreased demand.

Buccola discusses the concept of pricing efficiency in the context of an optimal information market. Potential causes for pricing inefficiency are identified. Buccola states that risk is an important element in all factors contributing to pricing inefficiency. The article concludes that pricing efficiency research generally fails to fully address the costs of risk and acquiring and evaluating information. These costs are important components of a carcass-based pricing system. By using a carcass-based system more information about the cattle is known to the buyer, thereby reducing risk and increasing pricing efficiency.

Considine et al. studied the long term effects of a new grading system on Canada's beef industry. The Canadian beef grading system was changed in 1972 to reflect consumers' demand for leaner beef. The highest grade under the new grading system was considerably leaner in terms of fat cover than the highest grade under the previous grading system. The grading system used prior to 1972 served wholesale and retail groups well, but provided little value to producers or consumers. Consumer preferences for leaner meat were not being addressed under the old grading system. The old grading system contributed to inefficiency in the Canadian beef industry as producers utilized longer feeding periods to produce fat cover which was undesirable to the

consumer and discarded as waste.

Weekly marketings of fed cattle were recorded to monitor the effects of the grading change on production practices. The study concluded that the grading change appears to have been beneficial to Canadian beef producers in the long run. However; the grading system change had considerable costs and a lengthy adjustment period for producers.

The scope of this study will not include the long-term effects of pricing cattle with a carcass-based system. However; it is important to understand the potential impact of an industry-wide change on both producers and consumers. The purpose of the grading change in Canada's beef industry was to improve efficiency in the industry and to better meet the consumers' demands. The carcass-based pricing concept will have a similar purpose in the U.S. cattle industry. Other long-term effects of a pricing system change in the fed cattle industry include: the costs of risk and acquiring and evaluating information as discussed by Buccola. These are costs that the beef industry will incur in moving to a carcass-based pricing system. However, the belief is that with increased information, the risk of incorrectly valuing fed cattle is reduced and pricing efficiency in the industry will be increased.

Owen, Sporleder, and Bessler investigate temporal relationships between fabricated meat cut prices, carcass value and fed cattle prices. Vector autoregression techniques are used to examine the links between fed cattle prices and wholesale beef cut prices through time. The basic hypothesis of the study is that the boxed beef cutout prices reported by the USDA are leading indicators of fed cattle price. This assumption

supports the use of a boxed beef cutout price to be used in a grid pricing system. The effectiveness of using wholesale beef prices to forecast daily fed cattle prices is also analyzed.

The study examined data on fed cattle price, boxed beef cutout values, and prices for twelve wholesale meat cuts and found that seasonality was a significant factor affecting the prices. The results indicated that certain fabricated wholesale beef cuts can be used in forecasting fed cattle price. The study concludes that the indicated relationships can be used to help forecast fed cattle prices more accurately than looking at only the previous period's fed cattle price.

Capps et al. examine the wholesale demand for twelve beef cuts for key factors that impact the prices of the beef-cuts at the wholesale level. A price-dependent demand model with lagged dependent variables is used to provide measures of price stickiness for wholesale beef-cut prices and to differentiate between short-run and long-run effects. The study hypothesizes that the key determinant of wholesale beef-cut prices is generally the wholesale quantity of the beef cuts. However, since wholesale quantities are directly correlated to production quantities, seasonality in wholesale beef-cut prices is believed to be evident due to seasonal production. Understanding the factors that affect the wholesale beef-cut prices can be used to understand changes in prices in both boxed beef cutout values and fed cattle prices as described by Owen, Sporleder and Bessler.

The results of the study indicate that seasonality is a statistically important factor for all of the wholesale beef-cut prices examined. The seasonal pattern varies by each cut. Depending on the cut, the wholesale beef-cut price can vary as much as six to

twenty-nine percent over a year. Price stickiness and marketing costs are also identified as key determinants of the beef-cut prices at the wholesale level.

Chapter 3

Theory and Procedures

Introduction

This chapter will present the theory, data and procedures used to develop the seasonal carcass price patterns and compare live weight cattle pricing to a formula-based grid pricing system. The first section of the chapter will focus on the data and methodology used to estimate seasonal carcass prices derived from wholesale beef-cut prices. The second section of the chapter will describe the procedures used to estimate individual animal values with both a live weight and grid pricing system. In addition, the second section of the chapter will describe the hypothesis tests used in testing for differences between variance and mean animal values found using the two pricing systems.

Seasonal factors have been proven to have a strong impact on commodity prices. Therefore, an understanding of seasonal price variations is fundamental for agricultural producers. Such knowledge assists the producers in making short-run price forecasts and in adjusting short-run marketing and production strategies. In the case of beef production, seasonal patterns for feeder cattle and fed cattle prices are well established and reported in the form of indices. However, cattle producers are increasing the mnumber of cattle sold on a carcass basis or "in the meat" with the price paid being determined according to a formula or "pricing grid".

Due to the increased use of "grid pricing" to market fed cattle, seasonal patterns of beef carcass prices are needed to assist producers in making informed marketing and

production decisions. Many producers are reluctant to use "grid pricing" due to the perceived variability of revenue received from this type of pricing system. By understanding the seasonal patterns of beef carcass prices, producers will be better able to understand the optimal time to market their cattle, given their estimates of how well their cattle will grade. Prices for wholesale meat cuts will be used with a boxed beef cut-out model to determine the seasonal price patterns of beef carcasses and the seasonal price spreads (premiums/discounts) between the quality and yield grades in the grid.

Grid pricing and carcass-based pricing of fed cattle is a relatively new practice in the beef industry. Prices received under this system are not publicly reported and private parties involved in carcasses trading are reluctant to reveal information about carcass grid prices paid and received. Thus traditional methods of calculating seasonal price patterns can not be used in the case of carcass prices. However, casual observation, as well as theory, indicates that seasonal price patterns exist in the premium and discount pattern used in grid pricing. Previous research has indicated that seasonal factors are statistically important in determining wholesale beef-cut prices (Capps, Farris, Byrne, Namken, and Lambert; Owen, Sporleder, and Bessler). Given the statistical significance of seasonal factors on wholesale meat prices found in previous studies, the hypothesis that seasonal patterns exist in formula-derived carcass prices based on wholesale beef cut prices is supported.

Theoretical Framework

The analysis proposed in this study is highly theoretical for several reasons. First, attempts to collect private data of grid prices have been unsuccessful because of

the proprietary nature of such information given all sales in this market are basically by private contract and not publicly reported. However, even if private data was available, problems still exist in that a significant volume of trade in this market has not existed long enough for enough data to be available to develop a reliable seasonality indices. Additionally, direct efforts to collect private data would suffer from the potential of not being representative since the efforts of several independent researchers could not be extensive enough to collect enough data to assure no bias existed in the data sample. The approach taken here, given these problems, is therefore believed to the best available at this time. However, this study does assume that the market for wholesale beef is competitive and that gross margins in the system on average will be fairly consistently driven to the processing cost, thus causing processing industry net profits to be minimal.

It is hypothesized in that in general the theoretical approach proposed in this study will track actual seasonality rather accurately, but at times the market will undergo periods of short-run disequilibrium that will not be tracked. Knowing the frequency and nature of these disequilibriums would provide insight into the competitiveness and price risk involved in the beef packing industry. However, data to determine this are not publicly available at the present time.

Seasonal Carcass Price Patterns

This study will estimate seasonal price patterns for carcasses by quality and yield grades using the OSU Boxed Beef Calculator developed by Dolezal, Gill and Gardner, together with USDA reported wholesale meat prices for commodity-trim boxed beef subprimals by cut as reported weekly in Livestock, Meat and Wool Market News and

seasonal indices. In particular, prices were not always available for each different weight category of the strip loin, tenderloin, and back rib cuts.

The "Boxed Beef Calculator" model is a Lotus-based spreadsheet which uses input information (Table 1) together with available price data (Table 2) to calculate the live and carcass value of individual animals. For consistency, a constant carcass weight of 730 pounds and processing cost of $80 was used in this study for all quality and yield grades examined. Dressing percentages of 62.8, 63.3, and 63.8 were used for yield grades 1 through 3, respectively. The model essentially contains a set of technical parameters that predict the pounds of nineteen different wholesale meat cuts yielded by cattle of differing weights and yield grade (Table 3). In brief, the model defines how Yield Grade #1 carcasses (Y1) yield more pounds of meat per pound of carcass weight than Yield Grade #2 (Y2) carcasses, and Y2 carcasses yield more pounds of meat per pound of carcass than Y3 carcasses, etc.. But perhaps more importantly the model describes the change in the mix of meats yielded by Y1, Y2, Y3, and Y4 carcasses. Thus given that different cuts of meat sell at different prices, Y1 through Y4 cattle will produce different aggregate meat values per pound of carcass or in general per carcass despite similarities in carcass weight. These values/prices, and their seasonal patterns for U.S. Choice and U.S. Select yield grades 1 through 3, will be determined by combining the computational/descriptive ability of the "Boxed Beef Calculator" model with a times series of USDA reported prices for the different boxed beef subprimals.

To determine the net value of the total carcass (and not just the meat produced from it) requires two additional considerations. First the value of by-products produced

daily in the National Carlot Meat Report ("Blue Sheet"). Prices were collected for the following cuts which are used in the "Boxed Beef Calculator": ribeye, shoulder clod, chuck roll, brisket, knuckle, inside round, gooseneck round, strip loin, bottom sirloin flap. ball tip and tri-tip, tenderloin, flank steak, inside skirt, cap and wedge meat, back ribs, 80% lean trim and 50% lean trim.

The meat prices were collected for the period, January 1991 to December 1995. A 53 week moving average of the weekly prices was taken and used to compute seasonal indices. An index value for each weekly price was calculated by dividing the center week of each period by the corresponding 53 week moving average. The index numbers generated for each week were then averaged over the data period. Finally, the fifty-two weekly average index numbers were averaged and each of the fifty-two average index numbers scaled by the ratio of 100 over the average of the fifty-two weekly index numbers. The computed indices and average price of each cut over the five year period considered were then imported into the "Boxed Beef Calculator." The indices and their respective five-year average prices were used with the "Boxed Beef Calculator" to generate typical seasonal prices for each meat cut.

Several of the cuts used in the study have prices for different sizes/weights of the cuts. The different weight cuts are result from the differing weights and yield grades of the carcasses. Often prices were not reported each week for each weight category of every cut. In weeks in which a price for a cut was not reported, linear interpolation between the last and next reported price was used to estimate the missing values in the seasonal indices. In particular, prices were not always available for each different weight

must be add to the value of the meat produced, and secondly the processing costs involved in converting a live animal into a set of boxed-beef subprimals and by-products must be subtracted. Estimates of the by-product values are available from Livestock, Meat and Wool Report. Previous research by Ward and Duewer and Nelson provide estimates of processing costs. As by-product values have a seasonal pattern, the values were treated as an additional cut of meat, with a seasonal price index being developed based on the same five years of price data. Thus, by processing the five year historical time series of USDA reported meat prices and by-product values through the "Boxed Beef Calculator" model a historical series of prices for each cell of a carcass pricing grid consisting of U.S. Choice and U.S. Select cattle sub-divided into yield grades 1 through 3 was generated.

Although a typical grid pricing system would include prices and associated premiums/discounts for cattle with quality grades of U.S. Prime or U.S. Standard and yield grades greater than three; the "Boxed Beef Calculator" is designed only for U.S. Choice and U.S. Select cattle with yield grades 1 to 3. Wholesale meat prices are also reported only for U.S. Choice and U.S. Select Y1 through Y3.

Grid Versus Live Weight Pricing

In order to examine the differences in individual animal values under the two pricing systems, two samples of data on individual animals were obtained. One sample was provided by a participating feedlot. It included information on individual animal feedlot and carcass performance from 30 pens of cattle sold in 1995 and 1996. Due to confidentiality agreements the data obtained from the feedlot will be referred to as

"Feedlot X" data. Additionally, a larger sample was obtained from the Cattlemen's Carcass Data Service (CCDS) at West Texas State University in Canyon, Texas. The CCDS data set included information on approximately 10 pens randomly chosen each month for the time period, February 1993 to December 1993. The CCDS is a service of the National Cattlemens' Beef Association in which producers pay a fee to receive carcass information on their animals. The data obtained from the CCDS contains data from producers from all fed cattle producing regions of the U.S. The distribution of the sample pens by yield and quality grade are compared with the distribution of the 1995 National Beef Quality Audit (NBQA) in Figures 1 and 2. The smaller sample obtained from Feedlot X was on average slightly worse in terms of both yield and quality grade than the results of the NBQA, while the larger sample from CCDS showed slightly higher quality overall with fewer cattle grading standard and fewer Y4 and Y5 than the NBQA. Although the distribution of yield and quality grades from the two samples differed slightly from the industry's typical distribution based on the NBQA, in general the samples used in the study are believed to be fairly representative of the industry.

The data sets included a total of 142 pens of cattle with information on the individual animal's live weight, hot carcass weight, yield grade, quality grade, and whether or not the animal was a dark cutter. The cash price used in the live weight pricing system was obtained from the USDA Livestock, Meat and Wool Market News. Prices are reported for four to five categories depending on the percentage of cattle grading U.S. Choice in the pen. The cash price for each pen was matched to the pens' sell date and percentage of cattle grading U.S. Choice. An example of the weekly cash

market price quotes is shown in Table 4.

The live value of each animal in each pen of cattle was determined by the following equation:

1) $LV_{it} = LW_i * CP_t$

Where the live value of the animal i in week t (LV_{it}) is determined by the live weight of the animal (LW_i) multiplied by the cash price (CP_t) for that week and given the quality of the pen.

The grid pricing system used in the study is based on carcass prices determined from wholesale meat cuts. To obtain the base price for the grid, carcass prices were estimated using wholesale meat prices for the selected year/week with the "Boxed Beef Calculator". Thus prices for U.S. Choice and U.S. Select Y1-Y3 carcasses were determined. The U.S. Choice Y3 carcass price is used as the base price with premiums for Y1, Y2; and discounts for U.S. Select carcasses being determined for each week. Premiums for carcasses grading U.S. Prime, and discounts for carcasses grading U.S. Standard, light and heavy carcasses, Y4, Y5, and dark cutting carcasses were obtained from 9 random "spot" quotes of the premiums and discounts from a leading beef packer. A simple average of these quotes was taken, and the average of each premium and discount was used to complete the grid. The premiums and discounts used in the grid are shown in Table 4. Thus, the spreads between the prices determined by the "Boxed Beef Calculator" change throughout the year, but the premiums/discounts which are not determined by the "Boxed Beef Calculator" are held constant throughout the year. This is again due to the fact that weekly data on U.S. Prime, U.S. Standard, Y4, and Y5

carcasses was not available for a sufficient period of time. Although, the premiums/discounts for the grid are held constant in the study due to data limitations, it is hypothesized that the premiums/discounts for non-conformance also exhibit seasonal patterns.

The value of each animal on the grid pricing system was determined from the following equation:

$$2)\ GV_{it} = BP_t + Y1_t + Y2_t + P - Se_t - S - Y4 - Y5 - LHC - DC$$

Where BP_t is the base price for U.S. Choice Y3 cattle in week t as determined by the use of the "Boxed Beef Calculator" using wholesale meat price data from week t. Premiums are added to the base price if the animal graded prime (P) or was a $Y1_t$ or $Y2_t$ carcass; discounts are subtracted from the base price for select (Se_t) and standard carcasses (S), yield grade 4 ($Y4$), yield grade 5 ($Y5$), light and heavy carcasses (LHC), and dark cutting carcasses (DC). Again, the premiums for Y1 and Y2 carcasses and discounts for select quality carcasses are time varying since they can be estimated with the "Boxed Beef Calculator". GV_{it} represents the value of animal i in week t based on the base price (BP_t) and the associated premiums and discounts for animal i.

After determining the value of the animals with both pricing systems, the difference in animal values yielded from the two pricing systems can be determined by the following equation.

$$3)\ LV_{it} - GV_{it} = DIF_{it}$$

Where the difference (DIF_{it}) is determined by subtracting the grid value of the animal (GV_{it}) from the live value of the animal (LV_{it}). A simple average of the animal values

in the pens and the difference is calculated in order to determine whether the pen on average received a higher value from grid pricing than from live weight pricing and to determine the average amount of the difference in animal values from the two pricing systems.

The study hypothesizes that both the quality of the pen and the time of year are factors in determining variation between the two pricing methods. To test this hypothesis, the animal values from the Feedlot X sample were reestimated holding the cash price and grid price constant throughout the year. Holding the prices constant, provides an estimate of the impact that animal quality had on the difference between the two pricing systems. Additionally, an "average" pen of cattle having approximately fifty percent of the cattle grading U.S. Choice and the other fifty percent grading U.S. Select and having less than ten percent of the pen as Y4 or Y5 carcasses was selected and values for the pen were estimated for every week. This allowed an estimate of the value of an "average" pen of cattle under both pricing systems to be calculated for each week of 1995.

Hypothesis tests

After the animal values for each data set were determined using each of the pricing systems, a set of hypotheses were tested. The null and alternative hypotheses and the decision rules for each of the tests are listed in Table 5. A five percent significance level was used for both of the hypothesis tests in the study. The first test examines whether animal values from a grid pricing system are significantly different than those values received under the traditional live weight pricing system. Due to the fact that the

set of cattle and not two separate sets/populations of animals), a paired difference test is used rather than a test of means (Lind and Mason). The test uses a student's t-statistic to determine whether or not the mean difference between the two systems is significantly different from zero using the following equation:

$$4) \qquad t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

Where d is the mean difference of the paired observations, s_d is the standard deviation between the paired observations and n is the number of paired observations. The calculated student's t-statistic is compared with the critical value determined by the number of head in the pen and the significance level chosen for the test.

The second test examines the hypothesis that the two pricing systems yield significantly different variances of animal values. To test this hypothesis an F-test is used. Where the F-statistic is calculated by taking a ratio of the variance of animal values for each of the two pricing systems. The following equation shows how the F' statistic is determined:

$$5) \qquad F' = \frac{s_G^2}{s_L^2}$$

Where s_L^2 is the variance of the animal values with the live weight pricing system and s_G^2 is the variance of animal values from the grid pricing system. The calculated F-test value is then compared with the critical value for five percent significance to determine whether the two pricing systems have different variances. The critical value varied for each pen due to the differences in pen size. Variance between the animal values is tested both within pens and across all pens to determine if the two pricing systems have significantly different variances.

both within pens and across all pens to determine if the two pricing systems have significantly different variances.

Table 1. OSU Boxed Beef Calculator Input Example

	Input Data		Calculated Values
Carcass Weight (lbs)	730	Calculated Live Weight	1162
Quality Grade (1=Ch, 2=Sel)	1	Gross Carcass Value	$852.04
Yield Grade (1,2, or 3)	1	Estimated Drop Credit	$96.95
Drop Credit ($/cwt)	$7.96	Gross Live Value	$948.98
Kill/Fab Cost Estimate	$80.00	Net Carcass Value ($/cwt)	$119.04
Estimated Dressing Percentage	62.8	Net Live Value ($/cwt)	$74.76

* Note Tables 1 -3 Are From OSU Boxed Beef Calculator

Table 2. Boxed Beef Calculator Price Table Example[1]

Boxed Beef Cuts	Price $/cwt	
	U.S. Choice	U.S. Select
112A Ribeye < 11 lbs	$363.66	$361.66
112A Ribeye > 11 lbs	$378.53	$317.30
114 Shoulder Clod	$111.97	$107.54
116A Chuck Roll	$121.57	$120.97
120 Brisket	$100.22	$96.66
167 Knuckle	$152.78	$144.03
168 Inside Round	$151.45	$127.85
170 Gooseneck Round	$142.32	$123.65
180 Strip Loin < 12 lbs	$286.30	$231.93
180 Strip Loin 12-13.9 lbs	$283.22	$228.5
180 Strip Loin > 14 lbs	$280.30	$227.93
184 Top Butt < 12 lbs	$170.55	$155.16
184 Top Butt > 12 lbs	$170.32	$155.71
185A Bottom Sirloin Flap	$182.74	$180.42
185B Bottom Sirloin Ball Tip < 2 lbs	$148.94	$138.26
185B Bottom Sirloin Ball tip > 2 lbs	$166.56	$158.24
185C Bottom Sirloin Tri-tip	$182.74	$175.66
189A Tenderloin < 5 lbs	$519.88	$488.47
189A Tenderloin > 5lbs	$465.34	$512.01
193 Flank Steak	$296.25	$281.53
Inside Skirt	$195.39	$195.39
Cap & Wedge Meat	$173.72	$152.65
Back Ribs	$82.80	$82.80
80% Lean Trim	$94.62	$94.62
50% Lean trim	$43.81	$43.81

[1] Prices are average prices for the first week of June

Table 3. Boxed Beef Calculator Cut-out Subprimal Percentage Yields for Yield Grades 1, 2, and 3

Boxed Beef Cuts	Percent of Carcass Weight		
	Yield Grade 1	Yield Grade 2	Yield Grade 3
112A Ribeye <11 lbs*	3.73	3.55	3.21
112 Ribeye >11 lbs *	3.73	3.55	3.21
114 Shoulder Clod	5.77	5.58	5.52
116A Chuck Roll	8.66	8.29	8.17
120 Brisket	3.19	3.05	2.86
167 Knuckle	3.00	2.79	2.71
168 Inside Round	6.29	5.93	5.68
170 Gooseneck Round	8.15	7.33	7.02
180 Strip Loin <12 lbs *	3.62	3.52	3.25
180 Strip Loin 12-13.9 lbs *	3.62	3.52	3.25
180 Strip Loin >14 lbs *	3.62	3.52	3.25
184 Top Butt <12 lbs *	3.23	3.16	3.12
184 Top Butt >12 lbs *	3.23	3.16	3.12
185A Bottom Sirloin Flap	.99	.98	.90
185B Bottom Sirloin Ball Tip <2 lbs *	.62	.66	.65
185B Bottom Sirloin Ball tip >2 lbs *	.62	.66	.65
185C Bottom Sirloin Tri-tip	.80	.77	.79
189A Tenderloin <5 lbs *	1.74	1.64	1.56
189A Tenderloin >5lbs *	1.74	1.64	1.56
193 Flank Steak	.50	.48	.45
Inside Skirt	1.25	1.24	1.16
Cap & Wedge Meat	5.23	5.02	4.80
Back Ribs	1.66	1.69	1.66
80% Lean Trim	9.46	9.61	9.72
50% Lean trim	3.97	4.07	3.70
Edible Tallow	14.29	16.91	18.50
Bone	13.86	13.73	14.60

* Note that only one weight of each cut is yielded by a given carcass depending on carcass size

Table 4. Slaughter Steer Market Price Example

April 1, 1993	Price Range	Weighted Average Prices
80-100% Choice	$84.16 - $85.75	$84.89
65-80% Choice	$83.40 - $84.00	$83.50
35-65% Choice	$81.82 - $84.60	$83.77
20-35% Choice	$81.75 - $83.52	$83.17
0-20% Choice	$80.50	80.50

Table 5. Premium and Discounts Used in Pricing Grid

	Prime	Standard	Y4	Y5	Light/ Heavy	Dark Cutters
3/3/95	$5.00	$12.00	$17.50	$22.50	$15.00	$25.00
5/30/95	$5.00	$30.00	$15.00	$20.00	$15.00	$30.00
7/14/95	$5.00	$20.00	$15.00	$20.00	$20.00	$33.00
8/11/95	$5.00	$14.00	$10.00	$15.00	$13.00	$32.00
11/3/95	$5.00	$44.00	$23.00	$28.00	$23.00	$38.00
1/3/96	$5.00	$24.00	$15.00	$20.00	$13.00	$31.00
1/19/96	$5.00	$9.00	$18.00	$23.00	$18.00	$35.00
2/16/96	$5.00	$15.00	$15.00	$20.00	$20.00	$30.00
4/26/96	$5.00	$18.00	$15.00	$20.00	$11.25	$32.00
Average	$5.00	$15.00	$16.25	$21.25	$13.13	$28.50

Table 6. Format for Hypothesis Tests

Paired Difference Test	Test of Variances
Step 1: H_o: $\mu_d = 0$ H_A: $\mu_d = 0$	Step 1: H_0: $\sigma_L^2 = \sigma_G^2$ H_A: $\sigma_L^2 \neq \sigma_G^2$
Step 2: Significance level of 5%	Step 2: Significance level of 5%
Step 3: Critical value is determined from significance level and # of observations	Step 3: Critical value is determined from significance level and # of observations
Step 4: Calculate student's t statistic (t^*)	Step 4: Calculate F'
Decision rule: Reject H_o if $t^* >$ critical t value	Decision rule: Reject H_o if $F' >$ critical F value

Figure 1

Distribution of Yield Grades

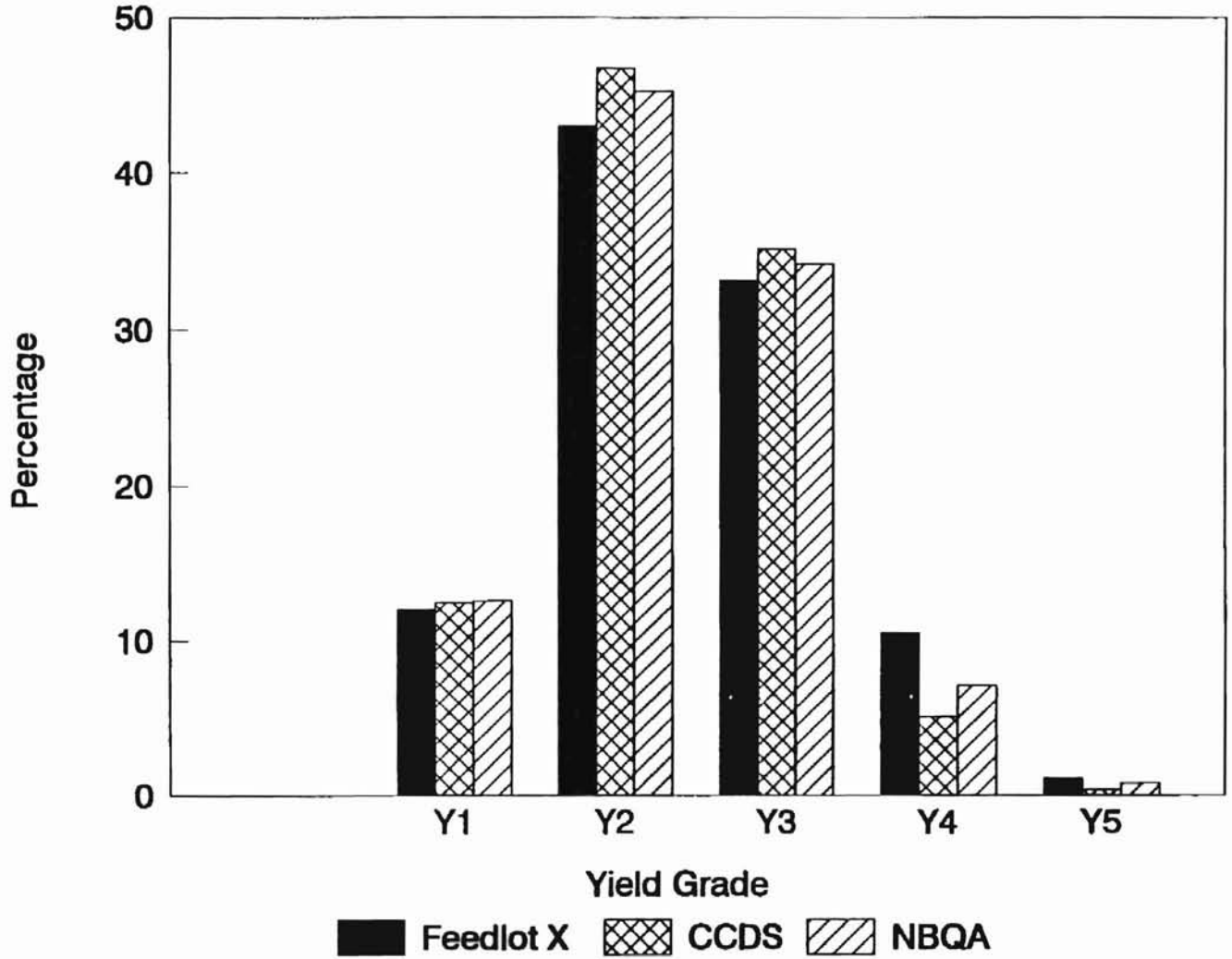
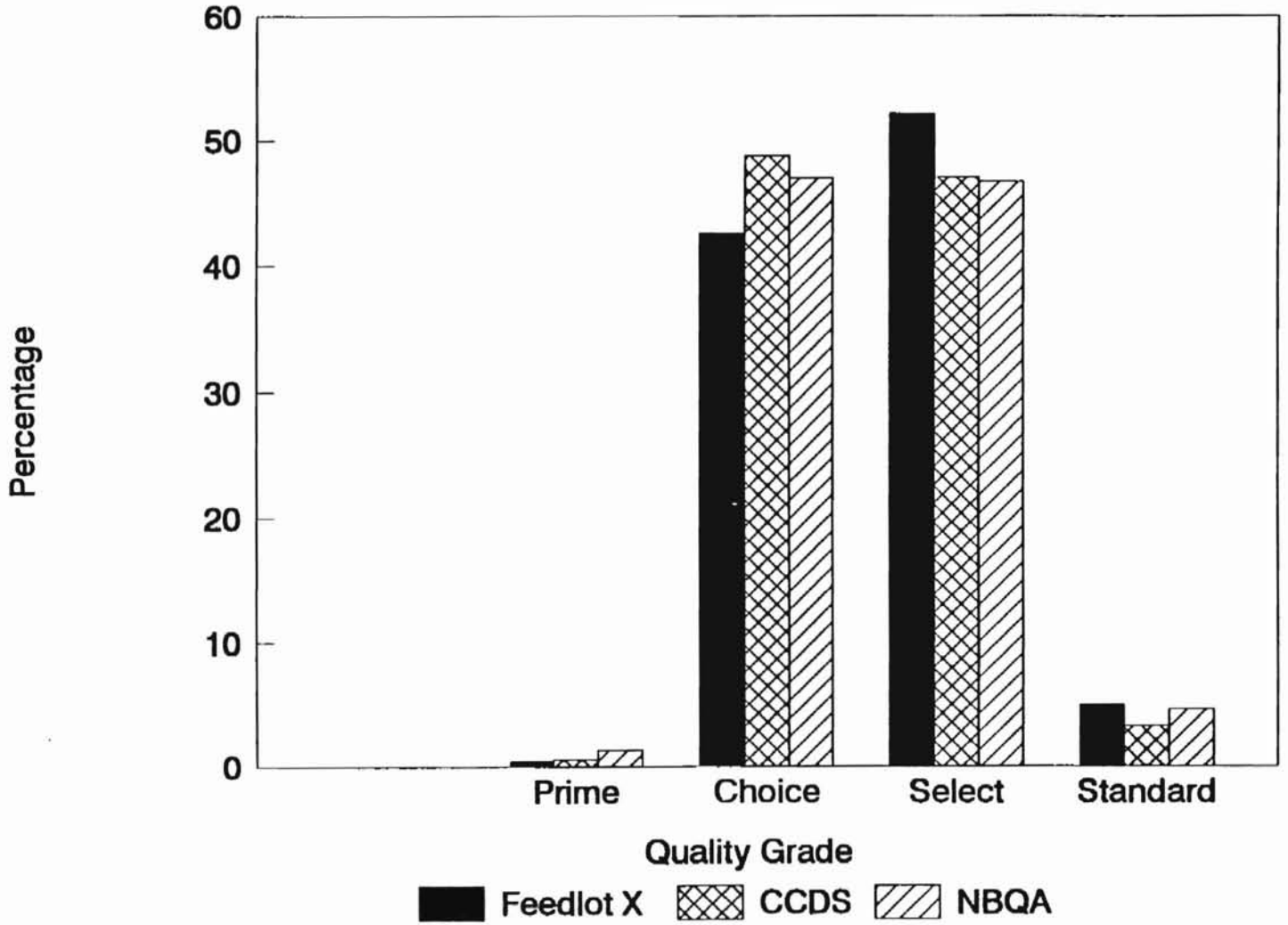


Figure 2

Distribution of Quality Grades



CHAPTER 4

Results

Introduction:

This chapter presents the results of the study. The chapter will be organized similar to the previous one with the first section of the chapter detailing the results of the seasonal price pattern estimation and the spreads. The second section of the chapter will present the results from the comparison of the grid and live weight pricing systems. Finally, the last section of the chapter will present the results from the hypothesis test and discuss their implications.

Seasonal Carcass Price Patterns

By processing the five year historical time series of USDA reported meat prices through the "Boxed Beef Calculator" model, a historical series of prices for each cell of the carcass pricing grid for U.S. Choice and U.S. Select cattle with yield grades of 1 to 3 was generated. Seasonal indices of prices for each cell of the grid were then constructed, i.e. a seasonal indices for U.S. Choice Y1, Y2 and Y3 as well as U.S. Select Y1, Y2 and Y3. Seasonal indices for U.S. Choice Y1, Y2, and Y3 prices followed closely the seasonal index pattern of the Texas/Oklahoma live steer seasonal price index (Figure 3). It should be noted that the Texas/Oklahoma seasonal price index used was a published monthly index (Trapp). Linear interpolation was used to derive comparable weekly values. The estimated linear relationship between the steer price index and the computed indices had an R^2 of .77. Although the general seasonal pattern

of the indices were the same, the derived seasonal index exhibits some variability around the steer price index. The indices for the U.S. Select Y1, Y2 and Y3 prices also displayed similar patterns as the U.S. Choice indices; however, the constructed indices for the select prices did not follow the indices for live cattle price as closely (Figure 4). The Select indices had an R^2 of .61 when linearly regressed against the steer price index. The variation of the Select indices from the steer price index in the last fifteen weeks of the year can likely be explained in part due to seasonal changes in the demand mix for retail beef.

In addition, the spread (premium/discount) between the grid prices was constructed and analyzed for seasonality. The results of calculating the price spreads between the various yield grades for U.S. Choice and U.S. Select carcasses are summarized in Table 6. The Choice Y1-Y2 price spread was fairly narrow, and relatively stable ranging from \$5.00 to \$4.34. The spread was wider in the first ten to fifteen weeks of the year, narrowed mid-year and again widened near the end of the year (Figure 5). The Choice Y1-Y3 spread was much wider and exhibited slightly greater volatility. The spread ranged from \$10.04 to \$8.92, and had a seasonal pattern similar to that of the Choice Y1-Y3 spread (Figure 6). The pattern of the Choice Y2-Y3 spread looks similar to the Y1-Y2 spread, but is not as wide, and is slightly wider in the last five weeks of the year than the Y1-Y2 spread (Figure 7). The range of the Y2-Y3 spread was \$5.12 to \$4.57. The price spreads between the yield grades for the U.S. Choice carcasses all exhibited definite seasonal patterns. The spreads between yield grades are typically narrowest at mid-year and widest at the end of the year.

The price spreads for the U.S. Select prices were also constructed. The Select Y1-Y2 spread ranged from $4.97 to $4.42. The spread was widest in the early part of the year. It narrows at mid-year and remains relatively constant for the latter half of the year (Figure 8). As with the U.S. Choice price spreads, the Y1-Y3 spread was the widest of the select spreads. The Select Y1-Y3 spread ranged from $9.87 to $8.78. The Y1-Y3 spread also appears to widen in the early part of the year, peaking at the widest point of $9.87 and declining sharply for the next few weeks while remaining fairly small and stable at the end of the year (Figure 9). The Select Y2-Y3 spread ranged from $4.90 to $4.53. The Y2-Y3 spread was narrower than the Y1-Y3 spread; however, the spread exhibits a nearly identical seasonal pattern to the Y1-Y3 spread (Figure 10). The widest point in the spread occurs in the same week for both the Select Y2-Y3 and Y1-Y3 spreads. The Y2-Y3 spread had much more volatility in the last half of the year than either of the other select spreads. All of the price spreads among yield grades of U.S. Select carcasses were narrowest a few weeks prior to the middle of the year, and peaked approximately five weeks prior. The narrowest point in the U.S. Select price spreads occurs a few weeks prior to the U.S. Choice price spreads narrowest point. The price spreads are widest at the beginning of the year and narrowest at mid-year for all of the price spreads examined.

The price spread between U.S. Choice and U.S. Select cattle was calculated to determine if the derived spread between quality grades had a seasonal pattern. The derived Choice-Select spread was plotted against the USDA boxed beef cutout spread (Figure 11). The spread has a somewhat similar seasonal pattern as the USDA spread.

However,from about the seventh week of the year through the thirty-second week, the derived spread is two to six dollars lower than the USDA spread. The derived spread also showed several weeks where the Choice-Select spread actually inverts, with U.S. Select cattle being worth more than U.S. Choice. Typically, the spread is not expected to invert; however, at the points where the spread inverts, the USDA spread is at its narrowest points. Although this result is not typical of the spread between quality grades, it is feasible due to changes in demand mix.

Grid Versus Live Weight Pricing

When comparing the live value of the animals within a pen with the estimated grid value of the animals, the average live value of the pens was consistently greater than the average grid value for each month of the CCDS data set. Over the eleven months represented by the CCDS data, the average difference between the live value of the pens and the grid value was $41.46. This indicates that for those pens of cattle and the cash market at the time, the values of the animals were worth more if priced using the traditional live weight pricing method than if an alternative formula-based grid pricing systems was used. The pooled data from Feedlot X also showed the average live value for the animals to be greater than the average grid value. However, the difference between the two pricing methods for Feedlot X cattle was only $12.43, which is substantially less than the difference between the pricing systems yielded by the CCDS data. Although, the data from Feedlot X had a higher average value using live weight pricing for all of the pens combined; eleven of the thirty pens in the sample had a greater average value when priced using the grid system than with the live weight pricing. A

summary of the live and grid values of the pens, difference between the pricing systems, and contemporary cash market is shown in Tables 8 and 9 for the CCDS data and Feedlot X data, respectively. The standard deviations of the animal values from both pricing methods are illustrated in Table 10. Additionally, the maximum and minimum values of the animals for each pricing method, as well as the value range within the pen is shown in Table 11.

Given that the premiums and discounts used to complete the pricing grid were based on a relatively small sample of random spot quotes, the sensitivity of the results to changing premiums/discounts was tested. The study hypothesizes that seasonal patterns exist in the premium.discount pattern. However both the discounts for Y4 and U.S. Standard were tested for sensitivity of the resulting animal values. The results of the sensitivity analysis indicated that the average difference in values will vary proportionally to the magnitude of the discount; however, the number of pens which have the greatest average grid value did not significantly change when either a substantially smaller or larger discount value was used to compute the value of the animal with the pricing grid.

Prices Held Constant

In order to separate the cause of the differences in pen values under the two pricing systems, the animal values of the data from Feedlot X were reestimated holding the cash price constant at $63.25 /cwt and the base grid price constant at $106.36 for each pen. The cash priced used was the approximate average cash price for all of the pens, the constant grid price represents the week that best corresponded with the selected

cash price. The reestimated animal values showed that only two of the thirty pens yielded higher average values with the grid pricing system than the live weight pricing (Table 12). The two pens that yielded the higher values on the grid system were the best quality pens in terms of yield and quality grade. The differences between the values of the two pricing systems for each of the pens were ranked by the magnitude of the difference in values between the pricing systems from the greatest difference to the smallest. The differences between the two pricing systems ranged from a -$5.74 (indicating that the grid valued the cattle in the pen an average of $5.74 more than live weight pricing) to $140.29, which indicates an the average animal value is $140.29 greater with live weight pricing than if priced on the formula-based pricing grid used in the study. The ranking of the values directly corresponded with the quality of the pen. Pens with higher percentages of Y1, Y2, and U.S. Choice cattle showed a consistently smaller difference between the two pricing systems, while the pens with higher percentages of cattle grading U.S. Standard, and Y4 and Y5 showed the greatest difference between the two pricing systems as these poor quality cattle were being overvalued by the live weight pricing system. These results indicate that the quality of the pen does have a significant impact on whether the cattle will have higher values if marketed on a grid system. The pen that showed the greatest difference was the poorest quality pen in terms of yield and quality grade. The pen consisted of 60 head of cattle of which ten percent graded standard and 30 percent were either Y4 or Y5. Considering the number of cattle in the pen whose carcasses are non-conforming to meatpackers boxed beef standards the grid places significant discounts on this pen.

Quality Held Constant

To test whether time of year had an impact on the difference in the values received with the two pricing systems, animal values were reestimated holding quality constant. A pen containing approximately fifty percent U.S. choice and fifty percent U.S. Select cattle in which less than ten percent of the animals grading Y4 or Y5 was selected as the constant quality pen; the cash prices and base grid prices used were the weekly 1995 prices. The values obtained by holding quality constant show that at certain times of the year, the formula-based grid pricing system will place higher values on the animals than live weight cash pricing. The values received for the pen with both live weight and grid pricing are illustrated in Figure 12. These results imply that consistent quality animals marketed throughout a given year will receive significantly different values with the two pricing method based on the time of the year. Although, the carcass prices were determined previously and found to have a similar seasonal pattern as the cash market due to the demand for various meat cuts the grid will place higher values on animals during the middle fifteen weeks of the year. This higher grid value can perhaps be attributed to the increase in the demand for the "middle meat cuts " such as strip loin, sirloin and tenderloin during the summer months. Retail beef demand has been shown to increase for these types of cuts from May to September.

As stated previously, animal quality and the relative cash market are believed to be key factors in determining whether cattle will receive a higher value per head on a grid pricing system than with live weight pricing. The weighted average distribution of yield grades and quality grades for the CCDS sample pens are shown in Tables 13 and

14. The distribution of quality and yield grades for Feedlot X are shown in Table 15. The distribution of the yield and quality grade are key factors in determining the grid value of the animals as premiums and discounts are based primarily on the yield grade and quality grade of the animals in the pen. The data from Feedlot X showed a higher percentage of cattle grading U.S. Standard and Y4 and Y5 cattle than the CCDS data set. This indicates that in general, the smaller data set from Feedlot X had a higher percentage of poor quality animals. These results can be expected as a average quality of small data sample from the feedlot can be skewed by a few extremely poor quality pens. Additionally, the CCDS represents producers who are interested in receiving carcass information on their animals and are willing to pay for the service, it can therefore be implied that the producers believe their cattle to be of above average quality.

Time Period/Cattle Supply Effects

The two samples of data used in this study represent two different time periods in which the cattle industry was at different points on the cattle cycle. The monthly average fed steer price for 1988 to 1997 is shown in Figure 11 to illustrate the differences between the time periods of the data sets. The CCDS data sample was from 1993, when fed cattle supplies were low and therefore resulting in a relatively high cash market with prices averaging approximately $76.50 (Figure 12) The data from the participating feedlot was more recent data from 1995-1996, a period in the market of larger than normal supplies which resulted in a low cash market with an average price of $63 (Figure 13). Typically, large supplies of cattle will result in high packer profits and the real spread between wholesale and live beef prices widens. However, low

numbers of cattle on feed will lead to lower packer profits and the spread between wholesale and live beef prices will narrow. Despite the impact of cattle numbers on packer profits, the formula-based pricing grid used in the study does not account for changes in actual cattle numbers, as it is based on typical seasonal price indices developed from five years of wholesale meat cut prices.

Thus given the extremely favorable cash market during 1993, the CCDS data can be expected to receive higher animal values with live weight pricing. Although the data in general represented high quality cattle with relatively low percentage of Y4, Y5 and U.S. Standard cattle, the formula-based grid used in the study resulted in lower animal values than the price determined by the relatively high cash market. However, the CCDS data would yield significantly different results if prices from 1995 were used. Given that 1993 was a year of relatively high fed cattle prices, the CCDS data was reestimated using 1995 fed cattle prices. The CCDS data showed an average difference of -$77.45 when 1995 prices were used to compute the live values of the animals. This indicates that in the two year span from 1993 to 1995 the average difference of animal values yielded with the two pricing systems had a range of nearly $120 per animal.

Another reason for the CCDS data set receives greater animal values with live pricing is that the grid pricing system used in the study was based on wholesale meat prices which are known to be "thin" and less responsive in terms of price changes than the market for fed cattle. Therefore, the prices received for the high quality cattle on the grid did not provide sufficient benefit to merit marketing the cattle on the formula-based pricing grid as opposed to using the cash market. Moreover, during periods of

low fed cattle supplies meat packers are more likely to overvalue cattle when purchasing on a live weight basis due to the need to meet their demands. The data from Feedlot X represented lower quality cattle in general than the CCDS data, yet 36 percent of the pens had a greater average value on the formula-based grid than on the cash market. Although the cattle from Feedlot X received discounts for non-conforming quality factors, the formula-based grid pricing system yielded higher values in almost half of the pens. This is hypothesized to be due to the extremely low cash market at the time. Given the low cash prices the cattle had higher average values on the grid despite being penalized with heavy discounts for non-conformance. Based on these results, the study implies that the contemporary cash market is as significant as animal quality when determining which pricing method to use to market fed cattle.

Hypothesis testing and implications

The paired difference test used to test if the mean difference between the two pricing methods was significantly different for zero indicated that in general the pricing systems do value cattle significantly different. Out of the 142 total pens examined in the study, only fourteen did not have significantly different values at the five percent level. The results of the hypothesis test show that ninety percent of the pens examined in the study did receive significantly different values from the two pricing system. This allows for the null hypothesis that the mean difference between the two pricing systems is zero to be rejected at the five percent level for ninety percent of the pens examined. Therefore, results of the hypothesis test show that the two pricing systems do value cattle differently.

The test of the variances showed that the variances of animal values within pens for the two pricing methods were the same for approximately half of the pens studied given a five percent significance level. Of the 142 pens in the study, only 70 had significantly different variances in animal values within pens. The variances across pens showed the variances in animal values yielded for the two pricing systems to be the same for both samples. The variance across pens was determined by pooling CCDS data by pens within a given month and computing the variance in animal values under the two pricing systems for all of the cattle sold within the given month. All thirty pens of data from Feedlot X were pooled and variance across the pens computed. Additionally, the summary data for Feedlot X and CCDS was used to test variances across pens.

The results of this test rejected the null hypothesis of the study that animal values received under the two systems have significantly different variances in half of the pens evaluated. Of the 142 pens used in the study, the F-test on 70 of the pens indicated significantly different variances within pens between the two pricing systems. This indicates that within a given pen of animals the variance of the animal values will be greater with a formula-based grid pricing system than with live weight pricing only for only half of the pens. Additionally, across pens several pens in a given month, the variance of values yielded from the two pricing systems is not significantly different. These results provide evidence that grid pricing is not any more volatile than live weight pricing for the individual producer. Moreover, given consistent quality of cattle produced the variation within pens between the two pricing systems is likely to be even less than fifty percent.

Table 7. Summary of Price Spreads for Yield Grades 1 - 3.

	U.S. Choice			U.S. Select		
	Y1-Y2	Y2-Y3	Y1-Y3	Y1-Y2	Y2-Y3	Y1-Y3
Average	4.74	4.84	9.58	4.63	4.59	9.22
Maximum	5.00	5.12	10.04	4.97	4.90	9.87
Minimum	4.34	4.57	8.92	4.42	4.33	8.78
Range	.66	.55	1.12	.55	.57	1.09

Table 8. Summary of CCDS Live Versus Grid Pricing
Monthly Weighted Averages

	Average Live Value	Average Grid Value	Average Difference	Average Cash Price
February 1993	$897.90	$836.79	$64.51	$80.81
March 1993	$865.18	$806.10	$57.08	$82.54
April 1993	$880.04	$836.328	$43.71	$81.79
May 1993	$935.83	$888.61	$47.22	$80.52
June 1993	$892.07	$845.59	$46.48	$78.77
July 1993	$862.14	$811.701	$50.44	$74.17
August 1993	$889.16	$865.25	$23.91	$74.74
September 1993	$871.02	$834.88	$36.14	$73.31
October 1993	$887.93	$853.14	$34.26	$71.31
November 1993	$841.13	$823.28	$17.86	$71.80
December 1993	$854.15	$819.69	$34.46	$71.80
Yearly Average	$879.64	$838.49	$41.46	$76.50

Table 9. Summary of Feedlot X
Live Versus Grid Values

Date	# of head	Average Live Value	Average Grid Value	Average Difference	Cash Price
02/16/95	66	$798.45	$762.56	$35.89	$74.00
05/04/95	90	$803.37	$745.43	$57.94	$66.75
05/17/95	77	$762.69	$739.94	$22.75	$63.65
05/25/95	80	$737.72	$718.69	$19.03	$64.08
05/31/95	71	$753.00	$774.38	($21.38)	$64.00
07/25/95	91	$785.69	$755.78	$29.91	$61.94
08/24/95	51	$846.37	$770.77	$75.60	$63.46
08/29/95	55	$775.51	$746.37	$31.85	$60.06
09/26/95	68	$766.78	$746.76	$20.02	$63.96
09/26/95	80	$728.92	$686.11	$42.81	$63.98
09/26/95	60	$849.44	$745.02	$104.42	$63.98
10/26/95	55	$827.96	$759.97	$67.99	$65.85
11/15/95	97	$772.31	$739.16	$33.15	$68.86
12/06/95	49	$866.92	$800.51	$66.41	$67.11
01/05/96	26	$785.45	$842.12	($56.67)	$64.04
01/05/96	32	$859.31	$890.53	($31.23)	$64.64
02/29/96	60	$831.50	$840.38	($8.88)	$62.99
03/20/96	75	$765.06	$791.34	($26.28)	$62.34
04/06/96	93	$638.20	$657.77	($19.58)	$62.01
05/02/96	152	$697.28	$754.90	($60.62)	$57.09
05/07/96	89	$797.73	$799.54	($1.81)	$60.28
05/08/96	83	$704.93	$703.11	$1.82	$60.28
05/14/96	59	$742.75	$769.18	($26.43)	$60.06
05/14/96	52	$676.67	$696.46	($19.79)	$60.06
05/31/96	110	$722.93	$745.38	($22.45)	$59.90
06/04/96	97	$724.17	$718.42	$5.75	$59.85
06/06/96	73	$666.90	$665.62	$1.29	$60.42
07/31/96	49	$699.92	$668.04	$31.91	$63.13
07/31/96	78	$750.80	$709.64	$41.15	$62.85
08/14/96	93	$697.08	$651.86	$45.22	$65.97

Table 10. Standard Deviation of Values for Feedlot X

Pen	Standard Deviation Live Value	Standard Deviation Grid Value
1	$89.17	$76.09
2	$83.39	$98.88
3	$68.99	$87.27
4	$91.41	$91.84
5	$56.07	$68.32
6	$42.69	$66.07
7	$70.54	$86.78
8	$85.30	$72.29
9	$78.31	$81.78
10	$75.62	$89.03
11	$58.52	$98.71
12	$64.39	$100.74
13	$67.80	$90.32
14	$54.25	$72.11
15	$83.26	$96.37
16	$70.30	$86.25
17	$72.22	$78.37
18	$70.06	$89.38
19	$59.71	$67.79
20	$61.11	$84.25
21	$63.52	$84.24
22	$66.96	$87.54
23	$77.11	$88.56
24	$65.39	$75.88
25	$57.95	$86.44
26	$66.63	$89.22
27	$57.92	$97.51
28	$57.38	$80.35
29	$64.12	$85.28
30	$58.93	$70.66

Table 11. Maximum and Minimum Values for Feedlot X Data

Pen	Maximum Live Value	Minimum Live Value	Maximum Grid Value	Minimum Grid Value	Range Live	Range Grid
1	$1013.06	$625.30	$ 963.48	$590.03	$387.76	$373.45
2	$1003.25	$443.89	$1027.23	$493.58	$559.37	$533.65
3	$ 900.01	$582.40	$ 964.20	$555.84	$317.61	$408.36
4	$ 946.67	$474.83	$ 895.61	$363.18	$474.83	$532.43
5	$ 867.20	$600.32	$ 904.68	$583.10	$466.88	$321.58
6	$ 899.37	$653.47	$ 917.19	$592.55	$245.90	$324.65
7	$1046.46	$716.46	$ 951.87	$538.05	$329.99	$413.83
8	$ 977.13	$539.58	$ 906.66	$591.04	$437.55	$315.62
9	$ 947.25	$583.95	$ 935.31	$524.30	$363.29	$411.01
10	$ 862.45	$536.79	$ 866.71	$380.77	$325.66	$485.94
11	$ 961.62	$727.45	$ 931.69	$499.36	$234.17	$432.32
12	$ 968.00	$662.45	$ 971.38	$443.47	$305.54	$527.91
13	$ 973.68	$617.67	$ 916.79	$563.69	$356.01	$353.10
14	$ 973.77	$773.11	$ 962.93	$659.11	$200.66	$303.82
15	$ 935.62	$681.39	$1009.75	$682.40	$254.24	$327.35
16	$1034.24	$691.65	$1104.10	$745.40	$342.59	$358.71
17	$ 979.49	$661.40	$ 976.81	$672.92	$318.10	$303.89
18	$ 910.79	$609.69	$1007.84	$409.13	$301.10	$598.70
19	$ 759.62	$494.84	$ 837.46	$443.89	$264.78	$393.57
20	$ 890.03	$561.19	$ 975.22	$526.85	$328.84	$448.37
21	$ 963.88	$633.54	$ 958.92	$597.16	$330.33	$361.76
22	$ 851.76	$552.16	$ 888.69	$493.87	$299.59	$394.82
23	$ 878.08	$542.94	$ 909.52	$494.38	$335.13	$415.14
24	$ 851.65	$467.27	$ 858.59	$424.38	$384.38	$433.70
25	$ 845.19	$543.29	$ 901.76	$529.71	$301.90	$372.05
26	$ 903.59	$526.94	$1010.38	$458.48	$376.65	$551.90
27	$ 816.88	$542.57	$ 875.02	$341.00	$274.31	$534.02
28	$ 799.86	$566.91	$ 823.43	$486.14	$232.95	$337.29
29	$ 903.15	$554.34	$ 866.53	$468.01	$348.82	$398.53
30	$ 852.99	$554.81	$ 822.66	$518.42	$298.18	$304.24

Table 12. Feedlot X Pen Values
Prices Held Constant

Date	# of head	Average Live Value	Average Grid Value	Average Difference
05/31/95	71	$744.18	$749.92	($5.74)
02/16/95	66	$682.46	$687.33	($4.87)
11/15/95	97	$709.39	$702.35	$7.05
04/06/96	93	$650.96	$623.87	$27.09
08/14/96	93	$668.33	$635.35	$32.98
07/31/96	49	$701.25	$668.01	$33.24
01/05/96	26	$775.76	$738.35	$37.41
05/31/96	110	$763.36	$722.39	$40.97
07/31/96	78	$$755.58	$709.64	$45.93
07/25/95	91	$802.31	$755.78	$46.53
05/25/95	80	$728.17	$681.08	$47.08
05/17/95	77	$757.90	$710.61	$47.29
05/14/96	52	$712.61	$665.18	$47.43
06/06/95	73	$698.14	$650.19	$47.95
05/14/96	59	$782.20	$733.90	$48.30
05/04/95	90	$761.25	$709.80	$51.45
09/26/95	68	$758.27	$705.63	$52.63
12/06/95	49	$817.06	$761.68	$55.38
01/05/96	32	$840.83	$784.56	$56.27
06/04/96	97	$764.93	$698.91	$66.01
05/02/96	152	$769.19	$702.13	$67.06
10/26/95	55	$795.27	$724.02	$71.25
09/26/95	80	$720.61	$646.52	$74.08
08/24/95	51	$843.57	$766.27	$77.30
08/29/95	55	$817.25	$739.71	$77.54
05/08/95	83	$739.67	$650.29	$89.38
02/29/96	60	$834.93	$740.38	$94.55
03/20/96	75	$776.23	$677.79	$98.44
05/07/96	89	$837.03	$734.95	$102.08
09/26/95	60	$839.75	$699.46	$140.29

Table 13. Weighted Average Pen Distribution
By Yield Grade for CCDS data

	% Y1	% Y2	% Y3	% Y4	% Y5
February	3.6	35.4	53.4	7.3	.2
March	15.9	52.7	29.6	1.7	.1
April	12.6	49.0	33.0	5.3	.1
May	6.0	43.0	44.4	5.4	.5
June	19.9	47.4	26.4	6.1	.3
July	8.2	48.8	38.4	4.4	.2
August	14.0	44.4	34.3	6.4	.9
September	14.6	44.9	34.0	5.9	.5
October	18.8	51.1	22.2	5.9	2.0
November	16.9	48.4	30.2	4.2	.4
December	7.2	50.0	38.1	4.7	0

Table 14. Weighted Average Pen Distribution
By Quality Grade for CCDS Data

	% Prime	% Choice	% Select	%Standard
February	0	49.5	48.9	1.6
March	.20	46.6	49.8	3.3
April	0.0	52.7	45.7	1.2
May	.70	57.2	37.6	3.6
June	.40	40.7	54.6	4.3
July	.70	47.2	48.8	2.6
August	.50	47.4	49.9	2.2
September	1.8	48.4	46.3	3.4
October	2.4	45.0	45.7	6.9
November	.40	57.2	34.7	7.6
December	.50	49.7	44.8	4.9
Yearly Average	.60	48.8	47.1	3.3

Table 15. Pen Distribution By Yield and Quality Grade for Feedlot X

Pen	% Y1	% Y2	% Y3	% Y4	% Y5	% Prime	% Choice	% Select	% Standard
1	25	33	29	11	2	3	79	18	0
2	33	46	19	2	0	0	37	47	16
3	17	52	18	10	3	3	52	40	5
4	20	41	30	9	0	0	42	54	4
5	2	97	1	0	0	3	80	17	0
6	5	39	51	5	0	0	65	35	0
7	3	48	34	14	1	0	35	65	0
8	2	45	38	15	0	0	82	18	0
9	11	51	33	3	2	0	30	68	2
10	12	50	25	10	3	0	25	62	13
11	3	20	47	28	2	0	22	68	10
12	27	24	38	11	0	0	38	58	4
13	16	53	24	7	0	0	55	45	0
14	4	47	41	8	0	0	65	35	0
15	19	58	23	0	0	0	46	50	4
16	16	41	31	6	0	0	72	25	3
17	0	23	53	24	0	0	63	37	0
18	0	16	48	33	3	1	29	67	3
19	4	41	44	11	0	3	60	37	0
20	2	25	45	23	5	0	25	63	12
21	11	74	13	2	0	0	5	73	22
22	13	43	35	9	0	0	14	44	11
23	9	52	39	0	0	0	44	52	4
24	13	52	33	2	0	0	48	52	0
25	12	46	32	8	1	0	54	46	0
26	13	43	35	8	0	0	14	75	11
27	10	25	50	15	0	0	26	74	0
28	24	31	27	18	0	0	50	50	0
29	13	53	27	8	0	0	44	55	1
30	30	34	26	7	2	0	40	60	4

Figure 3

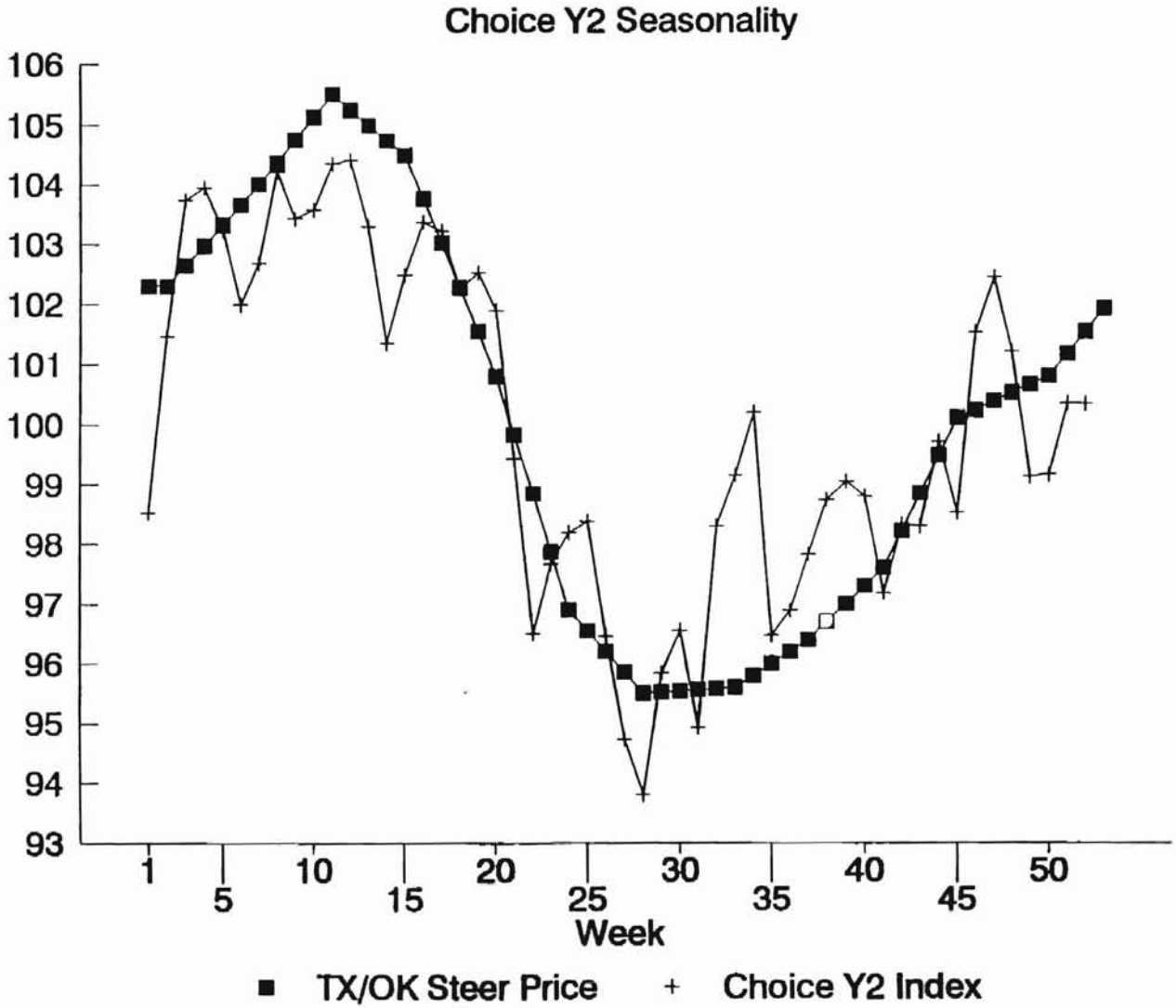

Choice Y2 Seasonality
106
105
104
103
102
101
100
99
98
97
96
95
94
93
1
5
10
15
20
25
30
35
40
45
50
Week
TX/OK Steer Price
Choice Y2 Index

Figure 4

Select Y2 Seasonality

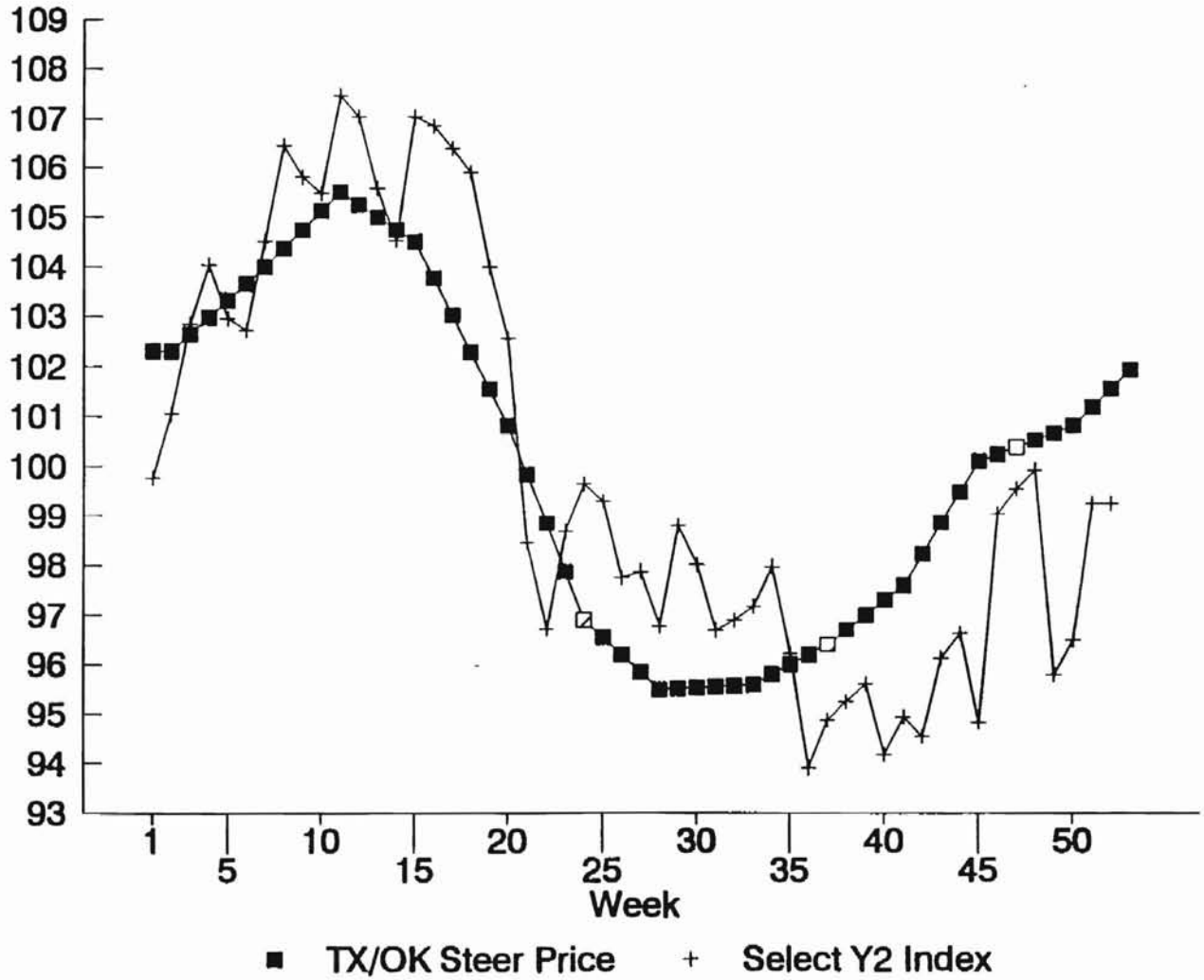


Figure 5

Choice Y1-Y2 Spread

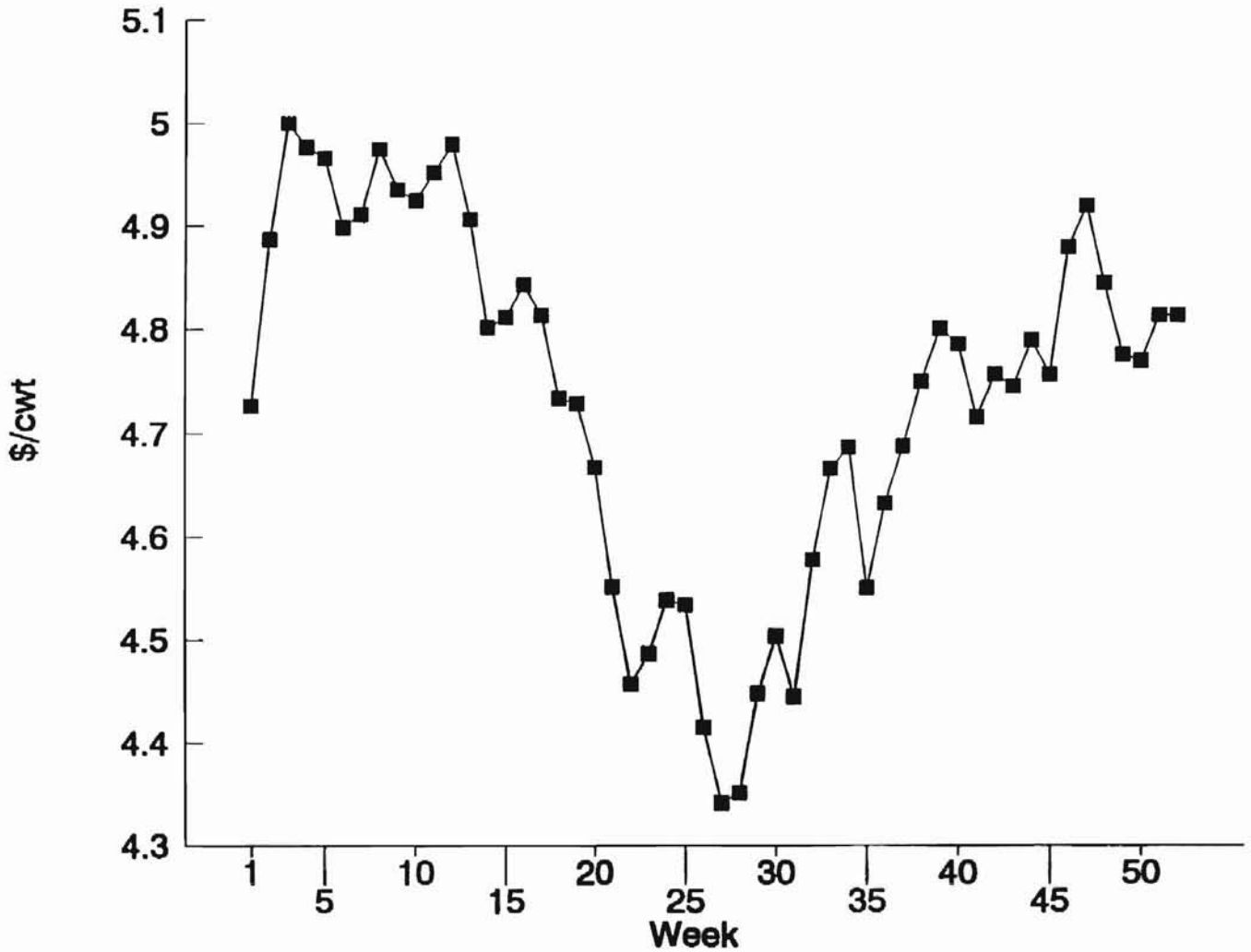


Figure 6

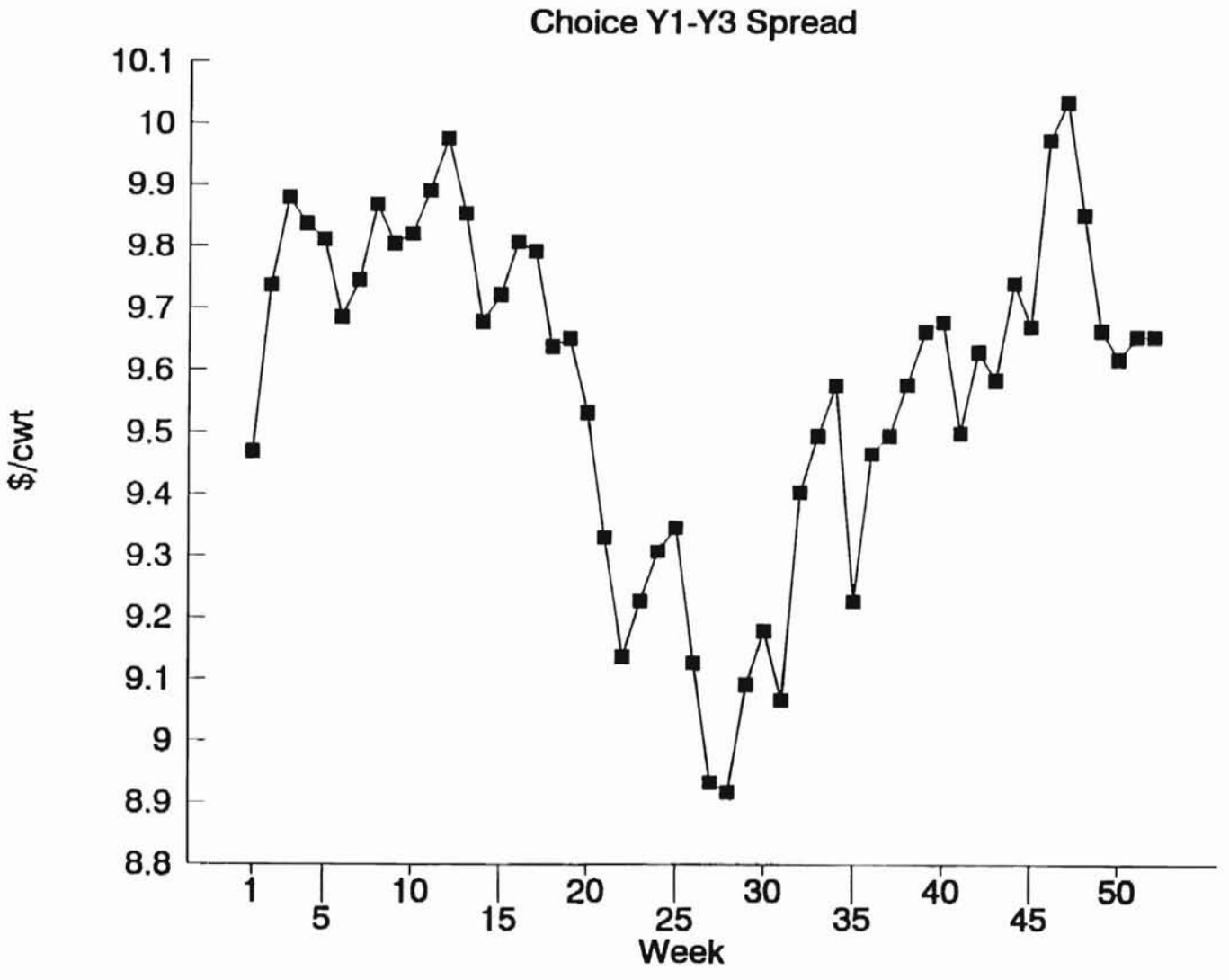

Choice Y1-Y3 Spread
$/cwt
10.1
10
9.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
9
8.9
8.8
1
5
10
15
20
25
30
35
40
45
50
Week

Figure 7

Choice Y2-Y3 Spread

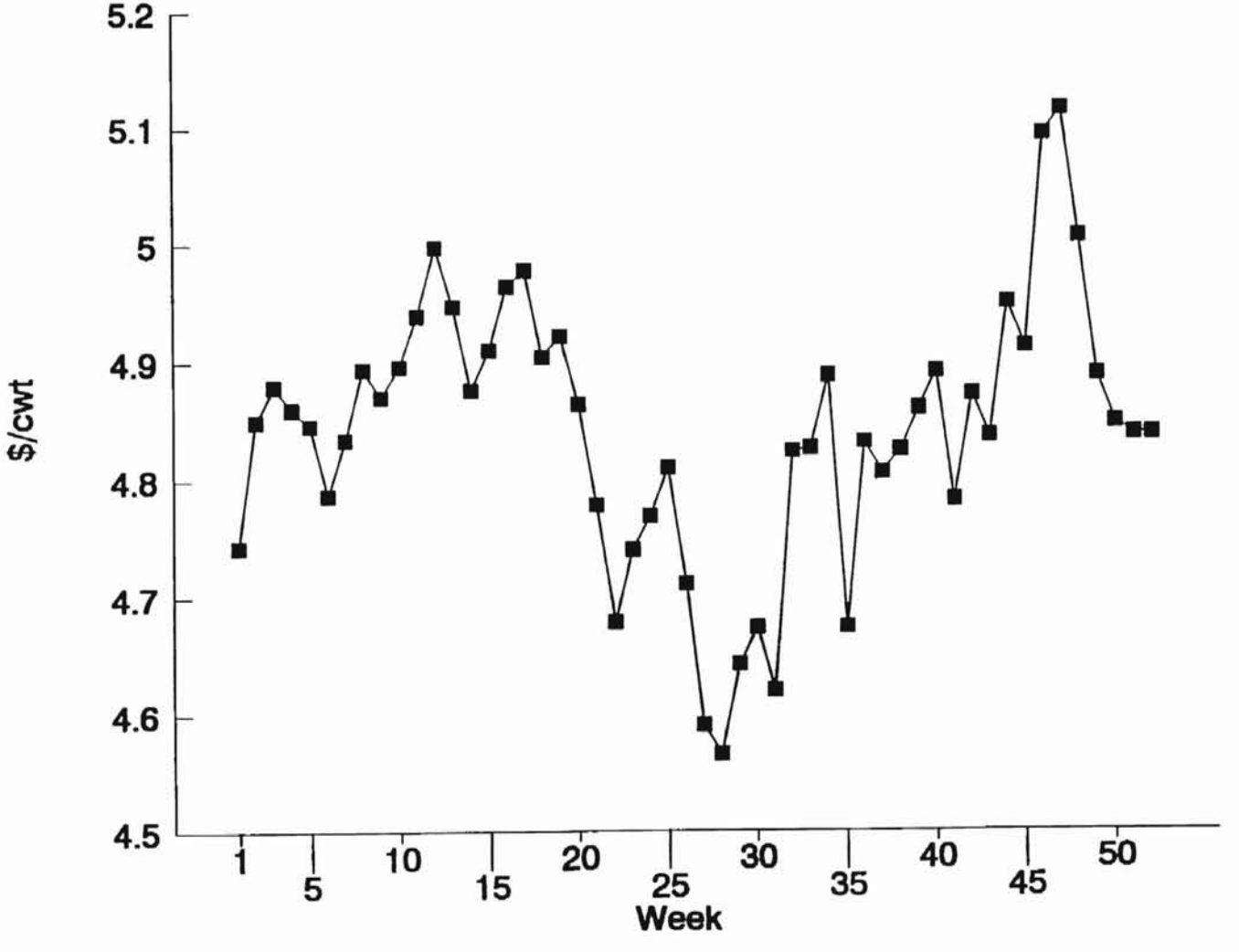


Figure 8

Select Y1-Y2 Spread

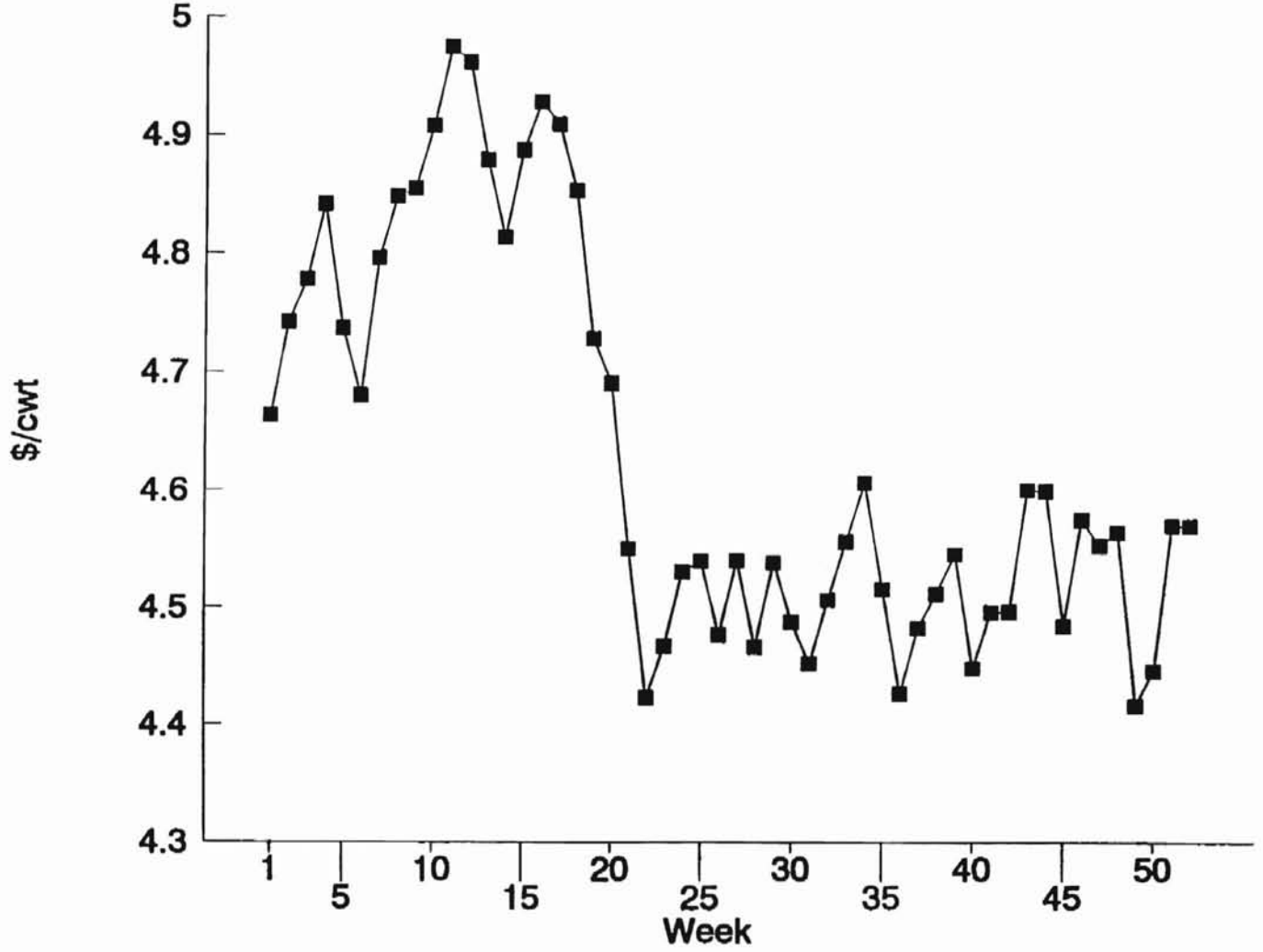


Figure 9

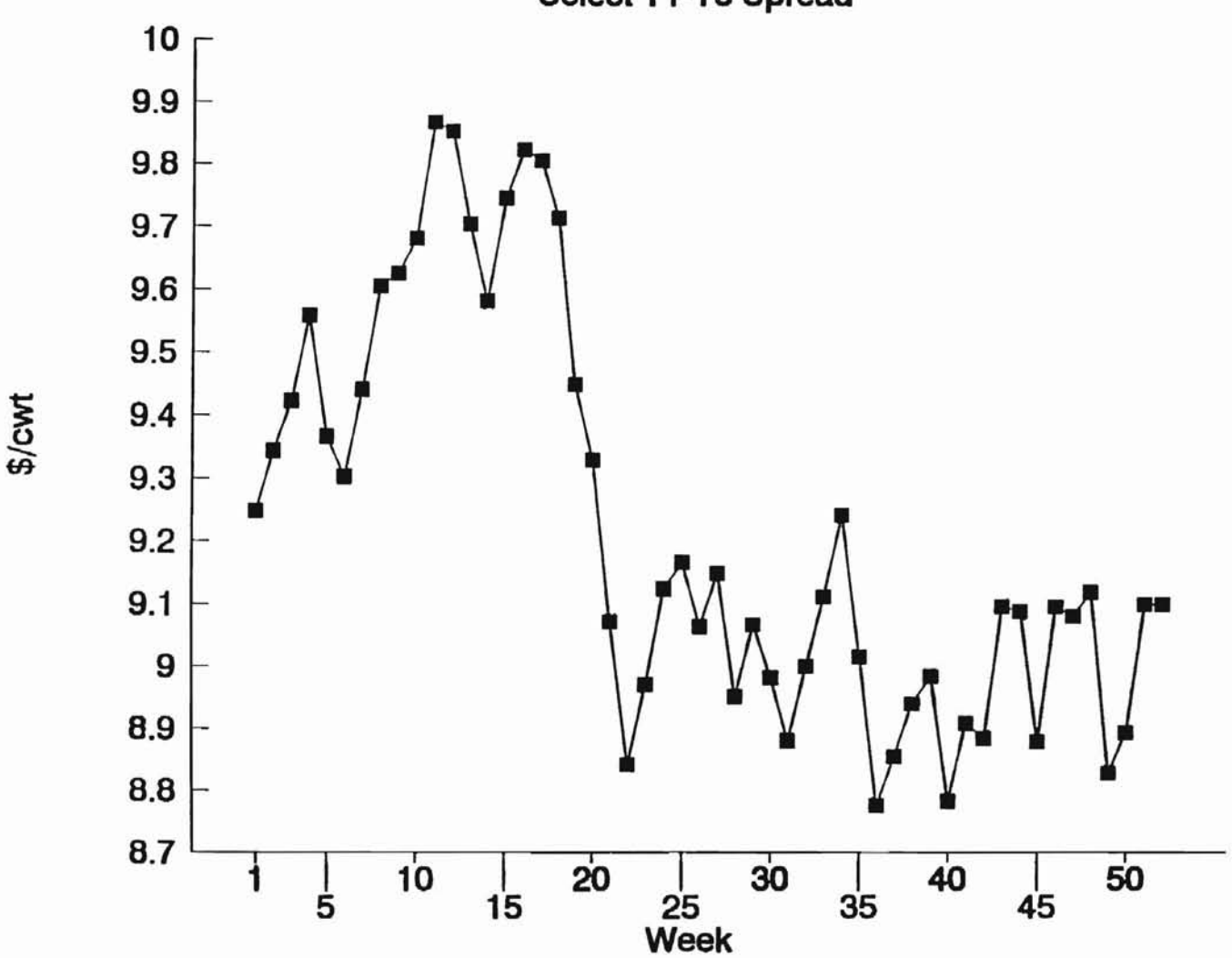

Select Y1-Y3 Spread
$/cwt
10
9.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
9
8.9
8.8
8.7
1
5
10
15
20
25
30
35
40
45
50
Week

Figure 10

Select Y2-Y3 Spread

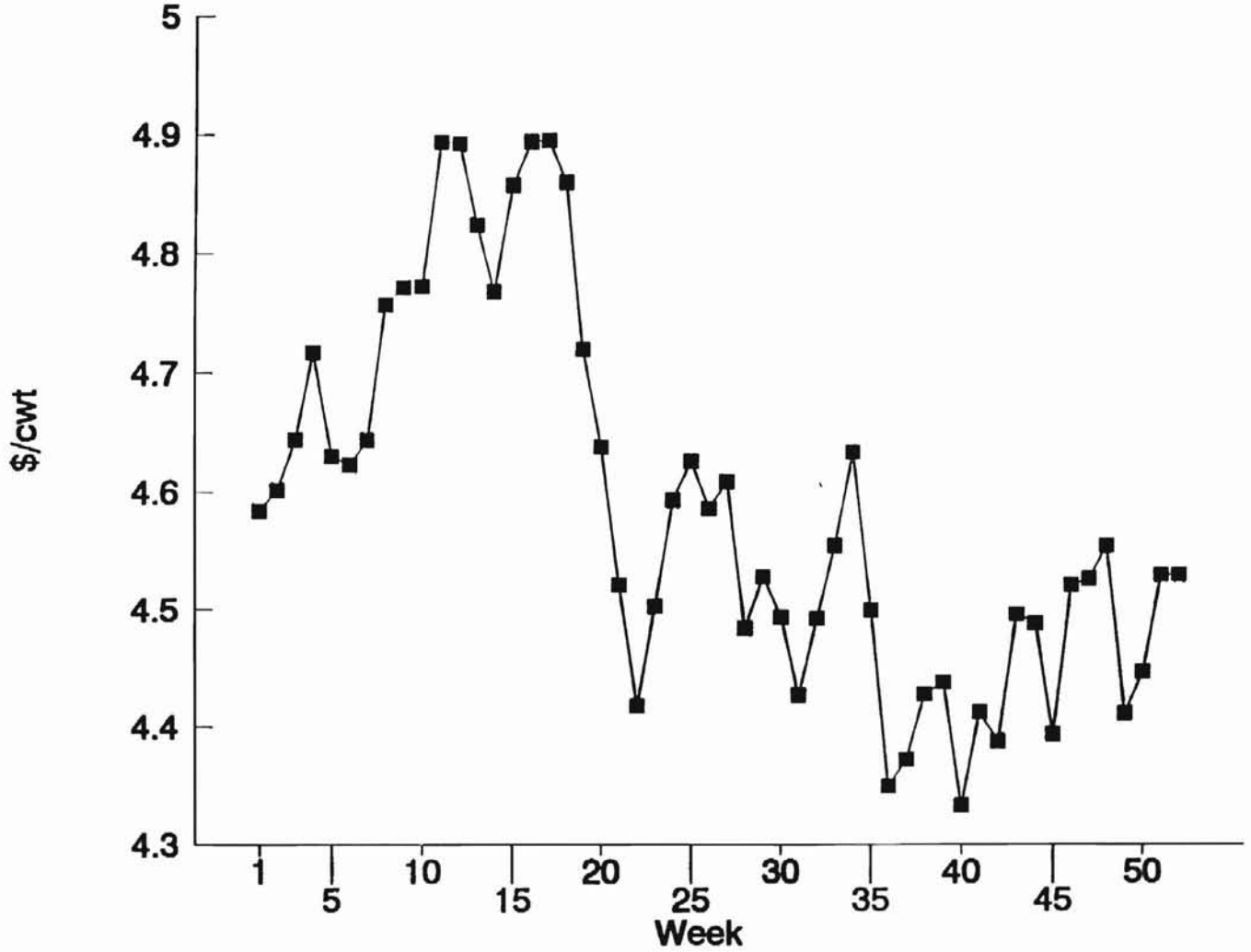


Figure 11

Choice-Select Spread

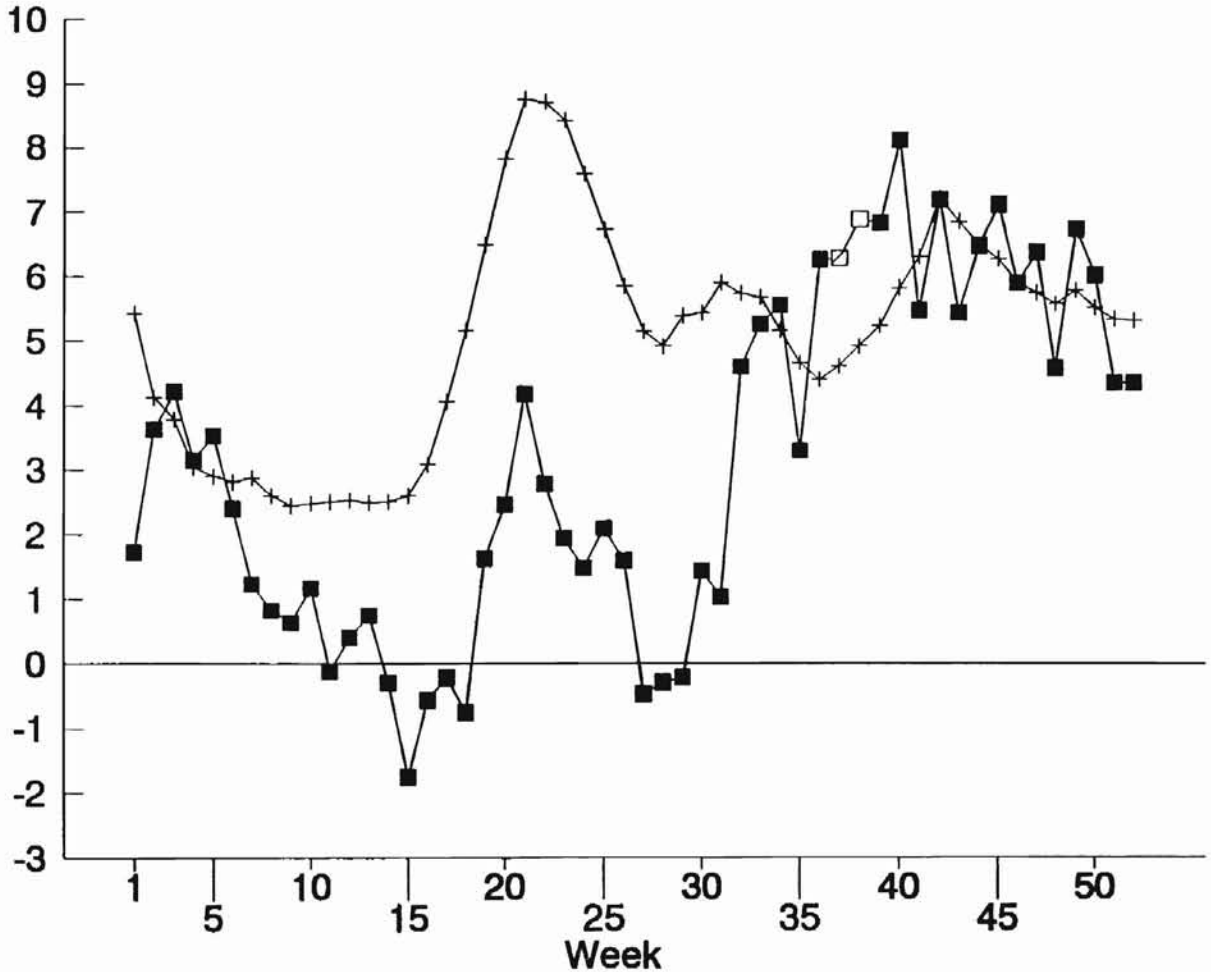


Figure 12

Live vs. Grid Value

Quality Held Constant

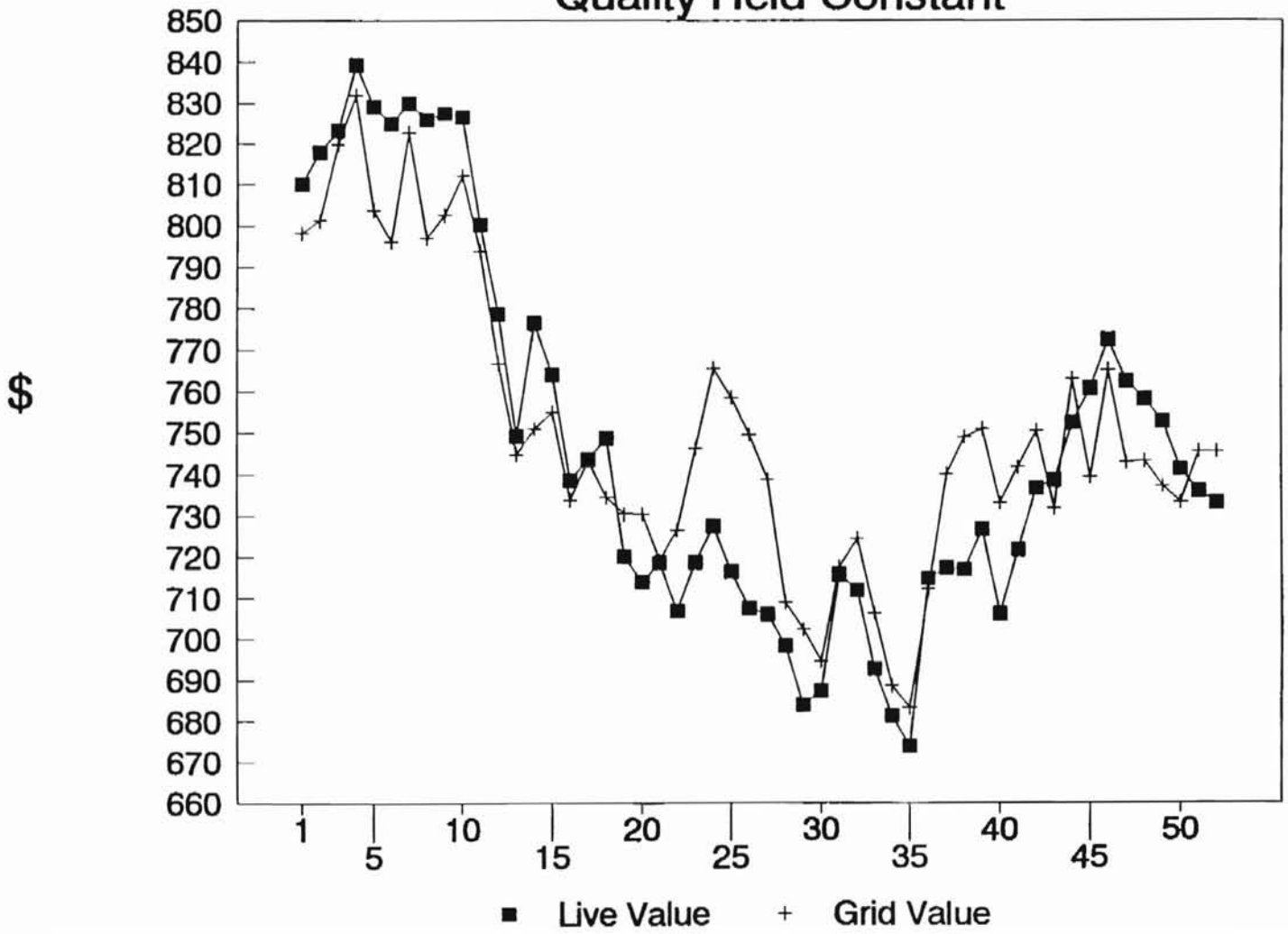


Figure 13
Monthly Average Fed Steer Price

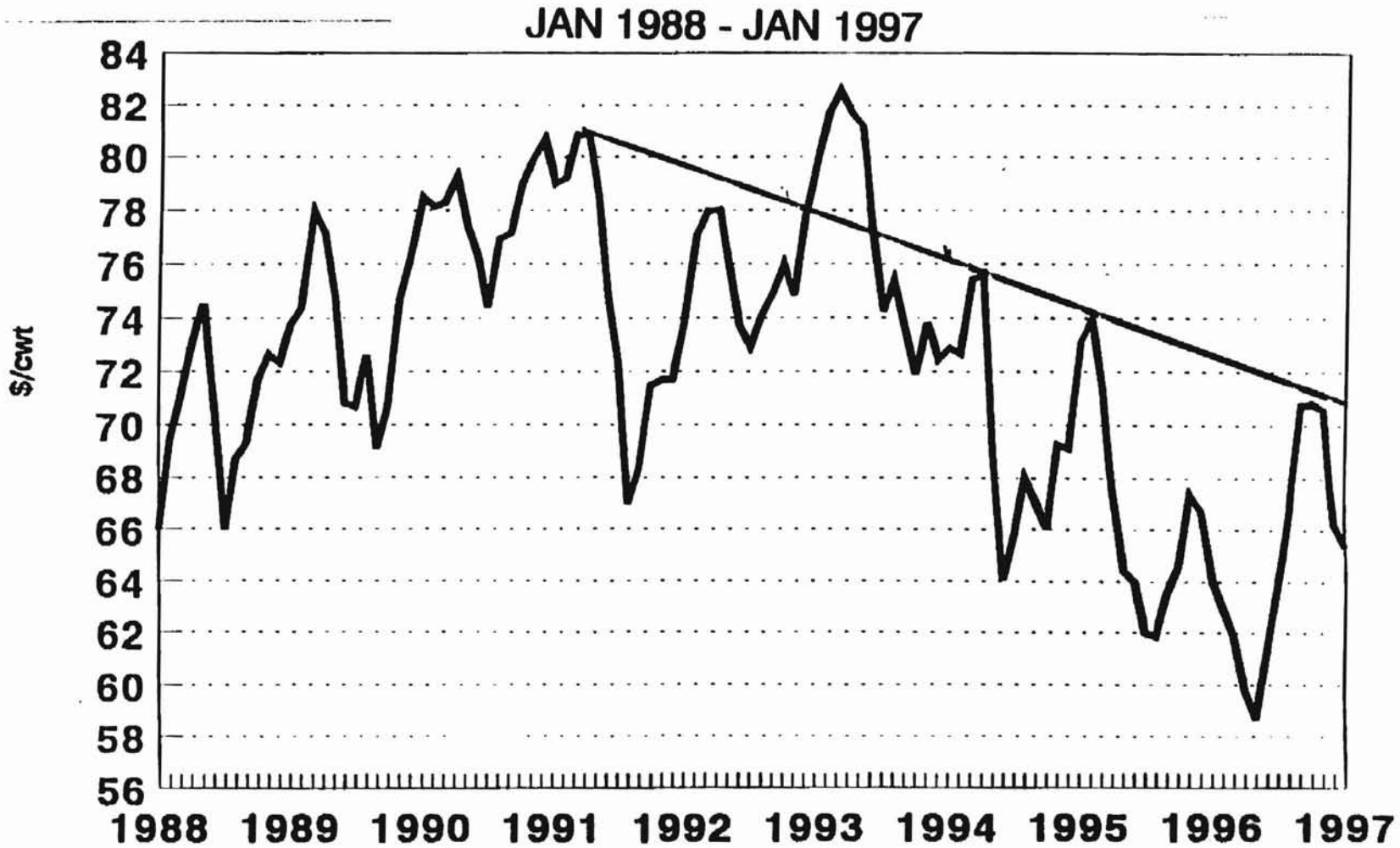


Figure 14

TX/W. OK Fed Steer Price

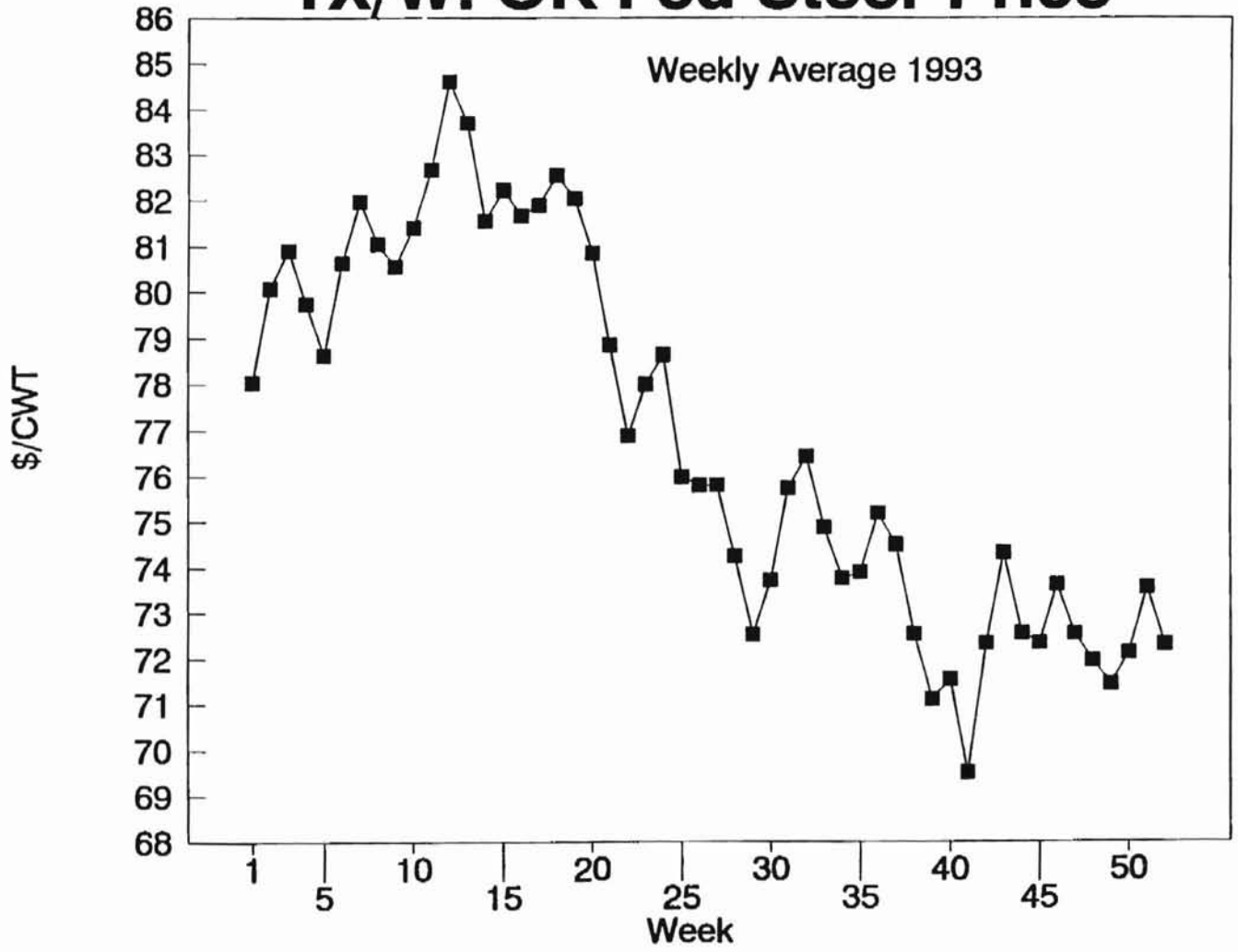
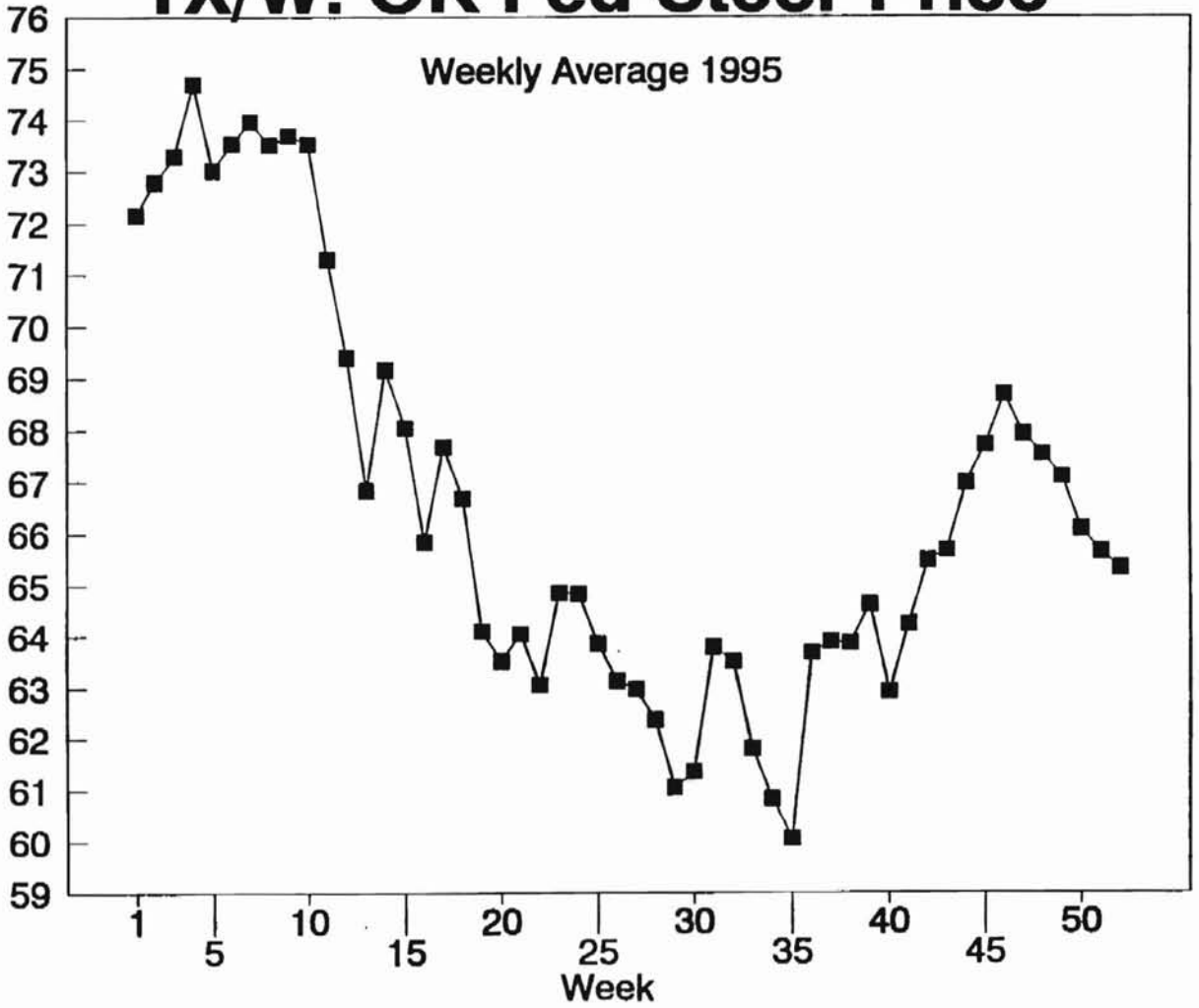


Figure 15

TX/W. OK Fed Steer Price



CHAPTER 5

Summary and Conclusions

With grid pricing becoming more prevalent in the fed cattle industry, an understanding of the linkages between live cattle prices and wholesale meat cut prices becomes necessary for informed live cattle marketing and production decisions. This study calculated the carcass prices for U.S. Choice and U.S. Select yield grade 1 through 3 cattle using a formula. The formula used in the study was the OSU Boxed Beef Calculator. The "Boxed Beef Calculator" uses price data for nineteen wholesale meat cuts together with primal yield information to determine the carcass and live value of an animal. The results of the study indicates that the seasonal indices for the formula derived carcass prices for various yield and quality grades of cattle follow closely the seasonal pattern of live cattle prices. Price spreads between differing yield and quality grades also exhibit seasonal patterns. The price spreads for each of the yield grades of select cattle examined display definite seasonal patterns with each of the spreads having nearly identical seasonal patterns. The price spreads for the varying yield grades of choice cattle were in general, slightly wider than the select spreads. The U.S. Choice spreads displayed a seasonal pattern somewhat similar to the select price spreads, with the narrowest point in the spreads occurring mid-year. Although seasonal patterns are present in the price spreads between yield grades, the seasonal variation in the spreads is usually less than one dollar per hundredweight of the carcass. Thus, given the relatively constant spreads, the seasonal variation in the derived spreads will likely not have a significant impact on producers' marketing decisions.

The study also found that grid pricing does value cattle significantly different that live weight pricing. Whether the pen of cattle have a higher value with a formula-based grid pricing system than live weight pricing depends on three key factors identified by the study. These factors are quality of the pen, time of year, and position of the contemporary cash market. Animal quality affects the premiums and discounts that are received, and the selling price of the cattle on a live weight basis. The time of year affects the values received from the two pricing systems, given that the derived seasonal carcass price patterns closely follow the pattern of live fed cattle prices, and the cash market is typically higher in the first quarter of the year than the contemporary grid price. The current market conditions in terms of number of cattle on feed and contemporary cash price are also important in determining the type of pricing system to use. Large numbers of cattle on feed result in high packer profits and hence low cash prices relative to wholesale meat prices, while low supplies will lead to decreased packer profits and a higher cash prices relative to wholesale meat prices as packers must compete aggressively to purchase sufficient numbers of cattle to meet their demand for boxed beef. The results of both data sets used in this study supported this theory.

Given the results presented here, the CCDS data showed that live weight pricing yielded higher animal values than the alternative formula-based grid pricing system. However, during the time period studied the cash market was fairly high with an average yearly price of $76.50, due to low supplies of cattle. The data from the individual feedlot showed that formula-based grid pricing yielded higher animal values in approximately one third of the pens; however, the Feedlot X data represented a period

of relatively low cash prices with the average cash price for the period of $62.93 due to extremely large supplies of fed cattle. Thus the industry situation in terms of number of cattle on feed which impact the cash market is vital in determining whether to market cattle on a formula-based grid pricing system as opposed to typical live weight pricing.

The results also indicate that the variance in values yielded from the two pricing systems on both individual animals and pens of cattle are not significantly different. Approximately one half of the pens studied had a greater variance of animal values within pens for the two pricing systems. This implies that grid pricing does not necessarily exhibit greater variability of profits than live weight pricing. Many producers are reluctant to use formula-based grid pricing because of the perceived variability of prices. However, the results of the study show that statistically the variance in animal values across pens is equal for both of the pricing methods. Furthermore, consistent quality of the animals produced will show even lower variance under the grid pricing system because variation of animal values under the grid pricing system are caused by animal quality.

Limitations and Research Opportunities

Due to the complexity of alternative fed cattle pricing systems and lack of publicly reported data in this area, this study has several limitations. First, the grid used for comparison in this study is only one of many possible formula-based pricing grids. The grid used in the study was derived from prices of individual wholesale meat cuts, while meatpacker will most likely base their grids on composite boxed beef cut-out values. At the time of this study, data on premiums/discounts were not available for a significant

period of time, thus a small sample of random "spot" quotes were used. However, in October 1996 the USDA Agricultural Marketing Service began reporting the average and range of premiums and discounts used in a number of grid pricing systems. Future research using this publicly available data may prove more accurate than the approach used in this study. Also, although the data used in this study was the most accurate available at the time; actual live prices received for the pens would have provided a more realistic comparison of the two pricing systems than matching the reported average prices to the individual pens distribution of quality grades.

The results of the study indicate the need for further research in several areas. The study implies that key linkages between the wholesale meat and carcass markets do exist. Given the results, further research focusing on the changes in the prices of individual cuts of meat that were the major causes of seasonal changes in price spreads between differing yield and quality grades is needed. Further study into the supply and demand forces creating the changes in premiums and discounts in the grid price system is also needed.

Bibliography

Barkema, Alan D. and Mark Drabenstott. "A Crossroads for the Cattle Industry" *Economic Review* (November/December 1990):47-61.

Buccola, Steven T. "Pricing Efficiency in Agricultural Markets: Issues, Methods and Results." *Western Journal of Agricultural Economics* 14(1): 111-121

Capps, Oral Jr., Donald E. Farris, Patrick J. Byrne, Jerry C. Namken, and Charles D. Lambert. "Determinants of Wholesale Beef-Cut Prices." *Journal of Agricultural and Applied Economics*. 26(1): 183-199.

Considine, Jennifer I., William A. Kerr, Gregory R. Smith, and S. Monica Ulmer."The Impact of a New Grading System on the Beef Cattle Industry: The Case of Canada." *Western Journal of Agricultural Economics*, 11(1986): 184-194.

Dolezal, Glen, Donald Gill, and Tom Garner, OSU Boxed Beef Calculator. Oklahoma Agricultural Experiment Station, 1995.

Duewer, L.A. and K.E. Nelson. *Beefpacking and Processing Plants: Computer-Assisted Cost Analysis*, USDA Staff Report AGES 9115, 1991

Faminow, Merle D., Monica de Matos, and R.J. Richmond. "Errors in Slaughter Steer and Heifer Prices." *Agribusiness* 12(January/February 1996):79-87.

Fausti, Scott W. and Dillon M. Feuz. " Production Uncertainty and Factor Price Disparity in the Slaughter Cattle Market: Theory and Evidence." *American Journal of Agricultural Economics* 77(August 1995):633-540.

Feuz, Dillon M., Scott W. Fausti and John J. Wagner. "An Analysis of the Efficiency of Four Marketing Methods for Slaughter Cattle." *Agribusiness* 9(December 1993):453-463.

Hayenga, Marvin L., Barbara S. Grisdale, Robert G. Kauffman, H. Russell Cross, and Lauren L. Christian. "A Carcass Merit Pricing System for the Pork Industry." *American Journal of Agricultural Economics* (May 1985):315-319.

Lind, Douglas A., and Robert D. Mason. Basic Statistics for Business and Economics: First Edition. Burr Ridge, Illinois. Irwin Publishing, 1994.

McClelland, Logan. Material presented at National Cattlemen's Association Mid-Year meeting. July 1995.

McCoy, John H. and M.E. Sarhan. Livestock and Meat Marketing: Third Edition New York, NY: Van Nostrand Reinhold Company Inc., 1988.

National Cattlemen's Association, "War on fat." Final report of the Value-Based Marketing Task Force, Denver, CO, 1990.

Owen, C. Jane, Thomas L. Sporleder, and David A. Bessler. "Fabricated Cut Beef Prices as Leading Indicators of Fed Cattle Price." *Western Journal of Agricultural Economics*, 16(26):86-92.

Purcell, Wayne D. Pricing and Grading Issues in Livestock and Meats: Implications of Efficiency and Industry Structure. Research Institute on Livestock Pricing, Research Bulletin 3-91. February 1991.

Schroeder, Ted C., Clement E. Ward, James Minert and Derrell S. Peel. "Beef Industry Price Discovery." in *Price Discovery in Concentrated Livestock Markets: Issues, Answers and Future Direction*. Editor, Wayne Purcell. Blacksburg, VA. Research Institute on Livestock Pricing, 1997.

Stolle, Jeff and Mike Fitzgerald. "Grid Pricing Designed to Enhance Price Discovery." *Nebraska Cattleman*. July/August 1995:12-18

Trapp, James N. "Seasonal Price Indices for Oklahoma Livestock and Livestock Products." *Current Farm Economics*. 69(1996):47-69.

Ward, Clement E. "Market Structure Dynamics in the Livestock-Meat Subsector: Implications for Pricing and Price Reporting." *In Key Issues in Livestock Pricing: A Perspective for the 1990s.*, eds., W. Purcell and J. Roswell. Blacksburg, VA: Research Institute on Livestock Pricing, 1987.

Unnevehr, Laurian J. and Sharon Bard. "Beef Quality: Will Consumers Pay For Less Fat?" *Journal of Agricultural and Resource Economics* 18(1993):288-295.

U.S. Department of Agriculture. *Livestock Meat and Wool Market News*. Washington, D.C. Agricultural Marketing Service. January 1991 to December 1991.

VITA

Michelle Beshear

Candidate for the Degree of

Master of Science

Thesis: VALUE-BASED FED CATTLE MARKETING: A COMPARISON OF LIVE WEIGHT VERSUS GRID PRICING SYSTEMS

Major field: Agricultural Economics

Biographical:

Personal Data: Born in Stillwater, Oklahoma, on March 9, 1973, the daughter of David and Nita Beshear.

Education: Graduated from Stuart High School in 1991; received Bachelor of Science degree in Agricultural Economics from Oklahoma State University in Stillwater, Oklahoma in May, 1995. Completed requirements for the Master of Science degree with a major in Agricultural Economics at Oklahoma State University in April, 1997.

Experience: Raised in an agricultural setting in Stuart, Oklahoma, employed as a research assistant for the Department of Agricultural Economics at Oklahoma State University as an undergraduate and as a graduate research assistant, 1995 to present.

Professional Memberships: Southern Agricultural Economics Association, American Agricultural Economics Association.