AN ANALYSIS OF FACTORS INFLUENCING FEEDER CATTLE FUTURES CONTRACT BASIS AND SPECIFICATIONS

By

FRED C. EILRICH

Bachelor of Science in Agriculture

Oklahoma State University

Stillwater, Oklahoma

1987

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, 1991

AN ANALYSIS OF FACTORS INFLUENCING

FEEDER CATTLE FUTURES CONTRACT

BASIS AND SPECIFICATIONS

Thesis Approved:

James N. Trapp
Thesis Adviser

Derrell S. Peel

Daniel S. Tilley

Kim B. Anderson

Norman N. Durham
Dean of the Graduate College

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to all the individuals who contributed to making my Masters program a reality. I would like to thank the instructors, administrators, staff members and my fellow graduate students for their part in making this program an enjoyable experience. Recognition as well to Dr. James E. Osborn and the Department of Agricultural Economics, for the financial assistance which has made this experience possible.

Foremost I convey thanks to my major advisor, Dr. James N. Trapp for his guidance, assistance, and especially his eternal perseverance to ensure that my program was completed. I would like to thank my committee members: Dr. Kim B. Anderson, Dr. Darrell S. Peel and Dr. Dan S. Tilley for their advice and suggestions during this program.

Acknowledgment to Tom Tippens and Professional Cattle Consultants Inc. for providing access to their detailed data base. I would also like to recognize Brent L Tweeten for his computer programming assistance and Darla Fuxa for her contribution to the graphical presentations.

To my parents F. G. and Mary Eilrich, and my brother Brad, who have encouraged and supported me throughout my academic career, I express my gratitude.

Finally my deepest appreciation goes to my best friend Sharon Hunter. Her undescribable optimism along with her unselfish assistance continually motivated me particularly when completion seemed unobtainable. But, most of all, I thank God for my son Travis, for it is he who made all the struggles worthwhile.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

Animal agriculture is a vital part of the agricultural sector in Oklahoma. Furthermore, because agriculture is a major contributor to Oklahoma's economic stability, animal agriculture has immense importance to the state. Cash receipts from farm marketing totaled $3.6 billion in 1989 with $2.4 billion or 67 percent of those receipts comprised of livestock and livestock product sales (Oklahoma Agricultural Statistics, 1989). Gross income from cattle and calves totaled $1.4 billion. This revenue was 2.36 times greater than the second highest gross income generating product, wheat. Oklahoma ranks third among the states in the number of beef cows that calved. Texas and Missouri rank first and second respectively (Agricultural Statistics, 1989).

Oklahoma is a leading producer of stocker cattle. As a state, Oklahoma currently ranks second to Texas in total stocker cattle production but the number of stocker cattle per square mile is two times greater than in Texas. Oklahoma leads the U.S. in the number of stocker cattle per square mile. Several factors contribute to Oklahoma's leadership in stocker cattle production. The first is Oklahoma's large population of beef cows. The second is the large supply of forage available in the state. Three-fourths of Oklahoma's 44 million acres of land is capable of producing forage that could be utilized by stocker or cow/calf enterprises.

In addition, Oklahoma ranks second only to Kansas among all states for winter wheat production with roughly 7 million acres planted in 1988 (Oklahoma Agricultural Statistics, 1989). Wheat pasture grazing of stocker cattle enables producers to increase revenue through beef production with little or no negative effects on the production of grain (Rodriguez, 1990). Survey work by individual researchers (Walker et al., 1988; Lansford et al., 1987; and Harwel, 1974) suggest approximately 50 percent of Oklahoma wheat acreage is typically grazed with an average stocking rate of approximately .5 head per acre for winter grazing. These numbers imply that approximately 1.75 million head of cattle can be grazed annually on winter wheat pasture in Oklahoma. Given the prices of 600 pound feeder steers and heifers in the Oklahoma City feeder cattle market in the fall of 1987 and spring of 1988, the value of these animals would have been approximately $944 million.

A final factor favoring stocker cattle production in Oklahoma is the existence of a major delivery market for feeder cattle in Oklahoma City. This market may have evolved because of other conditions favorable to stocker production such as its location relative to feedyards and Oklahoma's climatic conditions, but the market's current existence helps reinforce these factors.

Risk Management and Livestock Production

There are two distinct categories of cattle producers. First, there are small producers with primary income coming from off-the-farm sources. They are in the industry perhaps for the enjoyment received, or perhaps to utilize land that is held for investment and/or to utilize spare-time labor. The other group consists of larger, professional producers that rely heavily upon income received from their operation. Unlike small producers who have many unique reasons and goals for producing cattle, larger professional cattlemen possess a combination of two conflicting goals: profit maximization with risk minimization.

Considering the volatility of prices and their impact on profits, risk management is an essential element toward financial survival with beef production. In addition to the financial risk involved with lending capital, participants in the feeder cattle industry confront two other types of risk with production and marketing. Production risk is brought on by extreme climatic fluctuations, and/or unpredictable physical performance. The other cause of risk is marketing risk prompted by input and output price uncertainty. Managers and owners generally understand production risk more than marketing risk. Therefore, they are better equipped to manage production uncertainty risk at an acceptable level by having management plans to contend with nature's oscillations. Thus while most managers, with their experience, possess the capability to influence the production component so as to manage production risk, many managers seem less prepared to cope with market risk caused by price volatility.

Livestock input and output prices are determined in less than totally efficient markets driven by national and international supply and demand factors of which Oklahoma is a small part. If the price risk level could be controlled through market risk management within a range similar to the level of production risk, then profit volatility quite possibly could be reduced to a more acceptable range for most cattlemen. The level of potential profit is directly related to the level of potential risk. An acceptable range could therefore be defined as one that would allow producers to endure the periodic market-downsides without jeopardy to the firm's long-term survival.

Implementation of pricing and marketing strategies other than cash sales is necessary if producers are to attempt to manage the risks associated with the marketing phase of their operation. Forward pricing and using the futures markets to "hedge" are examples of alternative marketing strategies. One example of forward pricing is a contractual agreement between two parties based on the futures market. The agreement can be made months prior to the sale.

The futures price for a nonstorable commodity can be interpreted as reflecting the consensus of what traders expect the cash price to be at a particular time in the future, given currently available information (Leuthold, 1979). However, additional studies by researchers (Martin and Garcia, 1981; Leuthold and Hartmann, 1979; and Leuthold, 1974) resolved that futures markets were not consistently accurate or efficient forecasters of subsequent cash prices particularly for distant contracts months. Using more recent data, Shonkwiler concluded that live cattle and hog futures prices do not serve uniform roles as rational forecasting agencies. The departures from rationality observed suggests that traders are ignoring certain types of information concerning the evolution of actual market prices (Shonkwiler, 1986). These studies reflect problems with the futures markets as forecasting agencies. Therefore, the resulting hypothesis is that hedging can be a suitable risk management tool. The accurate expectation of cash price is not as important (excluding consideration of any foregone profits) when hedging because only the change in basis that occurs between initiation and completion of the hedge influences the final price received, where basis is defined as the difference between the cash and futures price.

A correctly executed hedge will leave the hedger less vulnerable to price volatility if variation in basis is less than the variation in cash price. With a hedge strategy correctly carried through to completion, the hedger fundamentally transfers a large segment of the price risk induced by price volatility to speculators in the futures market. The hedger retains only the portion of price volatility risk involved with the basis and interest expense on margin money if the market moves against the hedge. Ikerd stated that "livestock producers look to the futures market as a means of protecting their operations from the ever increasing risks of loss due to adverse cash price changes. Speculators, on the other hand, view the highly volatile prices as exceptional opportunities to make profits from wise futures trades" (Ikerd, 1978). The speculators are willing to accept the risk transfer with its potential for financial gain.

To conduct a hedge, the producer must take an equal and opposite position in the futures market to the position he holds in the cash market. In the case of the stocker operator, selling a feeder cattle contract on the futures or taking a short position would establish a hedged position. The operator presently holds what is described as a long position in the cash market because he owns the commodity in question. By taking an equal and opposite position to one's position in the cash market, the market participant has replaced the risks of rapid unanticipated price movements with a potentially smaller risk called "basis risk".

An understanding of the local basis is the key to translating a futures price into a probable price for local delivery. This is known as localizing the futures price. One essential criteria for determining a successful hedge is the accurate estimation of the local basis. When estimating the basis, adjustments in the quoted futures price are necessary. Futures contracts are for a specific commodity delivered to a specific location on a specific date. Therefore, differences between the commodity to be traded on the cash market from the specifications of the futures contract need to be recognized. The time difference of the sale, geographical location difference from the delivery market, and the quality difference from that specified by the contract have to be adjusted for. Basis risk increases the longer the time span between making the hedge and completing it and/or the greater the distance the hedger is from the delivery point. Producers do not always hold a commodity homogenous to the contract either. This is evident, for example, when producers hedge heifers with a feeder cattle contract defined for steers only. However, hedging a given set of cattle reduces price risk if the appropriate basis is more predictable than is the ultimate level of cash price at time of delivery (Price et al., 1979; Leuthold, 1977; and Elder, 1969).

Literature Review

Analysis of cash and futures relationships has been occurring since Working (1948) developed his concept of basis for grains. Working concluded that the basis for grain is determined by the charge for storage and is not just a residual between futures and cash. Interpretation of futures prices since then has been a matter of discussion. Some researchers support the market determined concept for nonstorable commodities such as livestock, while others have argued that the theory of storage which has evolved to help explain pricing patterns and processes for grains is not appropriate for nonstorable commodities. They have concluded that with nonstorable commodities, the basis is merely a residual. The following is a brief summary of previous research in this area. Certainly all relevant work to date has not been included, but the major issues regarding representation of basis analysis for nonstorable commodities are believed to be covered.

Paul and Wesson (1967) published one of the first analysis of the cash and futures price relationship for a nonstorable commodity. Previously they determined that the spread between cash price of soybeans and futures prices of oil and meal represented the processing cost of conversion. They expanded this concept of pricing services to the nonstorable commodity of fed cattle. Analogous to the soybean crushing study, they hypothesized that the spread between the combined spot cash price for feeder cattle plus the feed costs necessary to raise the animal to slaughter weight, and the futures price for fed cattle for the month the feeder animal would be ready for delivery, was a price for feedlot services. Paul and Wesson refer to this difference as the "quarterly spot forward margin". A conceptual approach of comparing custom-feeding arrangements to futures trading was used to explain pricing feedlot services. A positive sloped supply response curve was found when the quarterly spot forward margins of 1965 and 1966 were plotted against quarterly placements. This result suggested feedlot operators were responding to the futures prices by increasing placements when feedlot services (spot-forward margin) were low and vice versa.

Ehrich (1969) expanded on the Paul and Wesson concept by attempting to explain the behavior of cash and futures' price spreads. Based on breakeven analysis for the cattle feeding industry, a behavioral pattern between spot feeder cattle cash price and fed cattle futures was developed. Futures minus cash spreads were plotted against futures minus cost of gain spreads. The results suggested that the cash and futures price spreads adjust toward a breakeven relationship. Ehrich concluded that "under purely competitive market conditions, cash prices of feeder cattle and fed cattle futures prices will bear a relationship to one another which is determined by cost of feeding and level of futures prices. The price of feeder cattle will adjust to expected fed-cattle prices."

Miller and Kenyon (1977) provided additional support for the Paul and Wesson results by duplicating their model with extended data. The regression results again proved that feedlot placements had a significant positive relationship to feeding margins calculated with fed cattle futures as an expected price. Miller and Kenyon also developed a derived demand function for feeder cattle. They concluded that "fed cattle futures prices have been important in explaining the course of feeder cattle prices as a consequence of their use as expected output prices."

Livestock commodities differ from grains in two essential ways. First, livestock changes form over time and is being produced on a year-round basis. Secondly, virtually no storage capability exist for livestock commodities. Because of this, Researchers have focused on alternative methods to explain futures and cash relationships for livestock versus grains and the price performance of the futures market.

Leuthold (1974) utilized the mean-square error approach to analyze the efficiency of the futures market price to forecast future cash price conditions. Results indicated that for distant contracts further than 15 weeks from delivery, the current cash price was a better estimate of the future cash price than was the futures price. He commented that "the prices of cattle actually change less than the futures market anticipates or that the futures prices underestimate and overestimate swings in cattle prices." He concluded that "a producer would receive better information from the present cash price and avoid receiving false signals that would lead to a costly decision from a money loss or foregone profit."

Based on the assumption that the resulting price spread between live cattle futures and cash was the difference between current and expected supply conditions, Leuthold (1979) used monthly observations to explain the basis for delivery month as well as distant contracts. He suggested that "a better understanding of the basis can improve a market participants decision making and management of the basis." The regression equation included several variables hypothesized to shift supply conditions. He concluded that "a high proportion of the variation of the live-beef cattle basis, anywhere from two to seven months prior to contract delivery can be explained by factors which determine and shift the supply curve."

Price et al. (1979) expressed that basis behavior must be predictable if the live cattle futures market is to provide an adequate hedging mechanism. Least squares analysis was utilized to analyze four objectives concerning the behavior of basis variability in live cattle futures. Weekly data from four Kansas feedlots from January 1972 to December 1976 was analyzed. The objectives were to: 1) determine if basis movements were consistent from year to year; 2) isolate seasonality differences of nearby basis for all contracts; 3) test for differences between delivery and nondelivery periods and; 4) determine if location differences within Kansas had an influence on basis behavior. They concluded that year to year fluctuations infact were apparent, suggesting that a producer must market several times a year to average out profits or losses incurred from erratic basis movements. The results also concluded that with the exception of generally a narrower expected basis for October and a wider expected basis for June, there did not seem to be any differences in basis levels between contracts. No significant differences were found between location or between delivery and nondelivery periods. However, less variance was found in the basis for delivery months suggesting a more conservative basis must be used in nondelivery months.

Tomek (1980) lends support to Leuthold's (1979) analysis by restructuring Leuthold's original equation to clarify the relationship. Tomek states that "although Leuthold argues that the futures price and cash price move independently, the price of that futures contract should behave more like the cash price as the futures contract approaches maturity." He reinterprets Leuthold's empirical results to show that the results are consistent with that idea. Tomek added that "cash and futures prices for distant contracts are not necessarily related."

Garcia et al. (1984) used variate difference analysis to separate the basis for live hogs and cattle into two components (i.e., systematic and unsystematic). They conceptualized that the basis demonstrates a systematic component caused by cash and futures prices converging as the contract matures. The remaining unsystematic component was identified as a measure of risk. Regression analysis tested several variables related to long term basis movements and unexpected changes in prices that were hypothesized to influence the random component. The results suggests that there was not strong evidence supporting lower levels of risk as contracts approach maturity. They concluded that "more basis risk occurs when cash prices are high and that attention to certain circumstances should help traders with basis positions in reducing risk if additional information permits identifying periods of high within contract basis risk."

To better explain the basis relationships for nonstorable commodities, Naik and Leuthold (1988) tested the unbiasedness of the futures prices. They used correlation coefficients, regression coefficients, and basis equation tests. Regression analysis used daily cash prices from the Omaha market and futures prices from Chicago Mercantile Exchange for the period 1966 through 1986. Results indicated that the expected maturity basis is nonzero and thus is included in the basis along with a maturity basis risk premium and a speculative component. They suggested that "it was possible to anticipate a part of the maturity basis well ahead of time." The conclusion was that cash prices are related beyond one period and that the relationship exists not only through feed price relationships but also through the inventory effect resulting from flexibility in marketing.

Most previous cattle basis studies have focused on live cattle contracts. In contrast, this study was an attempt to gain a better understanding of the feeder cattle basis and determine the variances and seasonality of the eight nearby contract basis as well as distant contract relationships. The impacts of market determined prices of corn and fed cattle were also studied to evaluate if improvement in explaining basis behavior could be achieved by considering additional price information, thereby decreasing the basis risk involved when using the futures market to hedge.

Problems in Using Futures Markets

This thesis considers two major issues regarding usefulness of the futures.

1) The feeder cattle contract contains specifications of the quantity, quality and weight of the cattle being traded. To assure efficiency, the contract specifications have to correctly represent the majority of the livestock population that is being marketed under the contract classification, otherwise incorrect market signals will be sent by the contract.
2) As stated earlier, in order to use feeder cattle contracts effectively, the basis must be predictable. In addition to time and location differences, basis prediction (in the case of feeder cattle) is complicated by the fact that many producers want to use the contract to hedge different weights of feeder cattle. Further difficulty in basis prediction can be experienced due to seasonality fluctuations, fed cattle market condition changes, and feed grain price volatility, all of which are hypothesized to affect the feeder cattle basis.

Description of the Feeder Cattle Contract

The Chicago Mercantile Exchange (CME) Feeder Cattle Contract underwent critical changes in 1986 (CME Publications, 1985 and 1986). Beginning with the

September, 1986 contract, physical delivery was eliminated and cash settlement was introduced. All open positions at contract expiration are now settled in cash based on the U.S. Feeder Steer Cash Settlement Price (USFSP) rather than by delivering or receiving feeder cattle at a specified delivery point. Specification changes were also initiated by redefining the trading unit. The following table illustrates the feeder cattle contract before and after the modification.

TABLE I

CME FEEDER CATTLE CONTRACT CHANGES

Contract Specification	Pre-1986	Post-1986
Total Weight	44000	No Change
Steer Weight	575 - 700 lbs.	600 - 800 lbs.
USDA Grade	med. frame No. 1 & 2	60 - 80% Choice
Contract Months	Jan. Mar. Apr. May. Aug. Sept. Oct. Nov.	No Change
Settlement	Delivery	Cash
Delivery	1 of 11 delivery pts. in only 10 states	USFSP includes cattle from 27 states
Last Trading Day	20th of the month if business day or prior business day	Last non-holiday Thurs. of non-holiday week

Research Studies Conducted

Two independent studies were conducted to deal with the aforementioned issues. The following is a brief introduction to the two studies.

Contract Specification

The first study considers contract specifications. A question recently emerged within the cattle-feeding industry concerning the average weight of feeder cattle being placed in the feedlot. Interest in knowing the placement weight was created because of the manner in which the feeder cattle contract settlement price is calculated. Presently, the contract settlement price is calculated by averaging the prices received for 600 to 700 and 700 to 800 pound feeder cattle sold in 140 direct and auction sales markets located in 27 states. The averages found for each state are weighted by the state's relative share of all steers sold and by the region's share of beef cows to determine the final settlement price.

A trait desired of the Cash Settlement Price formula is that it span a weight range that includes the majority of the cattle being hedged with the current CME Feeder Cattle Contract. A principal portion of the cattle hedged with the CME Feeder Cattle Contract is cattle sold/bought for entry/placement into feedlots. This study analyzed the trends in feeder steer feedlot placement weights to determine: a) if the preponderance of cattle placed on feed is placed within the weight range of 600 to 800 pounds; and b) if the average placement weight of cattle has changed over time or can be expected to change in the future. Of concern, is the issue/hypothesis that if the majority of the cattle being placed lie in the 700 to 800 pound weight range, the calculated settlement price is unrealistically high and therefore, not representative. This bias would occur due to the characteristic nature of the 600 to

700 pound cattle price being generally higher than the 700 to 800 pound price. If feeder cattle placement weights are consistently and significantly higher than 700 pounds, then a reevaluation of the formula used to determine the cash settlement price should be assessed. One possible alternative formula is use of the 700 to 800 direct and auction sale price by itself. This formula may be simpler and more meaningful.

Basis Forecasting

The second study was conducted to create a more accurate method of predicting the basis for feeder cattle and subsequently to provide a practical tool with which to make and use these predictions. There are essentially two ways to estimate the basis. One is to analyze the historical price relationship between futures price and local spot market cash price. The other is to calculate actual cost of delivery on the futures market. Because delivery on a feeder cattle contract is no longer an alternative it would now seem imprudent to use the delivery cost technique. Using historical price relationships is now the only method available.

Producers typically use the futures market to hedge weights of feeder cattle other than just those represented by the feeder cattle contract. Feeder cattle prices vary systematically with weight under normal market conditions (i.e., lighter cattle generally command a higher price). Therefore, basis estimates need to consider the weight range of cattle being hedged. Seasonality fluctuations in the basis have been observed to exist and have to be considered. Anderson (1987) calculated monthly basis for specific weight ranges of cattle by calculating the average historical price differences between the Oklahoma City cash market price for different weights of cattle and the CME futures. He also calculated the variance and standard deviation of these differences to use as a measure of basis variability. Anderson's averages establish a forecasting cornerstone and are a major benefit toward basis estimation.

The inauguration of the new feeder cattle contract in September of 1986 brought with it new price relationships and thus perceivably a new basis relationship. Because of this, the Anderson averages will be recalculated here using post September, 1986 data to represent the appropriate basis. Additionally, this study hypothesizes that the feeder cattle basis is influenced by several market factors that influence expected derived demand for feeder cattle. Specifically this study will examine the potential for improving the accuracy of basis estimates through consideration of changes in fed cattle and corn prices.

Organization of Thesis

This thesis will not follow the traditional format for a thesis (introduction, statement of objective, literature review, methodology description, presentation of results, and summary). It will instead present three related, but independent chapters followed by a brief summary chapter. Chapter I has introduced the problem and stated the objectives sought. Chapters II and III will report the results of the two analyses conducted. Specifically, Chapter II will present the results of the study addressing the variation and trends existing in feeder cattle placement weights and the implication of the results found for specification of feeder cattle futures contract. Chapter III will present the results of the analyses conducted to develop an improved feeder cattle basis forecasting model. Chapters II and III will be written in the style of a professional paper or journal article. Chapter IV will be written as a user's manual to aid in the use and application of the basis forecasting model developed in Chapter III. The model has been programmed into a user friendly LOTUS 1-2-3 based program. Chapter IV will describe this program and its application. Finally, Chapter V will provide a brief summary of the key results found in the two studies conducted. Comments will be made regarding the implications of the results and needs for additional research to both improve and maintain the forecasting model developed.

CHAPTER II

FEEDER CATTLE PLACEMENT WEIGHTS

The current U.S. Feeder Steer Cash Settlement Price consists of a formula-determined average price for 600 to 800 pound feeder steers sold in auction markets and by direct sales in 27 states. A desired attribute of the Cash Settlement Price is that it accurately represent the majority of all cattle hedged with the CME Feeder Cattle Contract. A question has arisen in the industry of whether the Cash Settlement Price is a representative price when based on the current 600 to 800 pound weight range.

A significant segment of the CME Feeder Cattle Contract activity involves the hedging of feeder cattle being placed in feedlots. This study analyzed monthly average placement weights from 1978 to 1989. The objectives were to: a) determine the predominant average weight range of feeder cattle placement weights; b) to ascertain if a trend in placement weights exists and if any existing placement weight trend can be expected to continue; and c) to describe the distribution of placement weights. This study stops short of addressing the problems that may or may not exist if actual placement weights are found to be different than the range specified in the feeder cattle contract. It is hypothesized however that basis volatility will be higher for cattle whose weights lie outside or at the extremes of the weight range specified.

Public data sources such as the USDA and state agricultural statistics divisions do not report feedlot placement weight data. Therefore, any estimate of feedlot placement weights must be based on private data. A private data set was obtained from monthly newsletters of a consulting company (Professional Cattle Consultants of Weatherford, Oklahoma, hereinafter referred to as PCC). Considerable data on average placement weight, ration cost, and hay cost were recorded by PCC. This data set contains a historical summary from April 1978 to March 1989 of the average monthly placement weights, by specific region, of all pens of cattle placed on feed by approximately 120 feedlots. In every year since 1978, the set of feedlots supplying data to PCC fed approximately 25 percent of all the cattle fed in the United States.

The heaviest concentration of feedlots in this data set is in the Southern High Plains, specifically the panhandles of Texas and Oklahoma, Eastern Colorado, and the western two-thirds of Kansas and Nebraska. Smaller representations are present for Southern Texas and the Corn Belt. Data is distinguished according to six regions, including Southern Texas, the Southern Plains, the Central Plains, the Northern Plains, the Corn Belt, and the Desert. Hence, regional analysis of placement weight trends as well as a composite industry analysis can be done. Figure 1 displays the approximate boundaries of the six regions considered. These regional delineations were made because of perceived significant differences in characteristics of typical feedlots in these regions.

The data set is believed to reflect the feedlot placement weight trends and average levels across eight states. These states include: Colorado, Iowa, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, and Texas. Together these states account for approximately 70 percent of all the cattle fed in the United States.

Figure 1. PCC Regional Areas Map

A state-by-state breakdown of the data has not been kept. Hence, it is not possible quantitatively to assess if the distribution of total placements made by the reporting feedlots in each state is roughly equivalent to the distribution of total fed cattle placements in each state as reported by the USDA.

In addition to placement weight data, the data set also contained price data for feed costs. Specifically, the data reported the average price paid per ton for concentrate feed rations and the average price paid per ton of alfalfa hay. However, these feed cost data were not available by region. Hence it could only be used in conjunction with PCC industry average data.

Linear regression was used to analyze this data to determine the trend and seasonality of placement weights. The effects of ration cost and hay cost on placement weights were also examined based on the PCC compiled industry average.

Regional Differences

There are some apparent differences among the regions as to the extent of the increase in placement weights, but nonetheless all regions have shown a noticeable increase since 1978. Their individual trend graphs indicate an upward trend has been established since 1978 in all the regions. The Plains regions appear to have increased their placement weights approximately five to seven pounds per year. The Desert region consistently placed the lightest weight cattle during the time span that it was recorded. However, regression revealed that during that same period the Desert was increasing its placement weights approximately eleven pounds per year.

Figures 2-6 display the regional placement weight trends and provide their representative equations.

The trend graph for the Desert region depicts a shorter time period. This is due to the fact that PCC opted to drop the Desert region from its data set because it has a very small number of placements relative to the other regions, thus making its impact on the industry average slight. Due to the fact the South Texas region also had a small data sample as well as inconsistent reporting, it was not possible to estimate its trend. Because the Desert region and Southern Texas region data series were dropped from the industry average data series during the data period over which the equations were fitted, concern existed as to possible biases in the trend parameter estimates for the industry composite trend. (The trend line estimated for the industry average composite is graphed in Figure 7). Several dummy variables representing slope changes and intercept shifts coinciding with the termination date of data collection for these two regions were tested. All dummy variables tested were found to be insignificant and relatively small in magnitude. In addition, it is noteworthy that the Northern Plains and Corn Belt regions had average placement weights above 700 pounds continuously over the period from 1978 to 1989. Indeed, in a number of years the average placement weight in the Corn Belt was above 800 pounds. The average placement weights in the Central Plains region, the third of the three most important regions, trended upward and rose above 700 pounds in the same year as the industry average (i.e., 1983). Average placement weights in the Southern Plains also trended upward and are currently very close to an average of 700 pounds.

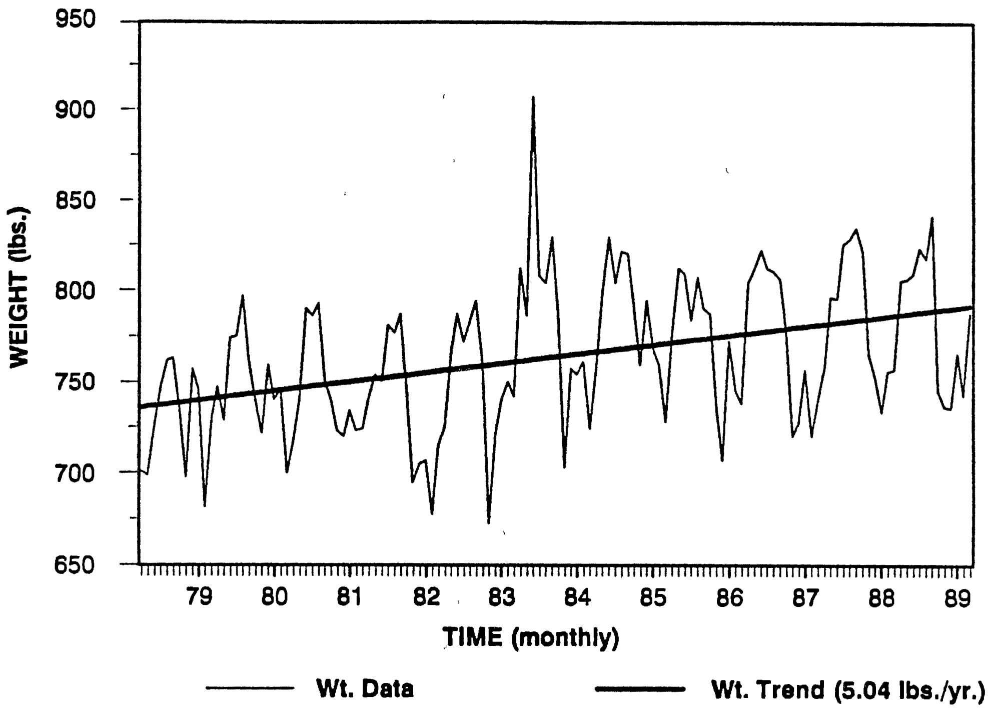

Figure 2. Regional Placement Weight Trend Analysis (North Plains) 1978 to 1989

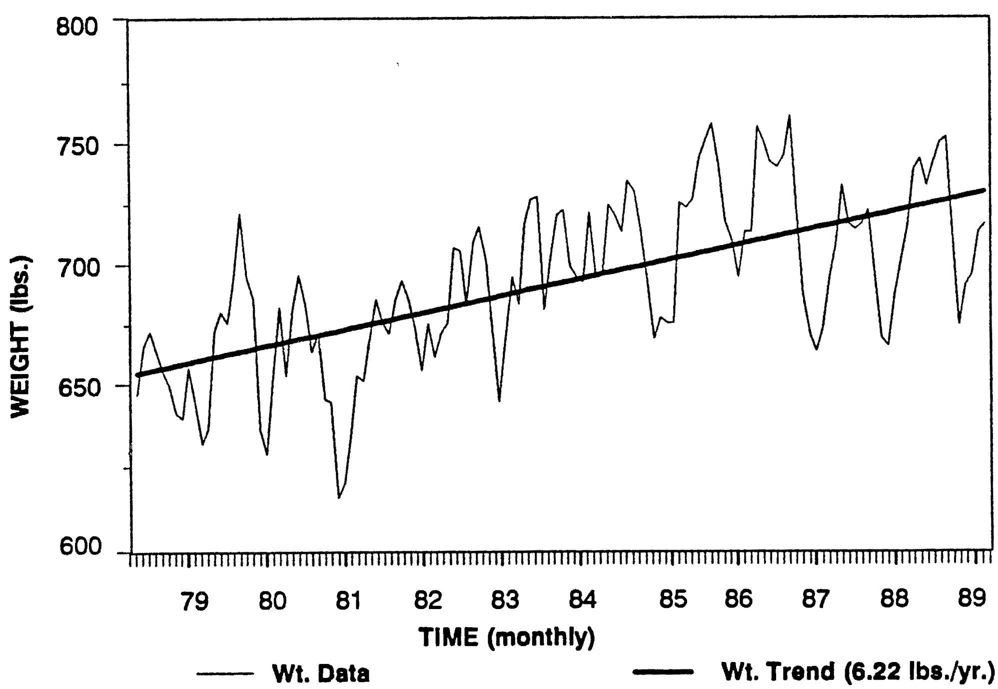

Figure 3. Regional Placement Weight Trend Analysis (Central Plains) 1978 to 1989

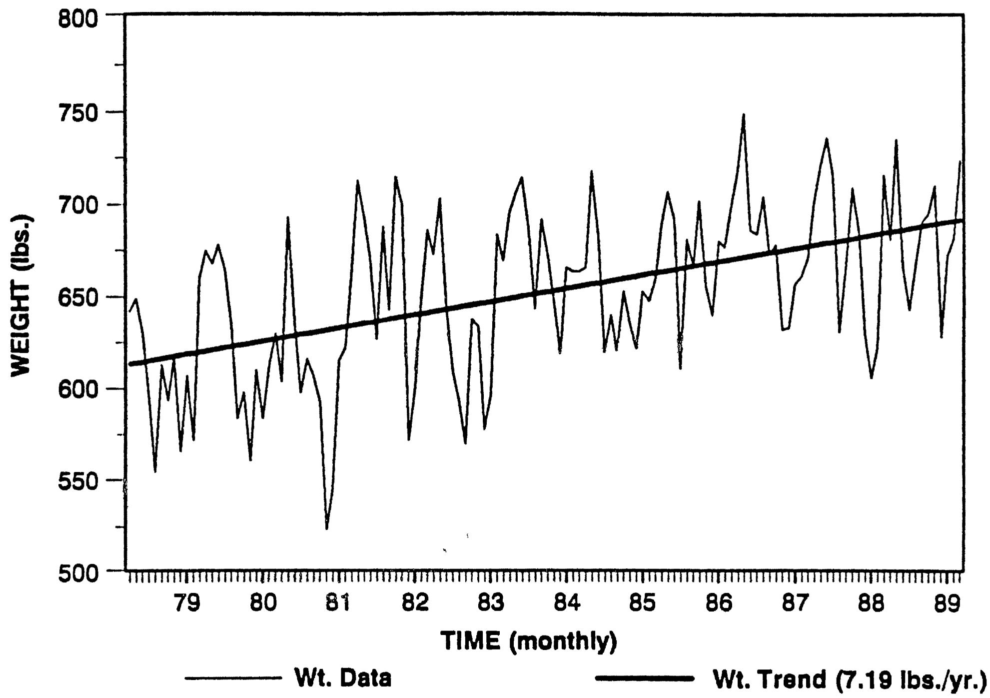

Figure 4. Regional Placement Weight Trend Analysis (South Plains) 1978 to 1989

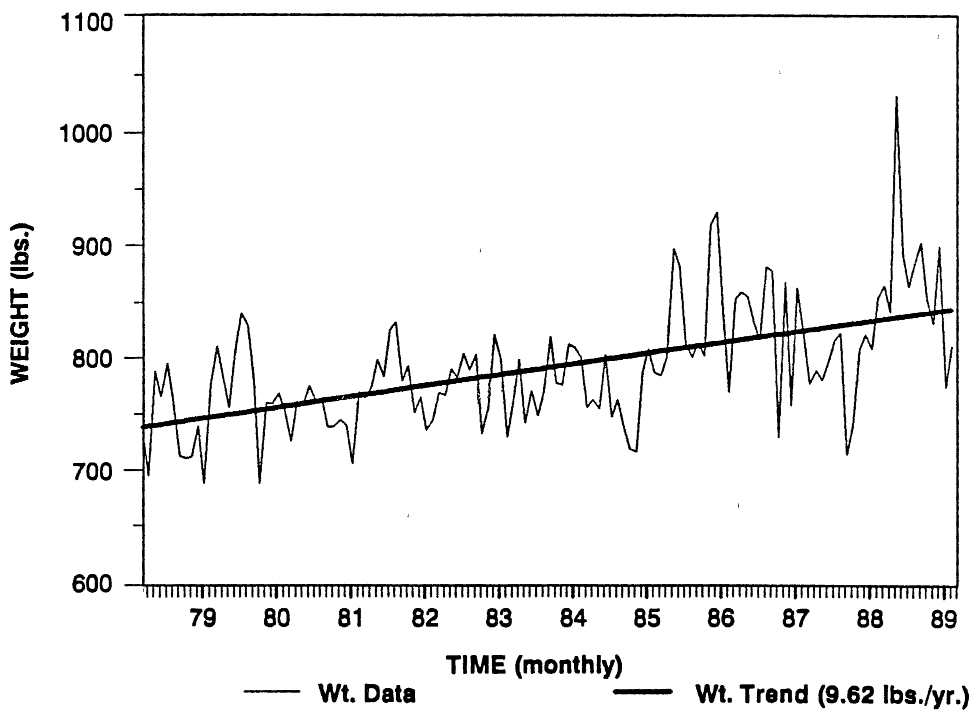

Figure 5. Regional Placement Weight Trend Analysis (Corn Belt) 1978 to 1989

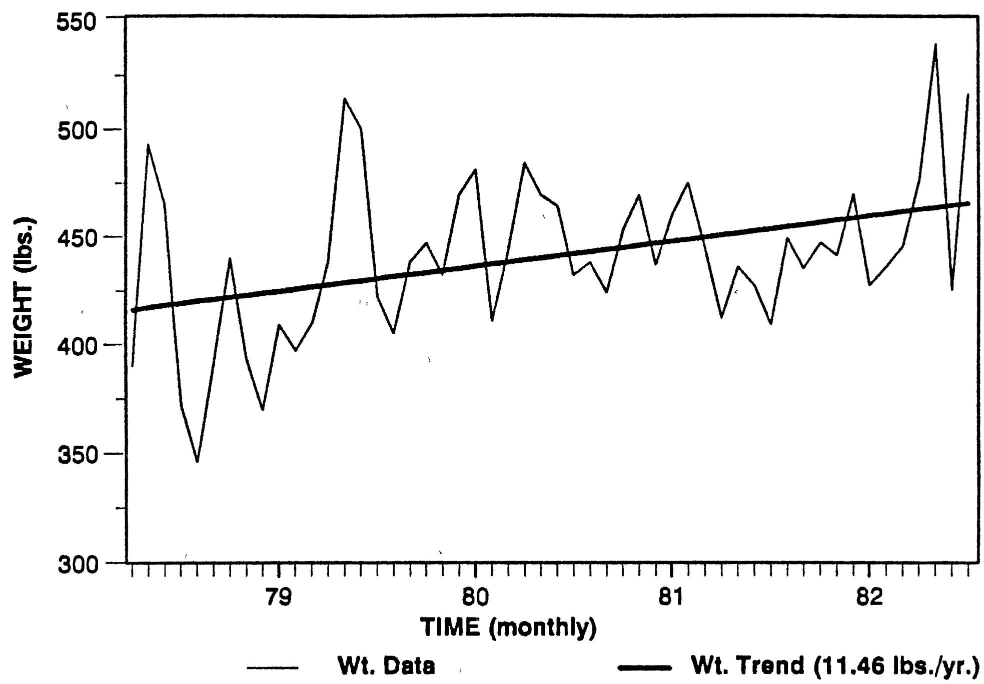

Figure 6. Regional Placement Weight Trend Analysis (Desert) 1978 to 1982

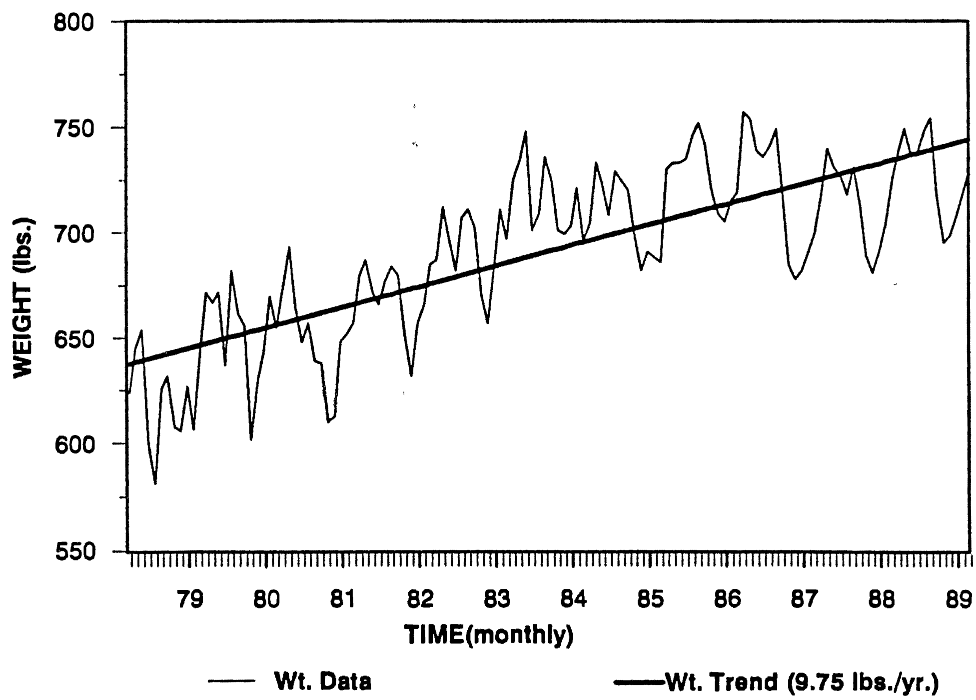

Figure 7. Placement Weight Trend Analysis (Industry Average) 1978 to 1989

Only Southern Texas, and the Desert region (to the extent data are available to describe it) continue to have average placements significantly below 700 pounds.

Although the data analyzed was not conclusive as to the magnitude of the trend difference in each region, it was significantly conclusive regarding the positive slope of the placement weight trend in each region. Further research is necessary before actual regional differences in placement weights can be estimated.

Industry Models

Simple trend models of the regional data indicated an upward trend existed in the placement weights for all regions and for the composite industry data series. However, the regional models were unable to consider whether changing feed costs had an influence upon placement weights due to the incomplete regional data series for ration and hay price. Likewise, casual observation of Figure 7 suggests that the rate of increase in placement weights over time began to slow some time around 1983 and 1984. This same possible change in slope of the placement weight trend also appears in the data for the Central and South plains regions (Figs. 3 and 4) which are two of the larger regions in the data set. Given these considerations the following composite industry model was estimated. The coefficients for all parameters and the coinciding standard errors and t-statistics are given in Equation 2.1. The variables "DFeb" through "DDec" represent the seasonal dummy variables for the months February through December. Concentrate feed ration cost is identified by "$Ration" and the identification for hay cost is "$Hay".

Equation 2.1

Variable	Coefficient	Std. Error	T-Statistic
Constant	-643.66	71.22	- 9.04
Time	15.78	0.96	16.52
(Time - 4/84)*DumK	- 12.70	2.40	- 5.28
DFeb	8.67	5.70	1.52
DMar	11.70	5.70	2.05
DApr	31.45	5.73	5.49
DMay	41.52	5.82	7.14
DJune	32.37	6.02	5.38
DJuly	12.90	6.25	2.06
DAug	22.95	6.22	3.69
DSept	30.41	5.91	5.15
DOct	19.86	5.75	3.45
DNov	- 8.90	5.71	- 1.56
DDec	- 13.95	5.71	- 2.44
$Ration	0.31	0.19	1.65
$Hay	- 0.44	0.26	- 1.67
MA(1)	0.42	0.09	4.47

R^2 = .903 D-W = 1.87

The model was corrected for serial correlation using a moving average process of order one (i.e., a MA (1) model).

<u>Estimated Time Trend</u>

Several approaches were used to estimate whether or not a change occurred in the placement weight trend during 1983 and 1984. They included the use of a nonlinear time variable (time squared and the log of time) and the use of a dummy variable to place a "kink" in the time trend. The approach achieving the most explanatory power was to inject a kink in the time trend. By systematic search, it was found that the best fit equation was achieved by placing the kink at the fourth month of 1984. The dummy variable is represented in the equation as (Time-4\84)*DumK.

A graph of the kinked function developed is displayed in Figure 8. The graph indicates that the average placement weight exceeded 700 pounds in mid 1983. Following the trend change of early 1984, the magnitude of the upward slope in trend decreased, but an upward slope, although slight, continued to be evident without any indication of immediate reversal or that the average was going to fall below 700 pounds in the near future.

The data this graph is based on does not allow one to determine or analyze the causes of this upward trend. Speculation, however, suggests that increased use of new technology has had a significant impact on the industry. Carefully planned crossbreeding programs utilizing genetic improvements along with the adoption of the use of implants and other managerial tools, have likely increased weaning weights and feedlot placement weights.

More stocker producers attempting to take advantage of the rapid early gains achieved by stocker cattle is a feasible explanation to the cause as well. An increase in backgrounding activity is possible if producer willingness to accept the extended period of risk has increased. This extended period can be a potentially valuable period because it allows them to take advantage of the increased gains instead of passing them on to the cattle feeder.

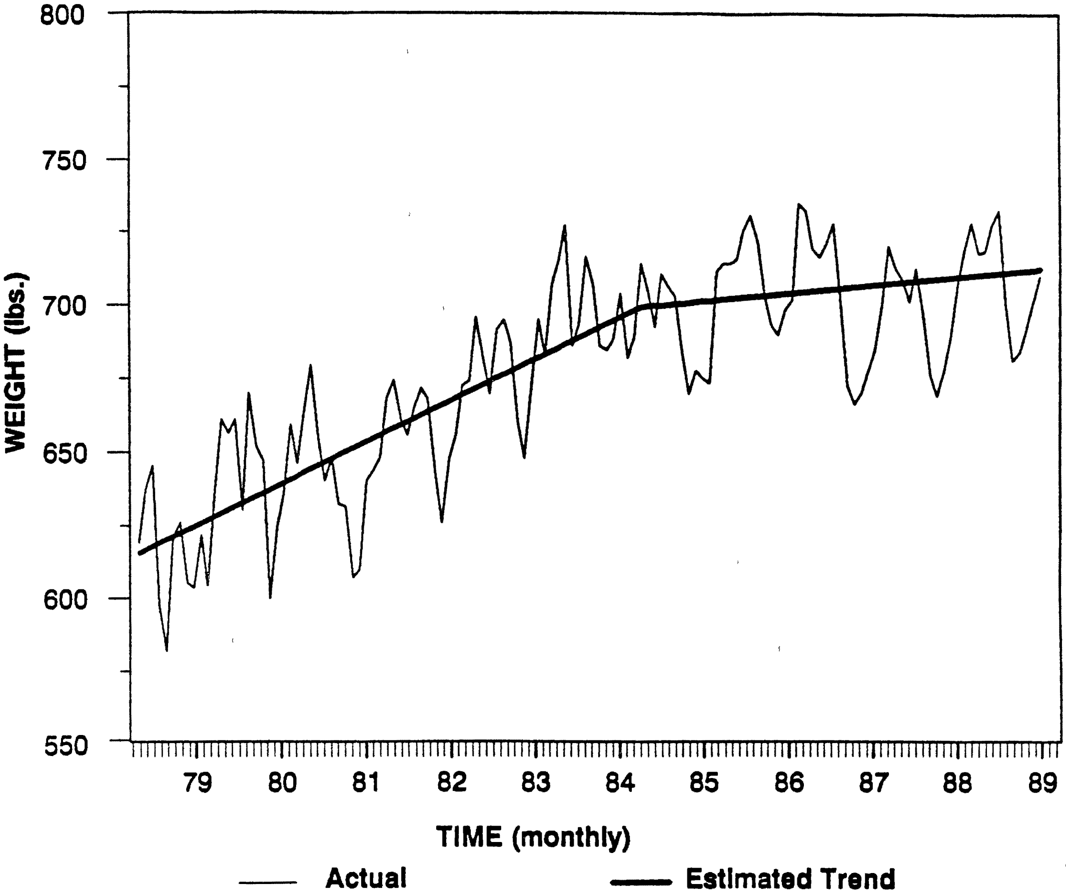

Figure 8. Kinked Placement Weight Trend Analysis (Industry Average) 1978 to 1989

Cattle numbers can impact the trend as well. When the availability of feeder cattle became extremely low as in 1987, feedlot managers and owners were forced to buy less desirable weight and quality cattle to assure that overhead costs were covered. These are but a few of the possible factors that can alter the trend.

The reason for the kink found to exist in the data has not been analyzed. Opinions of animal scientists and industry experts regarding this kink focus on the fact that no significant new crossbreeding programs or animal growth hormones have come forth since the early 1980's. Thus, much of the rise prior to the early 1980's was likely due to the aforementioned technological factors and the adjustment incentives they generated. Continued slow growth in placement weights after April 1984 is attributed to late adoption of these technologies by remaining portions of the industry as well as continued marginal improvements of feeding technology in the cattle industry. Certainly to resolve the specific cause of the estimated upward trend in feeder cattle placement weights, there is need for additional research.

Estimated Seasonality Pattern

Careful evaluation of Figures 7 and 8 suggest rather regular annual peaks and lows in the data. Dummy variables were included in the industry wide model to remove this seasonality. The dummy variables estimated by Equation 2.1 were plotted to create the bar graph in Figure 9 with January being used as the reference month. Therefore, the values plotted represent the increase or decrease in the placement weight for a given month relative to January's average placement weights.

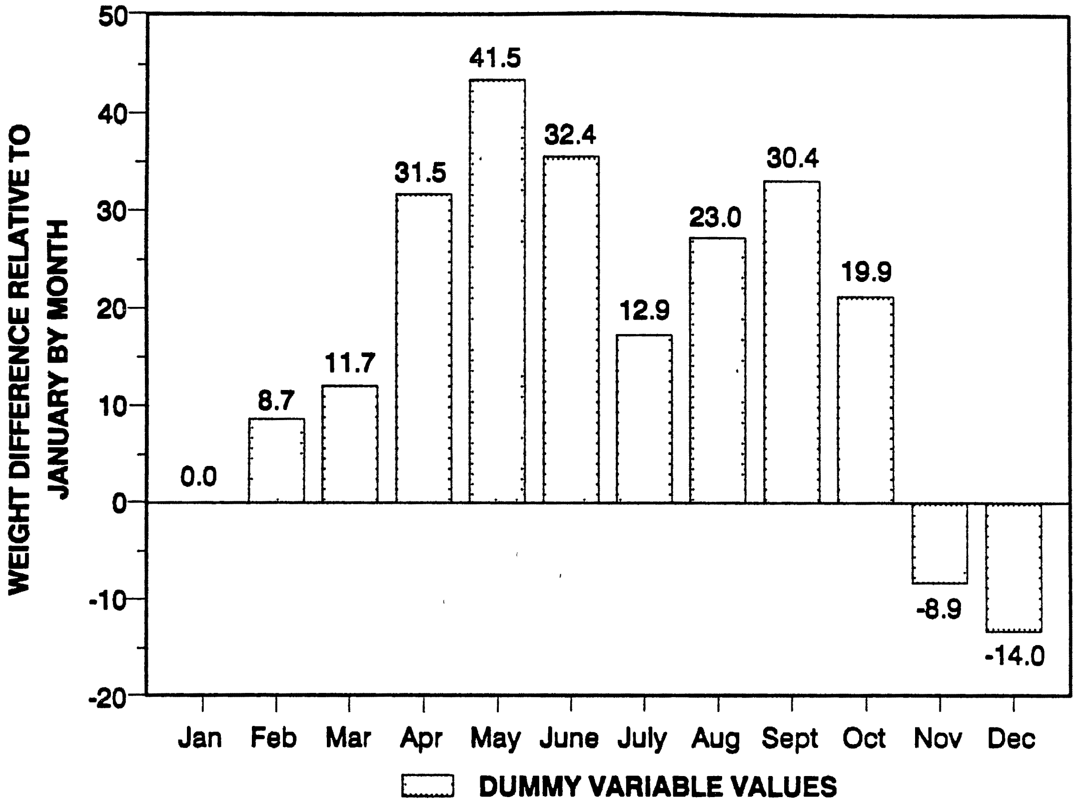

Figure 9. Estimated Seasonal Variation in Placement Weights (Industry Average) 1978 to 1989

Feeder cattle are expected to be heavier during the months that stocker cattle are coming off wheat and grass pasture. The bar graph indicates that placement weights increase until May and then decline rather irregularly to a low in December. The May peak likely coincides with the end of wheat pasture and spring grass winter backgrounding programs. Summer grass backgrounding programs likely end with the September rise in placement weights. Seasonality is a large contributor to variation from the basic time trend as evidenced by the magnitude of the dummy variable parameters.

Estimated Impact of Feed Costs

One unanticipated discovery from this study was the impact that ration and hay costs had on placement weights. Variations in feed costs were hypothesized to provide incentives to vary placement weights. One would hypothesize that as the cost of concentrate feed ration increases, the incentive for cattle feeders would be to shorten the feeding period by increasing placement weights and conversely, placement weights would decline as ration costs decrease. The parameter for $Ration should therefore be positive. Backgrounding costs (as proxied by hay price) is hypothesized to impact placement weights as well although in a reverse fashion. The expected sign on the $Hay parameter would be negative. High backgrounding costs would give an incentive for stocker producers to shorten the backgrounding period resulting in a reduced number of heavier stockers and thus forcing a downward swing in the placement weights. In order to accurately isolate any trends existing in placement weights over time, variations in placement weight attributable to changes in feed costs should be removed.

The two feed cost variables were found to have little impact on placement weight variation relative to the other factors (i.e., time and seasonality). Alternative model specifications of the two feed cost variables were examined, including specification of the concentrate and hay price as a ration and as a difference. Another alternative tested was to delete the hay price variable. None of these specifications were found to be better.

It was recognized that seasonality likely exists in concentrate and hay prices. Presumably, the dummy variables explain variation in seasonal placement weights due to hay and concentrate seasonal price variation as well as other factors. The intent of including the concentrate and hay price variables in the model was to evaluate the impact of long term shifts in concentrate and hay prices on placement weight separate from any seasonal impacts.

Even though ration and hay costs impacted placement weights the least amount relative to the other variables in the model, ration cost was found to have a statistically significant parameter at the 0.10 level with the anticipated sign. As previously stated, placement weights are expected to move in the same direction as ration costs, thus requiring a positive sign.

The use of hay costs in this analysis to represent grazing costs for backgrounding feeder cattle disclosed a similar outcome in that the statistical significance of the hay cost variable was at the 0.10 level and it contained the expected sign. Assuming hay costs are a reasonable proxy for grazing/backgrounding costs, the expected sign for hay price was negative because placement weights are hypothesized to swing in the opposite direction of grazing costs as previously indicated in the discussion.

The magnitude of the impact of hay and grain prices (finishing ration costs) on placement weights versus seasonality and trend is well illustrated by several examples. First, the placement weight change between March of 1987 when ration costs were at a relatively low price level and March of 1989 when ration costs were relatively high were estimated with the model. The ration costs increased during this period from $114.48 to $158.37. The finish ration price over time is graphed in Figure 10. Assuming hay prices were constant over this period, the estimated change in placement weights would be 19.6 pounds. Using the ration price level change and the model parameters for ration costs and time, the estimated placement weight change was partitioned. The change in ration costs would be expected to cause a 13.5 pound increase in placement weights with time being responsible for the remaining six pounds. However, hay costs were not constant as they increased significantly by escalating from $61.39 to $103.93 during this same period. Hay prices over time are shown in Figure 11. Considering the hay cost parameter, this change was expected to reduce placement weights 18.5 pounds and thus the resulting net gain effect due to the ration and hay price shifts would be approximately one pound.

To further evaluate the impact of the two feed variables, another sensitivity test was generated by analyzing the maximum and minimum spread between ration and hay costs. Figure 12 illustrates the price spread over time between ration and hay costs. The widest historical spread of the examined period occurred in August of 1983 and was $96.21.

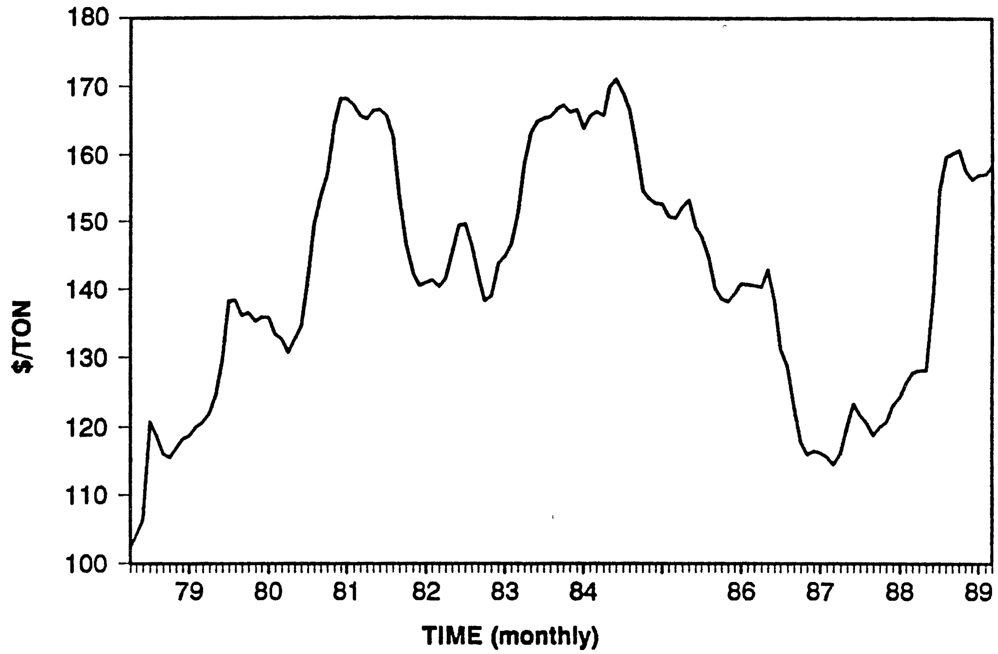

Figure 10. Finish Ration Price (Industry Average) 1978 to 1989

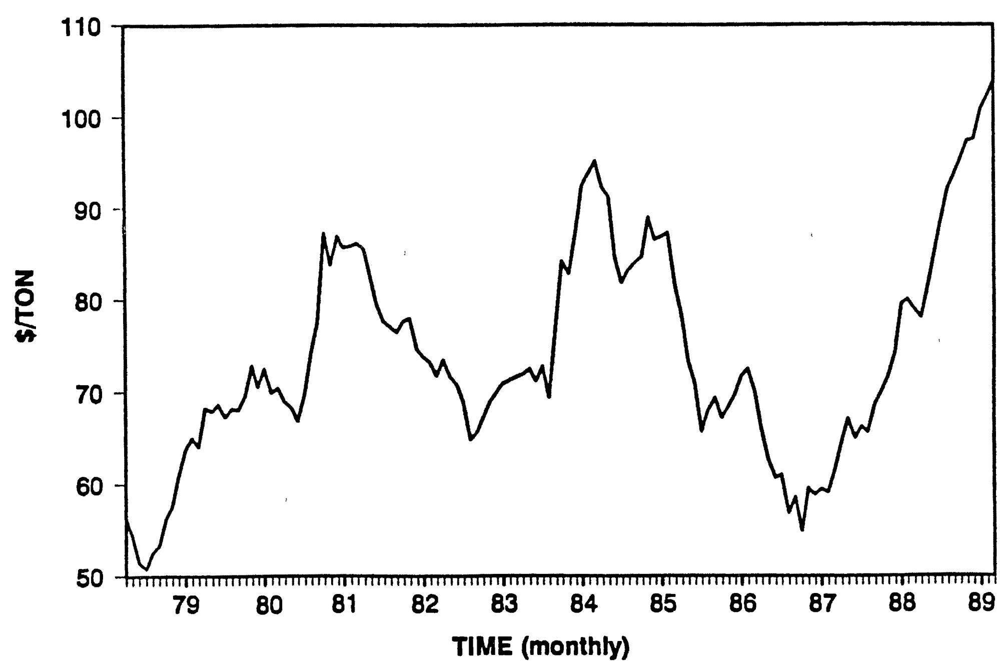

Figure 11. Alfalfa Hay Price (Industry Average) 1978 to 1989

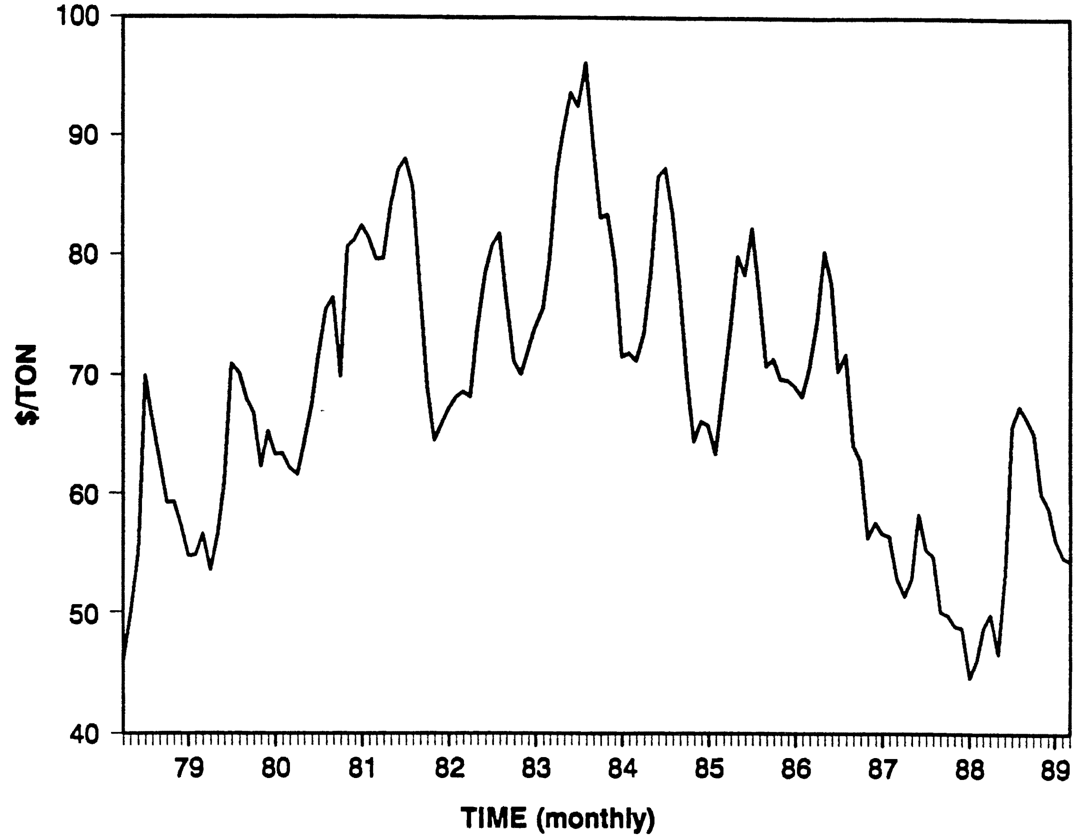

Figure 12. Ration - Alfalfa Price Spread (Industry Average) 1978 to 1989

The narrowest spread was $44.73 and occurred in January of 1988. If time and seasonality are held constant, this change in the ration/hay cost spread is calculated to produce approximately a 17 pound change in placement weights. This predicted 17 pound change translates to the maximum change expected from the widest to narrowest spread found in 10 years. This is a relatively small change when compared to the 55 pound variation that can occur within a single year due to seasonality. Hence, the original hypothesis that feeder cattle placement weights were extremely sensitive to changes in feed costs was rejected. A possible alternative hypothesis is that placement weights are not sensitive to feed costs because feeder cattle prices are. That is feed costs effect the structure of feeder cattle prices and that prices adjust the profit levels such that the incentive to alter placement weights is expunged by the same weights of cattle remaining the most profitable to feed. However, further research is needed to address this hypothesis.

Additional Considerations

In conducting the analysis of placement weight trends, a concern arose that shifts in the timing of placements during the year could change the annual average placement weights. Figure 13 indicates that the average number of placements per month as reported by the United States Department of Agriculture (USDA) between 1978 and 1989 varied significantly from month to month.

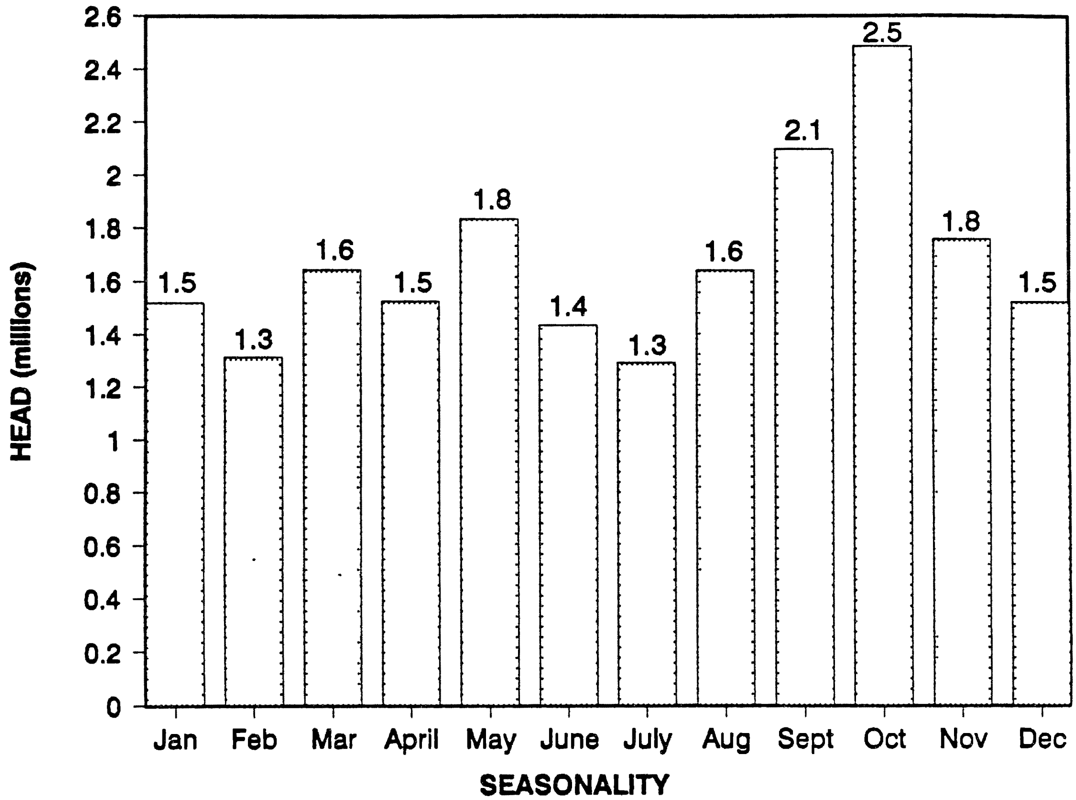

Figure 13. Average Number of Monthly Placements (USDA Reported) 1978 to 1989

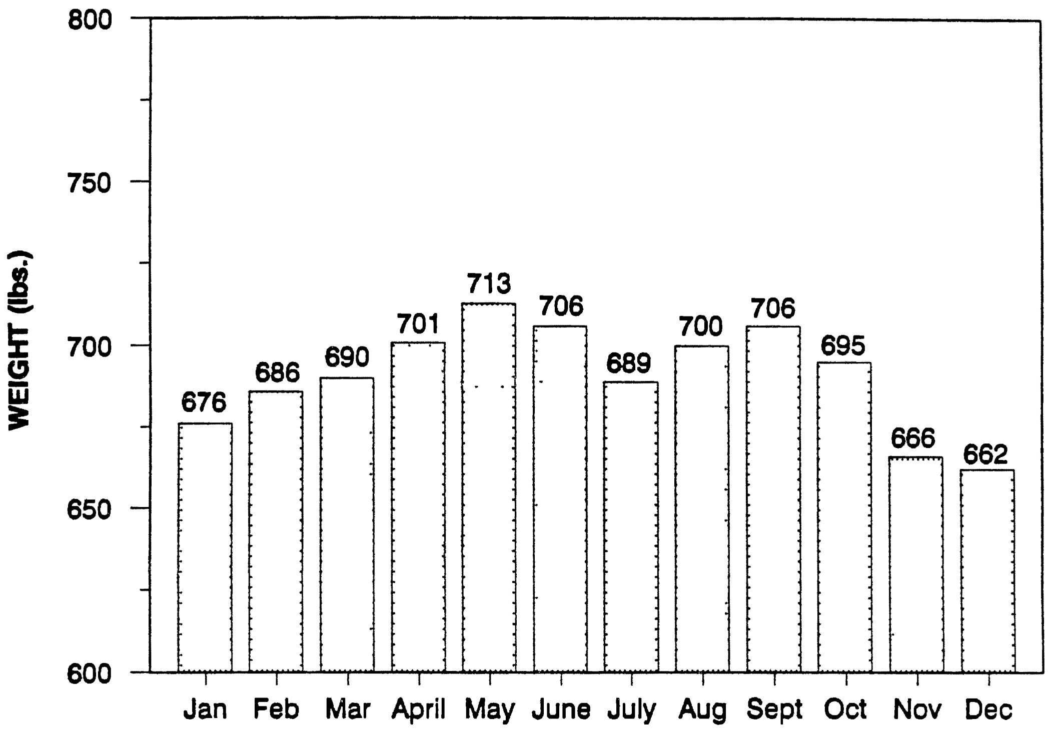

Figure 14. Average Seasonal Placement Weights (Industry Average)
1978 to 1989

Substantial seasonal changes in placement weights were indicated by the dummy variable parameters obtained through regression analysis (Figure 9) and again in the graph of seasonal variation of PCC reported placement weights constructed by using simple averages (Figure 14). In viewing Figure 13 and these two seasonal graphs, concern arises with regard to the potential that the simple annual average of the monthly placement weights may be significantly different than the weighted annual average of the monthly placement weights. Likewise, it is possible that the weighted annual average placement weight could change significantly over time without the monthly average placement weights changing (thus without the simple average of monthly placement weights changing) if, for example larger and larger percentages of cattle were placed over time during months of high average placement weights. Since the placement weight trend analysis considers only average monthly placement weights, and not the number of animals placed in each month, this possibility was a concern. The validity of this concern can be investigated by determining if the simple average annual placement weight has varied over time from the weighted average annual placement weight.

Table II reports both the simple and weighted annual average placement weights for the years 1979 through 1988. The simple average was calculated by summing the placement weights of each month of the year and dividing by twelve. Thus each month received the same weight. The weighted average was determined by multiplying each month's average placement weight by the percentage of cattle placed during the year in that month. Thus the weight for each month was proportional to the percentage of cattle placed that month. Casual observation of the two data series reveals no obvious differences in the simple versus the weighted average series.

TABLE II

PLACEMENT WEIGHT CALCULATION PROCEDURE DIFFERENCES

Year	Simple Avg.	Weighted Avg.
1979	646.33	646.81
1980	650.42	649.24
1981	665.58	667.40
1982	686.08	688.24
1983	714.25	715.87
1984	711.75	712.23
1985	722.08	723.95
1986	724.83	725.46
1987	709.92	711.57
1988	724.67	725.78

The simple averaging technique yielded an average over the entire period of 695.59 while the weighted average yielded an average of 696.65.

Placement Weight Distribution Considerations

The linear regression results previously reported are based on monthly average placement weight values. They do not show whether the distribution underlying these averages is broad or narrow or perhaps skewed in some fashion. In response to this failure, additional analysis work was completed to calculate the distribution of placement weights and to ascertain if this distribution has changed over time.

P.C.C. Placement Weight Distribution

Figure 15 depicts the distribution of placement weights as reported by PCC. As indicated previously, a primary concern being addressed is the speculation that the average placement weight has risen significantly above 700 pounds. Linear regression showed this to be the case. The results of linear regression are reinforced by the placement weight distribution graph. The percentage of animals placed above 700 pounds can be roughly calculated from the weight categories in Figure 15 by assuming a uniform weight distribution of the animals in the 651 to 725 pound group. This assumption leads to the allocation of one third of the animals in this group to be in the over 700 pound category. Based on this allocation, it was found that the distribution is substantially skewed to the left with approximately 61 percent of the placements weighing 700 pounds or more.

Further analysis of the placement weight distribution data reported by PCC was conducted to determine if the distribution had shifted over time. The nature of this analysis requires some detailed explanation of the data and procedure. PCC reports the average placement weight of cattle and the total number of cattle placed each month by region and month of placement. This data was used in the placement weight trend analysis previously reported.

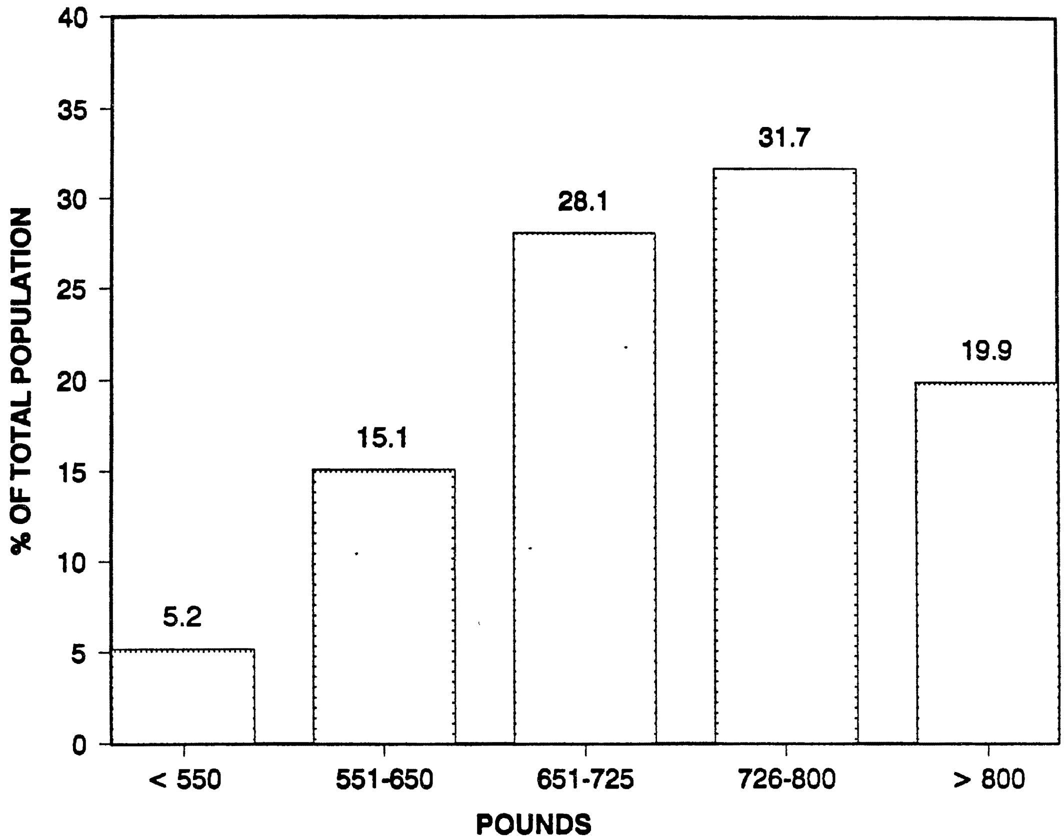

Figure 15. Reported PCC Placement Weight Distribution (Industry Average) 1978 to 1989

However, detailed data of the placement distribution (weight ranges as reported in Figure 15) are only available from the "closeout sheet" summaries compiled by PCC. The closeout sheet data report the placement weight distributions of cattle marketed during a given month. The placement dates/months of cattle marketed in a given month varies. In general, the placement month is approximately four to five months prior to the marketing month. The PCC closeout sheet data is compiled in such a way that it is impossible to precisely determine the placement month of cattle marketed in a given month. However, knowledge of the placement month is not needed to construct weight distribution histograms because the histogram is not month specific.

To analyze whether the placement weight distribution (histogram) has changed over time, the data must be separated into two or more data periods. It was felt that because of the size of the PCC sample (i.e., it includes 25 percent of all cattle fed) it provides a reasonable representation of the total industry's placement weight distribution for each month. However, the change in the total number of cattle marketed from month to month and over time by PCC client feedlots versus the total industry was not assumed to necessarily be the same (i.e., PCC marketings could change significantly due to addition or deletions of clientele from month to month). Thus in comparing placement weight distributions between two time periods it was deemed more accurate to use the USDA Cattle on Feed Report to determine animal numbers in each period rather than PCC data. Therefore, the procedure employed was to use the monthly placement weight distribution (as reflected in the PCC marketings closeout sheet summaries) to allocate the USDA reported marketings number into weight groups for the same month. The allocated USDA marketings data was then summed by weight groupings over the period in question to form a specific period histogram. In essence, this procedure amounts to "weighting" the monthly PCC closeout sheet placement weight distributions by the USDA reported industry wide marketings.

The procedure described above was used to form the histogram displayed in Figure 16. Two time periods were considered. The first period included data from January 1983 to December 1985. September of 1986 was the date the cash settlement was implemented by the Chicago Mercantile Exchange and the United States Feeder Steer Price (USFSP), more commonly known as the Cattle-Fax Price started being calculated. The other period included data from January 1986 to December 1988 which represented the time period following and including the implementation. The graph indicates that all weight classes below 700 pounds decreased between these two periods, while all weight classes above 700 pounds increased. Allocating the animals in the 651 to 700 pound class as previously described, revealed that approximately 58 percent of the cattle marketed had been placed weighing 700 pounds or more during the three-year period from 1983 to 1985, whereas, the three-year average from 1986 to 1988 showed an increase in placements above 700 pounds to approximately 65 percent of the total. Conversely, the 42 percent of cattle placed weighing less than 700 pounds prior to 1986 fell to 35 percent for the post-1986 average.

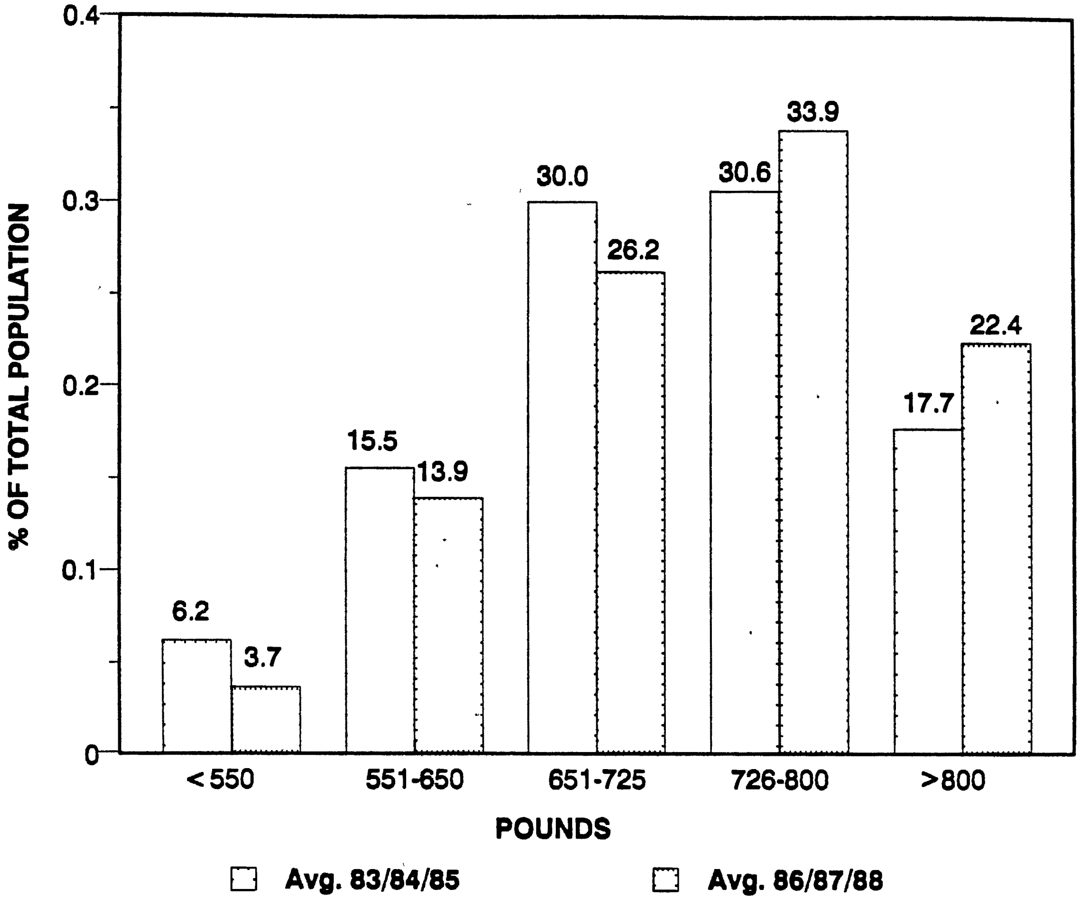

Figure 16. Reported PCC Placement Weight Distribution Trend (Industry Average) 1983 to 1988

Summary

The primary goal of this study was to ascertain if placement weights have increased significantly over the last 10 years and to identify the presence of any trends. If a trend did indeed exist, then for the purpose of determining cash settlement costs, a search for the period when average weights rose above 700 pounds was also of interest.

A major trend was concluded to exist for placement weights that was relatively strong until May of 1984, after which it slowed considerably but continued. It was also discovered that average placement weights surpassed 700 pounds in early 1983 and that the present trend demonstrates no signs of reversal. The model tested explained 90 percent of the variation found in feeder cattle placement weights. It indicated that significant seasonality existed and that concentrate feed ration and alfalfa hay did not contribute to placement weight variation in proportion to time and seasonality. Pertinent to the analysis conducted here is the fact that the results do not support the concern/possible argument that the record-high average steer placement weights of the past few years are due to temporary abnormal feed price levels.

It is also notable that approximately 67 percent (two-thirds) of all steers placed on feed fell in the 600 to 800 pound weight range over which the U.S. Feeder Steer Price is calculated. However, nearly twice as many of the animals placed within this weight range were placed at weights between 700 to 800 pounds versus 600 to 700 pounds (i.e., 41/67 or roughly 61 percent of the steers placed over the weight range from 600 to 800 pounds weighed more than 700 pounds).

This study indicated further evidence of increasing placement weights over time when the time period was divided into pre-1986 and post-1986 three year averages. Specifically, it revealed that the percentage of cattle placed that weighed more than 700 pounds increased between the two periods from 58 percent to approximately 65 percent. Likewise, the percentage weighing less than 700 pounds fell from 42 percent to approximately 35 percent.

As a final note, this study does suggest the current weight range used with the U.S. Feeder Steer Price does not appropriately represent the bulk of the contracting activity and reassessment of the formula could be required. Consequently, it also suggests that possible adjustments to the current CME Feeder Cattle Contract weight specifications should be made. However, it does not address the question of whether the contract fails or if basis variability is increased with the inappropriate weight range. Further research is justified in this area to gain a better understanding of basis volatility between the current contract and different weights of cattle, as well as the potential basis volatility between a new contract with perhaps a higher and/or narrower weight range, and different weights of cattle.

CHAPTER III

EXPLAINING BASIS BEHAVIOR

Accurate prediction of the basis at the time the hedge is to be completed is the key to making a successful hedge. If the accuracy of the basis estimation/forecasting methods employed does not exceed the accuracy level present in the cash price estimation/forecasting techniques, the level of marketing risk with hedging is comparable to that experienced when selling cattle in the cash market. Price asserted that the basis between the feeder cattle futures contract price and the current cash price is a residual value that reflects variations in expectations (Price et al., 1979). Because the specifications of the feeder cattle contract have recently changed, it has been hypothesized that the residual (basis) should have changed as well. This study was undertaken to respond to this issue and to develop an improved basis estimation procedure by explaining factors that influence basis behavior.

Feeder Cattle Contract Changes

The contract alterations that took effect beginning with the September 1986 contract were designed with the intent of correcting problems existing with the previous contract. The most significant changes made were the elimination of physical delivery and weight specification change. Cash settlement replaced physical delivery as an alternative for completion of the hedger's commitment. If producers have not offset their initial futures market position by the day after the contract expires, his/her transaction will be terminated by a cash settlement based on the United States Feeder Steer Price (USFSP). The USFSP is a seven day moving average price calculated by Cattle-Fax. The settlement price is established by the difference between the USFSP price and the closing contract price on the last day of trading. To participate in a cash settlement, the producer lets the contract expire without offsetting the future's position and the clearing house of the Chicago Mercantile Exchange (CME) executes the settlement.

All transactions performed in the futures market are required to conclude by the closing date of the contract month. Previously, there were two available alternatives to complete a futures market transaction. The first alternative was to offset the initial futures market transaction by executing an equal but opposite transaction after the commodity had been bought/sold in the cash market. For example, stocker cattle producers purchasing cattle would initially sell an appropriate number of feeder cattle contracts to establish a hedged position. Producers terminate their cash position when the cattle are sold in the cash market, but they continue to have a commitment (hold an open position) in the futures market. To close their futures market position, the producer would buy a feeder cattle contract for each contract that was initially sold. The hedge would then be fully executed.

The second alternative available under the old feeder cattle contract for completing a "sell" hedge was to deliver the commodity to a specified delivery market. The producer would not sell the commodity in the cash market but instead would physically deliver it. The contracted price would be received from someone with a long (bought) CME contract. With feeder cattle contract delivery, the cattle were graded by a U.S. Department of Agriculture grader and discounts were applied for any variation from the rigid contract specifications.

The delivery option had its disadvantages. Sellers and buyers were not always satisfied with the grader's perception of the feeder cattle. The sellers complained that the grader was often too strict while the buyers often felt that the graders were too lenient. Additionally, buyers often had their cattle delivered to inappropriate delivery markets and incurred further costs to transport the cattle to a desired location.

Estimating the Basis

Many details have to be acknowledged before the forecasted basis can be estimated. The most important aspect is the futures contract month that will be used to execute the "hedge". The month chosen must be the same month or one following the month in which the cattle will be sold in the cash market. If a month prior to the cash sale month is used, the "hedge" will be completed before the cash sale leaving the producer unprotected against market price volatility during the remaining time the cattle are owned. Once the futures contract month is determined, predicting an appropriate basis to use in feeder cattle hedging is complicated by the fact that many producers want to use the contract to hedge different weights of feeder cattle. The feeder cattle contract has typically been used to hedge cattle for sale/purchase at weights anywhere from 450 to 850 pounds. Producers also need to market feeder cattle in months that do not have contracts. This requires estimating the basis in some instances as much as two months prior to an available contract. In addition, there is the problem of when to place the hedge. Producers will own the cattle for possibly four to five months. They can place the hedge at any time during that period assuming that their financial obligations have not previously dictated the timing of placement. When these questions are resolved, basis estimation can be attempted.

Theoretical Considerations

The traditional method of estimating the forecasted basis for different weights of feeder cattle is to use simple averages of monthly basis values for the weight range of interest. Monthly averages only consider seasonality effects. Seasonality effects on individual animal performance cause substantial volatility in the feeder cattle market. Therefore, this method definitely has merit when additional information is not available and/or if basis behavior is not affected by market fundamentals and factors other than seasonality. This study however will hypothesize that basis behavior is affected by market fundamentals, especially for feeder cattle of a different weight than specified by the contract. If this hypothesis is true, then accuracy of basis estimation can be improved by considering those market fundamentals. The following table illustrates a simple feeder cattle budgeting exercise that forms the foundation for this hypothesis.

Gross revenue is calculated as the total weight of the animal at the end of the feeding phase multiplied by the price per pound expected for that animal. The feeding cost represents the cost that is accrued for the additional pounds gained during the feeding phase. This cost is obtained by multiplying the pounds gained by the calculated cost per pound of gain. Initial assumptions are made prior to the calculation of the finance cost. It is assumed that at breakeven, gross revenue is equal to the expenses and therefore gross revenue is the amount financed. The fraction of the year financed is equal to the days on feed divided by total days in a year. The annual interest rate is then multiplied by this fraction to determine finance costs. Feeding cost and finance costs are summed to equal total costs and are subtracted from gross revenue to obtain net revenue. Net revenue divided by the weight of the animal bought results in the breakeven price per pound.

TABLE III

A FEEDER CATTLE BREAKEVEN BUDGET

Gross Revenue	=	Fed Cattle Weight (lbs.) * Fed Cattle Price ($/lb.)
- Feeding Cost	=	[Fed Cattle Weight (lbs.) - Feeder Cattle Weight (lbs.)] * Cost of Gain ($/lb.))
- Finance Cost	=	Gross Revenue * (Interest rate ÷ 140/365)
Net Revenue		
Breakeven Feeder Cattle Price ($/lb.)	=	Net Revenue ÷ Feeder Cattle Weight

All variables used in the above breakeven budgeting process are expected values, except the purchase weight. If feed is prepurchased, the price of feed may be known, but the total feeding cost is not known since the slaughter weight and individual animal performance are unknown. Furthermore, the impact of a given fed beef or grain price change is not equal for different weights of feeder cattle. The breakeven price for lighter feeder cattle is changed more by a given fed cattle or feed price change than is the breakeven price for heavier feeder cattle. This is true for several reasons. First, the lighter the feeder animal is the fewer pounds the impact of any change in net revenue is spread. For example, a $10.00 change in net revenue changes the breakeven price for a 400 pound animal by $2.50/cwt. The same $10.00 change would change the breakeven price for an 800 pound animal by $1.25/cwt. Secondly, lighter animals have more weight to gain, hence, changes in feed price result in larger net revenue changes for lighter animals than for heavier animals.

The expected breakeven feeder cattle price per pound determines the price that the cattle-feeding industry is willing to pay for feeder cattle. Given the prior budgeting/breakeven equations, it follows that changes in expected fed cattle prices and the price of feed will impact the calculation of an expected feeder cattle breakeven price. Therefore, it is plausible that fed cattle and feed prices will impact basis behavior by causing variations in expected feeder cattle breakeven prices and hence upon feeder cattle demand. This is especially the case if the basis of concern is for feeder cattle of a different weight than the contract specifies and/or the sales date is in a month for which no feeder cattle contract exists.

Data

This study calculated basis estimates for four different weight classes of feeder steers. Basis estimates were calculated for all CME Feeder Cattle futures contract months against USDA reported Oklahoma City cash prices where basis is defined as the cash price minus the futures price.

Feeder cattle futures price data consisted of available price quotes extending from September of 1986 to June of 1990. The price quotes procured from Agriculture Futures, a daily CME information bulletin were Tuesday's closing price. Tuesday normally had the heaviest trading activity at the Oklahoma City market. The beginning of this period corresponded with the beginning of the use of a cash settlement based feeder cattle contract. The Tuesday feeder futures price was subtracted from the weekly average Oklahoma City cash price to produce a weekly basis figure for four classes of feeder cattle (400-500, 500-600, 600-700, and 700-800 pounds). Weekly average cash prices were published in the USDA weekly summary and statistics bulletin titled Livestock Meat and Wool. The basis data for each weight class were partitioned into the current month (nearby) basis and the basis for each of the five months prior to the current expiration month. An example of a current month basis would be a January basis calculated as the difference between an average weekly cash price in January minus the January futures contract price during the same week. An example of a one month prior basis would be a basis calculated as the difference between an average weekly cash price in December and the January futures contract price as priced on the CME during the same week.

Current month basis derived using the data described above are plotted over the time period examined for 400 to 500 and 700 to 800 pound feeders in Figures 17 and 18. The horizontal axis is labeled as weekly observations rather than time. As previously noted the table spans the time period from September of 1986 to June of 1990. However, a current month basis can not be calculated for months that do not have contracts. Hence the observations are not time continuous (i.e., the weeks of non-contract months are omitted).

A change in the magnitude and/or volatility of the basis is evident for both weight groups around May of 1987, which is represented by observations numbered 27 through 30 in Figure 17 and 26 through 29 in Figure 18. The primary cause of this basis pattern change has commonly been linked to the implementation of the new feeder cattle contract in September of 1986. Speculation is that the basis changed after producers and speculators using the new contract learned of the contract's characteristics. During this learning period the basis level and volatility reflected old patterns. But after the learning period, the basis took on its own new and different magnitude and degree of volatility. The validity of this contention will be addressed later in this study.

In order to test the hypothesis that market fundamentals effect basis behavior, live cattle futures price data and cash corn price data were collected. Weekly average southwest Kansas corn price data were collected from <u>Grain and Feed Market News</u> for the period from September of 1986 to June of 1990. Corn prices were included to proxy cost of gain estimates for the cattle feeding industry. Weekly average corn prices are not regularly reported for Oklahoma and therefore,

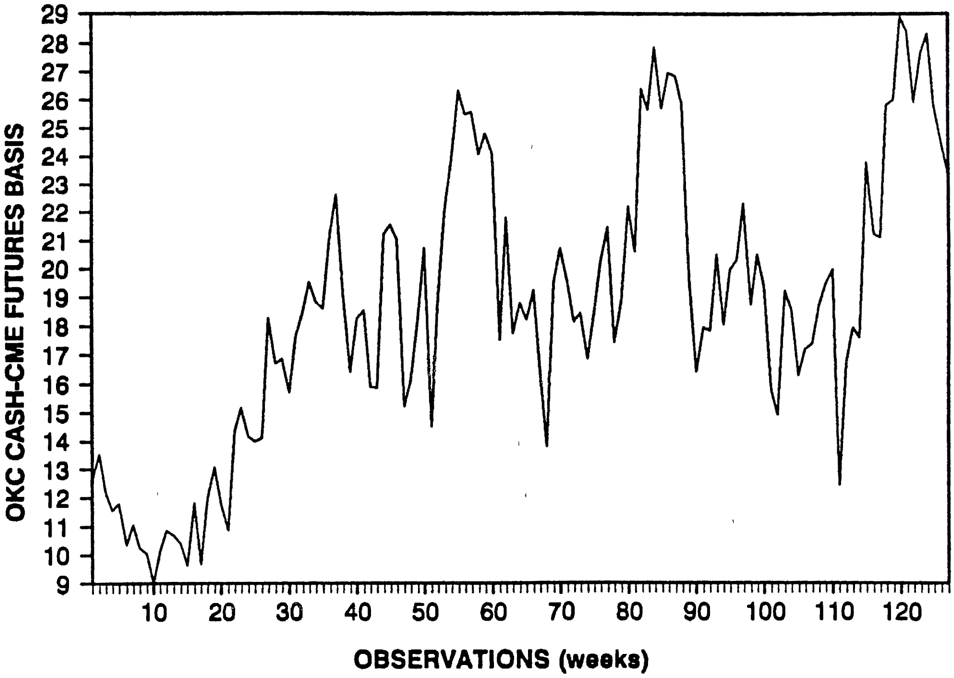

Figure 17. 400-500 lb. Basis Trend

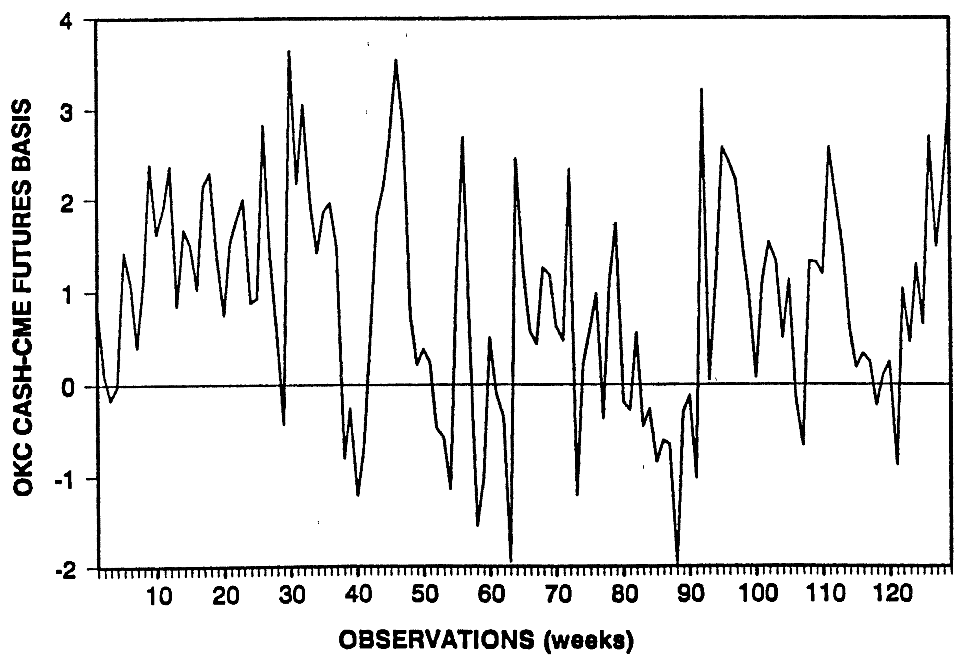

Figure 18. 700-800 lb. Basis Trend

southwest Kansas prices were employed. The Tuesday CME live cattle futures closing prices were obtained from Agriculture Futures to represent expected fed cattle prices.

Additional data were collected for other fundamental variables such as range condition and weekly live cattle cash quotes. Subsequent testing of these variables indicated that they did not add explanatory power beyond that given by consideration of live cattle futures prices and cash corn prices.

Estimated Feeder Cattle Basis Forecasting Equations

Linear regression equations were estimated to explain the effects of market fundamentals on feeder cattle basis behavior. The model chosen as the most accurate included dummy seasonal variables, live cattle futures, and corn price. Dummy variables were included to characterize the effect of seasonality on animal performance and its effects on supply and demand. More complex equations were attempted with additional variables such as squared and cubed live cattle and corn prices but, they too proved to be insignificant variables. Log transformations of the variables were also tried but failed to improve the model.

A question arises as to which live cattle futures contract price best represents the expected slaughter price for a given basis prediction. The live cattle futures month having the greatest impact on feeder cattle price being hedged was hypothesized to be the contract representing the projected month in which the feeder cattle in question would finish their fattening phase in the feedlot. Three different methods were applied to obtain the time span for the fattening phase and thus the appropriate live cattle contract month. One was to use the common "rule of thumb" estimate of 2.5 pounds of gain per day. This method did not recognize potential weight gain differences between weight classes. Another method was to use the average annual days on feed of different weight classes of cattle as reported by Professional Cattle Consultants (PCC). Table IV depicts the results of those averages by weight.

TABLE IV

DAYS ON FEED BY PLACEMENT WEIGHT RANGES

Weight Class	Days on Feed	Months on Feed
400-500 pounds	207.25	7
500-600 pounds	172.92	6
600-700 pounds	143.17	5
700-800 pounds	129.00	5

The third method considered was to use the PCC months on feed value and add one contract month. It was hypothesized that due to the conservative nature of most producer's estimate of growth, one contract beyond that projected as the end of the feeding phase would be viewed as the appropriate market indicator. The method that provided the best statistical strength was the third method (i.e., to use the PCC calculated average feeding period plus one contract month). Table V represents the final pairing between feeder cattle sale month and live cattle futures month used in the model.

TABLE V

LIVE CATTLE FUTURES CONTRACT MONTHS ASSOCIATED WITH DIFFERENT FEEDER CATTLE SALES MONTHS AND SALES WEIGHTS

Feeder Cattle Sale Month	Weight Class			
	400-500	500-600	600-700	700-800
January	October	August	August	August
February	October	October	August	August
March	December	October	October	October
April	December	December	October	October
May	February	December	December	December
June	February	February	December	December
July	April	February	February	February
August	April	April	February	February
September	June	April	April	April
October	June	June	April	April
November	August	June	June	June
December	August	August	June	June

Selection of a corn price to use in each basis forecasting equation was less complicated. The corn price used is the corn price at the time the feeder cattle are projected to be sold. This selection assumes that the relevant corn price for calculating a feeder cattle breakeven price is the one that exists at the beginning of the feeding period.

The regression models estimated are reported in Tables VI through XI. Values in parenthesis below each parameter are the standard errors of the parameters. Table VI reports the basis forecasting equation for each of the four weight groups of cattle assuming the cattle are hedged using the futures contract for the month of sale (i.e., the "current month" contract). The succeeding tables estimate the basis assuming the cattle are hedged using a contract one, two, three, four, or five months after the expected sales month. It might be necessary to use a contract after the sales month because no contract exists for the sales month desired. Likewise, in some cases, it could be desirable to use a contract month other than the sales month contract because of the existing basis relationships. This point will be discussed in more detail later.

A review of the regression results yields a few preliminary observations. The signs on the two market fundamental parameters were all as expected with the exception of the live cattle futures coefficient for the 700 to 800 pound current month equation. Live cattle and corn were expected to have a positive and negative sign respectively. The only exception occurred when the live cattle coefficient was nearly zero and statistically insignificant. Lighter weight classes appear to have stronger R-squares and larger fed beef and corn price coefficient magnitudes. This is particularly true when analyzing the coefficient magnitudes for the live cattle. The larger coefficient magnitudes suggest greater impact by market fundamentals on the lighter weight cattle. Thus, this pattern is consistent with the breakeven budgeting discussion previously presented.

TABLE VI

CURRENT MONTH BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

Variable	Weight Class 400-500	500-600	600-700	700-800
Constant	-24.89	-11.16	- .80	2.66
Mar. Dummy	2.93	3.65	.65	- .81
	(.96)	(.63)	(.45)	(.36)
April Dummy	5.79	6.77	2.82	- .42
	(.95)	(.63)	(.45)	(.35)
May Dummy	2.48	4.27	2.38	.40
	(.99)	(.65)	(.46)	(.36)
Aug. Dummy	- .20	1.86	1.95	1.12
	(1.09)	(.72)	(.50)	(.40)
Sept. Dummy	- .59	- .06	.24	.16
	(.95)	(.64)	(.46)	(.36)
Oct. Dummy	- .93	- .06	- .41	- .59
	(.94)	(.63)	(.45)	(.35)
Nov. Dummy	2.03	.97	.40	.79
	(.99)	(.66)	(.48)	(.38)
Live Cattle	.71	.29	.07	- .01
Futures	(.09)	(.06)	(.04)	(.03)
Corn Price	-2.81	- .29	- .23	- .57
	(1.20)	(.82)	(.57)	(.45)
R-squared	.72	.75	.48	.29
Std. Error	2.70	1.83	1.32	1.04
Observations	127	128	129	129

TABLE VII

ONE MONTH PRIOR BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

Variable	Weight Class 400-500	500-600	600-700	700-800
Constant	-25.44	-10.80	-2.44	2.03
Mar. Dummy	.74	.39	-1.35	-2.06
	(1.10)	(.76)	(.53)	(.46)
April Dummy	2.22	2.75	- .20	-2.23
	(1.08)	(.74)	(.51)	(.44)
May Dummy	5.90	6.67	2.95	- .78
	(1.08)	(.75)	(.52)	(.45)
Aug. Dummy	.40	2.23	1.87	.40
	(1.13)	(.78)	(.56)	(.48)
Sept. Dummy	-1.22	.66	.93	- .37
	(1.24)	(.87)	(.58)	(.50)
Oct. Dummy	-2.20	-1.97	-1.59	-2.10
	(1.09)	(.78)	(.53)	(.45)
Nov. Dummy	-2.62	-2.04	-2.35	-2.93
	(1.07)	(.75)	(.52)	(.45)
Live Cattle	.78	.37	.19	.08
Futures	(.10)	(.07)	(.04)	(.04)
Corn Price	-4.00	-2.20	-2.38	-2.13
	(1.25)	(.86)	(.60)	(.51)
R-squared	.67	.69	.56	.46
Std. Error	3.03	2.13	1.52	1.29
Observations	129	129	130	129

TABLE VIII

TWO MONTHS PRIOR BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

	Weight Class			
Variable	400-500	500-600	600-700	700-800
Constant	-25.32	-16.19	-5.56	-1.98
Mar. Dummy	- .87	.23	.69	.42
	(1.01)	(.64)	(.51)	(.54)
April Dummy	.93	1.93	.53	- .02
	(1.03)	(.64)	(.52)	(.55)
May Dummy	2.23	4.09	1.53	- .35
	(1.01)	(.63)	(.51)	(.54)
Aug. Dummy	1.25	3.87	3.37	1.44
	(1.01)	(.64)	(.52)	(.55)
Sept. Dummy	.14	3.39	3.45	2.14
	(1.07)	(.69)	(.56)	(.59)
Oct. Dummy	-1.84	1.14	2.02	.84
	(1.16)	(.72)	(.57)	(.60)
Nov. Dummy	-3.52	-2.14	-1.30	-1.67
	(1.01)	(.64)	(.52)	(.55)
Live Cattle	.80	.47	.25	.15
Futures	(.09)	(.06)	(.04)	(.05)
Corn Price	-4.54	-3.26	-3.39	-3.18
	(1.16)	(.73)	(.57)	(.61)
R-squared	.64	.69	.53	.36
Std. Error	2.85	1.82	1.47	1.56
Observations	128	129	130	130

TABLE IX

THREE MONTHS PRIOR BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

Variable	Weight Class 400-500	500-600	600-700	700-800
Constant	-25.35	-16.75	-10.48	-6.08
Mar. Dummy	4.04	3.58	3.97	4.51
	(1.09)	(.76)	(.61)	(.59)
April Dummy	3.31	2.53	3.23	3.29
	(1.07)	(.74)	(.60)	(.58)
May Dummy	5.57	4.58	3.28	3.11
	(1.06)	(.75)	(.61)	(.59)
Aug. Dummy	5.08	5.81	4.60	2.63
	(1.06)	(.75)	(.61)	(.58)
Sept. Dummy	5.53	5.91	5.58	3.86
	(1.06)	(.75)	(.62)	(.60)
Oct. Dummy	3.95	4.95	5.32	4.15
	(1.13)	(.81)	(.68)	(.65)
Nov. Dummy	1.43	2.23	3.11	2.28
	(1.17)	(.84)	(.67)	(.64)
Live Cattle	.77	.47	.33	.20
Futures	(.10)	(.07)	(.05)	(.05)
Corn Price	-5.27	-3.54	-4.61	-3.58
	(1.33)	(.93)	(.72)	(.69)
R-squared	.58	.61	.50	.42
Std Error	3.07	2.16	1.78	1.70
Observations	126	128	130	129

TABLE X

FOUR MONTHS PRIOR BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

Variable	Weight Class 400-500	500-600	600-700	700-800
Constant	-32.66	-23.71	-16.87	-12.71
Mar. Dummy	4.80	3.36	2.74	3.06
	(1.10)	(.78)	(.66)	(.62)
April Dummy	5.13	5.38	4.72	5.26
	(1.11)	(.81)	(.65)	(.62)
May Dummy	4.63	4.49	4.41	4.44
	(1.09)	(.78)	(.65)	(.61)
Aug. Dummy	9.59	10.43	6.64	3.37
	(1.05)	(.77)	(.65)	(.61)
Sept. Dummy	5.46	6.96	4.93	2.97
	(1.07)	(.77)	(.65)	(.61)
Oct. Dummy	5.76	6.88	5.73	4.09
	(1.06)	(.78)	(.66)	(.62)
Nov. Dummy	3.22	5.13	4.63	3.57
	(1.13)	(.86)	(.72)	(.68)
Live Cattle	.96	.62	.48	.36
Futures	(.10)	(.07)	(.06)	(.05)
Corn Price	-7.66	-5.42	-6.28	-5.76
	(1.35)	(.96)	(.78)	(.73)
R-squared	.65	.71	.58	.51
Std. Error	3.09	2.24	1.89	1.77
Observations	131	134	135	134

TABLE XI

FIVE MONTHS PRIOR BASIS FORECASTING EQUATIONS BY WEIGHT CLASS

	Weight Class			
Variable	400-500	500-600	600-700	700-800
Constant	-33.08	-18.10	-9.43	-6.47
Mar. Dummy	.39	- .71	-1.77	-1.13
	(1.19)	(.87)	(.71)	(.72)
April Dummy	5.02	1.65	.82	1.91
	(1.28)	(.88)	(.73)	(.74)
May Dummy	5.56	3.74	3.00	4.36
	(1.29)	(.92)	(.72)	(.75)
Aug. Dummy	5.98	4.80	1.37	.62
	(1.18)	(.85)	(.70)	(.72)
Sept. Dummy	9.34	8.30	4.24	1.82
	(1.20)	(.87)	(.72)	(.73)
Oct. Dummy	4.75	4.44	2.25	1.13
	(1.21)	(.86)	(.71)	(.73)
Nov. Dummy	4.28	3.61	2.30	1.64
	(1.21)	(.87)	(.71)	(.73)
Live Cattle Futures	.94	.53	.37	.28
	(.11)	(.08)	(.06)	(.06)
Corn Price	-6.69	-4.11	-4.90	-5.29
	(1.49)	(1.07)	(.82)	(.84)
R-squared	.66	.68	.51	.47
Std. Error	3.12	2.25	1.88	1.92
Observations	131	132	133	132

Evaluation of the Basis Forecasting Equations

The forecasting accuracies of the basis prediction models developed were evaluated by comparing their accuracy with the accuracies of a comparable traditional basis forecasting method. The traditional method is to use simple averages of historical basis for different months and weights. Tables providing the average monthly basis and its corresponding variability (standard deviation) for each of the specific weight ranges are presented in Appendix A. To establish if there was an improvement of forecasting ability when the market fundamental variables were considered, the basis prediction error of the simple averages was compared to the basis prediction error for the forecasting models presented in Tables VI through XI. The comparison results are exhibited in Table XII. The percentages represent the improved change or decrease in magnitude of expost prediction errors when the additional variables of live cattle futures and corn price are included in the model versus simple averages.

TABLE XII

PERCENTAGE CHANGE IN PREDICTION ERROR

Weight Class	Current Month	1 Month Prior	2 Month Prior	3 Month Prior	4 Month Prior	5 Month Prior
400-500	37	31	32	25	29	31
500-600	26	16	26	18	24	20
600-700	3	6	12	14	20	13
700-800	4	9	10	10	18	13

It is concluded from the table that the improvement in basis prediction is greater for lighter weight cattle. This again coincided with the theoretical conclusion that the market fundamental variables would have a greater impact on the breakeven price for lighter weight cattle. To further analyze this point, the coefficients were examined to determine if any magnitudinal patterns were present between weight classes and/or with respect to periods prior to delivery. The parameters to be reviewed are depicted in Table XIII.

TABLE XIII

FORECASTING EQUATION COEFFICIENTS

	400-500		500-600		600-700		700-800	
	Live Cat.	Corn	Live Cat.	Corn	Live Cat.	Corn	Live Cat.	Corn
Current Month	.71	-2.81	.29	- .29	.07	- .23	-.01	- .57
1 Month Prior	.78	-4.00	.37	-2.20	.19	-2.38	.08	-2.13
2 Month Prior	.80	-4.54	.47	-3.26	.25	-3.39	.15	-3.18
3 Month Prior	.77	-5.27	.47	-3.54	.33	-4.61	.20	-3.58
4 Month Prior	.96	-7.66	.62	-5.42	.48	-6.28	.36	-5.76
5 Month Prior	.94	-6.69	.53	-4.11	.37	-4.90	.28	-5.29

The table also supports the hypothesis that market fundamentals have a greater impact on the basis for light feeder cattle. It is shown that basis is more responsive to live cattle futures and corn price at lighter weights (i.e., the live cattle and corn price parameters are larger in the equations for lighter weight cattle).

Basis also exhibits, to some degree, more response to live cattle futures and corn for sales made one or more months prior to the futures contract expiration month. The parameters for live cattle and corn price across all weight groups have a distinct trend from current month to four months prior (i.e., the live cattle parameters are positive and increasing and the corn price parameters are negative and decreasing (increasing absolutely)). This pattern appears to be stronger the heavier the weight class. A change in the pattern is apparent across all weight groups between four and five months prior to futures contract expiration. The existence of this change may be related to the "rule of thumb" that the feeding phase is no more than 160 days long. If this rule is widely used, a basis between a cash price and futures prices more than 160 days into the future would not be relevant. The existence of this physical factor or some other force is possibly causing the change in the parameter trend/pattern noted. Further research including more extended months is needed to identify if it is a parameter pattern change or just coincidence.

Sources of Basis Volatility

The basis prediction equations developed attributes change in the basis to three sources: 1)seasonal variation as explained by the dummy variables; 2)variation due to live cattle futures price changes; and 3)variation due to corn price changes. A question of interest is which of these factors causes the most change in basis during a "typical year". To answer this question, the seasonal price change for live cattle futures and corn price over the data period for this study were determined. Seasonal corn price variation was found to be \$.25. The appropriate live cattle price variation to consider is unique to each weight class since different live futures contracts are used to predict basis for different weights of feeder cattle (i.e., the live cattle contracts considered for light feeder cattle are more distant contracts because of the longer feeding period required for them to reach their slaughter weight). The seasonal variation found in the set of live cattle contract prices used to predict the 400 to 500 pound feeder basis was \$7.07 while the seasonal variation found in the contracts used to predict the 700 to 800 pound basis was \$3.49.

The current (nearby) month basis prediction equations estimated in the preceding section for the 400 to 500 pound feeders and 700 to 800 pound feeders were used to translate the seasonal live cattle and corn price variation into expected annual basis variation. The results are presented in Table XIV. Likewise the differences between the high and low seasonal dummy values from the basis prediction equations for both weight classes were applied to ascertain the annual basis variation due to seasonality of all other factors. These results are also presented in Table XIV.

TABLE XIV

SOURCES OF ANNUAL VARIATION IN FEEDER CATTLE BASIS

Source	400-500 lb. Basis		700-800 lb. Basis	
	Absolute	Ratio	Absolute	Ratio
Seasonality	$7.69	41	$1.82	207
Live Cattle Price	$5.03	27	$ .03	4
Corn Price	$ .70	4	$ .14	16

The above table quickly points out two factors. First, over a typical one year period the 400 to 500 pound nearby basis is much more volatile than the 700 to 800 pound nearby basis in absolute terms. Furthermore, the actual basis for 400 to 500 pound feeders is considerably greater than the basis for 700 to 800 pound feeders. The average 400 to 500 pound nearby basis was $18.61 while the average 700 to 800 pound nearby basis was $.88. Thus in percentage terms as reflected by the ratio of estimated variation (absolute) to the average basis, the total expected annual variation in the 700 to 800 pound basis is greater. The second factor the table points out is that seasonal variation is the primary cause of basis change during a typical year, especially for the 700 to 800 pound contract.

The live cattle futures associated with 400 to 500 pound feeder cattle are more distant and therefore have greater seasonal pattern volatility. The association with these more volatile live cattle futures (7.07) versus the set of live cattle futures for the 700 to 800 pound basis (3.49) also contributes to the large volatility (absolute) of the 400 to 500 pound basis. The fact that live cattle futures prices and corn prices play a more significant role in basis volatility relative to seasonality for light cattle versus heavy cattle is once again consistent with the findings in the preceding section that light feeder cattle basis respond more to fundamental market variables than do heavy feeder cattle basis.

Structural Change

Market Driven Change

Previous speculation has been that the change in basis behavior pattern in Figures 17 and 18 occurring approximately nine months after adoption of the new feeder cattle contract was caused by the implementation of the new feeder cattle contract. However, this pattern change corresponded with a large increase in fed cattle and corn prices. Using bimonthly averages to avoid atypical changes occurring between any two random weeks, live cattle futures contracts selected as influencing 400 to 500 pound feeders increased $10.96 over the period from October of 1986 to September of 1987. During the same period, the contract associated with the 700 to 800 pound feeder cattle rose by $9.97. In Figures 17 and 18 this period corresponds to weeks 5 to 39. Although corn prices only increased $.16 during that same period, corn prices were in a definite upward trend and continued to increase through 1987 to June of 1988.

To determine if the changes in basis magnitude observed during the period in question could be attributed to the observed sharp rise in beef prices (and the smaller rise in corn prices), the changes that occurred were injected into the basis forecasting models for the 400 to 500 pound and 700 to 800 pound feeder steers. The expected change in basis as predicted by the model (given the fundamental market price changes occurring and normal seasonal change over the period) was \$7.30 for the 400 to 500 pound feeder cattle and \$.37 for the 700 to 800 pound feeder cattle. The realized change in basis was \$9.03 for the 400 to 500 pound feeder cattle and \$.67 for 700 to 800 pound. Thus in both cases, shifts in live cattle futures prices, corn prices, and normal seasonal changes accounted for a major portion of the actual basis change, (81 and 55 percent respectively) but not all of it. Consequently, it is concluded that significant changes in the market conditions may have caused much of the sharp changes in basis previously attributed to the adoption of the new feeder cattle contract, but additional factors were likely present since the actual changes were significantly bigger than the predicted changes.

Chow Test

The results found in the preceding section suggest the need for a more complex test to attempt to determine if the change in basis pattern was exclusively caused by the change in market fundamentals (i.e., live cattle and corn prices). A test commonly referred to as the Chow Test was performed. It was hypothesized that if the pattern change was associated with the implementation of a new feeder cattle contract, the parameters of the basis forecasting equation estimated with data from the period after the sharp increase in live cattle futures and corn price, would be different than the parameters found for the same equation using data prior to the price increase. The Chow test can be used to test this hypothesis against the null hypothesis that the parameters of the basis prediction equation have not changed and therefore that the pattern change was caused solely by the fluctuation in corn and fed cattle prices. Basis prediction equations were estimated for the two periods as well as an equation for the entire period. The 400 to 500 and 700 to 800 pound weight groups were examined. The three equations for each weight group are given in Tables XV and XVI.

Chow Test Results. The F-statistics for the 400 to 500 and 700 to 800 pound weight group was 4.96 and 2.26 respectively. At the 95 percent confidence level the null hypothesis was rejected for both groups. These results signify that the parameters of the two periods are different than the aggregate equation. Consequently, according to the Chow Test, the increase in live cattle futures and corn prices do not explain the entire change in basis pattern.

One of the noticeable changes was a change in basis volatility with both the 400 to 500 and 700 to 800 pound feeder cattle basis. The magnitude changed as well with the 400 to 500 pound basis. This might be contributed to a transitional stage occurring after the implementation of the new feeder cattle contract. The smaller magnitude and less volatility observed earlier in the new contract period might be explained by the conservative trade during that period due to the unknown effects of the new contract.

TABLE XV

400-500 CHOW TEST EQUATIONS

Variable	Time Segment 09-05-86 to 08-28-87	09-04-87 to 05-25-90	09-05-86 to 05-25-90
Constant	-8.04	-1.45	-24.89
Mar. Dummy	.91 (.96)	4.86 (1.10)	2.93 (.96)
April Dummy	2.01 (1.33)	7.95 (1.07)	5.79 (.95)
May Dummy	3.55 (1.85)	3.67 (1.14)	2.48 (.99)
Aug. Dummy	4.63 (2.65)	.93 (1.28)	- .20 (1.09)
Sept. Dummy	.76 (.97)	.35 (1.09)	- .59 (.95)
Oct. Dummy	- .39 (.82)	- .27 (1.08)	- .93 (.94)
Nov. Dummy	- .92 (.70)	2.81 (1.15)	2.03 (.99)
Live Cattle Futures	.27 (.24)	.31 (.14)	.71 (.09)
Corn Price	2.65 (4.89)	-1.21 (1.32)	-2.81 (1.20)
R-squared	.93	.58	.72
Std. Error	.97	2.60	2.70
Observations	34	93	127

TABLE XVI

700-800 CHOW TEST EQUATIONS

Variable	Time Segment		
	09-05-86 to 08-28-87	09-04-87 to 05-25-90	09-05-86 to 05-25-90
Constant	6.03	- .08	2.66
Mar. Dummy	.11	-1.15	- .81
	(.61)	(.42)	(.36)
April Dummy	.28	- .59	- .42
	(.82)	(.41)	(.35)
May Dummy	.54	.46	.40
	(1.29)	(.43)	(.36)
Aug. Dummy	1.40	.77	1.12
	(1.64)	(.49)	(.40)
Sept. Dummy	-1.07	.40	.16
	(.65)	(.43)	(.36)
Oct. Dummy	- .35	- .85	- .59
	(.54)	(.43)	(.35)
Nov. Dummy	.53	.85	.79
	(.58)	(.44)	(.38)
Live Cattle Futures	.05	.03	- .01
	(.19)	(.05)	(.03)
Corn Price	-4.64	- .44	- .57
	(4.29)	(.50)	(.45)
R-squared	.53	.33	.29
Std. Error	.76	1.05	1.04
Observations	33	96	129

Summary

Research results from this study determined that market fundamentals do impact feeder cattle basis behavior. Therefore incorporating them into a prediction model will improve the accuracy of basis prediction. The improvement was particularly evident for lighter cattle and somewhat noticeable for extended contract months. However, as the cattle weights become heavier, seasonality becomes the biggest source of volatility in absolute terms.

It was also determined that the sharp change in basis observed about nine months after the new feeder cattle contract was implemented is partially due to coinciding sharp changes in live cattle futures prices and corn prices, but a portion of the change appears to be attributable to the new contract specifications. To determine to what extent the observed pattern change is attributable to the new contract, additional research needs to be performed, such as generating equations for the Chow Test prior to the beginning of the new contract in September 1986.

CHAPTER IV

USER'S MANUAL FOR A BASIS FORECASTING PROGRAM

The research presented in Chapter III has demonstrated that current market information can be used to improve feeder cattle basis predictions. A problem arises when using this information. The calculations involved in using the information are rather cumbersome and confusing. Not only are several multiplications and additions required, but the right information must be matched with the right parameters. For example, the right live cattle contract price must be selected given the feeder cattle sales date and weight selected. To alleviate these computational problems, a microcomputer based program was developed. This program/model provides an easy method for input data to be entered and proceeds to match the input data with the correct equations and then generates a table of output values that predict the expected hedged price under a number of alternative situations and actions. Thus, the model can aid the producer in answering key questions that arise with hedging, including what contract month to use, and timing of the placement and completion of the hedge. This chapter will serve as a user's manual for the program.

Input Data Requirements

Marketing information and commodity prices are required as input in order to operate the basis forecasting model. The primary price data required are the futures prices for live cattle and feeder cattle. Prices for all contract months are requested by the program. These prices are available daily in the Wall Street Journal and various other newspapers, wire services, etc. The current corn price is also required. This price should be a price reflective of western Kansas corn price levels. The user must also input the current month and the current weight of the cattle to be hedged. Lastly, the expected sales date and weight of the cattle must be entered.

The program processes this data in several ways before it combines them with the basis forecasting equations present in the model. The basis forecasting equations require the corn price at the time the feeder cattle will be sold, rather than the current corn price. The program forecasts the corn price required by using the current corn price and a monthly seasonal index of corn prices calculated by Ward and Bliss (1989). The monthly index is based on historical seasonality patterns of corn prices in Western Kansas. If available information suggests that a variation from the normal seasonal pattern is expected, the information can be utilized to adjust the forecasted corn prices by directly entering adjustments to the forecasts made by the model.

Feeder cattle sales weights and dates are required for several reasons. First, the sales date indicates which feeder cattle contracts are relevant. Because a feeder cattle contract is not available for every month of the year, the relevant or "nearby" contract is not always the same month as the sales month. Secondly, the correct live cattle futures contract must be selected to match the feeder cattle weight and sales month selected. The closest live cattle contract month beyond the month that the specified feeder cattle would be expected to reach slaughter weight is used. Again since every month does not have a live cattle contract, and because feeding periods vary as feeder cattle weights change, the selection of the correct live cattle contract month is not a straightforward question. Rather than asking the user to do this, the rules for accomplishing this selection have been built into the program. Finally, the program makes use of projected sales weight to interpolate between basis forecasting models available for four specific weights. Models/equations are available to predict the basis (and hence the expected hedged cash price) for 450, 550, 650, and 750 pound cattle. If the expected sales weight specified does not match one of these weights, the model makes a forecast based upon a linear interpolation between the price forecasts made for the two weights the expected sales weight falls between.

Computer Model

The computer model is a Lotus 1-2-3 spreadsheet designed model. It is saved as a Lotus worksheet file named "BASIS". Any computer that is capable of accessing and running Lotus files will accommodate this model. The user is required to possess a basic understanding of feeder cattle basis and have minimal knowledge of Lotus operations.

BASIS is a macro-driven program that includes its own menu for ease of operation. Once BASIS is loaded, the input screen will appear with the menu located across the top of the screen. If for some reason the menu becomes deactivated, press "Alt A" to reactivate the menu. Pressing the first letter of each command in the menu or moving the cursor over the desired command and pressing "Enter" will initiate execution of that command. The "Print", and "Quit" commands are self explanatory. "Save" is a file extract command that will save the input and output sections of the spreadsheet under a particular filename. It's intended use is to allow users to save the case analyzed for different groups of cattle, dates, etc. for later review. The files saved with this command are values only and can not be recalculated. WARNING! Do not save a file with this command as "BASIS" or Lotus will overwrite the original computer model file. The other commands require supplementary description and will be addressed further as appropriate.

Input Section

To enter the relevant data, use the "Edit" command. This will allow the user to enter all the data needed and edit it later if required. The arrow keys will control the cursor and move it to the appropriate place in the input screen. Prices for feeder cattle and live cattle contract months must be entered. Current corn price and month, as well as sale month, and sale weight must also be recorded. Feeder cattle weight must be estimated by the user for the sale month as well as the two succeeding months. The results will then allow the user to evaluate the feeder cattle basis for the designated sale month and for cattle that are held for an extended period. Pressing "Enter" at any time during the edit sequence will retrieve the main menu. Forecasted corn price will be calculated simultaneously with main menu retrieval. At this time, the user must decide whether the given forecasted corn price is acceptable. If acceptable, the program will copy the forecasted corn price to the estimated corn price with the "Calculate" command. Adjustments can be made to the estimated corn price by reentering the "Edit" sequence. WARNING! Do not press "Calculate" after estimated corn prices have been adjusted or the computer will replace them with the internally forecasted price.

Output Section

After completing data entry, the computer results can be viewed by using the "Results" command. There are two output screens with the first being a set of expected hedgable cash prices and the second being the forecasted basis that were used to calculate the cash prices. Both result screens display tables with three rows and five columns of values. The values are estimated prices and basis for different sale month and hedging contract month combinations. Sale months are shown down the left side of the table and contract months are shown horizontally across the top of the table. The three sale months indicate the month chosen by the user and the two months following. The contract months are the "nearby contract" (current months if it exists) and the two subsequent contract months. Expected hedgable prices along with low and high estimates of the expected hedge prices are given to create a range of expected forecasts. The low price forecast represents one standard deviation less than the expected hedge price, while the high price forecast represents one standard deviation above the expected price. The standard deviation referred to here is the standard deviation of the estimated forecasting equation being used.

The outcomes are produced in a three by five table display that addresses only three contract months for each sale month with additional months denoted as NA. Due to the sequence of feeder cattle contract months, five contract columns are necessary to assure that the correct three are available in all cases. The second result screen is identical to the first with the exception that it represents actual basis forecasts as opposed to the hedge price forecasts seen in the first result screen.

Case Study 1

This section describes a step by step example of the model execution process with a given hedging scenario. The results and implications will ensue. The scenario consists of a wheat pasture steer grazing program. The date is November 1 with the steers weighing 375 pounds. The initial objective is to graze for 135 days until March 15 with a secondary objective of carrying the cattle for an additional 30 to 60 days of grazeout. Using data from a wheat pasture survey by Walker, et al., 1988, the steers are expected to gain 1.81 pounds per day for the first 135 days and 2.36 pounds per day for the next 60 days. This will result in an average growth rate of 1.98 pounds per day for the entire 195 day period.

Table XVII represents a sample input screen with the appropriate futures prices, current cash corn price, cattle weights and dates for the situation just described. To duplicate it, retrieve the "Basis" file into Lotus 1-2-3. Then using the "Edit" sequence, enter the appropriate information from the sample screen shown in Table XVII.

TABLE XVII

CASE STUDY 1 INPUT SCREEN

Contract Month	Feeder Cattle Price	Current			
		Corn Price	$2.22		
January	$82.12				
March	$80.97				
April	$79.90	Current			
May	$79.10	Month	11		
August	$78.75				
September	$78.40	Sale			
October	NA	Month	3		
November	$83.12				
				Estimated Input	
Contract	Live Cattle	Forecasted		---------------------------	
Month	Price	Sale	Corn	Corn	Sale
February	$73.97	Month	Price	Price	Weight
April	$74.20	March	$2.28	$2.28	619
June	$71.25	April	$2.35	$2.35	690
August	$69.60	May	$2.44	$2.44	761
October	$69.00				
December	$74.45				

The October price quote for feeder cattle was not available due to light or nonexistent trading on the new contract. Enter NA for nonexisting price quotes. This does not effect the model however because the October contract is not considered as an alternative in this situation. The feeder cattle sale weights were calculated employing the assumed daily gain values. After data entry is completed, press "Enter" again to retrieve the main menu. In this example, estimated corn price is assumed to be the same as the forecasted price, therefore enter "C" for calculate (the next case example will address adjusting the forecasted price to be different than the estimated price). All of the calculations have now been accomplished and the output screens are ready for viewing.

Press "R" to see the first output screen. Table XVIII is a copy of the screen that should appear.

TABLE XVIII

FIRST CASE STUDY 1 OUTPUT SCREEN

Expected Hedge Price			Contract Month				
			Mar	Apr	May	Aug	Sept
		Low	$86.35	$85.77	$85.53	NA	NA
	Mar	Expected	$87.58	$87.03	$86.90	NA	NA
		High	$88.82	$88.28	$88.26	NA	NA
Sale		Low	NA	$82.43	$82.53	$82.64	NA
Month	Apr	Expected	NA	$83.87	$84.41	$84.57	NA
		High	NA	$85.30	$86.29	$86.50	NA
		Low	NA	NA	$78.55	$79.90	$80.28
	May	Expected	NA	NA	$80.14	$81.19	$81.66
		High	NA	NA	$81.73	$82.47	$83.03

This screen shows the expected hedge prices forecasted by the model (i.e., the expected cash price). A feel for the accuracy of forecasts is given by the range of the low and high price values reported. Two-thirds of the time the actual price is anticipated to lie within this forecasted range.

The information in this portion of the output is to be used as a tool toward the decision making process and is not intended to be conceived as definite. Because the first objective is to analyze the hedging potential of cattle sold in March after wheat-pasture grazing, the first three rows of Table XVIII are the ones of primary importance. An examination of these three provides evidence that the March contract might be the contract that yields the strongest cash price relative to the futures (i.e., its expected hedgable price is the greatest). Further inspection reveals that it is also the contract with the smallest range between the high and low price making the low projected cash price more favorable than the low projected prices of the other two contracts. However, one should remember that one-sixth of the time the actual cash price can fall below the low price forecasted, likewise one-sixth of the time the actual cash price can be expected to be above the reported high forecast. Thus there is no absolute certainty of what the actual hedged price will be.

To evaluate the alternative objectives of holding the cattle one to two months longer for grazeout, the two additional sale months reported are used. Both the April and May sale months indicate that the most distant contracts are the best alternative to realize the strongest expected net cash price relative to the futures. Similar to the March sale month, there is however greater variance associated with the more distant contracts with the exception of the August contract for the May sale month. The forecasted cash prices for both sale months imply that there is some discount for weight gain and therefore the breakevens need to be calculated in order to determine if the gain associated with holding the cattle longer is profitable. If the cost for the additional gain is less than the increase in revenue received, and depending on the level of risk that a producer is willing to realize, grazeout could prove to be a economically feasible solution. This of course is dependent on availability of resources.

Press "Enter" and the second output screen will display. Table XIX is a representation of that screen. This table reports the forecasted basis computations that correspond with the above cash forecasts. Because basis estimation is the key to successful hedging, the forecasted basis figures are supplied to give a better understanding of the expected hedge price. If the user is familiar with historical basis averages, these estimates can become useful when evaluating the cash prices on the previous screen. The user can compare the model projected basis with the historical averages which gives an additional tool for decision making.

TABLE XIX

SECOND CASE STUDY 1 OUTPUT SCREEN

Forecasted Basis

			Contract Month				
			Mar	Apr	May	Aug	Sept
		Low	$5.38	$5.87	$6.43	NA	NA
	Mar	Expected	$6.61	$7.13	$7.80	NA	NA
		High	$7.85	$8.38	$9.16	NA	NA
Sale Month		Low	NA	$2.53	$3.43	$3.89	NA
	Apr	Expected	NA	$3.97	$5.31	$5.82	NA
		High	NA	$5.40	$7.19	$7.75	NA
		Low	NA	NA	-$0.55	$1.15	$1.88
	May	Expected	NA	NA	$1.04	$2.44	$3.26
		High	NA	NA	$2.63	$3.72	$4.63

Case Study 2

To explore further the possible uses of the model, another case study will be generated. This case will incorporate other functions of the model as well as additional occurrences present within the realm of feeder cattle hedging. New prices and weights will be entered into the input section to represent a different scenario and alternate price relationships between feeder cattle futures, live cattle futures, and corn prices will be entered. The scenario chosen reflects a summer grazing program on grass. The primary intention is to sell the cattle in September. However forecasts for one month prior and one month past September are desired. This is because unexpected forage conditions may cause grazing to terminate early or be extended longer. The data entry date is May 15 with the cattle weighing 550 pounds. Average daily gain is assumed to be 1.5 pounds per day as obtained from Oklahoma State University Enterprise Budgets. Table XX depicts the information to enter in the input screen.

TABLE XX

CASE STUDY 2 INPUT SCREEN

Contract Month	Feeder Cattle Price		
January	$82.75	Current Corn Price	$2.61
March	$81.65		
April	NA		
May	$84.75	Current Month	5
August	$83.07		
September	$82.67		
October	$82.70	Sale Month	8
November	$82.92		

Contract Month	Live Cattle Price
February	$75.32
April	$75.72
June	$73.70
August	$72.40
October	$74.60
December	$75.32

Forecasted Sale Month	Forecasted Corn Price	Estimated Input Corn Price	Estimated Input Sale Weight
August	$2.32	$2.65	688
Sept.	$2.32	$2.68	735
October	$2.32	$2.70	780

Analogous to the first case study, all the information from the sample screen, except the estimated corn price must be entered and the estimated sale weights calculated using the assumed daily gain values. However, there are two principal modifications to this second analysis as opposed to Case Study 1. The first change comes with the sale date entered. Because the scenario calls to analyze one month prior and one month past, the sale month entered must be one month prior to the primal choice. This allows September to be the middle sale month in the output screen. The other deviation is with the estimated corn price. Lets assume that after the data has been entered and the main menu has been retrieved, the forecasted corn price is not acceptable. The forecasted price is less than the price today. For illustration, assume that due to global economic forces, corn price is believed to be in an upward cycle and is expected to be steady to higher in the summer. Press "Edit" again rather than "Calculate" and enter the adjusted corn price expectations. The following table depicts the screen that will be reviewed when "Results" is entered. The August sale month has similar expected cash prices across all contract months. However as the contract months are extended, the range between high and low increases. In contrast to the winter wheat pasture case where both of the later contract months had greater expected hedgeable cash prices, the outcomes for the September and October sale months are quite different.

TABLE XXI

FIRST CASE STUDY 2 OUTPUT SCREEN

Expected Hedge Price

			Contract Month				
			Aug	Sept	Oct	Nov	Jan
	Aug	Low	$86.39	$86.21	$86.06	NA	NA
		Expected	$87.36	$87.24	$87.32	NA	NA
		High	$88.32	$88.26	$88.58	NA	NA
Sale Month	Sept	Low	NA	$83.03	$82.21	$81.79	NA
		Expected	NA	$83.86	$83.43	$82.93	NA
		High	NA	$84.70	$84.64	$84.06	NA
	Oct	Low	NA	NA	$81.65	$81.12	$80.53
		Expected	NA	NA	$82.60	$82.26	$81.89
		High	NA	NA	$83.54	$83.41	$83.25

The expected prices of the extended/distant contract months are considerably lower than the low forecasted prices of the nearby months making the nearby contracts clearly the best alternative. The nearby months also have the smallest range between high and low forecasted cash price. Again, the choice of the best sales month depends on forage conditions, cost of gain associated with later sales months, weight changes etc. relative to the revenue changes implied by the expected hedgable prices. The forecasted basis for this analysis is shown in Table XXII.

TABLE XXII

SECOND CASE STUDY 2 OUTPUT SCREEN

Forecasted Basis

			Contract Month				
			Aug	Sept	Oct	Nov	Jan
	Aug	Low	$3.32	$3.54	$3.36	NA	NA
		Expected	$4.29	$4.57	$4.62	NA	NA
		High	$5.25	$5.59	$5.88	NA	NA
Sale Month	Sept	Low	NA	$0.36	-$0.49	-$1.13	NA
		Expected	NA	$1.19	$0.73	$0.01	NA
		High	NA	$2.03	$1.94	$1.14	NA
	Oct	Low	NA	NA	-$1.05	-$1.80	-$2.22
		Expected	NA	NA	-$0.10	-$0.66	-$0.86
		High	NA	NA	$0.84	$0.49	$0.50

CHAPTER V

CONCLUSION AND IMPLICATIONS

This thesis addressed two major issues related to the feeder cattle futures market. The feeder cattle contract specifications were changed in September of 1986. The first issue addressed was whether the new contract weight specification (600 to 800) is an appropriate representation of the majority of feeder cattle being hedged with the feeder cattle contract. The second study addressed the importance of accurate basis estimation. The effect of market fundamentals (live cattle futures price and corn price) on basis behavior was examined. These two market fundamental variables along with seasonality patterns were included in a basis forecasting model. The basis forecasting model developed was incorporated into a computer model designed to aid producers in making feeder cattle hedging decisions.

Placement Weight Trends

The average placement weight of steers placed on feed is estimated to have exceeded 700 pounds since 1983. Placement weights were estimated to have trended upward at 15.8 pounds per year from April of 1978 to April of 1984. The primary cause of this rapid rise in placement weights is believed to be attributable to improved animal genetics and increased use of growth hormones in cattle backgrounding operations. However, to pinpoint the actual causes of the increase, more specific research in that area is required. After 1984, placement weights continued to trend upward, but at a slower rate of approximately 3.1 pounds per year. The estimated post 1984 upward trend in placement weights has a strong statistical significance and shows no signs of slowing.

The distribution of the placement weights of steers placed on feed is skewed to the left. Estimates indicate that 67 percent of all steers placed on feed from 1978 to 1989 weighed between 600 and 800 pounds. However, nearly twice as many of the steers placed within this weight range were placed at weights between 700 and 800 pounds, versus 600 to 700 pounds.

When the placement weight data was divided into pre-1986 and post-1986 periods, results indicated that the percent of feeder cattle placed in the two upper weight divisions increased between the two periods, while the percentage placed in the lower weight groups declined. The percent of feeder cattle placed at weights heavier than 700 pounds increased from 58 percent to approximately 65 percent, whereas the percent of feeder cattle placed below 700 pounds decreased from 42 percent to approximately 35 percent. Over the years 1986 to 1988, the average weight of steers placed on feed was 717 pounds. However, 59 percent of all steers placed on feed weighed more than 717 pounds while 41 percent weighed less than 717 pounds. Nearly half of all the steers placed on feed currently (42.6 percent from 1986 to 1988) weigh between 700 to 800 pounds.

With the upward trend in the average placement weights of steers, the percentage of steers placed on feed falling in the 700 to 800 pound weight range is expected to increase in the future. Thus, if a single 100 pound weight range were chosen to characterize the prices of feeder cattle placed on feed, it would clearly be the 700 to 800 pound weight range. If a wider range of 200 pounds were to be designated, it would appear that the weight range from 700 to 900 pounds may soon contain a larger percentage of the steers placed on feed than the 600 to 800 pound weight range. From 1986 to 1988, 24.4 percent of all steers placed on feed weighed between 600 and 700 pounds, while 22.4 percent weighed in excess of 800 pounds. With continuation of the current upward trend in average placement weights for steers, the percentage of steers placed on feed weighing over 800 pounds may soon exceed the percentage of steers placed on feed weighing between 600 and 700 pounds.

Although this study supports the need to reevaluate the weight specifications of the CME Feeder Cattle Contract, it is not conclusive. More comprehensive research is required to ascertain if the current contract fails or if basis variability is increased by the existing weight range. However, the evidence presented here indicates the number of steers placed on feed weighing between 600 and 700 pounds has become, and likely will continue to become, a smaller and thus less representative percentage of all steers placed on feed. Likewise, it suggests the 700 to 800 pound weight range has become a better description of all steers placed on feed and will likely continue to represent a larger percentage of the total population in question.

Basis Forecasting

As previous studies have indicated, accurate basis estimation is the major determinant of a successful hedge. Previous research has concluded that basis is not a market-determined charge, but rather a residual between futures and cash. However, it does not resolve if market fundamentals affect the variation of the feeder cattle basis. Evidence from this study indicated that the feeder cattle basis behavior is influenced by market fundamental factors, specifically by live cattle futures price and corn price. A portion of the variation in feeder cattle basis can be explained by the change in these two prices. Therefore basis estimation/forecasting accuracy can be improved by appraising the additional market information of live cattle futures and corn prices. To measure the introduced improvement, the expost prediction error of simple monthly basis averages were compared to the expost prediction error found when live cattle futures and corn prices were included in a basis forecasting model. The comparisons made indicate the average basis prediction errors were reduced by 11 to 30 percent. The largest improvement in forecasting accuracy was with the lighter weight cattle. This is consistent with the fact that the basis was found to be more responsive to live cattle futures and corn prices at lighter weights. This improvement also supported the theoretical conclusion that the market fundamental variables would have a greater impact on the breakeven price for lighter weight cattle.

Sources of basis volatility as well as structural change in basis patterns were addressed. In addition to being larger, the 400 to 500 feeder cattle basis was found to be more volatile in absolute terms during a typical year than the 700 to 800 pound basis. However, in percentage terms as reflected by the ratio of estimated variation to the average basis, the variation of the 700 to 800 pound basis is larger. Seasonal variation was determined to be the primary cause of basis change during a typical year especially for 700 to 800 pound feeder cattle. Live cattle futures and corn prices contributed more to the basis volatility for light cattle versus heavy cattle. These findings were consistent with the original hypothesis that light feeder cattle respond more to market fundamental variables than do heavy cattle.

Previous researchers have speculated that the new feeder cattle contract specifications implemented in September of 1986 caused changes in the basis. There was a noticeable change in feeder cattle basis approximately 8 months after the new contract was adopted. However, the beginning of the new feeder cattle contract occurred during a time when fed cattle and feed grains were in an upward price swing. These concurrent occurrences were analyzed to determine if the basis change was coincidental or in fact caused by one and/or the other of these price rises. The concurrent change in live cattle futures and corn price was estimated to have accounted for 81 percent of the actual change in basis for 400 to 500 pound feeder steers while they accounted for 55 percent of the actual change in basis for 700 to 800 pound feeder steers. The Chow Test was performed to further analyze the realized basis change. It supported the previous findings that the increase in live cattle futures and corn prices did not explain the entire change in the basis. Thus it was concluded that a portion of the sharp change in feeder steer basis following the implementation of the new contract can be contributed to the new contract specifications. Additional Chow Test equations must be created prior to 1986 to gain a better understanding of the impact that the new contract had on basis behavior.

Further research is essential to improve and maintain the forecasting model developed. It would be fruitful to update prediction equations periodically as data permits. Especially important are equation modifications if a new feeder cattle price index is calculated based on a 700 to 800 pound range as was addressed in Chapter II. The forecasting model would then need retesting to assure that it remains a more accurate method of basis estimation compared to using simple averages of past basis.

Application of the Basis Forecasting Models Developed

A computer program was written to employ the basis forecasting research findings. The program is named "BASIS" and allows user's to input raw data and receive a summarized output sheet of information that will assist in planning hedging strategies. The program user should not take the forecasts given as exact, but if used properly, the summarized results can serve as a foundation for basis estimation and can greatly improve the user's basis estimation accuracy. Chapter IV was written to serve as a user's manual to thoroughly describe the procedure for using the program. It includes two example scenarios to demonstrate the program's usefulness.

BIBLIOGRAPHY

Anderson, Kim B. Oklahoma City Minus Chicago Mercantile Exchange Stocker Steer Basis. Cooperative Extension Service Fact Sheet Publication No. 500. Oklahoma State University, 1987.

Bliss, Timm J. and Ward, Clement E. Seasonal Prices for Cattle and Feedgrains. Cooperative Extension Fact Sheet Publication No. 505. Oklahoma State University, 1989.

Chicago Mercantile Exchange, Commodity Marketing Series. How to Make Livestock Futures Work For You. 1985.

Chicago Mercantile Exchange, Commodity Marketing Series. Cash Settlement for Feeder Cattle Futures. 1986.

Chicago Mercantile Exchange, Commodity Marketing Series. Feeder Cattle Futures and Options. 1988.

Chicago Mercantile Exchange, Index and Option Market Statistics. Agricultural Futures-Cash Markets, Fundamentals: Daily Information Bulletin.

Chow, Gregory C. "Tests of Equality Between Sets of Coefficients in Two Linear Regressions." Econometrica. 28(1960):591-605.

Ehrich, R.L. "Cash-Futures Price Relationships for Live Beef Cattle." American Journal of Agricultural Economics. 51(1969):26-40.

Elder, William A. Uncertainty, and Futures Trading: Implications for Hedging Decision of Beef Cattle Feeders. Staff Paper P69-20. University of Minnesota Institute of Agriculture, 1969.

Garcia, P., R. M. Leuthold, and M.E. Sarhan. "Basis Risk: Measurement and Analysis of Basis Fluctuations for Selected Livestock Markets." American Journal Agricultural Economics. 66(1984):499-504.

Harwell, R.L. "Economic Interaction Between Wheat and Beef: Examining Winter Wheat Grazing Activity in the Southern Great Plains." Contributed paper, Western Agricultural Economics Association Annual Meetings, 1974.

Ikerd, John E. Basic Futures Trading And Livestock Hedging Livestock Futures Series. Cooperative Extension Fact Sheet Publication No. 430. Oklahoma State University, 1978.

Kmenta, Jan. Elements of Econometrics. New York, MacMillan Company. (1971):373-374.

Lansford, R.C., W.L. Harman and J.T. Musick. The Texas High Plains: Adjustments to Changing Economic and Resource Conditions, 1970-1985. Texas Agricultural Experiment Station Publication MP-1637. Texas A & M University, 1987.

Leuthold, Raymond M. "The Price Performance on the Futures Market of a Nonstorable Commodity: Live Beef Cattle." American Journal of Agricultural Economics. 56(1974):271-279.

Leuthold, Raymond M. "An Analysis of the Basis for Live Beef Cattle." North Central Journal of Agricultural Economics. 1(1979):47-52.

Leuthold, R.M., and P. A. Hartmann. "A Semi-Strong Form Evaluation of the Efficiency of the Hog Futures Market." American Journal of Agricultural Economics. 61(1979):482-488.

Martin, L., and P. Garcia. "The Price-Forecasting Performance of Futures Markets for Live Cattle and Hogs: A Disaggregated Analysis." American Journal of Agricultural Economics. 63(1981):209-215.

Naik, Gopal and Raymond Leuthold. "Cash and Futures Price Relationships for Nonstorable Commodities: An Empirical Analysis Using a General Theory." Western Journal of Agricultural Economics. 13(1988):327-338

Oklahoma Department of Agriculture, Oklahoma Agricultural Statistics Service. Oklahoma Agricultural Statistics 1988. Oklahoma City, 1989.

Oklahoma State University Enterprise Budgets. "Stocker Steers on Warm Season Pasture." Oklahoma State University Progress Report No. 13120009. Division of Agricultural Economics, 1990.

Paul, Allen B. and William T. Wesson. "Short-Run Supply of Services: The Case of Soybean Processing." Journal of Farm Economics. 48(1966):935-951.

Paul, Allen B. and William T. Wesson. "Pricing Feedlot Services Through Cattle Futures." Agricultural Economics Research. 29(1967):33-45.

Price, Robert V., Thomas H. Morgan, Arthur D. Dayton, and John H. McCoy. "Basis Variability of Live Cattle Futures at Selected Kansas Markets." North Central Journal of Agriculture Economics. 1(1979):133-139.

Purcell, Wayne D., David Flood, and James S. Plaxico. "Cash-Futures Interrelationships in Live Cattle: Causality, Variability, and Pricing Processes." Livestock Futures Research Symposium, ed. by R.M. Leuthold and P. Dixon. Chicago: Chicago Mercantile Exchange. (1979)135-56.

Rodriguez, A., J.N. Trapp, O.L. Walker and D.J. Bernardo. "A Wheat Grazing Systems Model for the U.S. Southern Plains. I. Model Description and Performance." Agricultural Systems. 33(1990a):41-59.

Rodriguez, A., J.N. Trapp, O.L. Walker and D.J. Bernardo. "A Wheat Grazing Systems Model for the U.S. Southern Plains. II. Economic Analysis of Grazing Management Decisions." Agricultural Systems. 33(1990b):61-75.

Shonkwiler, J. S. "Are Livestock Futures Prices Rational Forecasts?" Western Journal of Agricultural Economics. 11(1986):123-128.

Tippens, Tom. PCC Newsletter for Feedlot Managers. Professional Cattle Consultants Inc. Monthly.

Tomek, William G. "An Analysis of The Futures-Cash Price Basis For Live Beef Cattle: Comment." North Central Journal of Agricultural Economics. 2(1980):81-82.

U.S. Department of Agriculture, Economic Research Service. Livestock and Seed Division. Grain and Feed Market News. Washington, D.C., Weekly.

U.S. Department of Agriculture, Economic Research Service. Agricultural Statistics of Oklahoma 1989. U.S. Government Printing Office. Washington, D.C., 1989.

U.S. Department of Agriculture, Economic Research Service. Crop Reporting Board. Cattle on Feed. Washington, D.C., Monthly.

U.S. Department of Agriculture, Economic Research Service. Livestock and Seed Division. Livestock, Meat, Wool Market News. Washington, D.C., Weekly.

Walker, O.L., D.J. Bernardo, J.N. Trapp and A. Rodriguez. A Survey of Wheat-Pasture Utilization Systems in Western Oklahoma. Oklahoma Agricultural Experiment Station Publication P-903. Department of Agricultural Economics, Oklahoma State University, 1988.

Working, Holbrook. "The Theory of Price of Storage." American Economic Review. 39(1949):1254-1262.

APPENDIXES

APPENDIX A

BASIS CALCULATIONS

TABLE XXIII

400-500 STEER BASIS CALCULATIONS

9/86-7/90 AVERAGE OKC CASH MINUS CME FUTURE BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	5.43	16.52	17.18	18.17	18.90	19.54	19.77	NA
Feb.	NA	19.13	20.04	21.08	21.80	22.44	22.66	22.13
Mar.	22.85	20.58	21.41	22.12	22.89	23.34	23.56	23.06
Apr.	24.96	NA	23.11	24.60	25.24	25.63	25.83	25.18
May	20.80	21.26	NA	20.56	21.13	21.46	21.46	21.00
June	20.65	21.17	NA	NA	21.40	21.71	21.72	21.10
July	18.24	18.52	19.02	19.98	19.72	20.04	19.88	18.84
Aug.	18.86	19.39	20.13	21.36	19.30	19.76	19.85	19.25
Sept.	16.39	17.05	17.77	18.97	NA	17.25	17.07	16.45
Oct.	15.24	16.17	16.80	17.88	18.23	NA	15.71	15.45
Nov.	17.19	18.09	18.90	20.09	20.42	20.83	NA	17.15
Dec.	16.65	17.73	18.34	19.43	19.84	20.32	20.51	NA

STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	3.83	4.15	4.25	4.09	4.38	4.11	4.12	NA
Feb.	NA	5.43	5.52	5.31	5.04	5.03	5.06	5.07
Mar.	4.30	5.50	5.08	4.78	4.60	4.52	4.46	4.32
Apr.	5.10	NA	5.25	5.38	5.22	5.13	5.15	5.17
May	4.75	4.95	NA	4.00	4.31	4.40	4.47	4.59
June	4.38	4.64	NA	NA	3.48	3.49	3.64	4.04
July	3.10	3.35	3.26	3.45	1.90	2.13	2.33	2.67
Aug.	2.16	2.42	2.42	2.28	1.46	1.80	2.07	2.08
Sept.	3.61	3.70	3.87	3.94	NA	3.34	3.51	3.65
Oct.	3.58	3.68	3.89	3.94	4.17	NA	3.29	3.39
Nov.	4.78	4.73	4.70	4.68	4.88	4.75	NA	4.57
Dec.	4.73	4.91	4.89	4.88	5.00	4.90	4.88	NA

MODEL STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	2.53	2.72	2.63	2.89	NA	NA	NA	NA
Feb.	NA	3.53	3.72	3.86	NA	NA	NA	NA
Mar.	NA	3.04	2.84	2.79	3.17	NA	NA	NA
Apr.	NA	NA	3.11	3.39	3.44	3.30	NA	NA
May.	NA	NA	NA	2.84	3.12	3.02	3.17	NA
June	NA	NA	NA	NA	2.59	2.40	2.28	2.42
July	NA	NA	NA	NA	2.04	2.23	2.20	2.32
Aug.	1.77	NA	NA	NA	1.84	1.81	1.92	1.82
Sept.	1.99	NA	NA	NA	NA	2.28	2.07	2.12
Oct.	1.99	2.06	NA	NA	NA	NA	1.53	1.94
Nov.	3.19	2.90	2.77	NA	NA	NA	NA	3.06
Dec.	4.39	4.38	4.30	4.39	NA	NA	NA	NA

TABLE XXIV

500-600 STEER BASIS CALCULATIONS

9/86-7/90 AVERAGE OKC CASH MINUS CME FUTURE BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	7.28	8.38	9.11	10.10	10.80	11.44	11.69	NA
Feb.	NA	9.82	10.72	11.77	12.49	13.12	13.34	12.81
Mar.	13.76	11.54	12.32	13.02	13.80	14.25	14.46	13.96
Apr.	16.57	NA	14.72	16.21	16.85	17.24	17.44	16.79
May	12.91	13.36	NA	12.62	13.29	13.63	13.63	13.16
June	12.31	12.83	NA	NA	13.06	13.37	13.38	12.76
July	10.05	10.33	10.83	11.79	11.53	11.85	11.69	10.65
Aug.	10.36	10.88	11.62	12.85	10.79	11.26	11.34	10.74
Sept.	7.52	8.19	8.91	10.11	NA	8.39	8.21	7.59
Oct.	6.98	7.92	8.57	9.67	10.04	NA	7.48	7.20
Nov.	8.51	9.41	10.22	11.44	11.73	12.15	NA	8.41
Dec.	8.52	9.59	10.19	11.27	11.63	12.10	12.28	NA

STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	2.14	2.27	2.29	2.12	2.43	2.18	2.17	NA
Feb.	NA	2.84	2.97	2.92	2.77	2.83	2.90	2.87
Mar.	2.15	2.90	2.64	2.43	2.24	2.20	2.20	2.14
Apr.	3.03	NA	3.15	3.19	3.20	3.11	3.11	3.22
May	3.54	3.81	NA	3.14	3.24	3.29	3.33	3.42
June	3.75	4.13	NA	NA	2.26	2.50	2.79	3.28
July	3.17	3.40	3.26	3.47	1.67	2.04	2.25	2.72
Aug.	1.31	1.56	1.54	1.40	0.93	1.12	1.31	1.21
Sept.	2.42	2.52	2.71	2.76	NA	1.93	2.23	2.40
Oct.	1.42	1.51	1.70	1.75	1.98	NA	1.27	1.39
Nov.	2.71	2.60	2.54	2.55	2.74	2.63	NA	2.37
Dec.	3.28	3.40	3.38	3.38	3.49	3.41	3.39	NA

MODEL STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	1.45	1.56	1.43	1.50	NA	NA	NA	NA
Feb.	NA	2.30	2.48	2.65	NA	NA	NA	NA
Mar.	NA	1.61	1.66	1.61	1.86	NA	NA	NA
Apr.	NA	NA	2.49	2.69	2.85	2.78	NA	NA
May	NA	NA	NA	2.12	2.24	2.10	2.19	NA
June	NA	NA	NA	NA	1.31	1.55	1.64	2.10
July	NA	NA	NA	NA	1.56	1.82	1.91	2.04
Aug.	1.14	NA	NA	NA	1.31	1.23	1.42	1.22
Sept.	1.45	NA	NA	NA	NA	1.48	1.36	1.40
Oct.	1.39	1.40	NA	NA	NA	NA	1.25	1.38
Nov.	2.11	1.80	1.67	NA	NA	NA	NA	1.95
Dec.	3.13	3.20	3.18	3.16	NA	NA	NA	NA

TABLE XXV

600-700 STEER BASIS CALCULATIONS

9/86-7/90 AVERAGE OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	3.39	4.46	5.18	6.18	6.82	7.44	7.69	NA
Feb.	NA	3.75	4.66	5.70	6.42	7.06	7.27	6.75
Mar.	6.26	4.18	4.82	5.53	6.30	6.75	6.97	6.47
Apr.	8.16	NA	6.31	7.80	8.44	8.83	9.03	8.37
May	6.40	6.85	NA	6.00	6.79	7.12	7.13	6.65
June	6.22	6.74	NA	NA	6.97	7.28	7.29	6.68
July	4.90	5.17	5.68	6.64	6.38	6.69	6.54	5.50
Aug.	5.20	5.73	6.47	7.69	5.63	6.10	6.18	5.58
Sept.	3.04	3.70	4.43	5.63	NA	3.90	3.73	3.11
Oct.	2.66	3.60	4.23	5.30	5.65	NA	3.13	2.88
Nov.	3.92	4.82	5.63	6.82	7.15	7.56	NA	3.88
Dec.	4.85	5.92	6.52	7.60	7.96	8.42	8.61	NA

STANDARD DEVIATION OKC CASH PRICES MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	0.90	0.96	1.27	1.32	1.31	1.22	1.28	NA
Feb.	NA	0.93	1.07	1.30	1.52	1.68	1.76	1.70
Mar.	1.64	1.20	1.12	1.28	1.34	1.47	1.63	1.61
Apr.	2.34	NA	1.77	2.11	2.20	2.18	2.29	2.44
May	3.11	3.30	NA	2.21	2.62	2.75	2.80	2.92
June	3.95	4.31	NA	NA	2.13	2.50	2.84	3.41
July	3.98	4.14	4.00	4.22	2.57	2.86	3.06	3.53
Aug.	0.79	0.94	0.91	0.91	0.94	0.81	0.76	0.66
Sept.	1.54	1.63	1.83	1.83	NA	0.92	1.30	1.43
Oct.	1.13	1.12	1.14	1.17	1.23	NA	0.80	0.96
Nov.	1.47	1.38	1.28	1.32	1.20	1.22	NA	1.11
Dec.	1.85	2.07	2.06	2.03	2.05	1.96	1.96	NA

MODEL STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	0.96	0.87	1.02	1.21	NA	NA	NA	NA
Feb.	NA	1.01	1.11	1.39	NA	NA	NA	NA
Mar.	NA	1.07	1.07	1.26	1.69	NA	NA	NA
Apr.	NA	NA	1.61	1.98	2.04	1.99	NA	NA
May	NA	NA	NA	2.04	2.29	2.21	2.34	NA
June	NA	NA	NA	NA	1.73	1.98	2.06	2.50
July	NA	NA	NA	NA	2.10	2.18	2.20	2.33
Aug.	1.24	NA	NA	NA	1.09	1.14	1.36	1.41
Sept.	1.46	NA	NA	NA	NA	0.74	1.20	1.17
Oct.	1.25	1.20	NA	NA	NA	NA	0.95	1.09
Nov.	1.40	1.33	1.09	NA	NA	NA	NA	1.29
Dec.	1.67	1.72	1.62	1.65	NA	NA	NA	NA

TABLE XXVI

700-800 STEER BASIS CALCULATIONS

9/86-7/90 AVERAGE OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	0.96	2.03	2.75	3.75	4.39	5.01	5.25	NA
Feb.	NA	0.87	1.78	2.82	3.54	4.18	4.39	3.87
Mar.	2.01	0.07	0.57	1.28	2.05	2.50	2.72	2.22
Apr.	2.29	NA	0.44	1.93	2.56	2.96	3.16	2.50
May	1.66	2.11	NA	1.19	2.04	2.38	2.38	1.91
June	1.76	2.28	NA	NA	2.51	2.82	2.83	2.22
July	1.17	1.45	1.95	2.91	2.65	2.97	2.81	1.77
Aug.	1.46	1.98	2.72	3.95	1.89	2.36	2.44	1.84
Sept.	0.14	0.80	1.53	2.73	NA	1.00	0.83	0.21
Oct.	-0.12	0.81	1.44	2.52	2.87	NA	0.35	0.09
Nov.	1.68	2.57	3.38	4.57	4.90	5.31	NA	1.71
Dec.	2.81	3.93	4.54	5.64	5.92	6.39	6.57	NA

STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	1.05	1.06	1.35	1.49	1.21	1.24	1.34	NA
Feb.	NA	1.09	1.18	1.51	1.82	1.97	2.04	2.01
Mar.	2.40	0.93	1.36	1.82	2.00	2.19	2.36	2.38
Apr.	2.76	NA	1.25	2.00	2.25	2.36	2.54	2.72
May	1.81	1.96	NA	1.47	1.22	1.39	1.42	1.55
June	4.36	4.63	NA	NA	2.79	3.13	3.41	3.87
July	3.22	3.42	3.27	3.49	1.77	2.08	2.28	2.75
Aug.	1.32	1.59	1.50	1.33	0.94	0.89	0.93	1.05
Sept.	1.18	1.30	1.49	1.53	NA	0.72	0.90	1.07
Oct.	1.32	1.33	1.36	1.36	1.24	NA	0.98	1.15
Nov.	1.49	1.62	1.62	1.53	1.30	1.38	NA	0.76
Dec.	1.35	1.56	1.58	1.50	1.55	1.48	1.49	NA

MODEL STANDARD DEVIATION OKC CASH MINUS CME FUTURES BASIS

	Jan.	Mar.	Apr.	May	Aug.	Sept.	Oct.	Nov.
Jan.	0.91	0.84	1.04	1.18	NA	NA	NA	NA
Feb.	NA	1.00	1.05	1.35	NA	NA	NA	NA
Mar.	NA	0.75	1.05	1.50	1.85	NA	NA	NA
Apr.	NA	NA	1.17	1.73	1.76	1.74	NA	NA
May	NA	NA	NA	1.59	1.29	1.37	1.40	NA
June	NA	NA	NA	NA	2.68	2.93	3.04	3.35
July	NA	NA	NA	NA	1.36	1.53	1.72	1.84
Aug.	1.36	NA	NA	NA	0.77	0.83	1.11	1.03
Sept.	1.21	NA	NA	NA	NA	0.85	1.22	1.13
Oct.	1.36	1.47	NA	NA	NA	NA	0.94	1.14
Nov.	1.14	1.04	1.04	NA	NA	NA	NA	0.64
Dec.	1.28	1.29	1.14	1.23	NA	NA	NA	NA

APPENDIX B

ADVANCED USER'S MANUAL

The purpose of Appendix B is to provide a supplement to Chapter IV in the form of an advanced user's manual. Information presented here will aid in understanding the programming aspects of the "BASIS" model. Description of the calculating procedures and explanation of the most cumbersome equations will be given. Knowledge of these aspects of the model will be necessary if modifications are ever made to the "BASIS" program. For modification purposes, the cell location of each segment of the program will also be included to direct the user to the appropriate locality in the spreadsheet. First a summary of the methodology involved in the program's execution will be presented. The model is based on the linear regression equations presented in Chapter III. Table XXVII is an extracted segment of the output screen from the summer grazing case (Case 2) as presented in Chapter IV. The appendix discussion will focus on the origin of particular values from this table.

TABLE XXVII

EXAMPLE OUTPUT SCREEN

Expected Hedge Price						
		Contract Month				
		Aug	Sept	Oct	Nov	Jan
Sale	Low	$86.39	$86.21	$86.06	NA	NA
Month	Aug Expected	$87.36	$87.24	$87.32	NA	NA
	High	$88.32	$88.26	$88.58	NA	NA
	Low	NA	$83.03	$82.21	$81.79	NA
	Sept Expected	NA	$83.86	$83.43	$82.93	NA
	High	NA	$84.70	$84.64	$84.06	NA

Methodology

The following equation depicts the relationship specified and estimated to determine the basis between the August cash price and the August futures price. Equation B1 is the equation that generates the value $87.36 in Table XXVII.

B1) Aug. Cash - Aug. Feeder Cattle Futures = f(Aug. Dummy,
(in Aug) (in Aug.)

April Live Cattle Quote, and Corn Price)
(in Aug.) (in Aug.)

It is important to note that the equation is specified using price data available in August. The April Live Cattle contract price is the price that contract was trading in August.

It is assumed that the current time is May and that we want to use Equation B1 to forecast the expected hedgable cash price for feeders to be sold in August using the August Feeder Cattle contract. In May, the August prices are unknown (i.e., the August Feeder Cattle contract price in August, the corn price in August, and the price of the April Live Cattle contract). However, Equation B1 determines the "typical basis" in August given the market conditions reflected by the April Live Cattle contract and August corn price. If we know this basis and today's August Feeder Cattle contract price (today being some day in May) we can predict the expected hedgable cash price for selling an August contract today (in May).

To use Equation B1, we must supply forecasted values for the August corn price and the April Live Cattle quote in August. As previously discussed, the corn price is forecasted by using the current price and a seasonal index of corn prices.

Using this index, today's corn price is converted to a forecasted August corn price. To make this calculation, a complicated programming step is required. The correct monthly index value matching the months desired for the table being created must be selected.

The April Live Cattle contract price is forecasted using the current April Live Cattle quote (as quoted in May). This value, and all other live cattle contract prices, is part of the data entered by the user. The programming challenge in selecting the April Live contract to inject into the equation is to know which live cattle contract (among all those entered by the user) is the correct one. This depends upon the month of the feeder cattle sales and the sales weight of the feeder cattle.

Thus the expected hedgable August Cash price is finally determined as follows:

B2) Expected Hedgable Aug. Cash Price = Aug. Feeder Cattle Quote (in May)

+ f(Aug. Dummy, April Live Cattle Quote (in May), and Forecasted Aug. Corn Price (in May))

The estimated basis is added to the current August feeder cattle futures quote to estimate the forecasted (expected hedgable) cash price for August with an August contract.

Horizontally across the table to the August forecasted cash price using the September contract (i.e., the value $87.24), the forecasting procedure is the same. One exception is the futures quote selected and inserted into Equation B2 changes to the September feeder cattle quote. However, when the sale month is changed from August to September (the lower half of the table), a new forecasting equation must be used. It appears as follows and will generate the value $83.86 as seen Table XXVII.

B3) Sept. Cash - Sept. Feeder Cattle Futures = *f*(Sept. Dummy,
(in Sept.) (in Sept.)

June Live Cattle Quote, and Corn Price)
(in Sept.) (in Sept.)

In comparing Equations B2 and B3, the dummy variable and corn price are changed and the Live Cattle Futures quote can vary depending on the sales weight of the cattle being hedged. The forecasted values in the table are now for the September corn price and the June Live Cattle quote in September. The expected hedgable September Cash price is finally determined as follows:

B4) Expected Hedgable Sept. Cash Price = Sept. Feeder Cattle Quote
(in June)

\+ *f*(Sept. Dummy, June Live Cattle Quote, and Forecasted
(in June)

Sept. Corn Price)
(in June)

Spreadsheet Locations

Most of the program calculations are executed directly below the second output screen. The basis and standard deviation tables, along with the corn price index, are located to the right of the input screen. The basis tables are located in cell range I1..Q63 and contain the equations from each of the appropriate regressions. The relevant live cattle contract and corn price cell references are inherent in each equation. The live cattle contract month is based on sale month and sale weight. Therefore by using the combinations presented in Table XXVII, the relevant contract is chosen simultaneously with the basis calculation. When analyzing the basis computations, it is important to realize that the only applicable basis numbers in the tables are the basis that correspond to the three sale months used in the analysis. Corn price is zero for all months other than the three sale months. This was done for ease of program writing as well as the fact that if estimated corn prices are adjusted from the price forecasted with the historical index, all other months would require adjustments to be relevant.

Immediately right of the basis tables, there are four tables in cell range S1..AA63 containing model standard deviations for each weight range. The corn forecasting operations are located in cell range AC1..AF18. The Ward and Bliss index is in column AE and the forecasting is done in column AF. Column AD is required to give the user the opportunity to adjust the forecasted price. This column is referenced in the basis table equations.

For the forecasted cash price, the equations use the simple concept of feeder cattle basis plus the futures quote equal forecasted cash. The first cell reference is the calculated basis. Selecting the appropriate futures contract is accomplished with an indexing statement. If the cursor is in a high or low row, the last cell reference is one standard deviation. Some cells have a complicated choose statement prior to the equation. This statement uses criteria cell references to determine if the cell is included or denoted as NA. If the cell is to be equated, the computations are the same. This is evident by the last part of the equation being identical to those without the choose statements. The forecasted basis cell references are a facsimile to the forecasted cash price basis. Analogous to the forecasted cash price equations, some basis equations include complicated choose statements and standard deviation cell references.

Below the forecasted basis screen is the basis and standard deviation interpolation equations. In addition, the macro for the menu and all other procedures is located directly below the equations. The correct percentage needed for interpolation is located in range C63..E66 with each column representing a different sale weight. The interpolation percentage is based on the assumption that all weight range prices represent the price for the mid-weight (i.e., 450 pounds for the 400 to 500 pound range etc.). The equations to accumulate basis and standard deviation and multiply it by the appropriate interpolation percentage is in range A69..AC87. Finally the macro which drives the menu selection listing is located at the bottom of the spreadsheet in range A90..J108.

VITA

Fred C. Eilrich

Candidate for the Degree of

Master of Science

Thesis: AN ANALYSIS OF FACTORS INFLUENCING FEEDER CATTLE FUTURES CONTRACT BASIS AND SPECIFICATIONS

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Ellsworth, Kansas, June 1, 1959. The son of F.G. and Mary Eilrich.

Education: Graduated from Chisholm High School, Enid, Oklahoma, in May 1977; received Bachelor of Science degree in Agriculture with a major in Animal Science from Oklahoma State University in May 1987; completed requirements for the Masters of Science Degree at Oklahoma State University in May, 1991.

Professional Experience: Extension Assistant, February 1991 to May 1991; Graduate Research Assistant, August 1988 to February 1991; Graduate Teaching Assistant, August 1988 to December 1988, for the Department of Agricultural Economics, Oklahoma State University.