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THE COMPARISON OF FIVE DIFFERENT CATTLE FEEDING ENTERPRISES: A STOCHASTIC SIMULATION ON EXPECTED RETURNS AND THE EFFECTS OF LRP INSURANCE

by

Caleb H. Bott

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

INTERNATIONAL MASTER OF BUSINESS ADMINISTRATION

in

International Food and Agribusiness

Awarded by the Royal Agricultural College
in cooperation with Utah State University

Approved:

_____	_____
Dr. Dillon M. Feuz Major Professor	Dr. Donald L. Snyder Committee Member
_____	_____
Dr. Dale ZoBell Committee Member	Dr. Byron R. Burnham Dean of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

2010

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I declare that this dissertation embodies the results of my own research or advanced studies and that it has been composed by myself. Where appropriate, I have made acknowledgement to the work of others.

Signed,

Caleb H. Bott
Dated March 26, 2010

ABSTRACT

The Comparison of Five Different Cattle Feeding Enterprises: A Stochastic Simulation on Expected Returns and the Effects of LRP Insurance

by

Caleb H. Bott, International Master of Business Administration

Utah State University, 2010

Major Professor: Dr. Dillon Feuz
Department: Applied Economics

This was a study on the Utah cattle industry which compared five different feeding enterprises. These feeding enterprises included feeding cull cows, finishing beef yearling steers, finishing Holstein yearling steers, backgrounding beef steer calves, and backgrounding Holstein steer calves. The main purpose of this study was to determine which feeding enterprise was the most profitable for Utah cattle producers.

Another objective of the study was to determine if LRP insurance lowered the volatility in the returns to these feeding enterprises. In order to answer these two questions of interest, a historical analysis of Utah cattle and feed prices was conducted from 1990 through 2009. Weekly sales data were used, and seasonality and price trends were determined.

Next, enterprise budgets were created for each feeding enterprise to establish historical returns. Then, using the historical data as a foundation, a simulation analysis

was run to forecast future returns and determine the risk associated with each feeding enterprise. LRP insurance was also added to the model to simulate the effects it had on lowering risk.

After completing a simulation analysis and comparing means and standard deviations of the expected returns, portfolio theory was used to put the feeding enterprises into different portfolios to attempt to lower risk. Then stochastic dominance was used to conclude which feeding enterprise was the most preferred for Utah cattle producers.

The results of the study depend upon the producer's level of risk. The majority of producers have an ARAC value between -0.0002 and 0.0012. With that knowledge, the results suggested that the majority of Utah cattle producers should finish Holstein yearling steers. If a producer was highly risk seeking, then he or she was better off to feed cull cows. If the producer was highly risk averse, then he or she preferred a portfolio of cull cows and backgrounding both Holstein and beef steers with LRP insurance.

The results of the study also indicated that LRP insurance was an effective tool for lowering the variability in expected returns. However, the results suggested that the most preferred option for Utah cattle producers was to feed either cull cows or Holstein yearling steers without LRP insurance.

(129 pages)

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Caleb H. Bott

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ABBREVIATIONS

ADG—Average Daily Gain
AEV—Actual Ending Value
AMS—Agricultural Marketing Service
ARAC—Absolute Risk Aversion Coefficient
BB—Backgrounding Beef steers
BB_I—Backgrounding Beef steers with LRP Insurance
BH—Backgrounding Holstein steers
BH_I—Backgrounding Holstein steers with LRP Insurance
BSE—Bovine Spongiform Encephalopathy
CC—feeding Cull Cows
CDFs—Cumulative Distribution Functions
CV—Covariance
CWT—Hundred Weight
EEV—Expected Ending Value
FB—Finishing Beef yearling steers
FB_I—Finishing Beef yearling steering with LRP Insurance
F_{FC}—Futures price for Feeder Cattle
FH—Finishing Holstein yearling steers
FH_I—Finishing Holstein yearling steers with LRP Insurance
F_{LC}—Futures price for Live Cattle
FSD—First Degree Stochastic Dominance
LB—Pound
LBS—Pounds
LGM—Livestock Gross Margin
LRP—Livestock Risk Protection
Max—Maximum
Min—Minimum
NA—Not Available
NASS—National Agricultural Statistics Service
OLS—Ordinary Least Squares
P_A—Price of Alfalfa
P_{BS}—Price of Beef Steers
P_{BSS}—Price of Beef Slaughter Steers
P_{CC}—Price of Cull Cows
P_C—Price of Corn
PDFs—Probability Distribution Functions
P_{HS}—Price of Holstein Steers
P_{HSS}—Price of Holstein Slaughter Steers
SDRF—Stochastic Dominance with Respect to a Function
Simetar—Simulation & Econometrics to Analyze Risk
SSD—Second Degree Stochastic Dominance

Std Dev—Standard Deviation
U.S.—United States
USDA—United States Department of Agriculture
VS—Versus

CHAPTER 1

INTRODUCTION

Raising cattle is an extremely risky business, especially in today's volatile market place. Raising cattle for beef has always been a challenging venture for producers. However, changes in recent years have made the economics of beef production even more unpredictable. One of the main causes for this change has been high corn and alfalfa prices and greater volatility in these prices in recent years. According to the National Agricultural Statistics Service (1990-2009), between 1990 and 2005, the average price of corn in Utah was $2.87 per bushel. From 2006 to 2009, the average price of corn in Utah increased to $4.46 per bushel. 2008 was a particularly high year for corn prices as the average cost of corn in Utah during 2008 was $6.08 per bushel and reached an all time high of nearly $8.00 per bushel in June of that year.

Alfalfa hay prices have also increased significantly in recent years. The National Agricultural Statistics Service (1990-2009) reports that between 1990 and 2005, the average price for alfalfa hay in Utah was $78.18 per ton. From 2006 to 2009, the average price of Utah alfalfa hay notably increased to $126.52 per ton. 2008 had especially high prices with an average price of $160.42 per ton with prices reaching an all time high of $180 per ton in August of that same year.

Besides high feed costs, other costs of production have increased as well, causing the breakeven cost of feeding cattle to increase even more. As a result of higher production costs, beef producers are struggling. Many cattle feeding operations are

operating below breakeven costs. Due to significant losses in 2008 and 2009, some of these operations are going out of business.

To make matters worse, the high cost of producing cattle was not being matched with high cattle selling prices at the auction. For example, in Utah the average selling price for cattle for the year 2008 was $75.11 per hundred weight. Remember, this was the year with record high prices for corn and alfalfa as was stated before. Yet, the average price of $75.11 per hundred weight for 2008 was nearly the same as the average Utah beef selling price in 1990 of $75.79 per hundred weight. However, the prices of corn and alfalfa in 1990 were $2.89 per bushel and $84.92 per ton respectively compared to 2008 prices of $6.08 per bushel and $160.42 per ton.

"Cattle feeding is a risky venture where returns oscillate from large profits to heavy losses over short time periods" (Balasco et al. 2009). Take for example finishing yearling steers. In 2002, finishing a 900 pound beef yearling steer from October to February generated an average return on investment of nearly 13 percent. However, in 2004, the average return dropped to less than one percent; in 2006, it dropped to -6.5 percent; and in 2008, to -12.64 percent.

Feeding cull cows has historically proven to be a profitable venture for the few who have taken advantage of it (Feuz 1995). However, profitability of this feeding enterprise has also decreased in recent years. In 2002, feeding cull cows generated an average return on investment of 1.25 percent; 2004 brought a return of -1.35 percent; 2006, a return of -12.20 percent; and 2008, a loss of -24.34 percent.

Producers backgrounding steer calves have also struggled in recent years. One study by Lawrence (2006) showed that backgrounding steer calves in Iowa was unprofitable every year from 1995 through 2005. Backgrounding operations tend to do worse than finishing operations because feeder cattle markets tend to have longer lag times than fed cattle markets, which translates into increased uncertainty (Burdine et al. 2004).

The trend of feeding cull cows, yearling steers, and steer calves is that in recent years, market price volatility has increased and profitability has decreased (Feuz 2009A). Take for example the steer to corn ratio. For 1100 to 1300 pound Utah slaughter steers in 2009, the steer to corn ratio was 19.12. In 2008, that ratio was 7.45. That means that in 2008, the relative cost of corn with respect to price of the slaughter steer was much more expensive than in 2009. Similar patterns existed between other groups of cattle as well. Having high price volatility made feeding cattle extremely uncertain.

Considering the cost of feed, yardage, veterinary and medical supplies, and other production costs, and taking into account the low return on cattle today, can the beef industry afford to stay in business? Can feeding cattle still be a profitable enterprise? These and many other questions weigh heavily upon the minds of many beef producers.

This research was a study on portfolio theory of the Utah cattle feeding industry. In other words, the goal of this study was to help Utah cattle producers increase returns and decrease risk by evaluating a portfolio of cattle feeding enterprises. The research assumed that there were Utah farmers who had excess facilities and were looking to

purchase cattle to feed for approximately four months from October to February. The research also assumed that the farmer was able to take out a loan to purchase the cattle and feed needed during the feeding period.

There were two main objectives for this research. The first objective was to determine the profitability and risk associated with several cattle feeding alternatives in Utah. The second objective was to determine if purchasing price insurance on these feeding enterprises helped lower risk.

To address the first objective, five different feeding enterprises were considered. Two of the feeding enterprises were backgrounding operations: one operation feeding beef steer calves, the other operation feeding dairy steer calves. Two feeding enterprises also considered were finishing yearling steers: one operation feeding beef yearling steers, the other operation feeding dairy yearling steers. The final feeding enterprise examined fattening cull cows. Each feeding enterprise was analyzed in depth and it was determined which enterprise, or combination of enterprises, promised the highest return on investment depending, upon the producer's level of risk preference.

The second objective addressed whether price insurance lowered the risk of receiving a negative return on investment. Several forms of price protection exist such as hedging on the futures, purchasing options, entering into a contract, and so forth. However, extensive research has been done on these methods. The price protection method that was investigated in this research was through insurance. Livestock Risk Protection (LRP) insurance exists for Utah cattle producers (Risk Management Agency,

2009). LRP insurance fitted the four month feeding programs that were considered in the research. Yet, LRP insurance was only available for the finishing and backgrounding enterprises. It was not available for the cull cow enterprise.

To achieve the objectives of this study, Utah monthly average price data were collected from 1990 through 2009 for cattle, corn grain, and alfalfa hay. Enterprise budgets for each group of cattle were constructed and the historical returns were determined for each feeding enterprise. Simulation was then used to predict future returns and the risk associated with each feeding enterprise. The effects of LRP insurance were also simulated to see if price volatility was reduced. A portfolio analysis was then conducted to determine if risk could be lowered even more. Finally, stochastic dominance was used to rank the most preferred feeding enterprises both individually and in a portfolio. These results were reported and ranked at several different risk preference levels.

It was intended that the results from this research would help aid cattle producers (not just from Utah) to recognize the trends in cattle production and to make more informed decisions on the profitability and risks associated with various cattle feeding enterprises. Also, the results of this research were expected to help inform farmers on LRP insurance and the effects that this form of price protection has on cattle feeding risk. With the high level of unpredictability in the cattle industry, this analysis of Utah cattle feeding enterprises should be beneficial to beef producers.

The next chapter is a review of the academic literature on the topics that are discussed in this research. It covers risk, methods of lowering risk, specialty feeding programs, simulation analysis, portfolio theory, and stochastic dominance.

Following the literature review, the methods for this research are presented. Then a detailed description of the data collected is discussed. This chapter outlines the monthly average prices for Utah cattle, corn grain prices, alfalfa hay prices, and LRP insurance information. It then constructs enterprise budgets for each feeding enterprise.

After the description of the data, the following chapter is the findings of the research. The chapter reports historical returns, risk and simulated returns, effects of LRP insurance, a portfolio analysis, and a stochastic dominance ranking of the five feeding enterprises. Following the findings chapter, a conclusion and summary chapter highlights the main points of the research. Then, the final chapter is a brief summary of the author's thoughts on the research.

CHAPTER 2

LITERATURE REVIEW

As unfair as it may seem, risk is an inevitable truth that always accompanies cattle production. It simply cannot be ignored. The intent of this research was to identify some of the risks associated with cattle production and determine what steps could be taken to mitigate such risk. In order to fully understand this topic, an in-depth look at the literature available on the subject and definition of risk were conducted. Once the concept of risk is understood and appreciated, then steps can be taken to lessen the negative effects that are associated with risk in cattle production.

Risk

However simple the word may appear, the definition of risk is anything but simple. Several attempts have been made to define risk in works by Knight (1921), Mises (1928), and Kolmogorov (1933). Yet, all of these definitions prove to be contradictory or one-sided in their defense. According to Holton (2004), a definition of risk must cover any situation where a person cares about the outcome. He then made an attempt to define risk. "Risk is exposure to a proposition in which one is uncertain" (Holton 2004 : 22). Next, he gave an example of how death is certain if a man jumps out of an airplane without a parachute. Because death is certain, there is no risk involved.

In order to fully understand Holton's definition of risk, two other terms need to be defined: uncertainty and exposure. Both of these words need to be understood because

without uncertainty and exposure, risk cannot exist. Uncertainty is the possibility of more than one outcome (Hubbard 2007). In the skydiving example above, uncertainty does not exist because there is only one possible outcome: death.

The second definition needed to understand risk is exposure. Holton (2004 : 22) described exposure as "a self-conscious being is exposed to a proposition if the being would care whether or not the proposition is true." Referring back to the skydiving example, it can be applied that the proposition is whether or not death will occur. Because the skydiver cares about the outcome of the proposition, he is therefore exposed (Holton 2004).

Now that exposure and uncertainty have been defined, it is easier to understand why each element must be present in order to have risk. It is also evident how risk is such a large fact of life for agricultural producers, for they are both exposed to, and uncertain about their enterprises.

Several studies have been conducted on the risk that exists in agriculture. Mapp Jr. et al. (1979) studied risks such as weather, diseases, insect infestations, economic conditions, development and adoption of technological innovations, and public and private institutional policies. Farmers are affected by environmental policies and decisions made by financial institutions. Other risks include volatility in prices, costs, and production yields.

Another uncertainty to which cattle production is exposed is food scares, such as Bovine Spongiform Encephalopathy (BSE) and E. coli. These threats can happen at any

time and can be made know very quickly to the whole world. Smith et al. (1988) did a study that looked at the effects that media had on a milk contamination in Hawaii in 1982. Their results were that negative media coverage had a larger impact than positive media coverage.

The fact is, people respond greater to a scare than to something positive. One specific example happened in the cattle industry on April 16, 1996. Oprah Winfrey, the famous talk show host, mentioned to her video audience across the United States that because of reports of BSE, she could no longer eat a hamburger (even though no cases of BSE had yet been reported in the United States). Many would think a small comment like this would not have much of an effect on the beef industry. Yet, it did. To measure the effects of this statement, Schlenker and Villas-Boas (2006) compared it to an event that happened seven years later on December 23, 2003. An actual case of BSE was found in a dairy cow in the state of Washington. The study found that Oprah Winfrey's remark on BSE seven years earlier caused the futures price to drop 50 percent more than it did after the actual BSE case in 2003. Hence, great risk can be added to agricultural producers not only when there is an actual food scare, but also by the comments made by the media and influential people.

Agricultural producers act differently to the types and levels of risk that they face. As this research analyzes the risk associated with each cattle feeding enterprise, producers will act differently upon this information. A producer's level of risk preference or risk aversion is not easily defined. It depends upon the curvature of the producer's utility function. Because each producer's utility function is different and

extremely difficult to determine, an easier way to measure a producer's risk tolerance has been developed and is known as the Arrow-Pratt Absolute Risk Aversion Coefficient (ARAC).

If the ARAC value is positive, then it is said that the decision maker is risk averse; if the ARAC value is negative, then the decision maker is risk seeking; and if the ARAC value is zero, then the decision maker is risk neutral (Chavas 2004). A risk averse person is one who is willing to pay (or forgo) money to eliminate risk and is, in essence, worse off if exposed to risk. A risk seeking individual is a person who demands compensation if exposure to risk is eliminated. Finally, one who is risk neutral is neither better nor worse off by a modification to risk exposure.

Several studies in agriculture have been conducted to determine the ARAC values for the typical agricultural producer. Studies by Lin et al. (1974) and Halter and Mason (1978) suggest that the majority of agricultural producers' ARAC value is between -0.0002 and 0.0012. This assumption indicates that agricultural producers are slightly more risk averse than risk seeking.

This research looked at different cattle feeding enterprises and reported the level of risk that was associated with each enterprise. Types of risk that were included in this analysis were market price risk through uncertainty in cattle and feed prices and production risk through uncertainty in average daily gain and fluctuations in purchase weight. Then various tools were used to measure and reduce the risk associated with each enterprise.

Tools for Reducing Risk

Several different types of tools have been created to reduce the amount of risk to which cattle producers are exposed. Some of these tools include hedging on the futures and options markets, entering into a contract, and purchasing insurance.

Several studies have been done on these tools, specifically with hedging on the futures and options markets. One example of work that was done on futures and options was a study by Powers (1970) dealing with whether futures trading reduced price fluctuations in the cash markets. His findings suggested that the variance in cash prices for pork bellies and live beef was significantly lower when futures trading occurred.

Another study was done by Lapan et al. (1991) which looked at the effects of options and futures markets on production, hedging, and speculative decisions. Their findings suggested that when market prices were unbiased, optimal hedging required only futures; however, when market prices were biased then both futures and options were required for optimal hedging.

So, is the futures market truly efficient? Kofi (1973) performed a study to answer this question. The results of his study suggested that the futures markets did an exceptional job at their forward pricing function. Hence the futures market is efficient. However, although the futures and options markets have been proven efficient, very few cattle producers take advantage of these resources (Feuz 2009A).

Besides hedging on options and futures, another common form of price protection for cattle producers is entering a contract. One particular contract of interest is a forward

contract. This type of contract locks in a set price for the cattle in a future date. Many studies have been conducted to determine the efficacy of forward contracts. Elam (1992) found that forward contracts did eliminate basis risk for individual feeders. Yet, in the same study, a forward contract was compared to a futures hedge and it was found that a futures hedge generated $0.28 to $0.59/cwt more than a forward contract.

Forward contracts have also created a great deal of controversy. According to Schroeder et al. (1993), forward contracts had a large impact on the cash market. Their studies suggested that during times of large forward contracts, cash prices lowered by approximately $0.15 to $0.31/cwt. Yet in times when forward contracts were low, then cash prices were not affected.

Bastian et al. (2002) created various econometric models to determine the effects of mandatory price reporting which makes forward contract information publicly known. Their results indicated that the increase in knowledge did make the spot market more efficient but hurt the forward contract market. Forward contracts tended to be more advantageous for the buyer than the seller.

Because forward contracts have several disadvantages as was discussed above, this form of price protection was not used in the research. Another type of price protection that exists is insurance. Different types of insurance exist for cattle producers, as was mentioned before. One such type is called Livestock Gross Margin (LGM) insurance. However, this form of insurance is not applicable to the feeding programs that

were considered in this research. Because of that, the type of insurance that was analyzed was Livestock Risk Protection (LRP) insurance.

LRP insurance is yet another way for cattle producers to lower the risk associated with raising cattle and was specifically designed for feeder and fed cattle (Grunewald et al., no date). LRP insurance protects against large cash losses but also allows producers to enjoy higher market prices (Feuz 2009A). LRP insurance is very similar to a put option (Mark et al. 2005).

A few studies have been conducted on LRP insurance. Mark et al. (2005) compared the futures basis to the LRP basis on fed and feeder cattle. Their findings suggested that LRP insurance had a much larger effect on fed cattle than on feeder cattle. Coelho et al. (2008) determined that basic market fundamentals such as the price of corn and slaughter levels affected LRP basis. Feuz (2009A) used simulation analysis to determine the effects of LRP insurance given various production and market risks. His findings suggested that LRP insurance was a very good substitute for a put option. This is because the effects are similar but LRP insurance does not require a specific quantity of insurance to be purchased on the cattle. It also is sold through an insurance agent rather than a commodity broker, with whom many producers may prefer to work.

LRP insurance was the price protection tool that was chosen for this research. The effects of LRP insurance on backgrounding beef and Holstein steers and finishing beef and Holstein steers were simulated. Cull cows are not insurable under LRP insurance; therefore they were not evaluated in that part of the simulation.

Specialty Feeding Programs

Cattle production has changed dramatically over time. According to Koch and Algeo (1983), since 1958, numerous changes have taken place in the cattle industry such as an increase in beef consumption, changes in genetic research, increases in crossbreeding and importing new breeds of cattle, the introduction of large scale custom feeding operations, etc. These changes have forced cattle producers to adjust their production and marketing techniques.

Some ways that producers are responding to changes in the cattle industry include retaining ownership of their cattle for longer periods of time and feeding over the winter months. A study by Balasco (2009) indicates that farmers are starting to retain ownership of their cattle in order to protect against high loses. A study by Buccola et al. (1980) confirms that when cattle are fed over the winter, more profits can be earned by adding more weight to the cattle, increasing quality grades, and also through increases in market prices during the time frame.

One large change that has occurred in the cattle industry over time is taking cattle off pasture and feeding them high concentrated corn rations to increase average daily gain (ADG). This is known as finishing cattle and is often done in feedlots. Finishing cattle involves "placing feeder cattle on high-energy rations to increase weight and market desirability" (Ensminger and Perry 1997 : 784).

Finishing cattle on high concentrated corn rations was one type of feeding program that was analyzed in this research. Another type of feeding enterprise that was analyzed was backgrounding cattle.

Backgrounding is the feeding of calves from weaning until the time the calves are placed on finishing rations (Ensminger and Perry 1997). In other words, backgrounding prepares cattle for the feedlot. Calves being backgrounded, as compared to steers being finished, are fed a higher percentage of roughage than grain. In a backgrounding operation, a high ADG is not the main goal, because a high ADG "lessens, or eliminates, compensatory growth" (Ensminger and Perry 1997 : 875).

Studies show that the high corn ration diets discussed above work very well for feedlots, but not necessarily well for backgrounding (Buccola et al. 1980). One study by Lawrence (2006) showed that backgrounding calves was unprofitable from 1995 to 2005.

Ensminger and Perry (1997) in their work highlighted some of the advantages of backgrounding. They said that backgrounding: 1) allows producers to have ownership when the cattle have the most efficient ADG; 2) works well with roughages and byproducts; 3) is a good use of seasonal surplus labor and facilities that otherwise would not be fully used; and 4) is more flexible than other operations.

One group of cattle that is commonly ignored is cull cows. Unbeknownst to many producers, the sale of cull cows can account for around 15 to 30 percent of farm income (Feuz 1995). Most producers cull and sell their cows in the fall when prices are the lowest and the cattle are in poor condition. A large supply of thin cull cows going to

market in the fall provides an opportunity for producers to purchase these cattle at low cost, fatten the cattle over the winter, and sell the cattle in late winter/early spring when cull cow prices are at their highest (Boyles, no date).

Previous research has shown that it is best to feed cull cows for two to four months (Boyles, no date). Research has also indicated that thin cull cows fed during that time frame can gain between one to two quality grades (Pritchard and Burg 1993) which will generate an even higher selling price for the cattle. For these reasons, cull cows were chosen as one of the feeding enterprises that were evaluated in this research.

Feeding Holsteins is another enterprise that is often overlooked in both practice and in academic research, yet Holstein steers make up around 10 percent of the U.S. calf crop (Burdine et. al 2004). Holstein steers can be purchased relatively cheaply when compared to beef steers and provide another exploitable opportunity for cattle producers.

Research shows that Holstein steers perform just as well as, or better than beef steers in regards to ADG (Feedlot Performance and Cost Monitoring Program 1987; Fanatico 2000). Also, past studies indicate that a Holstein steer is more likely to grade prime than a beef steer (Burdine et al. 2004). Hence, two different groups of Holstein steers were also looked at in this research. One of the enterprises was backgrounding Holstein steer calves and the other was finishing Holstein yearling steers.

The final group of cattle that was represented in the research was beef steers. Feeding traditional beef breeds is the most common group of cattle to be fed by producers today and for good reason. Research shows that beef steers have a much better

feed conversion ratio than Holstein steers (Feedlot Performance and Cost Monitoring Program 1987; Fanatico 2000). Also, beef breeds sell for 20 percent higher on average than dairy and exotic breeds (Mark et al. 2005). Therefore, the significance of beef breeds cannot be overlooked in this research. Both backgrounding and finishing operations were analyzed for beef steers.

Simulation Analysis

Because the outcome for the five feeding enterprises was uncertain, a technique called simulation was used to analyze the risks and potential profits for each enterprise. Simulation is simply building a model of a real system in order to analyze and understand the system (Barreto and Howland 2006). Simulation is designed to solve stochastic dynamic models which cannot be solved analytically (Sims 1994).

The use of simulation is becoming more and more popular among researchers today. According to a study by Richardson et al. (2000), simulation's unique ability to provide a tool for evaluating risky alternatives and determining expected increases in commodity price risk will increase the interest in simulation as time continues. Because risk is so prevalent in today's agriculture, simulation proves to be a very useful tool.

Hundreds of studies have been done in agriculture using simulation analysis. These studies cover a broad range of agricultural topics. For example, Lopez et al. (2009) used simulation to forecast and analyze future Mexican meat consumption due to U.S. exports. Funke et al. (2009) used simulation to determine the impacts of industrial biofuels on South African agriculture. Also, Grove et al. (2007) used simulation to

analyze three alternative scenarios to determine if beef farmers should convert to game ranching. Numerous other agricultural topics have also been examined using simulation analysis.

Several computer programs have been created to simulate and analyze risk. The program of choice for this research was to use the Excel add-in created by Texas A&M called Simetar (Simulation & Econometrics to Analyze Risk) (Richardson et al. 2008). Simetar simulates given scenarios by creating stochastic (random) variables which are arbitrarily drawn and then applying those values to the parameters of the model. The program creates several trials or iterations of the event and each iteration has an equal probability of occurrence. When 100 or more iterations are simulated, an empirical probability distribution is created. Probability distributions can be used to gain a better understanding of the risk involved in the system being analyzed (Richardson et al. 2008).

This study used Simetar to conduct a simulation analysis on the five feeding enterprises. The simulation evaluated the risks and established expected returns associated with each enterprise. Simulation was also used to determine the effects of LRP insurance on expected returns.

Portfolio Theory

One way to lower risk associated with an investment is through the use of portfolio theory. The theory was pioneered by Markowitz (1952). In its simplest definition, it is a practice that strives to lower risk and increase the return on an

investment by grouping assets together. The theory chooses the best portfolios according to their mean and variance (Elton and Gruber, 1997).

On the subject of how to select a portfolio, Markowitz (1952 : 77) said, "The first stage starts with observations and experience and ends with beliefs about the future performance of available securities. The second stage starts with the relevant beliefs about future performances and ends with the choice of portfolio." Although in this quote Markowitz was referring to financial securities, portfolio theory can be applied to all sorts of assets. In particular, for the interest of this research, portfolio theory can be applied to agriculture.

Robinson and Brake (1979) suggest that agriculture is starting to use portfolio theory on more and more diverse problems. Since their study, several agricultural studies have been done on portfolio theory. For example, Teegerstorm et al. (1997) performed a study that used portfolio theory on cattle contract grazing. Cabrini et al. (2005) used portfolio theory to determine the efficiency of agricultural market advisory services. Nalley et al. (2009) applied portfolio theory to rice varietal selection. Numerous other studies have also been done using portfolio analysis in agriculture. All of these studies have something in common; they found that portfolio analysis proved to be a useful tool in lowering risk through diversification.

"Using location-specific empirical data, portfolio theory can provide producers a tool that is able to recommend a bundle of varieties to meet a specific objective, either

maximizing yield around a given variance or minimizing variance around a given yield" (Nalley et al. 2009 : 3).

In this research, portfolio theory was used to place combinations of feeding cull cows and backgrounding and finishing beef and Holstein steers. These enterprises were evaluated both with and without LRP insurance and it was determined if risk was reduced by creating a portfolio of different feeding enterprises. A cattle producer's risk will go from extremely risk seeking to extremely risk averse and everything in between and for that reason, a range of results needs to be presented to the producer (Teegerstorm et al. 1997). Agricultural producers who are more risk averse will prefer to have portfolios that are more diverse to help lower risk (Teegerstorm et al. 1997). For those who are more risk seeking, their portfolios will be less diverse.

Stochastic Dominance

The method that was chosen in this research to determine the best solution for cattle producers was that of stochastic dominance. As was mentioned previously in this chapter, making assumptions about a decision maker's utility function can be a very difficult task. However, predictions must be made about how a decision maker is going to react between pairs of uncertain alternatives without any foreknowledge of their utility (Hadar and Russel 1969). This is where stochastic dominance comes into play.

There are different levels of stochastic dominance that are used in making decisions. The first is called First-degree Stochastic Dominance (FSD). FSD says that for any two distributions, when one lies partly or entirely above the other, it is preferred

(Hadar and Russel, 1969). The next level of stochastic dominance is called Second-degree Stochastic Dominance (SSD). SSD says that an option is preferred if the area under its cumulative distribution is greater than or equal to the other cumulative distribution (Hadar and Russel 1969). It is important to note that FSD is the stronger of the two methods (Richardson et al. 2008). Whenever an option has FSD, then SSD is implied; but not vice versa (Hadar and Russel 1969).

At times, FSD and SSD are not sufficient to determine the most desirable alternative such as when the cumulative distributions of two risky alternatives intersect each other (Richardson et al. 2008). In this case, Stochastic Dominance with Respect to a Function (SDRF) is used. According to a study by Wilson and Dahl (2007), SDRF includes FSD, SSD, and higher order stochastic dominance. SDRF allows for multiple cumulative distributions to be compared to one another. Richardson et al. (2008) said that SDRF compares upper and lower ARAC values (Arrow-Pratt Absolute Risk Aversion Coefficients as was discussed previously) and returns the most preferred method according to the ARAC values.

Several agricultural studies have been conducted using stochastic dominance. For example, Flaten et al. (2008) used stochastic dominance to compare the risk between aquaculture and agricultural businesses. Field et al. (2003) used the same technique to evaluate the effectiveness of using crop and revenue insurance products as risk management tools. Gebremedhin et al. (1998) performed a stochastic dominance study on using sugar beets and navy beans for alternative crop rotations. Dias et al. (1999) did

a study using stochastic dominance to determine the economic and environmental risks associated with the land application of cattle feedlot manure.

Application

The literature review that was conducted in this chapter provided the framework for the studies and methods that were utilized throughout this research. Risk is the underlying theme of the research and was analyzed carefully. As the different cattle feeding enterprises were presented, risk was determined. Then LRP insurance was applied to these enterprises to see if any of the risk was absorbed. This was done through the use of simulation analysis and portfolio theory. Stochastic dominance was then used to determine the best feeding enterprise for the average Utah farmer. More information on the methods of this research is discussed in the next chapter.

CHAPTER 3

DATA AND METHODOLOGY

This chapter is an outline of the data used in the analysis and discusses the type of analysis to be conducted to accomplish the objectives of this research.

Utah Price Data

Weekly cattle prices from 1990 through 2009 for each feeding enterprise were collected. In order to do this, the purchase weight and selling weight of each group of cattle needed to be determined. For the first feeding enterprise, finishing beef yearling steers, the cattle were purchased at around 900 pounds and sold at approximately 1300 pounds. For the second feeding enterprise, finishing dairy yearling steers, the cattle were purchased at around the 1000 pound level and sold at approximately 1300 pounds. The next feeding enterprise, backgrounding beef steer calves, the calves were purchased at 550 pounds and sold at around 750 pounds. The backgrounding dairy steer calves enterprise purchased the calves at around 600 pounds and sold them at 800 pounds. And finally, the cull cow enterprise purchased the cows at 1000 pounds and sold them at 1300 pounds.

The information for the beef steer calves was collected from actual weekly sales data from the Producers Livestock Auction in Salina, Utah. The same source of information was used to gather the sales data for cull cows. The dairy steer calves sales data were gathered from the Smithfield, Utah Livestock Auction which sells a larger

number of Holstein steers on a weekly basis than the Producers Livestock Auction. Sales data for the 1300 pound slaughter steers for both the beef and dairy breeds were gathered from the Utah weekly direct cattle report that was reported by the Agricultural Marketing Service.

Following the collection of the cattle sales data, price data for corn grain, alfalfa hay, and grass hay were collected from 1990 through 2009. The data for corn grain came from the Ogden, Utah daily grain bid reported to the Agricultural Marketing Service. Alfalfa hay prices were found on the National Agricultural Statistics Service website using the quick stats feature. Grass hay was not included in these reports. The price of grass hay will be assumed to cost 75 percent of alfalfa hay (Feuz 2009B).

Utah LRP Insurance Data

Information on Utah LRP insurance was also gathered. Utah LRP insurance information went back to 2004 for the October feeding period. The information that was recorded was for feeder cattle and live cattle being fed for 17 weeks or 119 days. Premiums for 95 percent coverage were recorded for the time period.

The Expected Ending Value (EEV) and the Actual Ending Value (AEV) were also obtained. The EEV and AEV prices were very close to the current futures price. For simplicity's sake, the EEV and AEV that were used in this research were based upon futures prices for the time period. The Chicago Mercantile Exchange (CME) February futures prices in October for live cattle and feeder cattle were used for the EEV, and

CME February futures price in February for live cattle and feeder cattle were used for the AEV.

Price Analysis

Once the price data were collected, a simple price analysis of the data was conducted. In addition to computing summary statistics for each price series, trends and seasonal patterns in each series were quantified and illustrated graphically. It was felt that this information would be useful to many Utah farmers who would like to know the trends and seasonality of Utah cattle, corn grain, and alfalfa hay prices.

Creating Enterprise Budgets

Following the analysis of the price data, the next step was to create enterprise budgets for each feeding enterprise. These enterprise budgets were created by using the price information gathered on cattle prices and feed prices or costs. Then costs were determined for veterinary and medical expenses, yardage, trucking, interest, and an "other expenses" category which included miscellaneous expenses that may occur when raising the cattle.

Aside from the costs in the enterprise budgets, other important production factors were also determined, such as average daily gain and death rate. The enterprise budgets also included the feeding rations for each group of cattle.

The enterprise budgets were then used to calculate the historical returns for the five feeding enterprises. This showed which enterprise was the most profitable over

time. The historical returns gave an idea of the potential returns each feeding enterprise had, as well as some indication to the risks associated with each enterprise.

The historical returns were first calculated with yardage and then without yardage. This was done to show the effects of yardage on each enterprise. Yardage is the cost that the producer would pay to a feedlot if the cattle were being fed at the feedlot. Yardage includes the cost of labor to feed and care for the cattle and a charge for the facilities at the feedlot. In this research, the research assumed that the producer fed the cattle himself, so when yardage was included as an expense; it represented the producer's return on labor and facilities. When yardage was excluded as an expense, then the producer was not paid for his time or his facilities. Yardage in this case represented unpaid labor.

Simulation Analysis and Cumulative Distribution Functions

Following that, a simulation program created by Texas A&M called Simetar was used to conduct a simulation analysis using certain stochastic variables to determine the risk associated with each feeding enterprise. Running a simulation analysis forecasted future returns for each feeding enterprise as well as allowed for risk to be taken into account. Cumulative distribution functions (CDFs) were then presented to illustrate the simulated risk and returns.

In the past, simulation has proven to be an extremely useful tool for evaluating risky alternatives (Richardson et al. 2000). Considering the fact that cattle production is full of risk, simulation was used to evaluate this risk. Several types of risk exist from

production risk to market price risk, etc. The simulation included risk in the purchase price, the selling price, the purchase weight, and the average daily gain of the cattle. Also, risk was simulated in the costs of corn, alfalfa, and grass hay fed to the cattle.

The simulation conducted in this research is similar to a study done by Grove et al. (2007) where simulation was used to analyze three alternative scenarios to determine if beef farmers should convert to game ranching. The simulation used the price data gathered for the five cattle feeding enterprises and their enterprise budgets. The simulation showed the risk associated with each feeding enterprise as well as determined which feeding enterprise was the most profitable.

Next, the LRP insurance information gathered was incorporated into the simulation. The returns with the added LRP insurance were compared to the returns without price protection. This simulation showed which feeding enterprises were affected the most by purchasing LRP insurance and also by approximately how much LRP insurance lowered the price variability of the four enterprises eligible for coverage. This simulation was similar to work done by Feuz (2009A) that simulated the effects of LRP insurance on cow-calf operations.

Portfolio Theory and Stochastic Dominance

Once the level of risk was determined for the feeding enterprises, portfolio theory was then used to determine if risk could be lowered even more by feeding a combination of cattle. Portfolio theory was particularly useful because of the availability of location-specific data which was used to minimize variance around a given yield (Nalley et al. 2009).

There were numerous possibilities in which the five feeding enterprises could be grouped together into a portfolio. For example, if the producer had the capacity to feed 100 head of cattle, he could simply feed all beef yearling steers, or he could feed 50 head of beef yearling steers and 50 head of cull cows. He could also consider purchasing LRP insurance for only half of his herd instead of the entire herd. These were only a few of the many possibilities that existed when grouping the cattle together into portfolios. These portfolios were based around a producer's risk preferences. Agricultural producers who are more risk averse will prefer to have portfolios that are more diverse to help lower risk and producers who are more risk seeking will prefer portfolios that are less diverse (Teegerstorm et al. 1997).

Several other portfolio possibilities were analyzed and through the use of stochastic dominance, the best options were determined depending upon the producer's risk preferences. Risk levels were looked at from highly risk averse, to risk neutral, to highly risk seeking, and various levels in-between. The risk aversion coefficients that were used in the study ranged from negative one to positive one. This range was chosen because it included the range for the majority of agricultural producers as was discussed earlier. It also showed the preferences for highly risk seeking and highly risk averse producers. Reporting a wide range of results was in accordance with a study made by Teegerstorm et al. (1997) which indicated that a cattle producer's risk will go from extremely risk seeking to extremely risk averse and everything in between and for that reason, a range of results needs to be presented.

Stochastic Dominance with Respect to a Function (SDRF) was used to rank the most preferred feeding enterprises according to various risk preference levels. The risk levels used followed the levels set out by Lin et al. (1974) and Halter and Mason (1978). This method of research is similar to a study by Field et al. (2008) who used stochastic dominance to evaluate the effectiveness of using crop and revenue insurance products as risk management tools. However, in this research, the objectives were to determine the effectiveness of LRP insurance on cattle and to determine which cattle feeding enterprise was the most desirable given various risk preference levels.

CHAPTER 4

PRICE ANALYSIS AND ENTERPRISE BUDGETS

This chapter contains the results of the price analysis of Utah cattle prices and Utah corn and alfalfa prices. The first two sections are quite tedious yet necessary to understand price trends and seasonality in these markets. The price data reported below were then incorporated into enterprise budgets for the five cattle feeding enterprises. The last section of this chapter is an outline of Utah LRP insurance information. All of these data were used to conduct a simulation analysis, the results of which are presented in chapter 5.

Utah Cattle Prices

The prices reported in this chapter are monthly average prices. To calculate these monthly averages, weekly sales data reported by the Agricultural Marketing Service (2005-2009) were obtained and the weekly average for each weight and type of cattle was calculated. Then, the weekly averages for each month were averaged into a monthly average price. Cull cow prices are reported in this section along with cattle prices for 500 to 600 lb., 700 to 800 lb., and 800 to 900 lb. beef steers, as well as prices for 500 to 700 lb., 700 to 900 lb., and 900 to 1100 lb. Holstein steers. Also prices for slaughter steers for both beef steers and Holstein steers are shown.

Cull Cow Prices

Utah cull cow prices between 1990 and 2004 were found in a report by Holmgren et al. (no date). To collect the sales data from 2005 to 2009, weekly sales reports were downloaded from the Agricultural Marketing Service (2005-2009) website. Data were reported to the AMS from Producers Livestock Auction in Salina, Utah. All prices were monthly averages and included cows in the following quality grades: cutting, boning, breaking, and commercial. Prices were traced from January 1990 through December 2009.

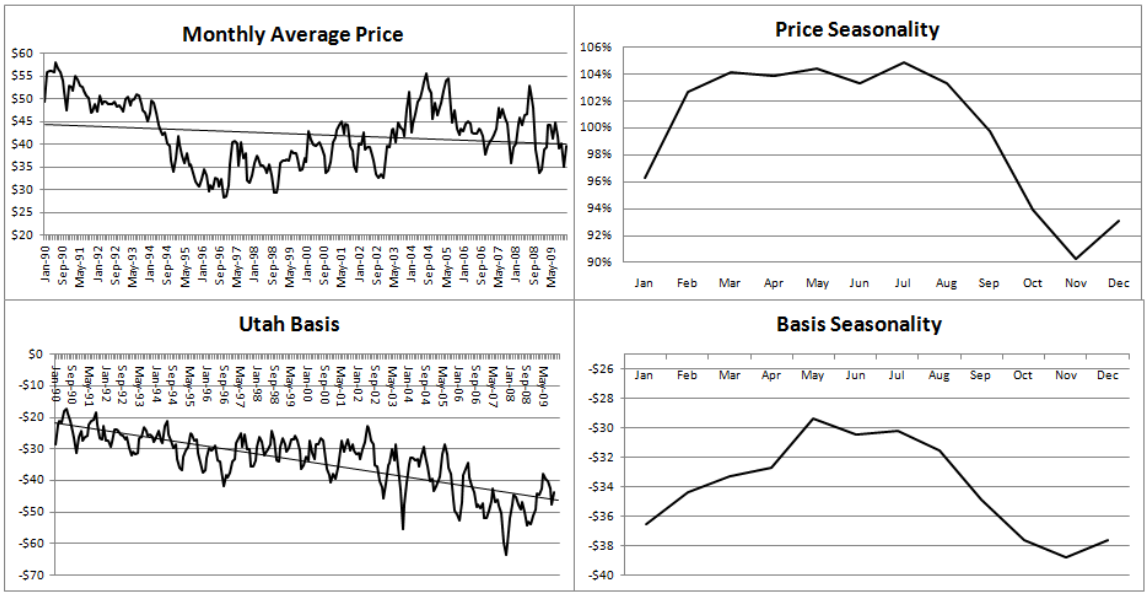
Table 4-1: Utah Monthly Average Price for Cull Cows

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$49.45	$55.88	$56.25	$56.25	$56.00	$57.97	$56.63	$55.88	$54.08	$51.53	$47.41	$53.04	**$54.20**
1991	$52.63	$51.75	$55.00	$54.15	$52.94	$52.66	$51.94	$50.81	$50.19	$47.00	$47.25	$48.88	**$51.27**
1992	$47.18	$50.63	$48.91	$49.52	$49.28	$48.75	$48.95	$48.82	$49.42	$48.30	$48.72	$47.82	**$48.86**
1993	$47.30	$49.97	$50.47	$48.70	$49.60	$49.97	$51.00	$50.89	$48.88	$47.48	$47.00	$45.07	**$48.86**
1994	$47.05	$49.69	$49.22	$46.88	$44.22	$43.37	$42.11	$42.60	$40.10	$39.73	$36.44	$34.01	**$42.95**
1995	$36.98	$41.82	$39.97	$37.48	$35.85	$37.94	$35.41	$35.69	$33.83	$31.80	$30.91	$30.88	**$35.71**
1996	$32.49	$34.45	$33.14	$29.79	$30.93	$30.25	$32.57	$32.50	$30.78	$32.24	$28.20	$28.50	**$31.32**
1997	$31.00	$35.49	$40.45	$40.81	$40.20	$35.21	$40.48	$37.10	$38.04	$32.10	$31.47	$33.07	**$36.29**
1998	$35.78	$37.38	$36.93	$35.22	$35.28	$34.40	$33.68	$35.52	$33.22	$29.35	$29.32	$30.82	**$33.91**
1999	$35.85	$36.32	$36.47	$36.78	$36.32	$38.47	$38.05	$38.10	$36.85	$34.38	$34.47	$36.94	**$36.58**
2000	$36.25	$42.85	$41.13	$39.93	$39.57	$39.85	$40.53	$39.03	$37.43	$33.78	$34.38	$36.13	**$38.41**
2001	$40.56	$41.44	$43.19	$44.23	$45.03	$42.29	$44.50	$44.34	$39.75	$38.48	$35.32	$34.01	**$41.10**
2002	$40.19	$39.83	$42.60	$38.83	$39.53	$39.44	$37.44	$36.52	$33.53	$32.57	$33.44	$32.57	**$37.21**
2003	$34.80	$39.80	$39.38	$43.09	$43.58	$40.43	$44.90	$43.81	$43.25	$41.93	$47.73	$51.51	**$42.85**
2004	$42.60	$44.58	$46.69	$49.46	$50.34	$52.42	$53.60	$55.60	$52.51	$51.39	$45.63	$49.00	**$49.49**
2005	$46.46	$48.22	$49.12	$51.84	$53.88	$54.47	$47.83	$44.82	$47.49	$43.54	$41.99	$43.33	**$47.75**
2006	$42.82	$44.51	$44.99	$44.54	$42.53	$42.42	$42.39	$43.51	$43.11	$41.70	$37.85	$39.69	**$42.51**
2007	$40.67	$41.03	$42.03	$43.50	$48.05	$45.85	$47.86	$45.83	$44.67	$38.78	$35.89	$39.39	**$42.79**
2008	$40.33	$44.48	$45.86	$44.25	$46.39	$46.77	$52.84	$51.51	$47.96	$38.80	$35.68	$33.73	**$44.05**
2009	$34.50	$38.91	$39.48	$44.22	$44.31	$41.36	$44.85	$41.73	$39.00	$40.17	$35.07	$39.71	**$40.28**
Average Prices													
Overall	**$40.74**	**$43.45**	**$44.06**	**$43.97**	**$44.19**	**$43.71**	**$44.38**	**$43.73**	**$42.20**	**$39.75**	**$38.21**	**$39.40**	**$42.32**
Last 5 Yr.	**$40.96**	**$43.43**	**$44.30**	**$45.67**	**$47.03**	**$46.17**	**$47.16**	**$45.48**	**$44.45**	**$40.60**	**$37.29**	**$39.17**	**$43.47**
Last 2 Yr.	**$37.41**	**$41.69**	**$42.67**	**$44.23**	**$45.35**	**$44.07**	**$48.84**	**$46.62**	**$43.48**	**$39.48**	**$35.37**	**$36.72**	**$42.16**

The highest monthly average cull cow prices occurred in 1990 with an annual average price of $54.20 per hundred weight (cwt). From 1990 to 2009, the annual

average price decreased by nearly 26 percent. Figure 4-1 shows more information on price trends and seasonality of Utah cull cow prices.

Figure 4-1: Utah Cull Cow Price Data



As can be seen in the top left graph in figure 4-1, relatively high prices were received for cull cows in the early 1990s. The mid-90s proved to produce very low prices for cull cows. In 2003, prices started to strengthen again. However, during the final years of the time frame, prices started to decrease again. The overall trend for the time period was downward sloping. The top right graph in figure 4-1 is the seasonality of Utah cull cow prices. It was calculated by taking the average price for each month during the time frame and comparing that average to the overall annual average. During the time period, prices tended to be higher from February through August, and lower from September through January.

The bottom left graph in figure 4-1 is the basis for Utah cull cow prices. The basis is the local cash price of the cattle minus the Chicago Mercantile Exchange (CME) Live Cattle futures price. The basis trend was downward sloping where by the end of 2009 the basis was twice as weak as it was in 1990. The bottom right graph in figure 4-1 shows the seasonality of the cull cow basis. It was calculated by comparing the average basis between 1990 and 2009 to the monthly average. The basis was stronger from April through August, and weaker from September through March.

500 to 600 Lb. Beef Steer Prices

Utah beef steer prices were also evaluated. From 1990 through 2004, the numbers came from the report by Holmgren et al. (no date). From 2005 onward, the data came from the Utah Department of Agriculture and the prices reported to the Agricultural Marketing Service (2005-2009) from Producers Livestock Auction in Salina, Utah. Prices for 500 to 600 lb., 700 to 800 lb., and 800 to 900 lb. beef steers were collected.

Table 4-2: Utah Monthly Average Price for Beef Steers 500 to 600 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$87.50	$90.13	$92.75	$95.00	$100.67	$99.13	$90.81	$92.31	$92.47	$91.50	$89.38	$95.38	**$93.08**
1991	$95.22	$103.25	$100.50	$103.10	$103.63	$104.56	$94.06	$91.81	$93.63	$90.65	$87.44	$85.50	**$96.11**
1992	$88.32	$87.00	$91.00	$92.30	$91.63	$89.88	$87.38	$88.85	$88.75	$89.18	$89.06	$88.38	**$89.31**
1993	$91.90	$93.78	$98.50	$94.35	$99.63	$100.81	$91.80	$92.75	$94.00	$90.08	$89.10	$86.21	**$93.58**
1994	$89.05	$93.22	$93.66	$92.23	$87.92	$83.74	$81.21	$81.30	$76.71	$73.65	$73.78	$73.00	**$83.29**
1995	$76.73	$80.78	$76.49	$75.08	$68.88	$71.63	$64.13	$64.35	$63.77	$62.08	$63.38	$61.31	**$69.05**
1996	$60.09	$63.75	$63.19	$56.72	$54.92	$57.17	$54.35	$60.33	$61.30	$58.85	$60.35	$59.73	**$59.23**
1997	$70.74	$74.97	$81.67	$82.26	$82.71	$81.00	$79.30	$83.28	$83.56	$81.77	$79.80	$80.16	**$80.10**
1998	$82.71	$86.53	$85.80	$88.29	$86.20	$81.16	$73.41	$71.17	$68.91	$69.78	$73.63	$71.96	**$78.30**
1999	$79.08	$86.13	$83.93	$80.00	$81.26	$81.35	$80.55	$83.98	$84.41	$83.60	$83.61	$89.13	**$83.09**
2000	$92.99	$97.02	$97.94	$96.64	$98.35	$94.99	$97.24	$95.54	$89.65	$91.99	$86.99	$93.96	**$94.44**
2001	$99.65	$101.41	$102.55	$100.78	$96.29	$94.53	$95.69	$96.67	$97.41	$90.19	$85.31	$88.23	**$95.73**
2002	$90.61	$96.44	$92.59	$92.49	$86.74	$89.61	$85.61	$82.32	$79.32	$77.40	$80.10	$84.88	**$86.51**
2003	$85.83	$87.30	$90.25	$95.26	$91.64	$87.91	$89.43	$96.94	$98.50	$101.49	$100.74	$103.24	**$94.04**
2004	$95.35	$102.00	$109.42	$106.25	$112.21	$114.69	$116.44	$121.50	$114.24	$112.60	$109.88	$107.94	**$110.21**
2005	$109.86	$111.27	$118.11	$130.41	$129.58	$124.94	$121.69	$119.04	$118.79	$120.55	$121.81	$125.72	**$120.98**
2006	$128.00	$126.60	$123.57	$121.55	$124.85	$117.88	$119.55	$117.97	$119.53	$115.58	$100.50	$99.99	**$117.96**
2007	$101.52	$106.25	$112.83	$112.89	$113.22	$109.23	$111.79	$112.41	$112.95	$110.16	$104.57	$105.51	**$109.44**
2008	$106.52	$108.94	$114.80	$110.61	$114.83	$109.97	$108.24	$104.62	$101.91	$92.47	$95.30	$90.38	**$104.88**
2009	$96.39	$100.36	$109.74	$110.22	$110.03	$112.75	$104.09	$100.59	$94.16	$93.84	$97.42	$98.30	**$102.32**
Average Prices													
Overall	**$91.40**	**$94.86**	**$96.96**	**$96.82**	**$96.76**	**$95.35**	**$92.34**	**$92.89**	**$91.70**	**$89.87**	**$88.61**	**$89.44**	**$93.08**
Last 5 Yr.	**$108.46**	**$110.68**	**$115.81**	**$117.14**	**$118.50**	**$114.95**	**$113.07**	**$110.92**	**$109.47**	**$106.52**	**$103.92**	**$103.98**	**$111.12**
Last 2 Yr.	**$101.45**	**$104.65**	**$112.27**	**$110.42**	**$112.43**	**$111.36**	**$106.16**	**$102.60**	**$98.04**	**$93.15**	**$96.36**	**$94.34**	**$103.60**

The year with the highest average annual price was 2005 at $120.98/cwt. The month with the highest price in 2005 was in April at $130.41/cwt. This was the highest monthly average price received for 500 to 600 pound beef steers recorded in the time period. From 1990 through 2009, the average annual price increased by nearly 10 percent.

Figure 4-2: Utah 500 to 600 Lb. Beef Steer Price Data

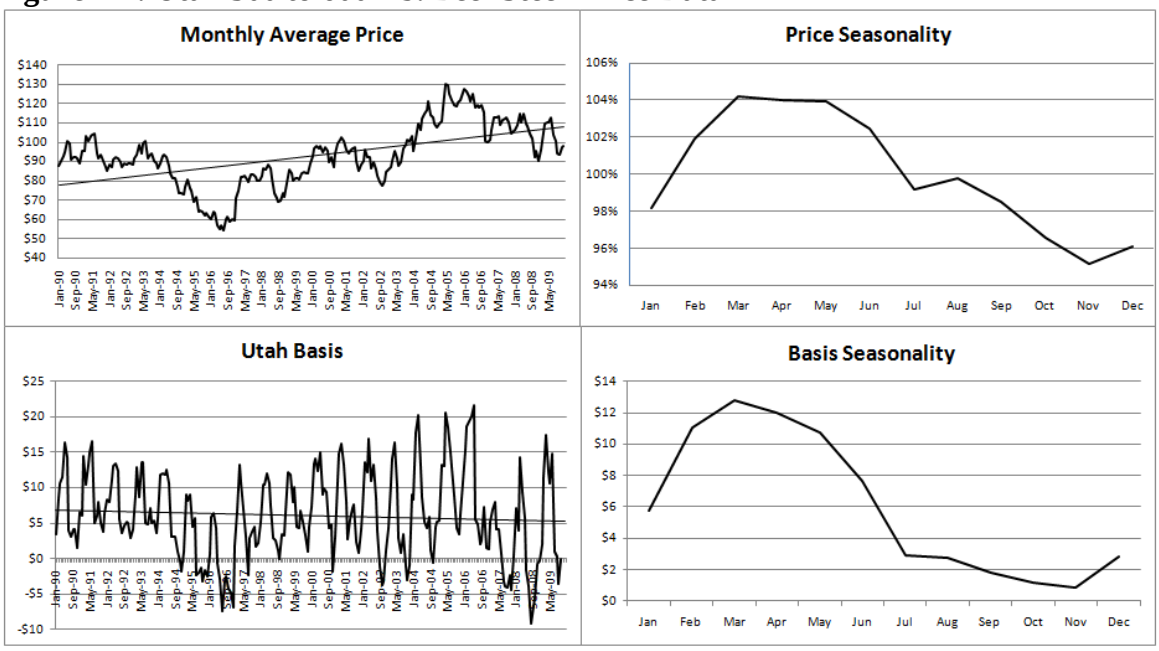


Figure 4-2 shows an overall increase in the trend line indicating that prices increased over time. Between 1990 and 1994, prices stayed around $90 to $100/cwt. In the middle of the 1990s, prices decreased tremendously and after that time, gradually increased. Prices during the time period on average were higher from February through June, and lower from July through January with especially low prices from October through December.

The basis for 500 to 600 pound beef steers was almost always positive meaning that the Utah cash price was higher than the CME Feeder Cattle futures price. However, there was a slight negative slope in the trend line indicating that the basis gradually became weaker overtime. The seasonality of the basis showed that the stronger months were January through June and the weaker months were July through December.

700 to 800 Lb. Beef Steer Prices

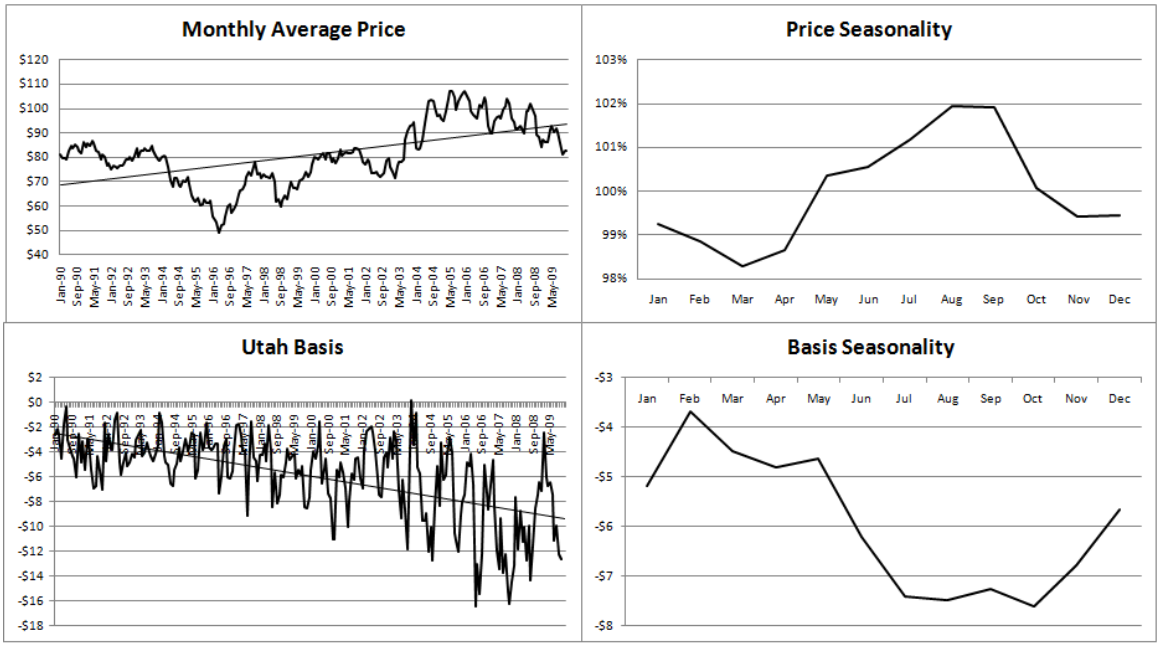
Utah beef steers between 700 to 800 lbs. followed a similar pattern to the 500 to 600 lb. beef steers. The year 2005 produced the highest average annual price and 1996 generated the lowest average annual price. Between 1990 and 2009, the average annual price increased by 6 percent.

Table 4-3: Utah Monthly Average Price for Beef Steers 700 to 800 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$81.40	$79.50	$79.63	$79.03	$82.50	$84.53	$83.75	$85.50	$84.06	$82.88	$81.85	$86.19	**$82.57**
1991	$84.28	$85.60	$84.75	$87.00	$85.58	$82.66	$82.25	$79.03	$81.27	$80.13	$76.54	$77.50	**$82.22**
1992	$75.28	$76.55	$76.10	$75.53	$76.85	$76.81	$77.00	$79.35	$79.31	$80.03	$78.88	$80.63	**$77.69**
1993	$83.60	$80.32	$82.57	$82.93	$83.88	$82.88	$82.80	$84.75	$82.81	$80.83	$79.01	$78.44	**$82.07**
1994	$79.99	$80.58	$80.01	$76.03	$70.56	$68.02	$71.57	$71.49	$68.24	$67.77	$70.63	$70.00	**$72.91**
1995	$71.94	$68.81	$64.40	$62.31	$62.00	$63.27	$60.44	$60.97	$62.75	$61.48	$61.45	$62.12	**$63.49**
1996	$55.78	$54.12	$53.00	$49.08	$52.27	$52.63	$55.79	$59.81	$60.81	$57.10	$58.95	$61.06	**$55.87**
1997	$64.90	$66.44	$66.69	$68.79	$71.87	$73.96	$72.43	$74.61	$78.16	$72.90	$73.42	$71.66	**$71.32**
1998	$73.22	$71.90	$72.08	$71.65	$73.79	$69.79	$62.08	$62.96	$59.71	$62.42	$64.30	$62.71	**$67.21**
1999	$67.83	$70.16	$67.52	$67.67	$67.01	$70.73	$70.82	$71.35	$74.01	$71.99	$74.08	$77.02	**$70.85**
2000	$80.33	$79.77	$79.24	$80.86	$81.88	$79.40	$81.96	$81.69	$78.13	$79.43	$77.72	$79.90	**$80.02**
2001	$83.49	$80.61	$81.50	$81.99	$81.46	$81.75	$82.22	$83.84	$83.67	$83.21	$80.08	$78.00	**$81.82**
2002	$76.94	$79.00	$78.16	$73.36	$73.77	$73.95	$73.19	$72.25	$72.98	$73.49	$78.85	$79.77	**$75.48**
2003	$76.33	$73.87	$71.65	$76.63	$78.32	$78.10	$79.31	$87.20	$90.94	$92.84	$93.69	$94.38	**$82.77**
2004	$83.67	$83.33	$83.96	$87.45	$93.96	$99.94	$103.24	$103.61	$103.10	$100.44	$97.06	$97.50	**$94.77**
2005	$96.17	$94.77	$98.82	$103.93	$107.00	$107.20	$104.69	$99.77	$103.27	$105.03	$106.52	$106.96	**$102.84**
2006	$105.30	$103.12	$99.04	$97.33	$96.55	$95.80	$101.61	$100.50	$104.79	$103.35	$92.94	$90.02	**$99.19**
2007	$89.68	$94.77	$96.47	$96.80	$95.75	$99.33	$101.22	$104.14	$101.88	$96.18	$94.55	$91.85	**$96.88**
2008	$91.85	$93.17	$91.78	$89.90	$99.11	$98.91	$102.27	$99.53	$97.14	$89.42	$88.59	$84.16	**$93.82**
2009	$87.25	$86.49	$86.38	$91.32	$93.09	$90.61	$91.87	$90.42	$85.55	$81.36	$82.58	$82.59	**$87.46**
Average Prices													
Overall	**$80.46**	**$80.14**	**$79.69**	**$79.98**	**$81.36**	**$81.51**	**$82.02**	**$82.64**	**$82.63**	**$81.11**	**$80.58**	**$80.62**	**$81.06**
Last 5 Yr.	**$94.05**	**$94.46**	**$94.50**	**$95.85**	**$98.30**	**$98.37**	**$100.33**	**$98.87**	**$98.53**	**$95.07**	**$93.03**	**$91.12**	**$96.04**
Last 2 Yr.	**$89.55**	**$89.83**	**$89.08**	**$90.61**	**$96.10**	**$94.76**	**$97.07**	**$94.97**	**$91.35**	**$85.39**	**$85.58**	**$83.38**	**$90.64**

From 1990 through 2009, the month with the highest prices on average was August with an average of $82.64/cwt. In the last five years of the time period, the highest prices came in July with an average of $100.33/cwt. In the last two years, the highest prices were in July again with an average of $97.07/cwt.

Figure 4-3: Utah 700 to 800 Lb. Beef Steer Price Data



As can be seen in figure 4-3 and as is consistent with figure 4-2, prices for 700 to 800 lb. steers remained steady in the early 1990s and decreased greatly in the mid-90s. After that time, prices increased. The overall price trend was upward sloping. Seasonality in prices showed that prices were higher in July through September, and were lower from October through June.

A great deal of volatility existed in the basis for this weight group. Only one time throughout the time period was the cash price for this weight group higher than the CME Feeder Cattle futures price. The seasonality in the basis showed that the basis was the strongest in February and was the lowest in October.

800 to 900 Lb. Beef Steer Prices

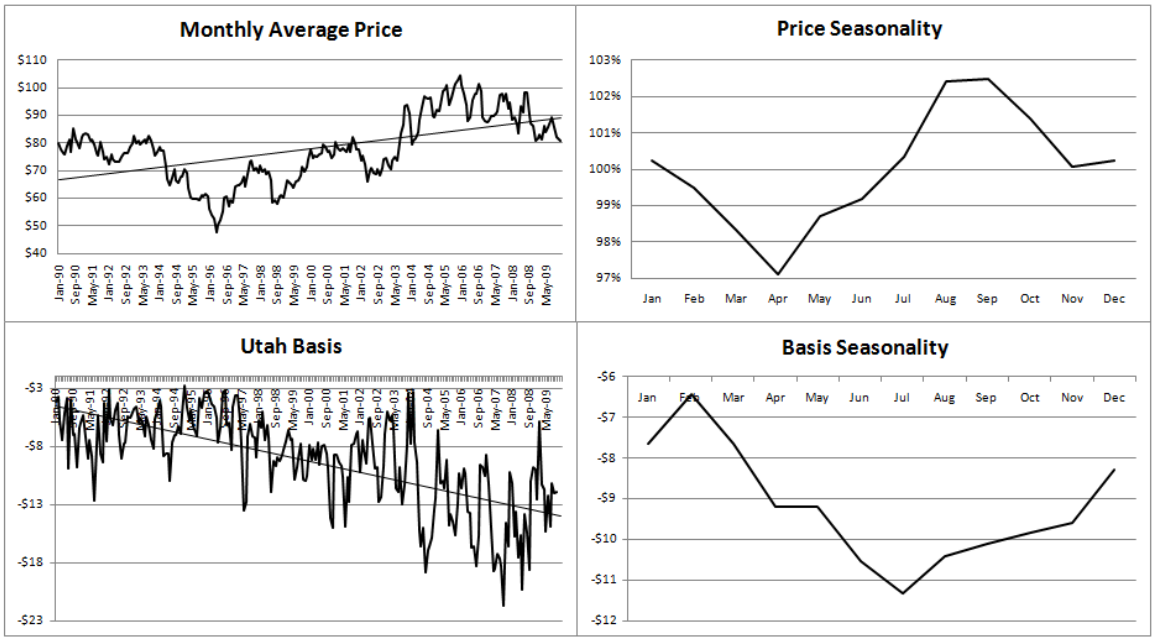
Utah beef steers between 800 to 900 lbs. also followed a similar pattern to the two lighter weight groups discussed previously with 2005 producing the highest average annual price and 1996 generating the lowest average annual price. Between 1990 and 2009, the average annual price increased by 5.73 percent.

Table 4-4: Utah Monthly Average Price for Beef Steers 800 to 900 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$79.92	$77.88	$76.44	$76.06	$79.17	$81.06	$76.88	$85.26	$81.31	$80.49	$78.03	$82.33	**$79.57**
1991	$83.21	$83.41	$82.93	$80.89	$81.25	$79.29	$76.50	$75.41	$80.23	$76.98	$74.28	$74.88	**$79.10**
1992	$72.50	$76.02	$74.22	$73.20	$73.32	$73.38	$74.88	$76.19	$76.38	$76.38	$78.60	$79.92	**$75.41**
1993	$82.45	$79.95	$81.00	$79.63	$80.54	$81.25	$79.73	$82.54	$80.72	$77.70	$75.57	$76.98	**$79.84**
1994	$78.38	$77.35	$77.13	$71.50	$66.80	$64.49	$67.16	$70.61	$66.67	$65.69	$67.98	$67.88	**$70.14**
1995	$70.58	$68.98	$63.64	$60.22	$59.57	$59.67	$59.74	$59.22	$61.30	$60.64	$61.63	$60.51	**$62.14**
1996	$56.10	$53.90	$52.35	$47.82	$50.11	$52.31	$55.32	$60.05	$60.58	$56.96	$59.11	$58.29	**$55.24**
1997	$64.30	$64.66	$64.75	$65.63	$67.91	$64.37	$68.83	$73.29	$73.64	$70.21	$70.94	$69.02	**$68.13**
1998	$71.71	$69.73	$70.36	$68.91	$69.53	$66.54	$58.55	$59.31	$58.16	$60.85	$60.92	$60.06	**$64.55**
1999	$64.33	$66.33	$65.56	$64.50	$63.83	$66.00	$66.53	$68.16	$71.41	$69.54	$71.61	$74.02	**$67.65**
2000	$77.88	$74.47	$75.63	$75.13	$75.74	$76.35	$79.31	$78.35	$76.86	$77.25	$74.63	$75.90	**$76.46**
2001	$80.19	$77.91	$77.01	$77.99	$77.70	$76.83	$79.44	$76.84	$82.00	$80.00	$77.55	$77.46	**$78.41**
2002	$73.66	$75.34	$72.16	$66.03	$70.10	$70.92	$69.29	$68.56	$70.66	$68.30	$70.97	$74.13	**$70.84**
2003	$74.70	$71.75	$70.42	$73.67	$74.94	$73.52	$76.77	$83.66	$86.74	$93.36	$93.85	$90.82	**$80.35**
2004	$79.30	$80.85	$81.58	$83.84	$88.32	$92.85	$97.17	$96.72	$96.22	$96.59	$89.61	$89.28	**$89.36**
2005	$92.02	$91.48	$93.83	$98.84	$99.54	$100.83	$94.00	$96.48	$99.90	$101.45	$102.71	$104.66	**$97.98**
2006	$101.21	$98.00	$93.88	$87.86	$89.52	$95.60	$98.04	$97.69	$101.44	$98.75	$89.25	$88.17	**$94.95**
2007	$87.53	$88.04	$89.79	$89.96	$90.63	$91.44	$97.38	$97.99	$95.33	$97.81	$92.38	$94.75	**$92.75**
2008	$88.31	$89.19	$86.84	$83.63	$93.56	$91.31	$98.38	$98.44	$90.03	$87.00	$86.22	$80.59	**$89.46**
2009	$81.83	$83.09	$81.11	$86.33	$84.13	$85.75	$88.13	$89.17	$85.77	$82.08	$81.45	$80.73	**$84.13**
Average Prices													
Overall	**$78.01**	**$77.42**	**$76.53**	**$75.58**	**$76.81**	**$77.19**	**$78.10**	**$79.70**	**$79.77**	**$78.90**	**$77.86**	**$78.02**	**$77.82**
Last 5 Yr.	**$90.18**	**$89.96**	**$89.09**	**$89.32**	**$91.47**	**$92.99**	**$95.18**	**$95.95**	**$94.49**	**$93.42**	**$90.40**	**$89.78**	**$91.85**
Last 2 Yr.	**$85.07**	**$86.14**	**$83.98**	**$84.98**	**$88.84**	**$88.53**	**$93.25**	**$93.80**	**$87.90**	**$84.54**	**$83.83**	**$80.66**	**$86.79**

Figure 4-4 shows the same price trend as the previous two charts. The overall trend increased with a low in the mid-90s. Seasonality in prices for this weight range suggested that prices were higher from July through October, and significantly lower from November through June.

Figure 4-4: Utah 800 to 900 Lb. Beef Steer Price Data



The basis for 800 to 900 pound beef steers had even more volatility than the two lighter weight groups evaluated above. Figure 4-4 shows the largest gap between the CME Feeder Cattle futures and the cash price was in May of 2007 where the Utah cash price was around $22 lower than the futures price for the time period. The trend in the basis was downward sloping with an even faster decrease in the cash price relative to the futures price than the two lighter weights evaluated in this research. The seasonality of the basis suggested a stronger basis in the winter months and a weaker basis throughout the rest of the year, with an especially weak basis in the summer.

Beef Slaughter Steer Prices

Prices for beef slaughter steers between 1990 and 2004 were found by Holmgren et al. (no date). To collect the data from 2005 to 2009, weekly sales reports were

downloaded from the Agricultural Marketing Service (2005-2009) website. Data used for the slaughter steers were reported to the AMS from the Utah Direct Cattle Report. The numbers were monthly averages for all choice steers sold between the 1100 to 1300 lb. weight group.

Table 4-5: Utah Monthly Average Price for Beef Slaughter Steers

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$77.55	$76.75	$77.88	$78.55	$77.13	$76.06	$75.20	$76.38	$77.25	$79.05	$80.00	$79.75	**$77.63**
1991	$79.05	$79.13	$80.38	$80.03	$77.13	$73.50	$71.55	$66.25	$67.75	$69.85	$71.25	$69.33	**$73.77**
1992	$71.85	$76.25	$77.88	$76.65	$75.06	$73.32	$72.14	$73.38	$74.13	$74.85	$74.50	$77.75	**$74.81**
1993	$79.55	$81.00	$82.80	$81.50	$78.25	$76.00	$73.75	$74.69	$72.81	$71.35	$71.81	$71.00	**$76.21**
1994	$72.05	$73.00	$75.06	$73.18	$65.25	$62.63	$65.15	$65.13	$65.63	$66.30	$67.81	$68.88	**$68.34**
1995	$73.00	$72.88	$68.73	$66.60	$63.13	$63.75	$61.95	$62.13	$62.13	$64.20	$67.13	$65.38	**$65.92**
1996	$63.50	$62.13	$61.63	$58.60	$59.38	$60.75	$62.50	$65.13	$70.00	$70.10	$70.63	$66.00	**$64.19**
1997	$63.80	$66.25	$67.06	$67.20	$64.88	$63.13	$63.10	$64.00	$64.50	$66.50	$67.13	$65.00	**$65.21**
1998	$63.00	$60.50	$61.75	$63.70	$63.88	$62.38	$59.50	$58.13	$58.00	$60.70	$61.75	$60.00	**$61.11**
1999	$60.25	$61.88	$64.00	$64.40	$64.69	$65.31	$63.06	$64.63	$65.19	$67.70	$70.00	$69.83	**$65.08**
2000	$68.00	$68.25	$71.50	$72.80	$71.00	$69.13	$66.30	$65.50	$64.38	$66.70	$69.63	$73.67	**$68.90**
2001	$78.30	$78.88	$79.50	$77.20	$74.00	$73.25	$70.50	$69.50	$67.75	$65.50	$63.56	$63.08	**$71.75**
2002	$67.00	$71.17	$71.17	$67.30	$65.50	$63.38	$62.50	$63.25	$63.50	$64.70	$69.25	$72.50	**$66.77**
2003	$78.00	$78.75	$76.75	$79.30	$78.25	$76.50	$75.20	$80.00	$87.00	$95.50	$98.50	$96.33	**$83.34**
2004	$78.63	$78.13	$85.67	$85.80	$88.83	$86.50	$83.50	$84.25	$81.75	$83.88	$83.50	$86.00	**$83.87**
2005	$88.75	$88.13	$90.00	$93.00	$90.83	$83.75	$82.00	$79.50	$82.75	$86.63	$88.50	$92.63	**$87.20**
2006	$93.75	$88.75	$85.50	$82.70	$79.44	$79.50	$82.00	$84.50	$88.00	$88.53	$87.06	$86.16	**$85.49**
2007	$87.30	$88.25	$94.25	$96.63	$95.50	$88.50	$88.63	$90.90	$92.25	$89.88	$91.50	$84.25	**$90.65**
2008	$92.00	$90.00	$89.13	$88.13	$93.50	$95.50	$93.67	$98.20	$96.75	$90.50	$89.25	$85.25	**$91.82**
2009	$83.13	$80.88	$81.00	$85.50	$84.40	$81.75	$81.70	$81.33	$81.00	$80.90	$83.00	$80.00	**$82.05**
Average Prices													
Overall	**$75.92**	**$76.05**	**$77.08**	**$76.94**	**$75.50**	**$73.73**	**$72.69**	**$73.34**	**$74.13**	**$75.17**	**$76.29**	**$75.64**	**$75.21**
Last 5 Yr.	**$88.99**	**$87.20**	**$87.98**	**$89.19**	**$88.73**	**$85.80**	**$85.60**	**$86.89**	**$88.15**	**$87.29**	**$87.86**	**$85.66**	**$87.44**
Last 2 Yr.	**$87.56**	**$85.44**	**$85.06**	**$86.81**	**$88.95**	**$88.63**	**$87.68**	**$89.77**	**$88.88**	**$85.70**	**$86.13**	**$82.63**	**$86.94**

The year with the highest average annual price was 2008 with an average of $91.82/cwt. The single highest monthly average price occurred in November, 2003 which was $98.50/cwt. From 1990 to 2009, the average annual price increased by approximately 5.70 percent.

From 1990 through 2009, March was the month with the highest prices averaging $77.08/cwt. During the last five years of the time period, April had the highest prices at

$89.19/cwt. During the last two years, the month with the highest prices shifted to August with an average of $89.77/cwt. This was a definite departure from the historical seasonal pattern.

The month with the lowest overall prices was July with an average of $72.69/cwt. July also had the lowest prices in the past five years with an average of $85.60/cwt. In the past two years, December had the lowest prices with an average of $82.63/cwt.

Figure 4-5: Utah Beef Slaughter Steer Price Data

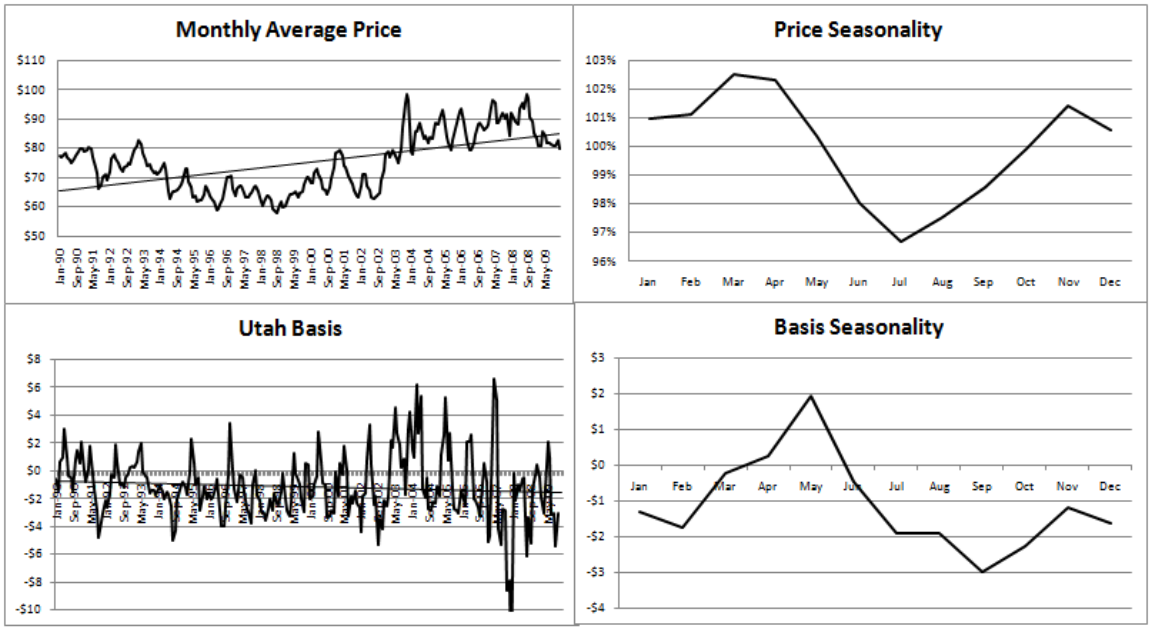


Figure 4-5 shows that the prices for live steers gradually decreased from 1990 until late 1998 when prices started to increase. In the past two years prices dropped significantly. The overall price trend was upward sloping. Prices for slaughter steers were the highest from October through May and were lowest from June through September.

The basis of Utah beef slaughter steers gradually became weaker over time. In the most recent years of the time period, the basis became more volatile seeing large and sudden changes, going from weak to strong and then back to weak again. However, compared with other groups of cattle, Utah beef slaughter steers did very well in maintaining their price relative to the CME Live Cattle futures market. Seasonality existed for the basis as well and showed that the basis tended to be strong in March, April, and May and weak in the remaining nine months.

Holstein Slaughter Steer Prices

Prices for Holstein slaughter steers between 1990 and 2004 were found by Holmgren et al. (no date). To collect the data from 2005 to 2009, weekly sales reports were downloaded from the Agricultural Marketing Service (2005-2009) website. Data used for the Holstein slaughter steers were reported to the AMS from the Utah Direct Cattle Report. These steers weighed between 1100 and 1300 lbs.

Table 4-6: Utah Monthly Average Price for Holstein Slaughter Steers

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$67.05	$67.00	$67.63	$67.60	$67.38	$66.50	$65.40	$67.00	$67.13	$69.20	$70.25	$70.00	**$67.68**
1991	$69.40	$69.56	$71.25	$70.97	$67.25	$64.25	$62.60	$58.44	$59.13	$59.95	$61.50	$59.83	**$64.51**
1992	$62.40	$65.50	$67.56	$66.75	$66.06	$63.50	$62.45	$63.94	$65.13	$65.80	$63.75	$67.75	**$65.05**
1993	$70.15	$71.38	$73.00	$71.00	$69.88	$67.00	$64.25	$66.06	$63.63	$61.80	$62.38	$62.00	**$66.88**
1994	$62.30	$63.25	$65.63	$63.75	$55.50	$53.13	$55.80	$55.63	$54.75	$56.70	$58.19	$58.88	**$58.62**
1995	$63.40	$61.19	$58.31	$57.15	$53.19	$54.00	$52.90	$51.50	$52.50	$55.20	$57.13	$55.67	**$56.01**
1996	$53.50	$52.13	$51.63	$48.60	$49.38	$50.75	$52.70	$55.38	$60.00	$60.10	$60.63	$56.00	**$54.23**
1997	$53.70	$55.50	$56.81	$57.20	$54.88	$53.13	$54.10	$54.00	$54.50	$56.50	$57.13	$55.00	**$55.20**
1998	$53.00	$50.50	$51.75	$53.70	$53.88	$52.38	$49.50	$48.50	$48.00	$50.70	$51.75	$50.00	**$51.14**
1999	$50.25	$51.88	$54.00	$54.40	$54.69	$55.31	$53.06	$54.63	$55.19	$57.70	$60.00	$59.83	**$55.08**
2000	$58.00	$58.25	$61.50	$62.80	$60.88	$59.13	$56.30	$55.50	$54.38	$56.25	$59.63	$63.67	**$58.86**
2001	$68.30	$68.88	$69.25	$67.20	$64.00	$63.25	$60.50	$59.50	$57.75	$55.50	$53.56	$53.08	**$61.73**
2002	$57.00	$61.17	$61.17	$57.30	$55.50	$53.38	$52.50	$53.25	$53.50	$54.70	$59.25	$62.50	**$56.77**
2003	$68.00	$68.75	$66.75	$69.30	$67.88	$66.50	$65.30	$70.25	$77.00	$85.50	$88.50	$86.33	**$73.34**
2004	$68.63	$68.13	$75.67	$75.80	$78.83	$77.25	$73.50	$74.25	$71.75	$73.88	$73.50	$75.75	**$73.91**
2005	$78.88	$78.13	$80.00	$83.00	$80.83	$73.75	$71.80	$69.50	$72.75	$76.50	$78.50	$82.50	**$77.18**
2006	$83.75	$78.75	$75.50	$72.70	$69.44	$69.50	$72.00	$79.50	$77.75	$76.50	$74.50	$74.50	**$75.37**
2007	$77.30	$78.25	$84.25	$86.63	$80.50	$74.33	$73.63	$75.90	$77.25	$74.88	$77.00	$76.50	**$78.03**
2008	$77.00	$75.00	$74.13	$73.13	$78.17	$80.00	$78.67	$83.20	$81.75	$75.50	$71.75	$65.25	**$76.13**
2009	$63.13	$60.88	$61.00	$65.50	$64.40	$61.75	$61.70	$61.33	$61.00	$60.90	$63.00	$60.00	**$62.05**
Average Prices													
Overall	**$65.26**	**$65.20**	**$66.34**	**$66.22**	**$64.62**	**$62.94**	**$61.93**	**$62.86**	**$63.24**	**$64.19**	**$65.09**	**$64.75**	**$64.39**
Last 5 Yr.	**$76.01**	**$74.20**	**$74.98**	**$76.19**	**$74.67**	**$71.87**	**$71.56**	**$73.89**	**$74.10**	**$72.86**	**$72.95**	**$71.75**	**$73.75**
Last 2 Yr.	**$70.06**	**$67.94**	**$67.56**	**$69.31**	**$71.28**	**$70.88**	**$70.18**	**$72.27**	**$71.38**	**$68.20**	**$67.38**	**$62.63**	**$69.09**

Utah Holstein slaughter steer prices decreased significantly in 2009. From 1990 to 2009, the average annual price decreased by 8.32 percent. 1998 proved to be the year with the lowest average annual price and 2007 was the year with the highest average annual price.

From 1990 to 2009, the month with the highest prices was March with $66.34/cwt. However, in the last five years of the time period, the month with the highest prices switched to April with an average of $76.19/cwt and in the last two years, the highest prices came in August with an average of $72.27/cwt.

The month with the overall lowest prices was July with an average price of $61.93/cwt. During the last five years of the time period, July maintained the lowest

prices with an average of $71.56/cwt. However, during the last two years, the lowest prices came in December with an average of $62.63/cwt.

Figure 4-6: Utah Holstein Slaughter Steer Price Data

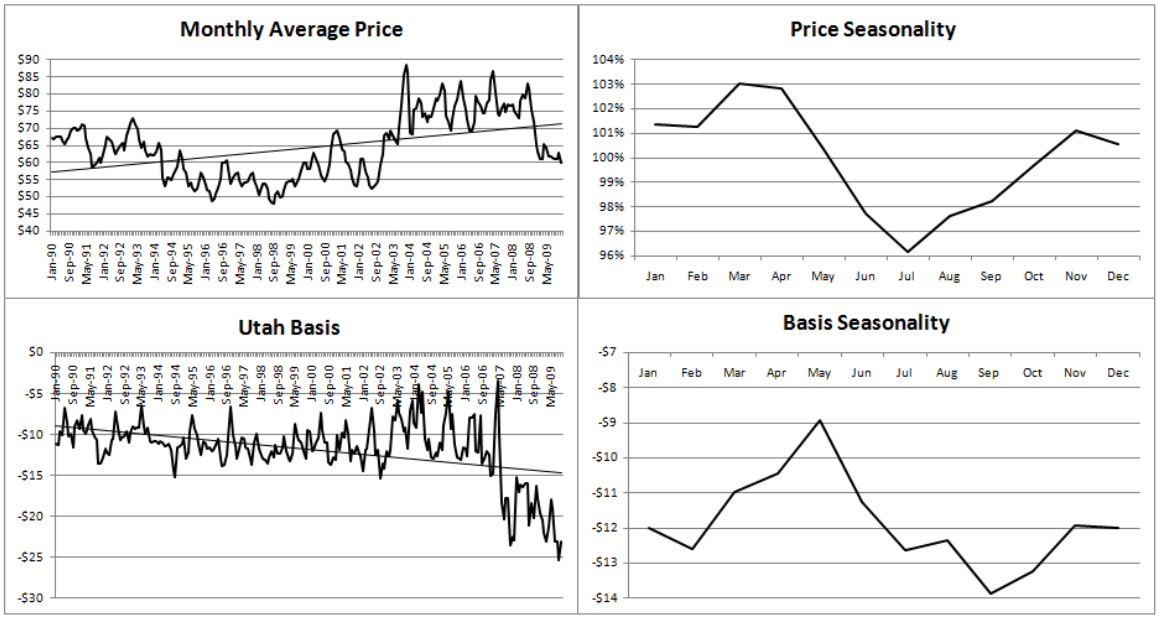


Figure 4-6 shows a similar price pattern to other cattle enterprises. The mid-90s returned low prices with the all time low in 1998 and the high in 2003. The overall trend was upward sloping. Prices decreased tremendously in the most recent months of the time period. In 2009, Holstein slaughter steers brought $20/cwt less than beef breeds which was the largest difference than any other time on the chart. Prices for Holstein slaughter steers were the highest in March and April and were the lowest from June through August.

The Holstein slaughter steer basis weakened over the time period. The $20 difference between Holstein and beef steers was also evident in the basis as can be seen

in the large drop in the graph in 2008. The basis tended to be the strongest in April and May, and the lowest in September and October. For more information on slaughter steer prices, see Appendix A, "Monthly Average Prices for Beef Slaughter Steers versus Holstein Slaughter Steers."

500 to 700 Lb. Holstein Steer Prices

The price for Holstein steers was reported in the following weight ranges: 500 to 700 lbs., 700 to 900 lbs., and 900 to 1100 lbs. However, in contrast to all the other price data that were gathered, the data for these Holstein feeder steers only went back to 1996. Sales information between 2004 and 2009 was collected through the reports that were downloaded from the Agricultural Marketing Service (2005-2009) website. Data used for Holstein steers were reported to the AMS from the Smithfield Livestock Auction in Smithfield, Utah. Data prior to 1996 no longer exist for this auction. Data between 1996 and 2003 were difficult to obtain. The author of this paper met with the owner of the Smithfield Livestock Auction who provided several weekly sales reports in this time period. However, data between January 2002 and June 2003 were missing. In order to prevent gaps in the data, average monthly prices during this time frame were estimated. The estimations for these prices were calculated using OLS regression. Refer to Appendix A, "The OLS Regression," for more information regarding the estimates that were made.

Table 4-7: Utah Monthly Average Price for Holstein Steers 500 to 700 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1996	$43.02	$47.03	$48.11	$41.35	$38.97	$40.83	$38.26	$43.21	$32.75	$34.00	$34.75	$35.67	**$39.83**
1997	$38.65	$53.50	$54.31	$58.38	$65.80	$67.08	$63.00	$68.00	$64.38	$61.10	$60.33	$62.67	**$59.77**
1998	$61.33	$67.63	$70.50	$70.75	$72.25	$75.81	$56.38	$54.06	$57.50	$51.33	$53.92	$48.25	**$61.64**
1999	$54.83	$58.94	$64.13	$67.75	$60.00	$71.50	$64.55	$66.69	$65.00	$68.50	$69.25	$68.10	**$64.94**
2000	$71.63	$74.75	$80.63	$80.83	$78.13	$80.50	$74.83	$75.85	$77.50	$74.13	$65.50	$66.50	**$75.06**
2001	$73.25	$73.50	$81.04	$79.13	$75.88	$75.50	$78.33	$83.00	$73.28	$67.25	$59.50	$61.00	**$73.39**
2002	$69.59	$73.87	$74.23	$73.91	$69.01	$72.13	$67.78	$62.99	$58.09	$56.41	$58.50	$60.37	**$66.41**
2003	$61.92	$65.63	$70.49	$75.38	$71.43	$68.29	$70.38	$71.88	$77.17	$80.00	$80.83	$83.00	**$73.03**
2004	$68.00	$69.13	$77.83	$85.33	$87.67	$90.25	$93.38	$88.50	$91.50	$86.63	$84.58	$85.08	**$83.99**
2005	$84.29	$82.75	$87.00	$91.53	$99.00	$106.00	$96.46	$92.50	$89.04	$94.38	$89.00	$94.50	**$92.20**
2006	$94.38	$100.13	$98.95	$91.17	$87.17	$90.00	$86.38	$92.00	$90.00	$82.38	$86.88	$62.92	**$88.53**
2007	$63.67	$66.63	$67.17	$74.50	$77.63	$75.75	$78.13	$75.38	$73.13	$66.92	$64.00	$66.67	**$70.80**
2008	$67.50	$60.08	$61.63	$61.33	$61.80	$74.75	$60.50	$59.33	$58.42	$52.38	$47.50	$51.00	**$59.68**
2009	$56.75	$56.00	$53.75	$58.50	$66.75	$70.00	$62.00	$58.17	$58.88	$55.38	$56.75	$54.50	**$58.95**
Average Prices													
Overall	**$64.91**	**$67.83**	**$70.70**	**$72.13**	**$72.25**	**$75.60**	**$70.74**	**$70.82**	**$69.04**	**$66.48**	**$65.09**	**$64.30**	**$69.16**
Last 5 Yr.	**$73.32**	**$73.12**	**$73.70**	**$75.41**	**$78.47**	**$83.30**	**$76.69**	**$75.48**	**$73.89**	**$70.28**	**$68.83**	**$65.92**	**$74.03**
Last 2 Yr.	**$62.13**	**$58.04**	**$57.69**	**$59.92**	**$64.28**	**$72.38**	**$61.25**	**$58.75**	**$58.65**	**$53.88**	**$52.13**	**$52.75**	**$59.32**

First, we will look at the prices for the 500 to 700 lb. Holstein steers. Prices increased significantly over the time frame. From 1996 to 2009, the average annual price increased by over 48 percent. 2005 was the year with the highest average annual price at $92.20/cwt. 1996 proved to be the year with the lowest average annual price at $39.83/cwt.

Figure 4-7: Utah 500 to 700 Lb. Holstein Steer Price Data

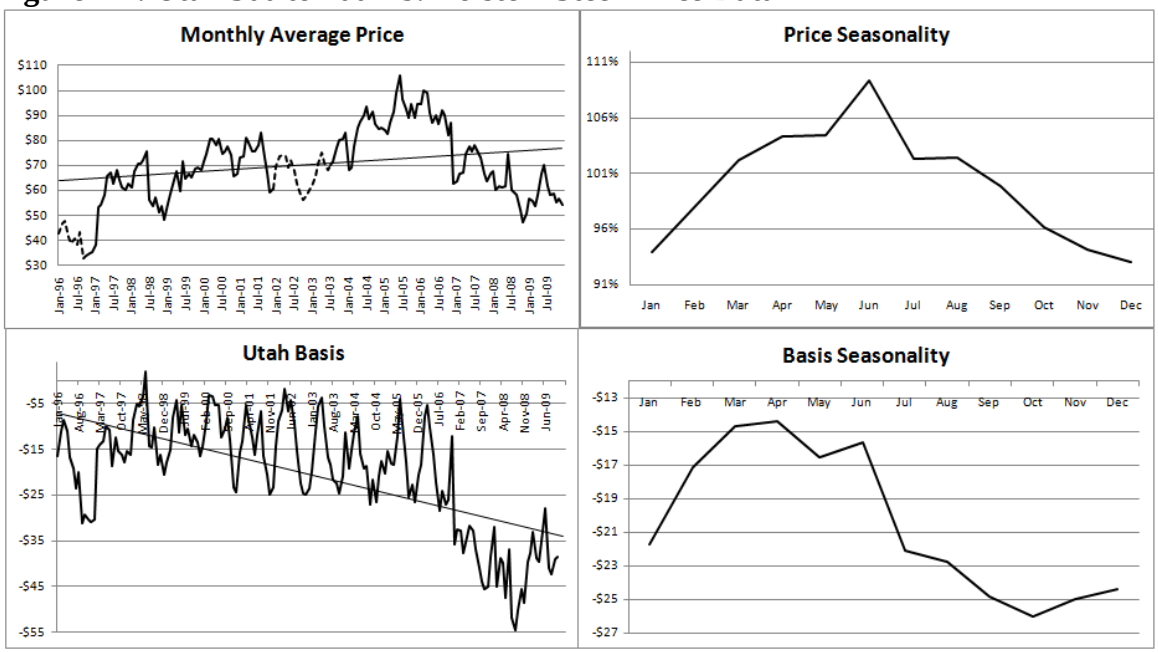


Figure 4-7 shows an overall increase in prices over time. 1996 showed particularly low prices per hundred weight. In fact, during this time, 500 to 700 lb. steers were selling for less than 700 to 1100 lb. steers. The dotted line shows where the gap in the data existed and those values were estimated using OLS regression as was mentioned earlier. Very strong seasonality prices existed with this weight group. Prices were much higher than average between March and August, and tended to be lower between September and February.

The basis for this weight group weakened dramatically during the time frame which indicated that relative to beef prices, Holstein prices decreased greatly. February through June were the months that tended to have the stronger basis, and from July through January, the basis weakened significantly.

700 to 900 Lb. Holstein Steer Prices

Similar to the lighter weight group, Utah Holstein steer prices between 700 to 900 lbs. increased immensely. From 1996 to 2009, the average annual price increased by nearly 47 percent. 2005 proved to be the year with the highest prices and 1996 had the lowest prices.

Table 4-8: Utah Monthly Average Price for Holstein Steers 700 to 900 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1996	$39.30	$38.71	$39.32	$34.76	$36.68	$36.92	$39.50	$42.76	$38.63	$38.01	$36.75	$39.25	**$38.38**
1997	$41.32	$50.58	$53.56	$55.25	$62.95	$57.42	$59.50	$65.15	$60.88	$57.80	$58.83	$55.33	**$56.55**
1998	$56.67	$61.63	$63.16	$62.43	$59.88	$60.81	$53.69	$51.50	$47.25	$45.92	$46.23	$44.00	**$54.43**
1999	$46.33	$53.51	$55.63	$61.13	$56.38	$63.00	$63.35	$61.81	$60.70	$61.03	$56.75	$60.45	**$58.34**
2000	$64.44	$65.94	$67.38	$68.67	$70.00	$69.33	$64.83	$65.78	$67.81	$64.69	$60.63	$62.67	**$66.01**
2001	$66.44	$66.00	$67.15	$70.00	$68.06	$69.92	$66.00	$70.50	$62.53	$67.17	$56.00	$52.00	**$65.15**
2002	$57.79	$58.82	$61.77	$57.40	$57.82	$58.61	$57.06	$54.30	$52.62	$53.03	$57.42	$55.96	**$56.88**
2003	$53.72	$54.04	$54.43	$59.30	$59.94	$59.82	$68.63	$68.19	$73.17	$76.80	$75.83	$81.75	**$65.47**
2004	$62.75	$65.50	$71.88	$77.75	$78.29	$81.00	$85.83	$89.00	$82.25	$75.50	$79.00	$73.13	**$76.82**
2005	$79.19	$73.88	$76.97	$80.45	$80.53	$90.00	$81.06	$86.25	$79.98	$80.46	$82.13	$83.42	**$81.19**
2006	$81.00	$83.38	$80.19	$74.17	$73.08	$79.75	$79.63	$80.00	$77.92	$72.42	$65.45	$60.92	**$75.66**
2007	$63.90	$61.25	$66.98	$69.06	$66.25	$66.75	$71.13	$70.42	$71.25	$62.67	$61.94	$58.58	**$65.85**
2008	$52.00	$58.21	$57.88	$59.63	$59.33	$66.17	$59.50	$58.75	$60.83	$54.17	$51.31	$45.50	**$56.94**
2009	$43.50	$54.75	$54.53	$55.81	$59.85	$60.10	$56.63	$60.25	$59.54	$57.65	$57.83	$56.25	**$56.39**
Average Prices													
Overall	**$57.74**	**$60.44**	**$62.20**	**$63.27**	**$63.50**	**$65.68**	**$64.74**	**$66.05**	**$63.95**	**$61.95**	**$60.44**	**$59.23**	**$62.43**
Last 5 Yr.	**$63.92**	**$66.29**	**$67.31**	**$67.82**	**$67.81**	**$72.55**	**$69.59**	**$71.13**	**$69.90**	**$65.47**	**$63.73**	**$60.93**	**$67.21**
Last 2 Yr.	**$47.75**	**$56.48**	**$56.20**	**$57.72**	**$59.59**	**$63.13**	**$58.06**	**$59.50**	**$60.19**	**$55.91**	**$54.57**	**$50.88**	**$56.66**

From 1996 to 2009, the month with the highest prices was August with an average of $66.05/cwt. June maintained the highest prices in the past five years and past two years was well with averages of $72.55/cwt and $63.13/cwt respectively.

Figure 4-8: Utah 700 to 900 Lb. Holstein Steer Price Data

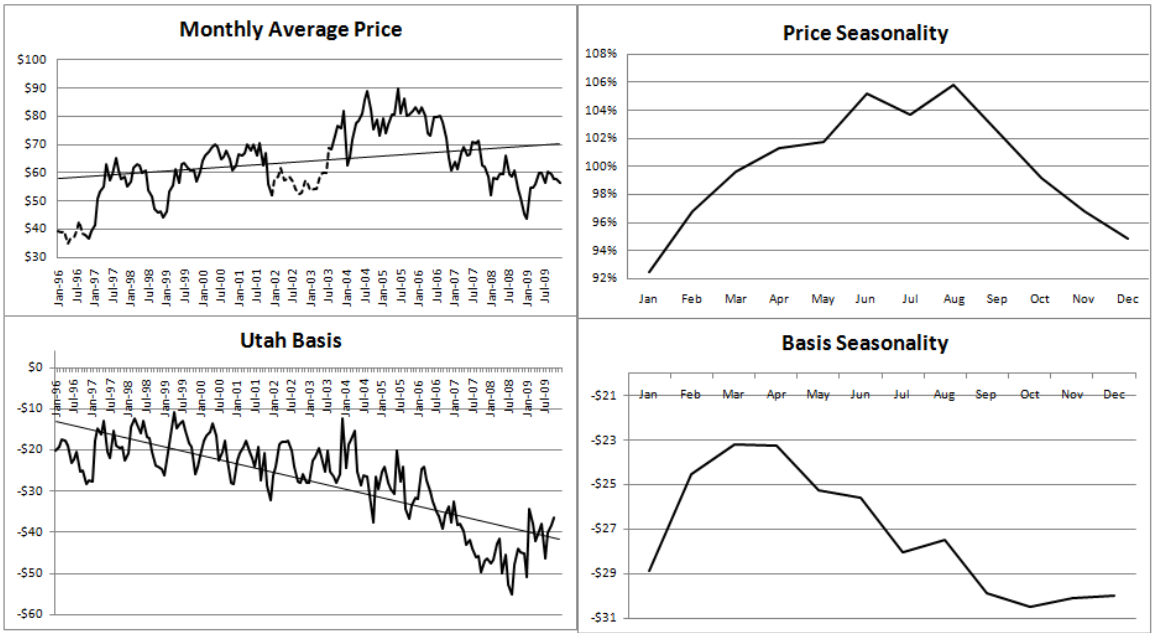


Figure 4-8 shows an upward trend in cattle prices over the time series. Yet, as can be seen, from 2005 onward, prices decreased dramatically. Per pound prices in the mid-1990s were higher for this weight range than for the lighter weights. The dotted line shows where sales data were estimated. The seasonality of these prices returned higher prices from April through September and lower prices in the remaining months.

The basis for this weight group weakened significantly over the time frame. In 2008, the basis reached its weakest ever at $55.00 below the futures price of feeder cattle. The seasonality of the basis showed that the basis was stronger in February, March, and April, and then decreased throughout the other nine months.

900 to 1100 Lb. Holstein Steer Prices

Utah Holstein steers between 900 and 1100 lbs. saw the largest increase in average annual prices than any other cattle enterprise evaluated in this research. Between 1996 and 2009, the average annual price increased by over 50 percent. This weight group followed the same pattern as all of the other feeder cattle groups with 2005 returning the highest average annual prices and 1996 with the lowest prices.

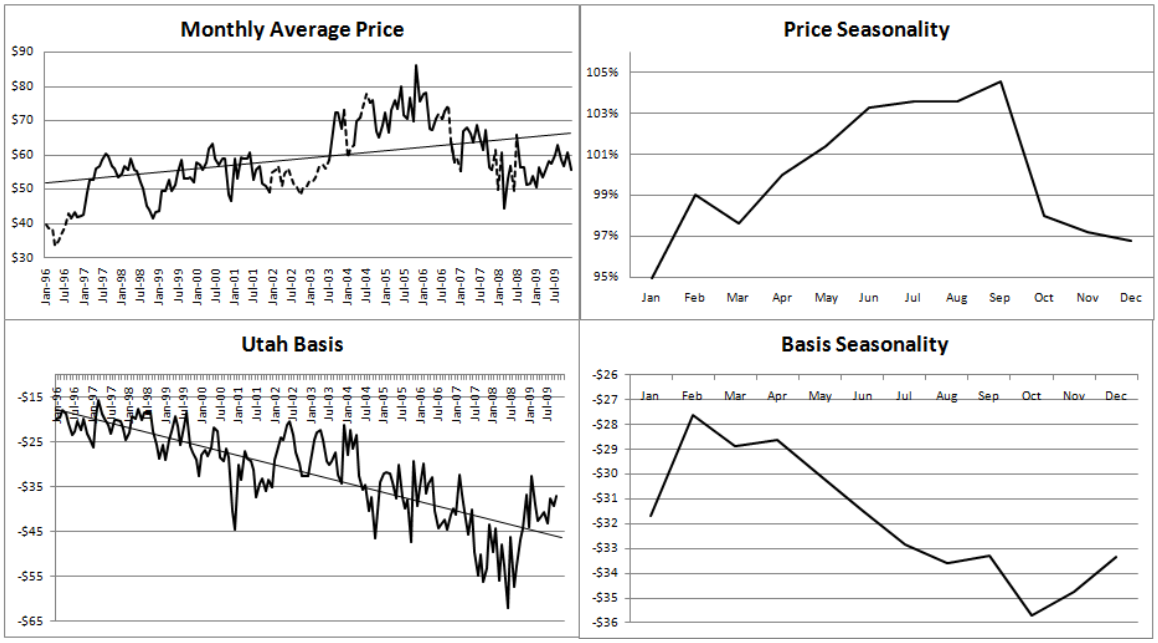
Table 4-9: Utah Monthly Average Price for Holstein Steers 900 to 1100 Lbs.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1996	$39.58	$38.53	$38.75	$33.67	$34.82	$36.64	$39.10	$42.97	$41.55	$43.26	$41.93	$42.27	**$39.42**
1997	$42.71	$49.08	$52.63	$52.88	$56.00	$56.67	$58.50	$60.40	$59.75	$56.90	$56.17	$53.50	**$54.60**
1998	$54.67	$56.91	$55.56	$58.85	$55.63	$55.25	$52.19	$50.22	$45.19	$44.17	$41.42	$43.13	**$51.10**
1999	$43.67	$49.38	$49.56	$52.63	$49.63	$51.33	$54.75	$58.69	$53.25	$53.19	$53.50	$52.00	**$51.80**
2000	$57.94	$56.97	$55.69	$58.00	$61.81	$63.45	$58.83	$57.00	$58.83	$58.83	$48.38	$46.50	**$56.85**
2001	$58.75	$53.25	$59.25	$58.83	$59.00	$60.56	$52.83	$55.50	$56.83	$51.75	$51.00	$49.00	**$55.55**
2002	$54.96	$55.66	$56.59	$51.07	$54.65	$56.00	$53.70	$51.11	$50.62	$48.56	$50.62	$51.10	**$52.89**
2003	$52.31	$52.21	$53.38	$56.74	$57.02	$55.87	$58.56	$64.08	$72.33	$72.30	$67.50	$73.00	**$61.28**
2004	$59.15	$61.74	$62.88	$69.67	$71.00	$73.77	$77.70	$75.31	$75.94	$66.75	$65.19	$68.63	**$68.98**
2005	$72.50	$66.44	$73.04	$75.84	$73.44	$79.88	$71.50	$70.50	$76.72	$69.96	$86.25	$75.81	**$74.32**
2006	$77.71	$78.25	$67.75	$67.35	$70.50	$71.83	$70.50	$72.68	$74.72	$64.00	$57.81	$58.81	**$69.33**
2007	$55.25	$67.00	$68.13	$66.38	$63.50	$68.63	$65.42	$61.58	$67.13	$56.38	$55.83	$61.55	**$63.06**
2008	$49.97	$60.83	$44.50	$53.25	$56.69	$49.62	$66.00	$56.50	$56.25	$51.38	$51.75	$53.75	**$54.21**
2009	$50.50	$56.38	$53.56	$55.42	$58.08	$57.38	$59.88	$62.88	$58.50	$56.84	$60.75	$55.50	**$57.14**
Average Prices													
Overall	**$54.98**	**$57.33**	**$56.52**	**$57.90**	**$58.70**	**$59.78**	**$59.96**	**$59.96**	**$60.54**	**$56.73**	**$56.29**	**$56.04**	$57.89
Last 5 Yr.	**$61.19**	**$65.78**	**$61.40**	**$63.65**	**$64.44**	**$65.47**	**$66.66**	**$64.83**	**$66.66**	**$59.71**	**$62.48**	**$61.08**	$63.61
Last 2 Yr.	**$50.24**	**$58.60**	**$49.03**	**$54.33**	**$57.38**	**$53.50**	**$62.94**	**$59.69**	**$57.38**	**$54.11**	**$56.25**	**$54.63**	$55.67

Figure 4-9 shows a similar pattern to the previous two price charts. The overall price trend increased overtime. Mid-1990s' prices were several dollars per hundred weight higher than Holstein steers in lighter weight categories. More gaps existed in the sales data for this weight group compared to the lighter weight groups for Holstein steers and as a result, more sales data had to be estimated. The dotted line shows where this information was estimated. This weight group followed the same seasonality pattern as

the two lighter weight groups for Holstein steers; the prices tended to be higher than average from May through September, and lower than average from October through April.

Figure 4-9: Utah 900 to 1100 Lb. Holstein Steer Price Data



The basis for this weight group was consistent with lighter weight Holstein steers: it became weaker over time. This indicated that Holstein steer prices fell significantly relative to beef steer prices. The basis was stronger in February, March, and April, and was weaker throughout the rest of the year. For more information on feeder prices, see Appendix A, "Monthly Average Prices for Beef Steers versus Holstein Steers." Also, to read more on Utah cattle prices in general, refer to Appendix A, "The Overall Price of Cattle from 1990 to 2009."

Utah Feed Prices

The two main sources of feed for cattle in this research were corn grain and alfalfa hay. Because these two feeds were the largest percentage of total feeding costs, only these prices were reported. Prices reported were on a per bushel basis for corn and a per ton basis for alfalfa.

Alfalfa Hay Prices

The data for Utah alfalfa prices came from the National Agricultural Statistics Service (1990-2009) website. The prices used were the monthly average prices received by Utah farmers for dry alfalfa hay.

Table 4-10: Utah Monthly Average Price for Alfalfa Hay

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$85.00	$85.00	$86.00	$86.00	$85.00	$86.00	$86.00	$85.00	$80.00	$85.00	$86.00	$84.00	**$84.92**
1991	$84.00	$74.00	$69.00	$69.00	$66.00	$64.00	$61.00	$59.00	$59.00	$55.00	$52.00	$53.00	**$63.75**
1992	$55.00	$53.00	$54.00	$54.00	$55.00	$61.00	$64.00	$64.00	$62.00	$61.00	$61.00	$61.00	**$58.75**
1993	$60.00	$61.00	$66.00	$67.00	$70.00	$71.00	$62.00	$63.00	$62.00	$63.00	$65.00	$68.00	**$64.83**
1994	$70.00	$65.00	$67.00	$67.00	$67.00	$76.00	$79.00	$76.00	$79.00	$73.00	$82.00	$86.00	**$73.92**
1995	$83.00	$85.00	$83.00	$80.00	$75.00	$75.00	$74.00	$69.00	$67.00	$61.00	$63.00	$63.00	**$73.17**
1996	$61.00	$59.00	$60.00	$57.00	$59.00	$57.00	$73.00	$74.00	$68.00	$67.00	$73.00	$78.00	**$65.50**
1997	$83.00	$83.00	$84.00	$83.00	$88.00	$85.00	$89.00	$84.00	$84.00	$85.00	$86.00	$85.00	**$84.92**
1998	$84.00	$80.00	$81.00	$78.00	$77.00	$76.00	$81.00	$81.00	$80.00	$78.00	$79.00	$75.00	**$79.17**
1999	$75.00	$76.00	$66.00	$64.00	$62.00	$63.00	$71.00	$74.00	$74.00	$77.00	$77.00	$76.00	**$71.25**
2000	$73.00	$73.00	$71.00	$68.00	$68.00	$64.00	$74.00	$84.00	$82.00	$82.00	$82.00	$82.00	**$75.25**
2001	$82.00	$86.00	$87.00	$85.00	$93.00	$96.00	$100.00	$98.00	$97.00	$98.00	$97.00	$98.00	**$93.08**
2002	$93.00	$97.00	$95.00	$92.00	$93.00	$96.00	$94.00	$103.00	$99.00	$97.00	$97.00	$94.00	**$95.83**
2003	$94.00	$93.00	$90.00	$93.00	$99.00	$93.00	$83.00	$83.00	$81.00	$76.00	$70.00	$87.00	**$86.83**
2004	$84.00	$78.00	$75.00	$81.00	$90.00	$88.00	$90.00	$87.00	$85.00	$86.00	$92.00	$87.00	**$85.25**
2005	$85.00	$91.00	$99.00	$92.00	$90.00	$95.00	$95.00	$90.00	$95.00	$97.00	$100.00	$104.00	**$94.42**
2006	$95.00	$100.00	$96.00	$106.00	$98.00	$101.00	$101.00	$101.00	$97.00	$99.00	$99.00	$101.00	**$99.50**
2007	$100.00	$105.00	$105.00	$110.00	$120.00	$130.00	$130.00	$130.00	$132.00	$132.00	$135.00	$140.00	**$122.42**
2008	$145.00	$145.00	$145.00	$150.00	$155.00	$160.00	$170.00	$180.00	$170.00	$170.00	$170.00	$165.00	**$160.42**
2009	$150.00	$145.00	$150.00	$140.00	$145.00	$130.00	$110.00	$105.00	$105.00	$105.00	$100.00	$100.00	**$123.75**
Average Prices													
Overall	**$87.05**	**$86.70**	**$86.45**	**$86.10**	**$87.75**	**$88.35**	**$89.35**	**$89.50**	**$87.90**	**$87.35**	**$88.30**	**$89.35**	**$87.85**
Last 5 Yr.	**$115.00**	**$117.20**	**$119.00**	**$119.60**	**$121.60**	**$123.20**	**$121.20**	**$121.20**	**$119.80**	**$120.60**	**$120.80**	**$122.00**	**$120.10**
Last 2 Yr.	**$147.50**	**$145.00**	**$147.50**	**$145.00**	**$150.00**	**$145.00**	**$140.00**	**$142.50**	**$137.50**	**$137.50**	**$135.00**	**$132.50**	**$142.08**

The highest prices for alfalfa in Utah happened in 2008 where the average annual price was $160.42/ ton. The lowest average annual price occurred in 1992 at $58.75/ton. Between 1990 and 2009, the average annual price for alfalfa increased by 45.73 percent.

From 1990 to 2009, the month with the highest average prices was August with an average of $89.50/ton. During the past five years, June was the month with the highest prices at $123.20/ton on average. In the last two years of the time period, May had the highest alfalfa prices with an average price of $150/ton.

Figure 4-10: Utah Alfalfa Hay Price Data

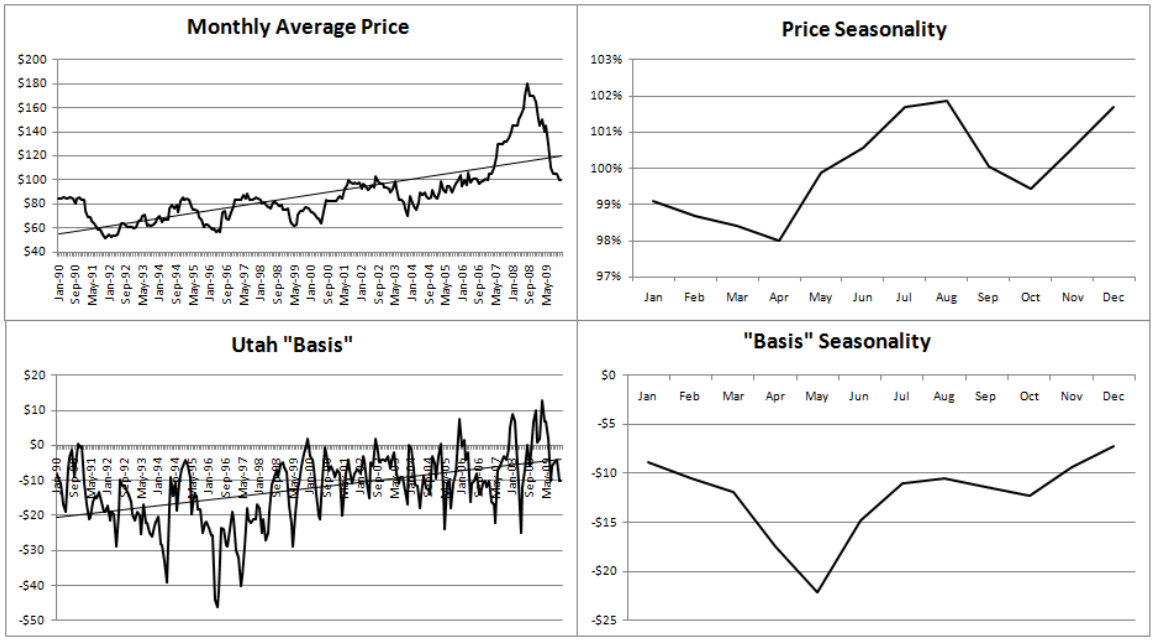


Figure 4-10 shows the gradual increase alfalfa hay prices had over time until 2007 when a dramatic increase occurred, lasting into late 2008. After that time prices decreased back down to around the $100/ton range. The overall trend was upward

sloping. Hay prices tended to be the highest in July, August, and December, and the lowest in March and April.

There is no futures market for alfalfa hay, so basis, in the way it has been defined, does not apply to this commodity. However, if the local cash price for alfalfa hay is compared to the national average price, it can still be determined where Utah prices are in respect to the rest of the country. Figure 4-10 shows this new "basis." As can be seen, the basis became stronger over time meaning that Utah producers came closer to paying what the average producer paid for alfalfa in the rest of the country. The basis tended to be the strongest from July through March, and the weakest from April through June.

Corn Grain Prices

Utah corn prices came from the USDA and were reported to the Agricultural Marketing Service (2005-2009) website. The original numbers were reported in price per hundred weight. To compare these prices with the appropriate futures prices which were reported in bushels, all the figures were converted into bushels using the assumption that one bushel of corn equals 56 pounds.

The year with the highest corn prices was 2008 where the average annual price was $6.08/bushel. 1999 was the year with the lowest average annual price at $2.33/bushel. Between 1990 and 2009, the average annual price increased by 48.58 percent.

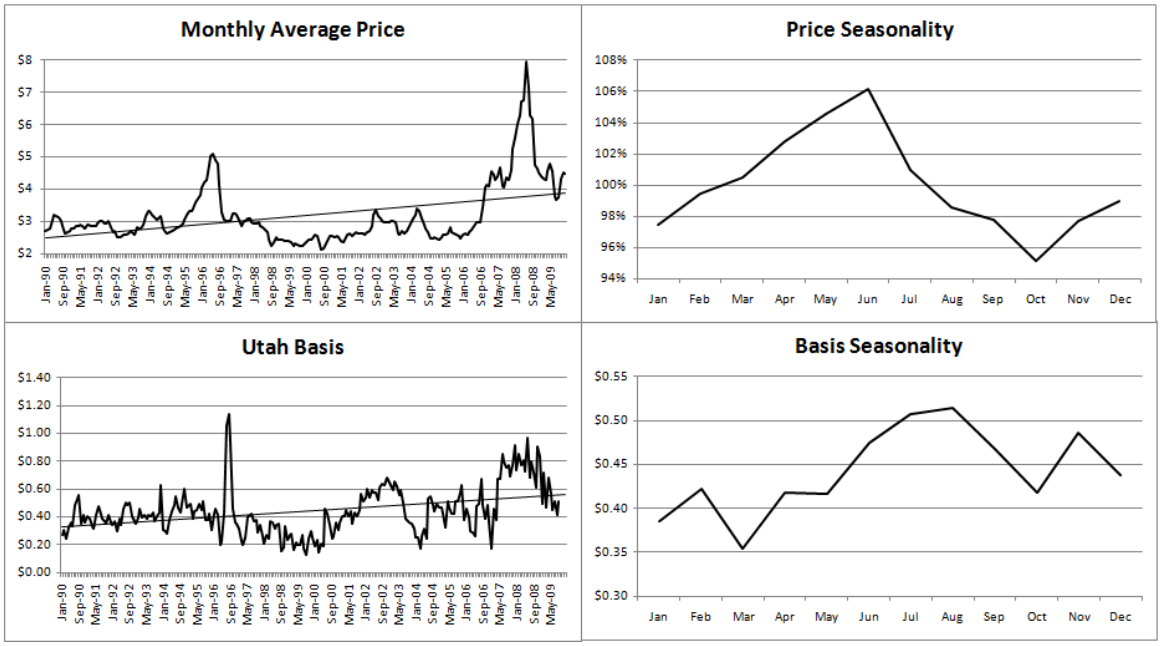
Table 4-11: Utah Monthly Average Price for Corn Grain

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1990	$2.71	$2.74	$2.78	$3.05	$3.21	$3.16	$3.14	$3.00	$2.85	$2.65	$2.67	$2.72	**$2.89**
1991	$2.78	$2.79	$2.87	$2.87	$2.90	$2.87	$2.79	$2.88	$2.89	$2.86	$2.85	$2.87	**$2.85**
1992	$2.92	$3.02	$3.02	$2.92	$2.93	$3.02	$2.83	$2.68	$2.69	$2.49	$2.51	$2.55	**$2.80**
1993	$2.57	$2.58	$2.64	$2.70	$2.68	$2.60	$2.82	$2.80	$2.78	$2.89	$3.17	$3.34	**$2.80**
1994	$3.33	$3.20	$3.13	$3.04	$3.10	$3.17	$2.79	$2.66	$2.64	$2.66	$2.69	$2.76	**$2.93**
1995	$2.80	$2.83	$2.85	$2.92	$3.06	$3.22	$3.33	$3.34	$3.41	$3.61	$3.71	$3.81	**$3.24**
1996	$4.04	$4.20	$4.31	$4.74	$5.03	$5.10	$4.92	$4.79	$4.14	$3.29	$3.04	$3.00	**$4.22**
1997	$3.00	$3.03	$3.23	$3.24	$3.21	$3.06	$2.87	$3.00	$3.02	$3.10	$3.10	$2.99	**$3.07**
1998	$2.92	$2.96	$2.96	$2.86	$2.84	$2.74	$2.67	$2.42	$2.24	$2.37	$2.52	$2.45	**$2.66**
1999	$2.44	$2.43	$2.40	$2.40	$2.39	$2.38	$2.24	$2.31	$2.27	$2.25	$2.25	$2.27	**$2.33**
2000	$2.35	$2.43	$2.45	$2.48	$2.59	$2.54	$2.27	$2.12	$2.17	$2.31	$2.47	$2.53	**$2.39**
2001	$2.55	$2.52	$2.54	$2.50	$2.40	$2.37	$2.50	$2.60	$2.62	$2.53	$2.61	$2.66	**$2.53**
2002	$2.64	$2.64	$2.61	$2.58	$2.66	$2.69	$2.87	$3.20	$3.36	$3.16	$3.11	$3.03	**$2.88**
2003	$2.98	$2.98	$2.99	$3.00	$3.01	$2.99	$2.62	$2.59	$2.69	$2.62	$2.72	$2.79	**$2.83**
2004	$2.92	$3.08	$3.23	$3.41	$3.33	$3.11	$2.90	$2.79	$2.67	$2.49	$2.49	$2.52	**$2.91**
2005	$2.46	$2.42	$2.49	$2.59	$2.59	$2.64	$2.82	$2.66	$2.61	$2.59	$2.56	$2.46	**$2.58**
2006	$2.59	$2.62	$2.58	$2.66	$2.76	$2.86	$2.98	$2.97	$2.97	$3.42	$4.04	$4.12	**$3.05**
2007	$4.08	$4.57	$4.44	$4.29	$4.42	$4.66	$4.09	$4.06	$4.36	$4.27	$4.59	$5.24	**$4.42**
2008	$5.62	$6.01	$6.30	$6.74	$6.76	$7.96	$7.14	$6.29	$6.18	$4.74	$4.65	$4.53	**$6.08**
2009	$4.41	$4.34	$4.27	$4.56	$4.79	$4.57	$3.78	$3.68	$3.76	$4.34	$4.52	$4.48	**$4.29**
Average Prices													
Overall	**$3.11**	**$3.17**	**$3.20**	**$3.28**	**$3.33**	**$3.38**	**$3.22**	**$3.14**	**$3.12**	**$3.03**	**$3.11**	**$3.16**	**$3.19**
Last 5 Yr.	**$3.83**	**$3.99**	**$4.02**	**$4.17**	**$4.26**	**$4.54**	**$4.16**	**$3.93**	**$3.98**	**$3.87**	**$4.07**	**$4.17**	**$4.08**
Last 2 Yr.	**$5.01**	**$5.18**	**$5.29**	**$5.65**	**$5.77**	**$6.27**	**$5.46**	**$4.99**	**$4.97**	**$4.54**	**$4.58**	**$4.51**	**$5.18**

Between 1990 and 2009, the month with the lowest overall prices was October with an average of $3.03/bushel. In the last five years of the time period, January had the lowest prices with an average of $3.83/bushel. In the last two years, December had the lowest prices with an average of $4.51/bushel.

Figure 4-11 shows a similar pattern to figure 4-10. Corn prices increased overtime with a large increase and drop in 1996 and another one, this time even larger, in 2007 and 2008. Utah farmers paid more for corn from March through July, and less for corn from August through February.

Figure 4-11: Utah Corn Grain Price Data



The basis for corn grain became stronger over the time period. As can be seen in the graph, Utah farmers always paid more for corn than the going CME corn grain futures price. During the entire time frame, the Utah corn price never fell below the futures price. The basis was the strongest in July and August, and was the weakest in March. For further information on corn and alfalfa prices, see Appendix A, "Price of Corn and Alfalfa."

Enterprise Budgets

The price analysis from above has shown that there is a great deal of price risk associated with raising cattle. When prices from 1990 through 2009 are applied to an enterprise budget for each group of cattle, the impact of this price risk on historical returns becomes evident.

In addition to showing price level risk, the price analysis has also shown when cattle are at their seasonal high and their seasonal low. By purchasing cattle during their seasonal low and selling them during their seasonal high, greater profits may be generated.

In order to calculate the historical returns for the five feeding enterprises being represented in this research, not only did monthly average prices need to be gathered, but also all of the costs associated with each feeding enterprise. It was assumed that the cattle were purchased in October, fed for 100 or 120 days depending on the enterprise, and then sold in February. Because of this, only the prices in these two months were used. The table below shows the prices that were used.

Table 4-12: Utah Cattle Prices for the Five Feeding Enterprises

	Beef Yearling Steers		Beef Feeder Steers		Holstein Yearling Steers		Holstein Feeder Steers		Cull Cows	
Buy/Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
Description	900 lb feeder	Slaugher Steer	500-600 lb	700-800 lb	1000 lb feeder	Slaugher Steer	500-700 lb	700-900 lb	Cutter Grade	Breaker Grade
Month	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb	Oct	Feb
1990	$ 80.49		$ 91.50						$ 44.32	
1991	$ 76.98	$ 79.13	$ 90.65	$ 85.60		$ 69.56			$ 40.42	$ 55.02
1992	$ 76.38	$ 76.25	$ 89.18	$ 76.55		$ 65.50			$ 41.54	$ 53.83
1993	$ 77.70	$ 81.00	$ 90.08	$ 80.32		$ 71.38			$ 40.84	$ 53.13
1994	$ 65.69	$ 73.00	$ 73.65	$ 80.58		$ 63.25			$ 34.17	$ 52.83
1995	$ 60.64	$ 72.88	$ 62.08	$ 68.81		$ 61.19			$ 27.35	$ 44.46
1996	$ 56.96	$ 62.13	$ 58.85	$ 54.12	$ 43.26	$ 52.13	$ 34.00		$ 27.73	$ 36.63
1997	$ 70.21	$ 66.25	$ 81.77	$ 66.44	$ 56.90	$ 55.50	$ 61.10	$ 50.58	$ 27.61	$ 37.73
1998	$ 60.85	$ 60.50	$ 69.78	$ 71.90	$ 44.17	$ 50.50	$ 51.33	$ 61.63	$ 25.24	$ 39.74
1999	$ 69.54	$ 61.88	$ 83.60	$ 70.16	$ 53.19	$ 51.88	$ 68.50	$ 53.51	$ 29.57	$ 38.61
2000	$ 77.25	$ 68.25	$ 91.99	$ 79.77	$ 58.83	$ 58.25	$ 74.13	$ 65.94	$ 29.05	$ 45.56
2001	$ 80.00	$ 78.88	$ 90.19	$ 80.61	$ 51.75	$ 68.88	$ 67.25	$ 66.00	$ 33.09	$ 44.06
2002	$ 68.30	$ 71.17	$ 77.40	$ 79.00	$ 48.56	$ 61.17	$ 56.41	$ 58.82	$ 28.01	$ 42.35
2003	$ 93.36	$ 78.75	$ 101.49	$ 73.87	$ 72.30	$ 68.75	$ 80.00	$ 54.04	$ 36.06	$ 42.31
2004	$ 96.59	$ 78.13	$ 112.60	$ 83.33	$ 66.75	$ 68.13	$ 86.63	$ 65.50	$ 44.20	$ 47.40
2005	$ 101.45	$ 88.13	$ 120.55	$ 94.77	$ 69.96	$ 78.13	$ 94.38	$ 73.88	$ 37.45	$ 51.27
2006	$ 98.75	$ 88.75	$ 115.58	$ 103.12	$ 64.00	$ 78.75	$ 82.38	$ 83.38	$ 35.87	$ 47.32
2007	$ 97.81	$ 88.25	$ 101.52	$ 94.77	$ 56.38	$ 78.25	$ 66.92	$ 61.25	$ 33.36	$ 43.62
2008	$ 87.00	$ 90.00	$ 92.47	$ 93.17	$ 51.38	$ 75.00	$ 52.38	$ 58.21	$ 33.37	$ 47.28
2009		$ 80.88		$ 86.49		$ 60.88		$ 54.75		$ 41.37

The prices shown above were from October 1990, until February 2009. Notice that there were missing data for Holstein steers because data between 1990 and 1996

could not be found at the Smithfield, Utah Livestock Auction. Also, the prices for cull cows were adjusted. The October prices shown assumed the cull cows were sold at cutter grade (which is the lowest carcass grade) and February prices assumed the cows were sold at breaking grade (an increase in body condition of two quality grades). This assumption is consistent with studies done in the past (Pritchard and Burg 1993).

Feed costs were also analyzed in this study. The rations calculated for each enterprise included alfalfa hay, grass hay, and corn grain. It was assumed that all of the feed needed during the four month feeding program was purchased up front in October. Therefore, only October prices were evaluated. These prices are displayed in table 4.13. Grass hay prices were calculated at 75 percent of alfalfa hay prices.

Table 4-13: Utah October Average Feed Prices

Month	Alfalfa	Corn	Grass Hay
1990	$ 85.00	$2.65	$ 63.75
1991	$ 55.00	$2.86	$ 41.25
1992	$ 61.00	$2.49	$ 45.75
1993	$ 63.00	$2.89	$ 47.25
1994	$ 73.00	$2.66	$ 54.75
1995	$ 61.00	$3.61	$ 45.75
1996	$ 67.00	$3.29	$ 50.25
1997	$ 85.00	$3.10	$ 63.75
1998	$ 78.00	$2.37	$ 58.50
1999	$ 77.00	$2.25	$ 57.75
2000	$ 82.00	$2.31	$ 61.50
2001	$ 98.00	$2.53	$ 73.50
2002	$ 97.00	$3.16	$ 72.75
2003	$ 76.00	$2.62	$ 57.00
2004	$ 86.00	$2.49	$ 64.50
2005	$ 97.00	$2.59	$ 72.75
2006	$ 99.00	$3.42	$ 74.25
2007	$132.00	$4.27	$ 99.00
2008	$170.00	$4.74	$ 127.50

Two other variable costs were considered in this study. These costs included yardage costs and interest. Yardage costs are the costs that a producer would pay a feedlot to feed his cattle for the time period. Yardage includes a charge for labor and facilities. Because this research assumed the producer would feed the cattle and not send them to a feedlot, yardage was not actually paid to a feedlot. If the producer pays this cost to himself, then he is receiving a return on his time and facilities. If he chooses not to pay himself, then the yardage value represents unpaid labor.

Table 4-14: Yardage Costs and Interest Rates for October

Month	Yardage Rates	Interest Rates
1990	$ 0.25	12.00%
1991	$ 0.25	10.00%
1992	$ 0.25	8.00%
1993	$ 0.25	8.00%
1994	$ 0.25	9.75%
1995	$ 0.25	10.75%
1996	$ 0.25	10.25%
1997	$ 0.25	10.50%
1998	$ 0.30	10.12%
1999	$ 0.30	10.25%
2000	$ 0.30	11.50%
2001	$ 0.30	7.53%
2002	$ 0.30	6.75%
2003	$ 0.30	6.00%
2004	$ 0.30	6.75%
2005	$ 0.30	8.75%
2006	$ 0.30	10.25%
2007	$ 0.33	9.74%
2008	$ 0.35	6.56%

The yardage rates shown in table 4-14 were the rates reported in the Nebraska Beef Report (2009). The interest rates were calculated by taking the prime rate plus two percent. It was assumed that the loan was taken out the day the feed and cattle were purchased and was paid back in full the day the cattle were sold to avoid any extra interest costs.

The rest of the costs that were associated with each feeding enterprise remained constant over the time period because their effect on returns was minimal. These costs are reported in table 4-15. Some numbers were the same among enterprises, but others were unique to each feeding enterprise.

Table 4-15: Summary of Constant and Variable Costs in Each Feeding Enterprise

	Beef Yearling Steers	Beef Feeder Steers	Holstein Yearling Steers	Holstein Feeder Steers	Cull Cows
Number of Cattle	100	100	100	100	100
Days on Feed	120	100	120	100	100
Purchase Weight	900 lbs	550 lbs	1000 lbs	600 lbs	1000 lbs
Month Purchased	Oct	Oct	Oct	Oct	Oct
Month Sold	Feb	Feb	Feb	Feb	Feb
Avg. Daily Gain	3.5 lbs	2.25 lbs	3.5 lbs	2.25 lbs	3.2 lbs
Death Loss	2%	2%	2%	2%	2%
Pencil Shrink	3%	3%	3%	3%	3%
Purchase Price	Variable	Variable	Variable	Variable	Variable
Sell Price	Variable	Variable	Variable	Variable	Variable
Trucking Distance	100	100	100	100	100
Trucking Rate	$0.08/mile	$0.05/mile	$0.08/mile	$0.05/mile	$0.08/mile
Alfalfa Price	Variable	Variable	Variable	Variable	Variable
Alfalfa Consumed	5.5 lb/head/day	2.0 lb/head/day	10.5 lb/head/day	10.0 lb/head/day	6.7 lb/head/day
Corn Price	Variable	Variable	Variable	Variable	Variable
Corn Consumed	19.7 lb/head/day	5.5 lb/head/day	21.0 lb/head/day	6.5 lb/head/day	27.0 lb/head/day
Grass Hay Price	Variable	Variable	Variable	Variable	Variable
Grass Consumed	4.5 lb/head/day	13.0 lb/head/day	0	5.0 lb/head/day	0
Vet and Med	$10.00	$8.00	$10.00	$8.00	$8.00
Yardage	Variable	Variable	Variable	Variable	Variable
Interest	Variable	Variable	Variable	Variable	Variable
Other Expenses	$5.00	$5.00	$5.00	$5.00	$5.00

The first five rows in table 4-15 are assumptions that were made before any research was done on this study. These assumptions were typical for these cattle feeding

enterprises. The number of cattle that was chosen was 100 head. Feeding fewer animals would likely result in higher yardage cost per head than those reported by the Nebraska Beef Reports and used in this analysis. The returns that are given in chapter 5 were reported on a per head basis. The two finishing enterprises fed the cattle for 120 days each. The backgrounding enterprises and the cull cow enterprise assumed the cattle were on feed for 100 days. These numbers were chosen because feeding the cattle for these time periods would put on the desired end weight. The purchase weights that were chosen were good fits for backgrounding and finishing enterprises that would allow for the desired end weights to be produced. Also, local cash prices were available for these weights. The October purchase date was selected because there is a great deal of cattle sent to market during this time and cattle tend to sell at their seasonal low. A February sale date was simply the result of the 100 or 120 day feeding periods. However, February also proved to be when seasonal prices were on a rise.

An average daily gain (ADG) of 3.5 lbs. was chosen for the two finishing yearling steer enterprises based upon a study by Neubold et al. (2008) where yearling beef steers placed in a feedlot and fed until finishing weight had an ADG between 2.98 lbs and 3.77 lbs. Holstein yearlings were given the same ADG because according to studies done by the Feedlot Performance and Cost Monitoring Program (1987) and Fanatico (2000), Holstein yearling steers performed just as well as beef steers in ADG, but had a higher feed conversion ratio. An ADG of 2.25 lbs. was used for the two backgrounding enterprises. Several studies suggest that ADG in backgrounding operations should be keep between 1.5 lbs and 2.5 lbs to avoid over fleshy calves (Lalman, no date; Heldt, no

date). ADG for cull cows was selected at 3.2 lbs. This was because of a study on cull cow performance which determined that the average cull cow placed on feed gained 3.2 ± 0.6 lbs per day (Agriculture and Rural Development 2007).

The death loss for all five enterprises was figured at two percent. This was the value that was given by the Nebraska Beef Report (2009) as a common death rate for cattle in feedlots.

A pencil shrink of three percent was figured for all five feeding enterprises. This number was based upon a study by Boyles et al. (No date) that says that cattle will shrink around two percent the first hour they are in a moving truck and four percent the second hour. Assuming the cattle would be in the truck for 1.5 hours, a pencil shrink of three percent was averaged.

The trucking distance of 100 miles assumed that was the total miles driven, including pickup and delivery of the cattle. This number was simply an assumption which can easily be adjusted. The important information is the trucking rate. The trucking rate was based upon the Nebraska Beef Report (2009) which said the cost of pulling a 55,000 pound, three-axle trailer full of cattle was $3.25 per mile.

The rations for the feeding enterprises were determined using a ration balancing program. The rations were based upon the type of cattle and the average daily gain that was desired for each group. Larger rations were figured for Holstein cattle to assure that they were able to achieve the same ADG as the beef cattle.

Veterinary and medical costs were figured at $10/head for the two finishing enterprises and $8/head for the other three enterprises. The finishing enterprises had higher costs because they held the cattle for 20 days longer than the other enterprises. Other expenses were set at $5/head for all five enterprises. The numbers used for veterinary and medical costs as well as other expenses were based upon similar budgets constructed by Holmgren et al. (2005) and Feuz (2006).

By combining the information in table 4-15 with all of the variable costs that were reported in tables 4-12 through 4-14, enterprise budgets from 1990 through 2009 were created. Collecting this information also made it possible to conduct an analysis on historical returns which is reported in chapter 5.

LRP Insurance

According to Mark et al. (2005), the way in which LRP insurance works is really quite simple. At the time the insurance is purchased, an expected ending value (EEV) is estimated. This expected value is basically the current futures price of the cattle for the month in which they will be sold. The producer will then choose which level of coverage he desires. This level can be between 70 to 95 percent of the EEV. The premium is then calculated based upon the level of coverage chosen. The United States government subsidizes 13 percent of the premium.

Once the insurance period is over, the coverage price chosen by the producer at the beginning of the contract is compared to the actual ending value (AEV) for that type of cattle. According to the same study by Mark et al. (2005), the AEV for live cattle is

determined by taking the weighted average of the direct slaughter steer price of a five-area region in the Midwest. The price used for the AEV for live cattle can be found on the Agricultural Marketing Service (2005-2009) website. The AEV for feeder cattle is a seven day rolling national average for 700 to 849 pound medium or medium/large #1 framed steers. This price can be found online on the Chicago Mercantile Exchange website (www.cmegroup.com).

If the AEV is larger than the coverage price, then no indemnity will be paid to the producer. If the AEV is less than the coverage price, then an indemnity is paid which is simply the coverage price minus the AEV. If the indemnity is collected, the gain or loss from the LRP insurance is the indemnity minus the premium paid. If no indemnity is paid, the loss to the producer is the premium paid.

As was mentioned in chapter 3, the EEV and AEV prices are very close to the current CME futures price. For that reason, the EEV and AEV that were used in this research were based upon futures prices for the time period. Table 4-16 shows these values.

Table 4-16: February Futures Prices in October and February

	Live Cattle		Feeder Cattle	
	EEV	AEV	EEV	EEV
Year	Oct Futures	Feb Futures	Oct Futures	Feb Futures
1990-1991	$74.44	$78.00	$83.30	$88.75
1991-1992	$75.07	$75.72	$83.73	$79.10
1992-1993	$71.60	$78.85	$79.90	$84.73
1993-1994	$74.75	$73.33	$82.41	$81.37
1994-1995	$68.15	$72.47	$71.84	$71.71
1995-1996	$66.59	$63.49	$62.22	$57.94
1996-1997	$63.61	$68.73	$64.22	$68.23
1997-1998	$69.03	$65.22	$78.18	$76.09
1998-1999	$64.97	$64.76	$73.48	$73.90
1999-2000	$69.48	$70.09	$81.79	$83.65
2000-2001	$72.36	$80.69	$88.25	$86.66
2001-2002	$71.32	$73.03	$84.75	$82.80
2002-2003	$73.45	$80.61	$78.23	$76.69
2003-2004	$85.50	$77.22	$91.33	$84.15
2004-2005	$89.66	$89.93	$103.97	$98.04
2005-2006	$93.04	$91.32	$109.15	$107.93
2006-2007	$90.64	$93.34	$103.11	$99.36
2007-2008	$98.76	$92.00	$111.75	$104.95
2008-2009	$93.52	$82.84	$98.46	$92.64

The live cattle and feeder cattle futures prices that are reported in table 4-16 were the values used for the EEV and AEV. These numbers were then adjusted to fit the two Holstein feeding enterprises. According to Mark et al. (2005), the EEV for Holsteins is 80 percent of the EEV for beef steers, and the same rule applies for the AEV.

To calculate the premium for the coverage level, the premiums per hundred weight paid in Utah for each enterprise were gathered for October contracts between 2004 and 2008 at a 95 percent coverage rate. The data were very limited.

Table 4-17: Utah October LRP Insurance Premiums

	2004	2005	2006	2007	2008
Live Cattle	$ 2.24	$ 1.33	$ 1.47	$ 2.12	$ 3.00
Feeder Cattle	$ 2.22	$ 1.56	$ 2.27	NA	NA

Table 4-17 shows premiums paid by Utah producers for 95 percent coverage. No other information was available for Utah producers purchasing coverage in October. Because this information was so limited, the premium paid was made stochastic as was explained in chapter 3. The information on Utah LRP insurance was used to simulate the effects LRP insurance had on the expected return for the four eligible feeding enterprises.

CHAPTER 5

FINDINGS

This chapter discusses the results from the tests that were set up and explained in previous chapters. First, the historical returns for the five feeding enterprises are determined. Next, a simulation analysis is conducted on the returns to feeding the five enterprises without LRP insurance. Following that, a simulation analysis is conducted to determine the effects of LRP insurance on lowering price volatility. The concluding section of this chapter constructs various portfolios and then uses stochastic dominance to determine which portfolio is the most desired according to the producer's risk preferences.

Historical Returns

To see which enterprises were profitable since 1990, each enterprise was run through its respective enterprise budget that was created in chapter 4. The analysis assumed that 100 head of cattle were purchased in each enterprise. Using all the information that was reported in chapter 4, the historical returns for each enterprise were calculated. Table 5-1 is a summary of the results. The numbers reported are on a per head basis and include yardage.

Table 5-1: Historical Returns (Including Yardage)

	Beef Yearling Steers	Beef Feeder Steers	Holstein Yearling Steers	Holstein Feeder Steers	Cull Cows
1990-1991	$23.75	-$10.64	NA	NA	$25.43
1991-1992	$33.42	-$53.33	NA	NA	$53.72
1992-1993	$116.60	-$14.16	NA	NA	$52.44
1993-1994	-$14.26	-$22.44	NA	NA	$35.72
1994-1995	$95.43	-$22.78	NA	NA	$4.48
1995-1996	-$29.74	-$69.16	NA	NA	-$67.99
1996-1997	$67.73	$39.97	$52.11	$57.30	-$43.97
1997-1998	-$129.94	-$58.72	-$159.87	-$34.04	-$14.61
1998-1999	$5.31	$3.47	$23.99	-$28.23	$29.91
1999-2000	$9.79	-$2.29	$22.59	-$34.73	$78.50
2000-2001	$62.82	-$49.10	$98.83	-$74.92	$59.13
2001-2002	-$66.95	-$56.46	$56.23	-$97.34	-$15.63
2002-2003	$111.79	-$26.95	$165.01	-$74.12	$6.57
2003-2004	-$89.42	-$72.98	-$45.61	-$106.20	$23.01
2004-2005	$3.90	-$56.94	$143.34	-$87.66	-$9.46
2005-2006	-$50.49	-$51.66	$101.37	-$73.07	-$1.99
2006-2007	-$74.08	-$97.70	$112.13	-$186.56	-$76.03
2007-2008	-$100.36	-$60.54	$83.86	-$150.77	-$59.91
2008-2009	-$146.86	-$82.60	-$95.31	-$118.48	-$167.04
Avg 1990-2009	**-$9.03**	**-$40.26**	**NA**	**NA**	**-$4.62**
Avg 1996-2009	**-$30.52**	**-$44.04**	**$42.97**	**-$77.60**	**-$14.73**
Avg 1990-1994	**$50.99**	**-$24.67**	**NA**	**NA**	**$34.36**
Avg 1995-1999	**-$15.37**	**-$17.34**	**-$15.29**	**-$9.92**	**-$3.63**
Avg 2000-2004	**$4.43**	**-$52.49**	**$83.56**	**-$88.05**	**$12.72**
Avg 2005-2009	**-$92.95**	**-$73.12**	**$50.51**	**-$132.22**	**-$76.24**

As can be seen from the results, there was a great deal of volatility in historical returns between years and enterprises. For the beef yearling steer enterprise, the most profitable year was the 1992-1993 feeding season when raising 100 head of cattle would have generated a profit of approximately $116.60/head. From 1990 to 2009, 10 of the years produced positive results. However, nine years reported negative returns. A particularly poor period was 2008-2009 where producing 100 yearling steers to a finishing weight would have resulted in an approximate loss of -$146.86/head. The overall average for 900 pound steers between 1990 and 2009 generated an average loss of -$9.03/head. Nevertheless, when the data are broken up into five year increments, historical returns change. Between 1990 and 1994, the average profit was $50.99/head.

Between 1995 and 1999, there was an average yearly loss of -$15.37/head. Between 2000 and 2004, a small profit on average was returned of $4.43/head. From 2005 to 2009, finishing beef yearling steers once again generated losses, this time an average of -$92.95/head.

Backgrounding beef steer calves was not as profitable over the years as finishing yearlings. As can be seen from the analysis, the most profitable time for backgrounding steers was the winter of 1996-1997 where the enterprise returned a profit of $39.97/head. Out of the 19 years in the time frame, only two years yielded a positive return. The period with the largest loss was in 2006-2007 where the approximate loss estimated was -$97.70/head. The overall average between 1990 and 2009 estimated an average yearly loss of -$40.26/head. When the overall average was split into five year increments, an average positive return was never produced.

Data for Holstein steers were only available from 1996 onward; hence the first six years of the data set show NA for not available. Finishing Holstein yearling steers proved to be very successful according to the analysis. 2002-2003 proved to be the most profitable feeding season generating a profit of approximately $165.01/head. Only three of the years generated a loss, the largest loss happened in 1997-1998 with an average of -$159.87/head. The overall average from 1996 to 2009 showed an average yearly profit of $42.97/head. Between 1996 and 1999, the average year generated a loss of -$15.29/head. Between 2000 and 2004, the average was a profit of $83.56/head, and from 2005 until 2009, the average was $50.51/head.

Backgrounding Holstein steer calves proved to be much less profitable than finishing Holstein yearling steers. Out of the years that were analyzed, only one year returned a profit (1996-1997) which was $57.30/head. Each year after that time generated a negative return. The year with the largest loss was 2006-2007 where it was estimated that the loss would be -$186.56/head. The 1996 to 2009 average generated an estimated yearly loss of -$77.60/head. When the average for the time period was split up into five year increments, a per year average profit was still not generated.

Feeding cull cows was somewhat profitable from 1990 to 2009. The highest profits for this enterprise were realized in the 1999-2000 feeding season with a profit of $78.50/head. Of the 19 years that were tested, 10 years generated a positive return. The most unprofitable time to raise cull cows was 2008-2009 where the loss was expected to be -$167.04/head. Between 1990 and 2009, the overall average was a loss of -$4.62/head. Between 1990 and 1994, the average returned a profit of $34.36/head. Between 1995 and 1999, the average returned a loss of -$3.63/head. Between 2000 and 2004, the average was a positive return of $12.72/head. From 2005 to 2009, the average year showed a loss of -$76.24/head.

Next, the five feeding enterprises were compared to each other by comparing the average yearly profits for the time period. Yet, because there were missing data for the two Holstein steer enterprises, the average that needed to be compared was from 1996 to 2009. For this reason, table 5-1 has included this average. When this was done, finishing Holstein steers was the most profitable enterprise (the other four enterprises all produced an average negative return during the period). Between the years 1990 and 1994, the

enterprise that was the most profitable was finishing beef yearling steers. A close runner up was feeding cull cows. Between 1995 and 1999, none of the feeding enterprises produced a positive return. From 2000 to 2004, finishing Holstein yearling steers was the most profitable enterprise. Feeding cull cows came in second place and finishing beef yearling steers came in third. From 2005 to 2009, finishing Holstein yearling steers was by far the most profitable enterprise; everything else proved to be unprofitable during the time frame, each generating large losses.

One important point to mention with these results is that yardage was included. This means that if the producer wants to receive a return on his time and facilities, then these would be the returns. However, if the producer is willing to not receive a return on his time and facilities, then the results would be different. Table 5-2 shows these new results without the exclusion of yardage.

Table 5-2: Historical Returns (Excluding Yardage)

	Beef Yearling Steers	Beef Feeder Steers	Holstein Yearling Steers	Holstein Feeder Steers	Cull Cows
1990-1991	$53.75	$14.36	NA	NA	$50.43
1991-1992	$63.42	-$28.33	NA	NA	$78.72
1992-1993	$146.60	$10.84	NA	NA	$77.44
1993-1994	$15.74	$2.56	NA	NA	$60.72
1994-1995	$125.43	$2.22	NA	NA	$29.48
1995-1996	$0.26	-$44.16	NA	NA	-$42.99
1996-1997	$97.73	$64.97	$82.11	$82.30	-$18.97
1997-1998	-$99.94	-$33.72	-$129.87	-$9.04	$10.39
1998-1999	$41.31	$33.47	$59.99	$1.77	$59.91
1999-2000	$45.79	$27.71	$58.59	-$4.73	$108.50
2000-2001	$98.82	-$19.10	$134.83	-$44.92	$89.13
2001-2002	-$30.95	-$26.46	$92.23	-$67.34	$14.37
2002-2003	$147.79	$3.05	$201.01	-$44.12	$36.57
2003-2004	-$53.42	-$42.98	-$9.61	-$76.20	$53.01
2004-2005	$39.90	-$26.94	$179.34	-$57.66	$20.54
2005-2006	-$14.49	-$21.66	$137.37	-$43.07	$28.01
2006-2007	-$38.08	-$67.70	$148.13	-$156.56	-$46.03
2007-2008	-$60.76	-$27.54	$123.46	-$117.77	-$26.91
2008-2009	-$104.86	-$47.60	-$53.31	-$83.48	-$132.04
Avg 1990-2009	**$24.95**	**-$11.95**	**NA**	**NA**	**$23.70**
Avg 1996-2009	**$5.30**	**-$14.19**	**$78.79**	**-$47.75**	**$15.11**
Avg 1990-1994	**$80.99**	**$0.33**	**NA**	**NA**	**$59.36**
Avg 1995-1999	**$17.03**	**$9.66**	**$17.71**	**$17.58**	**$23.37**
Avg 2000-2004	**$40.43**	**-$22.49**	**$119.56**	**-$58.05**	**$42.72**
Avg 2005-2009	**-$54.55**	**-$41.12**	**$88.91**	**-$100.22**	**-$44.24**

When yardage was taken out of the equation, the historical returns changed a great deal. From 1996 through 2009, three of the five feeding enterprises returned an on average positive return in contrast to only one enterprise with a positive return when yardage was included. An interesting point was that from 1990-1999, all of the feeding enterprises, including the two backgrounding enterprises, produced positive returns on average. However, when you get into the 2000s, large losses started to lower the average returns. Take for example the 2008-2009 feeding period. Because of the high feed costs, none of the enterprises produced positive returns, even when yardage was excluded.

Simulation Analysis without LRP Insurance

As was discussed in the methodology chapter of this research, once historical profitability was determined, the risk associated with each feeding enterprise could be analyzed. This was done by using the Excel add-in, Simetar. First, the risk associated with the five feeding enterprises without any price protection was calculated. In order to do that, a few more stochastic variables needed to be created. Table 5-3 shows which variables were included.

Table 5-3: Stochastic Variables

	Purchase Price	Selling Price	Corn Price	Alfalfa Price	Grass Price	Purchase Weight	ADG
Finishing Beef Yearling Steers							
Min	$56.96	$58.39	$2.25	$55.00	$41.25	$807.50	2.50
Max	$101.45	$95.49	$4.74	$170.00	$127.50	$892.50	3.50
Mean	$78.73	$75.74	$2.96	$86.42	$64.82	$850.00	3.00
Std Dev	$13.86	$11.42	$0.67	$27.14	$20.35	$29.30	0.33
CV	$17.60	$15.08	$22.55	$31.40	$31.40	$3.45	11.06
Finishing Holstein Yearling Steers							
Min	$43.26	$49.11	$2.25	$55.00	$41.25	$950.00	2.20
Max	$72.30	$82.97	$4.74	$170.00	$127.50	$1,050.00	3.20
Mean	$56.72	$65.34	$2.96	$86.42	$64.82	$1,000.00	2.70
Std Dev	$9.34	$10.25	$0.67	$27.14	$20.35	$29.30	0.33
CV	$16.47	$15.69	$22.55	$31.40	$31.40	$2.93	12.28
Backgrounding Beef Steers							
Min	$58.85	$46.16	$2.25	$55.00	$41.25	$522.50	1.50
Max	$120.55	$107.13	$4.74	$170.00	$127.50	$577.50	2.50
Mean	$89.21	$79.83	$2.96	$86.42	$64.82	$550.00	2.00
Std Dev	$16.76	$15.23	$0.67	$27.14	$20.35	$29.30	0.50
CV	$18.79	$19.08	$22.55	$31.40	$31.40	$5.33	25.00
Backgrounding Holstein Steers							
Min	$34.00	$20.60	$2.25	$55.00	$41.25	$570.00	1.75
Max	$94.38	$87.09	$4.74	$170.00	$127.50	$630.00	2.75
Mean	$67.34	$60.17	$2.96	$86.42	$64.82	$600.00	2.25
Std Dev	$16.55	$17.94	$0.67	$27.14	$20.35	$29.30	0.33
CV	$24.58	$29.82	$22.55	$31.40	$31.40	$4.88	14.74
Feeding Cull Cows							
Min	$25.24	$36.63	$2.25	$55.00	$41.25	$950.00	2.50
Max	$44.32	$55.02	$4.74	$170.00	$127.50	$1,050.00	3.50
Mean	$34.17	$45.50	$2.96	$86.42	$64.82	$1,000.00	3.00
Std Dev	$6.04	$5.67	$0.67	$27.14	$20.35	$29.30	0.33
CV	$17.68	$12.46	$22.55	$31.40	$31.40	$2.93	11.06

The purchase price and selling price for the cattle as well as the purchase weight and average daily gain were made stochastic, meaning that they were drawn at random from a normal distribution by Simetar. The purchase price for feed was also made stochastic. All other costs that were used to estimate the historical returns before remained constant. Table 5-4 shows the fixed values that were used for each variable.

Table 5-4: Fixed Variables

Assumptions	Yearling Beef Steers	Beef Feeder Steers	Yearling Dairy Steers	Dairy Feeder Steers	Cull Cows
Number of Cattle	100	100	100	100	100
Days on Feed	120	100	120	100	100
Death Loss	2%	2%	2%	2%	2%
Pencil Shrink	3%	3%	3%	3%	3%
Month Purchased	Oct	Oct	Oct	Oct	Oct
Month Sold	Feb	Feb	Feb	Feb	Feb
Trucking Distance	100	100	100	100	100
Trucking Rate	$0.08/mile	$0.05/mile	$0.08/mile	$0.05/mile	$0.08/mile
Alfalfa Consumed	5.5 lbs/head/day	2.0 lbs/head/day	10.5 lbs/head/day	10.0 lbs/head/day	6.7 lbs/head/day
Corn Consumed	19.7 lbs/head/day	5.5 lbs/head/day	21.0 lbs/head/day	6.5 lbs/head/day	27.0 lbs/head/day
Grass Consumed	4.5 lbs/head/day	13.0 lbs/head/day	0	5.0 lbs/head/day	0
Vet and Med	$10.00	$8.00	$10.00	$8.00	$8.00
Yardage	$0.33/head/day	$0.33/head/day	$0.33/head/day	$0.33/head/day	$0.33/head/day
Interest Rate	8.11%	8.11%	8.11%	8.11%	8.11%
Other Expenses	$5.00	$5.00	$5.00	$5.00	$5.00

To analyze the risk of these five enterprises, Simetar created 1000 iterations where the seven stochastic variables in table 5-3 were drawn at random from a normal distribution and compared to the fixed variables in table 5-4 to generate a return for each iteration. Figure 5-1 shows the cumulative distribution functions (CDFs) for the estimated returns of each enterprise.

Figure 5-1: CDFs for Each Feeding Enterprise (without LRP Insurance)

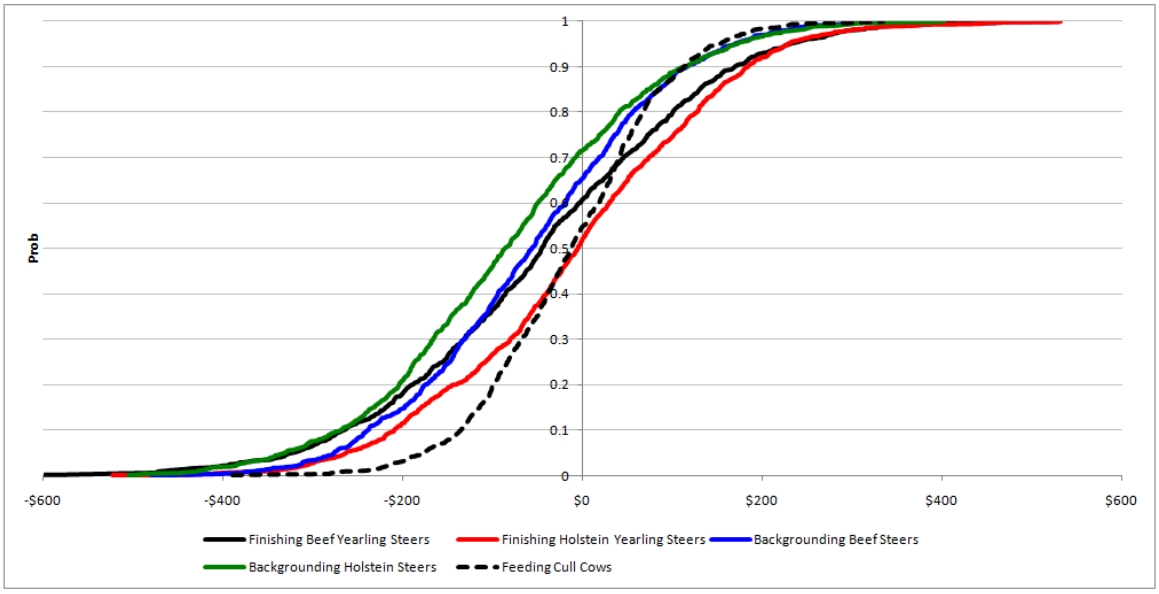


Figure 5-1 illustrates the risk of each feeding enterprise. As can be seen, there was approximately a 60 percent chance of receiving a negative return when finishing beef yearling steers, or looking at it from the opposite direction, there was a 40 percent chance of receiving a positive return on finishing beef yearling steers. Finishing Holstein yearling steers had a 48 percent chance of returning a positive return. Feeding cull cows had a 45 percent chance of receiving a positive return. Backgrounding beef steers only provided a 35 percent chance of receiving a positive return. Backgrounding Holstein steers was even riskier with only a 28 percent chance of receiving a positive return.

The optimal feeding enterprise to choose depends upon the producer's risk preference (i.e. is the producer risk averse or risk seeking?). For example, finishing Holstein yearling steers provided the best chance of receiving a positive return at 48 percent. Yet, the possibility of receiving a positive return on cull cows was only slightly

smaller at 45 percent. However, the slope of the CDF for the Holstein yearling steer enterprise was less steep than the cull cow enterprise which means the upper and lower tails of the Holstein yearling steer enterprise's CDF extended out further than the cull cow enterprise's CDF. This means that the possibility of generating higher profits existed with the Holstein yearling steer enterprise. A risk seeker may prefer this option to the cull cow option. Also, this Holstein enterprise was eligible for LRP insurance which may affect the decision as well. In fact, the other finishing enterprise and the two backgrounding enterprises were also eligible for LRP insurance. Adding this option may change the volatility in returns and make the cull cow feeding enterprise less attractive to producers.

Simulation Analysis with LRP Insurance

The simulation analysis was repeated with the assumption that the producer purchased LRP insurance to reduce some of the down side price risk. Remember, LRP insurance is not available for cull cows so the cull cow enterprise was omitted from this simulation. In order to successfully simulate the effects of LRP insurance, a few more variables needed to be defined. As was explained in the LRP insurance section of chapter 4, LRP insurance is based upon an EEV, a coverage price, an AEV, and a premium. Using the futures values from the tables in chapter 4, summary statistics could be calculated and used to form new stochastic variables for the model.

Table 5-5 shows the summary statistics needed to generate stochastic variables in the Simetar program. Both the AEV and the premium were made stochastic in the

simulation. The EEV that was used was the mean of the AEV and remained constant throughout the simulation. This was done because the mean difference between the EEV and the AEV series was equal to zero (Feuz 2009B).

Table 5-5: Stochastic Variables for LRP Insurance

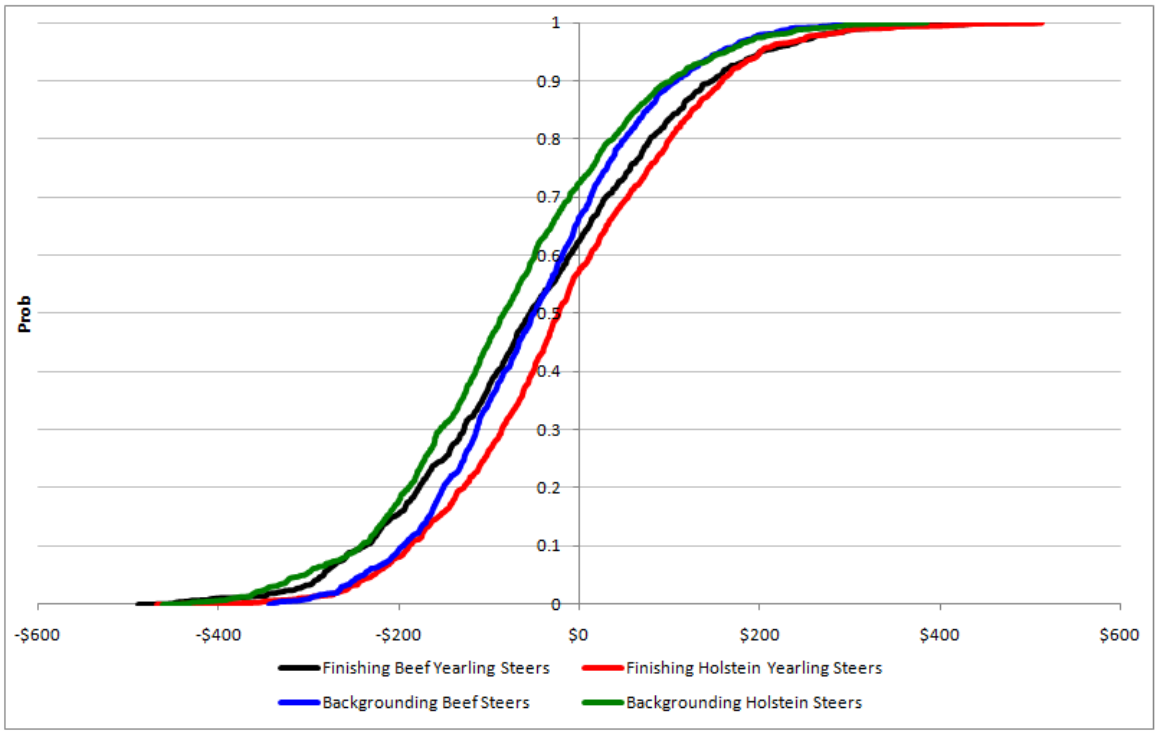
	AEV	Premium	AEV	Premium
Finishing Beef Yearling Steers			**Backgrounding Beef Steers**	
Min	$63.49	$1.33	$57.94	$1.06
Max	$93.34	$3.94	$107.93	$2.34
Mean	$77.16	$2.33	$83.67	$1.89
Std Dev	$9.50	$0.90	$12.84	$0.56
CV	$12.31	$38.44	$15.34	$29.74
Finishing Holstein Yearling Steers			**Backgrounding Holstein Steers**	
Min	$50.79	$1.33	$46.36	$1.06
Max	$74.67	$3.94	$86.34	$2.34
Mean	$61.72	$2.33	$66.94	$1.89
Std Dev	$7.60	$0.90	$10.27	$0.56
CV	$12.31	$38.44	$15.34	$29.74

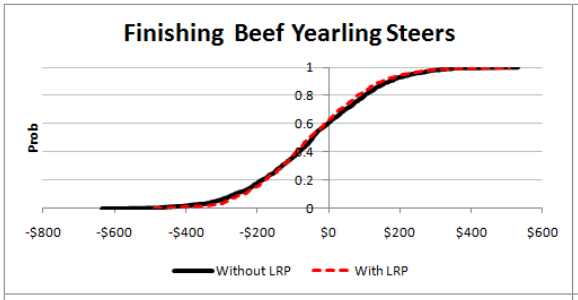
When these stochastic and fixed variables were added into the Simetar program and the 1000 iterations from before were recalculated, a new return was determined for each iteration. This return included the effects of LRP insurance on the four feeding enterprises eligible for coverage.

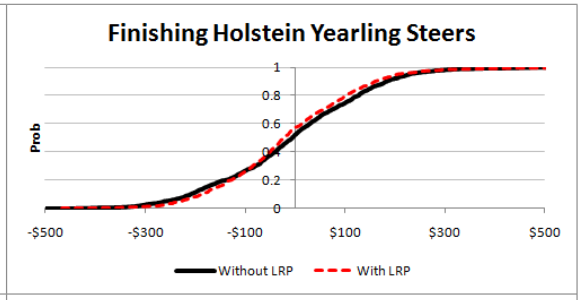
The effects of LRP insurance were similar with each feeding enterprise. When cash prices were high, LRP insurance slightly lowered the return (loss of the premium), but when cash prices were low, then the indemnity kicked in and protection was provided against large losses. LRP insurance had a larger effect on the two beef breed enterprises

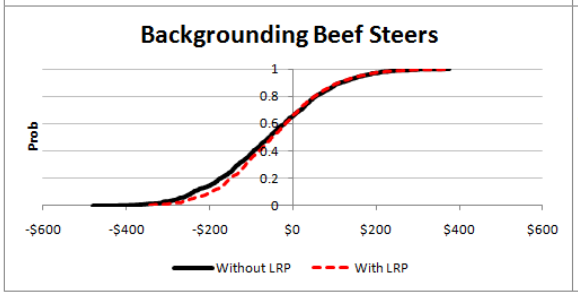
than on the two dairy breed enterprises, especially on the backgrounding Holstein steer enterprise.

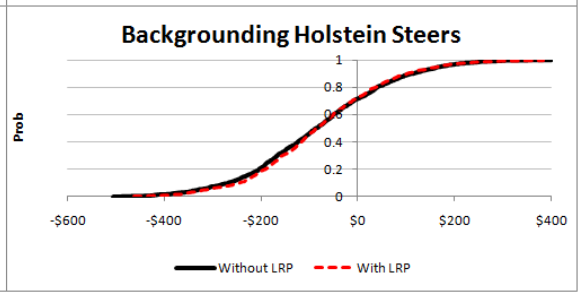
Figure 5-2: CDFs for Each Feeding Enterprise (with LRP Insurance)











The CDFs shown in figure 5-2 show that LRP insurance did provide protection on the variability of expected returns. This effect can be seen more clearly if it is graphed as a Probability Density Function (PDF). To view these PDFs, see Appendix B, "The Effects of LRP Insurance on Expected Returns."

LRP insurance had the largest effect on the volatility of finishing beef yearling steers and backgrounding beef steer calves. LRP insurance had less effect on the volatility in the finishing Holstein steers enterprise and even less effect on the backgrounding Holstein steers enterprise.

Portfolio Analysis and Stochastic Dominance

Before using stochastic dominance to determine the best case scenario under different levels of risk, various portfolios were constructed with different combinations of the five feeding enterprises. The purpose of this was to see if the risk associated with raising cattle could be lowered any more by adding LRP insurance.

First, the five feeding enterprises without any price protection were observed. The first set of portfolios that were looked at contained combinations of two, three, four, and five enterprises being raised together in their respective portfolios. There were a total of 31 different options that could be chosen from these five different feeding enterprises.

The next set of portfolios observed were from the four feeding enterprises that were eligible for LRP insurance coverage. When only portfolios with 100 percent LRP insurance coverage were considered, then 15 portfolio possibilities existed.

The last set of portfolios considered what would happen if the producer wanted to set up a portfolio that could include any combination of the two scenarios that were mentioned above. That is, that the portfolio could contain cattle that were both insured with LRP insurance and cattle that were not insured. There were a total of 511 possibilities in which the portfolio could be constructed. For more information on this, see Appendix B, "Portfolio Possibilities."

Appendix B shows how the portfolios have been constructed. To determine which portfolio was the best stochastic dominance was used. First, portfolios for a producer who was not interested in purchasing LRP insurance were examined. Table 5-6 shows these results.

Table 5-6: Top Five Most Preferred Options without LRP Insurance

ARAC Value	-1	-0.1	-0.01	-0.001	-0.0001	-0.00001	0	0.00001	0.0001	0.001	0.01	0.1	1
Most Preferred	CC	CC	FH	FH	FH	FH	FH	FH	FH	FH+CC	FH+CC	FH+CC	FH+CC
2nd Most Preferred	FB	FB	FB	FH+CC	FH+CC	FH+CC	FH+CC	FH+CC	FH+CC	CC	FH+BB+ CC	FH+BH+ CC	FH+BH+ CC
3rd Most Preferred	FH	FH	CC	CC	CC	CC	CC	CC	CC	FH	FB+FH+ BB+CC	FH+BB+ CC	FH+BB+ CC
4th Most Preferred	BH	BH	FH+CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	FB+FH+ CC	BB+BH+ CC	BB+BH+ CC
5th Most Preferred	BB	BB	FB+CC	FB+FH	FH+BB+ CC	FH+BB+ CC	FH+BB+ CC	FH+BB+ CC	FH+BB+ CC	FH+BB+ CC	FH+BB+ BH+CC	FB+FH+ BB+CC	FB+FH+ BB+CC

Abbreviation	Definition
FB	Finishing Beef yearling steers
FH	Finishing Holstein yearling steers
BB	Backgrounding Beef steers
BH	Backgrounding Holstein steers
CC	feeding Cull Cows

The top row in table 5-6 shows the Arrow-Pratt Absolute Risk Aversion Coefficient (ARAC) values. In this case they range from -1 to 1. An ARAC value of -1 means the producer is highly risk seeking. An ARAC value of 0 means the producer is

risk neutral and an ARAC value of 1 indicates that the producer is highly risk averse. The results showed that if a producer's ARAC value was between -0.01 and 0.0001, then the most preferred enterprise was to finish Holstein yearling steers without any other enterprise. The next best option was to have a portfolio of finishing Holstein yearling steers along with feeding cull cows.

However, as the producer diverted away from the risk neutral mind set to a risk seeking one, then the most preferable option changed from finishing Holstein yearling steers to feeding cull cows. If the producer's ARAC value was more risk averse, then more diversification was desired. As can be seen in the table, the most preferred option with an ARAC value of 1 was a portfolio with cull cows and Holstein yearling steers.

The next set of portfolios was then reviewed. These portfolios looked only at the enterprises that were eligible for LRP insurance coverage. Cull cows were not eligible for this coverage and did not appear in any of the options in table 5-7.

Table 5-7: Top Five Most Preferred Options with 100 Percent LRP Insurance Coverage

ARAC Value	-1	-0.1	-0.01	-0.001	-0.0001	-0.00001	0	0.00001	0.0001	0.001	0.01	0.1	1
Most Preferred	FB_I	FB_I	FH_I	FH_I	FH_I	FH_I	FH_I	FH_I	FH_I	FH_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I+BH_I	FB_I+FH_I+ BB_I
2nd Most Preferred	FH_I	FH_I	FB_I	FH_I+BB_I	FH_I+BB_I	FH_I+BB_I	FH_I+BB_I	FH_I+BB_I	FH_I+BB_I	FH_I+BB_I	FB_I+FH_I+ BB_I+BH_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I+BH_I
3rd Most Preferred	BH_I	BH_I	BB_I	FB_I+FH_I	FB_I+FH_I	FB_I+FH_I	FB_I+FH_I	FB_I+FH_I	FB_I+FH_I	FB_I+FH_I	FH_I+BB_I	FB_I+BB_I+ BH_I	FB_I+BB_I+ BH_I
4th Most Preferred	BB_I	BB_I	FB_I+FH_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I+ BB_I	FB_I+FH_I	FH_I+BB_I+ BH_I	FH_I+BB_I+ BH_I
5th Most Preferred	FB_I+BH_I	FB_I+BH_I	BH_I	FB_I	FH_I+BH_I	FH_I+BH_I	FH_I+BH_I	FH_I+BH_I	FH_I+BB_I+ BH_I	FB_I+FH_I+ BB_I+BH_I	FB_I+FH_I+ BH_I	FB_I+FH_I+ BH_I	FB_I+FH_I+ BH_I

Abbreviation	Definition
FB_I	Finishing Beef yearling steers with LRP Insurance
FH_I	Finishing Holstein yearling steers with LRP Insurance
BB_I	Backgrounding Beef steers with LRP Insurance
BH_I	Backgrounding Holstein steers with LRP Insurance

Table 5-7 shows that for a relatively risk neutral producer, the most preferred option was to finish Holstein yearling steers with LRP insurance. If the producer had an ARAC value between -0.001 and 0.00001, then the top five most preferred options stayed the same. If the ARAC value was closer to 1 or more risk averse, then once again a portfolio was desired because it contained more diversification. In this case, when the ARAC value was equal to 1, then the most preferred option was to have a portfolio with yearling beef and Holstein steers as well as beef steer calves. However, if the producer's ARAC value shifted to become more risk seeking, then the best option was to finish beef yearling steers with LRP insurance.

The next set of portfolios examined what happened when the portfolios in tables 5-6 and 5-7 were combined to form a portfolio option that allowed for cattle to be purchased with or without LRP insurance.

Table 5-8: Top Five Most Preferred Options when LRP Insurance Is Optional

ARAC Value	-1	-0.1	-0.01	-0.001	-0.0001	-0.00001	0	0.00001	0.0001	0.001	0.01	0.1	1
Most Preferred	CC	CC	FH	FH	FH	FH	FH	FH	FH	FH+CC+ FH_I	CC+FH_I+ BB_I	CC+FH_I+ BB_I	CC+BB_I+ BH_I
2nd Most Preferred	FB	FB	FH+FH_I	FH+FH_I	FH+FH_I	FH+FH_I	FH+FH_I	FH+FH_I	FH+CC+ FH_I	CC+FH_I	FH+CC+ BB_I	CC+BB_I+ BH_I	CC+FH_I+ BB_I
3rd Most Preferred	FB+FB_I	FB+FB_I	FB	CC	FH+CC+ FH_I	FH+CC+ FH_I	FH+CC+ FH_I	FH+CC+ FH_I	FH+FH_I	CC	CC+FB_I+ FH_I+BB_I	CC+BB_I	CC+BB_I
4th Most Preferred	FB_I	FB_I	FH_I	FH_I	CC	CC	CC	CC	CC	FH	CC+FH_I	CC+FH_I+ BB_I+BH_I	CC +FH_I
5th Most Preferred	FH	FH	FB+FB_I	FH+CC+ FH_I	CC+FH_I	CC+FH_I	CC+FH_I	CC+FH_I	CC+FH_I	FH+FH_I	FH+CC+ FH_I+BB_I	CC+FB_I+ FH_I+BB_I+ BH_I	CC+FB_I+ FH_I+BB_I+ BH_I

Abbreviation	Definition
FB	Finishing Beef yearling steers
FH	Finishing Holstein yearling steers
BB	Backgrounding Beef steers
BH	Backgrounding Holstein steers
CC	feeding Cull Cows
FB_I	Finishing Beef yearling steers with LRP Insurance
FH_I	Finishing Holstein yearling steers with LRP Insurance
BB_I	Backgrounding Beef steers with LRP Insurance
BH_I	Backgrounding Holstein steers with LRP Insurance

Surprisingly, with the options that were included in this portfolio, the best case scenario for an ARAC value of 0 was to simply finish Holstein yearling steers without LRP insurance. The top five best options stayed the same between -0.0001 and 0.0001. As the level of risk shifted to risk seeking, then the best option switched to feeding cull cows. If the ARAC value was more risk averse, then once again a portfolio was chosen. With an ARAC value of 1, the best option was to have a portfolio that fed cull cows and backgrounded both Holstein and beef steer calves with LRP insurance.

Several studies have been conducted to determine the average ARAC value for agricultural producers. Studies by Lin et al. (1974) and Halter and Mason (1978) concur that the majority of agricultural producers' ARAC value is between -0.0002 and 0.0012. Taking this information into account, the following was determined. When LRP

insurance was not considered, the best option for most Utah cattle producers was to finish Holstein yearling steers alone or to feed an equal combination of cull cows and yearling Holstein steers together. When only options with 100 percent LRP insurance coverage were considered, then the best option for the majority of Utah cattle producers was to finish Holstein yearling steers with LRP insurance. If the cattle producer was impartial towards purchasing LRP insurance, meaning that he or she was equally willing to buy the coverage or forego it, the best case scenario for most Utah cattle producers was to not buy the coverage, but rather to finish Holstein yearling steers.

CHAPTER 6

CONCLUSION AND SUMMARY

As was discussed in the introductory chapter of this research, two main questions were meant to be answered in this study. The first question dealt with which of the five feeding enterprises, or any combination of the five feeding enterprises, would generate the largest return for Utah cattle producers. The second question looked at the effects of LRP insurance on lowering the volatility of cattle prices and ensuring a positive return to cattle producers.

Conclusion: Which Feeding Enterprise Should Utah Cattle Producers Feed?

The answer to this question is not simple and, as it has been explained, depends upon the producer's risk preferences. Because every producer has different risk preferences, multiple answers to this question exist.

First, if a producer did not want to purchase LRP insurance but was willing to raise any combination of the five feeding enterprises, then the following was the result. If the producer had an ARAC value between -0.01 and 0.0001, then the most preferred feeding enterprise was to finish Holstein yearling steers alone. If the ARAC value was between -1 and -0.1, then the most preferred feeding enterprise was to feed cull cows alone. If the producer's ARAC value was between 0.001 and 1, then the most preferred option was a portfolio of cull cows and yearling Holstein steers together.

Which feeding enterprise was the best when LRP insurance was included? To answer this question, first options when everything was 100 percent covered by LRP insurance were observed. If the producer had an ARAC value between -0.01 and 0.001, indicating that he or she was between somewhat risk seeking and somewhat risk averse, the most preferred option was to finish Holstein yearling steers with LRP insurance. If the producer had an ARAC value between -1 and -0.1 which means that he or she was highly risk seeking, then the best option was to finish beef yearling steers with LRP insurance. If the producer had an ARAC value between 0.01 and 1, then he or she preferred to feed a portfolio of cattle containing beef and Holstein yearlings as well as beef calves.

Now, assuming that the producer had the option to purchase LRP insurance on all, some, or none of the cattle that he or she decided to feed, the following results occurred. The most preferred option for a producer with an ARAC value between -0.01 and 0.0001 was to finish Holstein yearling steers alone without LRP insurance. If the producer had an ARAC value between -1 and -0.1, then the most preferred option was to feed cull cows alone. If the producer was highly risk averse with an ARAC value greater than 0.001, then the most preferred option was to feed a portfolio of cattle. With an ARAC value of 1, the mort preferred option was to feed cull cows and background both beef and Holstein steers with LRP insurance.

As was determined from the results, finishing beef or Holstein yearling steers or feeding cull cows was always a part of the most preferred option for Utah cattle producers no matter the ARAC value. Also, none of the backgrounding operations

appeared alone in any of the most preferred options. Hence, it was implied that backgrounding steer calves was less profitable than finishing yearling steers or feeding cull cows. The one enterprise that performed the worst was backgrounding Holstein steers. This was because Holsteins do not perform as well as beef breeds in backgrounding operations (Ensminger and Perry 1997).

Conclusion: Should LRP Insurance Be Purchased?

LPR insurance was proven in this research to be an effective tool to lower the volatility of expected returns. When the standard deviations of the simulated returns without LRP insurance were compared to the simulated returns with LRP insurance, the effect of LRP insurance became very noticeable.

Adding LRP insurance to the beef yearling steer enterprise lowered the standard deviation of its projected returns by 10.93 percent. It caused the standard deviation of the Holstein yearling steer enterprise to decrease by 11.32 percent. For the backgrounding beef and Holstein steer enterprises, LRP insurance caused the standard deviations to decrease by 12.67 percent and 8.30 percent respectively. Therefore, over the four enterprises, adding LRP insurance lowered the standard deviation by 10.8 percent on average. This meant that there was 10.8 percent less volatility in the returns that were generated by the feeding programs when LRP insurance was included.

It is important to understand that even though LRP insurance did lower some of the risk associated with raising cattle; it also lowered the highest possible return a producer could receive. For example, if local cash markets were high at the time the

cattle were sold but the AEV was higher than the coverage price, then the producer lost the premium that was paid for the LRP insurance. Where LRP insurance proved useful was when there were large losses in the cattle market. The coverage kicked in when prices dropped unexpectedly low and an indemnity was paid to the producer to help compensate for the large loss he or she received on the cash market.

Considering the information that was given above that LRP insurance lowered volatility and prevented against large, unexpected losses in the cash market, should LRP insurance be purchased on cattle that are eligible for the coverage? According to the stochastic dominance test that was conducted in chapter 5 and discussed in the previous section of this chapter, the answer is probably no. According to previous research, the majority of agricultural producers have an ARAC value between -0.0002 and 0.0012. When these ARAC values were taken into account and used to rank the most preferred enterprises to feed, then the majority of Utah cattle producers preferred to finish Holstein yearling steers without LPR insurance. The second most preferred option for the majority of Utah farmers was to finish Holstein yearling steers with LRP purchased on only half of the herd. Having 100 percent LRP insurance coverage on a herd never became a preferred option for the majority of agricultural producers.

If the producer was more risk averse than the majority of cattle producers, then LRP insurance was a good way to protect against uncertainty. Yet, if the producer was more risk seeking than the majority of agricultural producers, then the most preferred option did not include LRP insurance coverage. The third most preferred option did

include partial LRP insurance coverage for producers with ARAC values less than or equal to -0.1.

Therefore, should LRP insurance be purchased? According to this research, the majority of Utah cattle producers were better off not purchasing LRP insurance unless the producer was highly risk averse. If the producer was not highly risk averse, then more money was made by feeding cull cows or finishing Holstein yearling steers without LRP insurance. Cull cows were not eligible for LRP insurance. However, the standard deviation for the returns with feeding cull cows was lower than any of the standard deviations of the other enterprises when LRP insurance was included.

Conclusion: Other Questions That Were Answered in This Study

As the two main questions were answered in this research, other questions that may be heavy on a beef producers mind were answered as well. Some of these indirect questions that were answered include the trend in local cash prices, the seasonality of local cash prices, the trend in the basis, the seasonality of the basis, the historical profitability of the cattle, the amount of money a producer could lose, and the amount of money a producer could earn.

What Was the Trend in Local Cash Prices in Utah?

First, the data on Utah cattle prices in chapter 4 showed the price trend in cattle prices from 1990 to 2009. The trend over the time period was positive for most of the groups of cattle. The overall price trend increased during the time period for beef slaughter steers going from around $67/cwt in 1990 to $85/cwt in 2009. For Holstein

slaughter steers, the trend increased as well going from $55/cwt to $72/cwt. The price trend for 500 to 600 pound beef steers increased from $79/cwt to $109/cwt. For 600 to 700 pound beef steers, the price trend increased from $69/cwt to $93/cwt and for 800 to 900 pound beef steers the price trend increased from $67/cwt to $89/cwt. For 500 to 700 pound Holstein steers, the price trend increased from $64/cwt to $77/cwt. The price trend for 700 to 900 pound Holstein steers increased from $59/cwt to $70/cwt and the price trend for 900 to 1100 pound Holstein steers increased from $52/cwt to $67/cwt over the time period. However, the price trend for cull cows during the time period was downward sloping. From 1990 to 2009, the price trend dropped from $45/cwt down to $40/cwt.

What Was the Seasonality of Local Cash Prices in Utah?

Each group of cattle had a strong seasonal pattern as well. The highest prices for beef and Holstein slaughter steers occur in March and the lowest prices tended to occur in July. For 500 to 600 pound beef steers, the highest prices were in March and the lowest prices were in November. For 700 to 800 pound beef steers, the highest prices were in August and September, and were the lowest in March. For 800 to 900 pound beef steers, prices were the highest in September and were the lowest in April. For 500 to 700 pound Holstein steers, June had the highest prices and December had the lowest prices. For 700 to 900 pound Holstein steers, August had the highest prices and January had the lowest prices. For 900 to 1100 pound Holstein steers, prices were the highest in September and the lowest in January. For cull cows, the month with the highest prices was July and the month with the lowest prices was November.

What Was the Trend in the Basis for Utah Cattle?

The trend in the basis for all of the cattle groups that were discussed in chapter 4 was downward sloping. This means that over the time period, the local cash prices in Utah weakened compared to the futures prices. This indicates that Utah cattle prices were not as strong as cattle prices in states with greater cattle production such as Nebraska or Texas.

What Was the Seasonality of the Basis for Utah Cattle?

There was also a strong pattern of seasonality in the basis for all of the cattle groups that were analyzed. For beef and Holstein slaughter steers, May had the strongest basis and September had the weakest. For 500 to 600 pound beef steers, March had the strongest basis and November had the weakest. For 700 to 800 pound beef steers, February had the strongest basis and October had the weakest. For 800 to 900 pound beef steers, February had the strongest basis and July had the weakest. For 500 to 700 pound Holstein steers, April had the strongest basis and October had the weakest. For 700 to 900 pound Holstein steers, March and April had the strongest basis and October had the weakest. For 900 to 1100 pound Holstein steers, February had the strongest basis and October had the weakest. Finally, for cull cows, May was the month with the strongest basis and November was the month with the weakest basis.

What Was the Historical Profitability for These Five Feeding Enterprises?

The historically profitability of the five feeding enterprises produced interesting results that were affected greatly by whether yardage was included in the results or not.

When yardage was included, between 1996 and 2009, the only feeding enterprise that produced an average positive return each year was to finish Holstein yearling steers. All of the other feeding enterprises produced negative results on average. However, when yardage was excluded from the historical test, then the results changed. Finishing Holstein yearling steers was still the most profitable enterprise during the time frame. However, feeding cull cows and finishing beef yearling steers also produced an average profit during the time frame. If the historical returns for the five feeding enterprises were the only method used in this research to determine which feeding enterprise was the most profitable, then the best option would be to finish Holstein yearling steers, followed by feeding cull cows, finishing beef yearling steers, backgrounding beef steers, and lastly, backgrounding Holstein beef steers.

What Was the Most a Producer Could Expect to Make or Lose?

Assuming that the death rate did not exceed the two percent that was projected and that cattle prices in the future follow similar patterns to what happened in the past, then the simulation that was run in the research answered this question. First, returns when LRP insurance was not included were examined. For finishing beef yearling steers, the most one could expect to make was $529.70 per head and the most one could lose was -$635.84. For Holstein yearling steers, the most is $531.97 and the least was -$523.66. For backgrounding beef and Holstein steers, the most was $376.06 and $401.00 and the least was -$506.18 and -$389.92. Feeding cull cows provided an opportunity to make up to $334.05 and lose up to -$389.92.

When LRP insurance was included in the simulation, the most one could make when finishing beef yearling steers was $507.80 per head and the most one could lose was -$489.81. For Holstein yearling steers, the most was $512.82 and the least was -$467.66. For backgrounding beef steers, the most was $512.82 and the least was -$467.66. When backgrounding Holstein steers, the most one could expect to make per head was $368.21 and the least was -$344.55.

Summary

This study was successful in its attempt to answer the two main questions of interest in the research. The first question was which of the five feeding enterprises—finishing beef yearling steers, finishing Holstein yearling steers, backgrounding beef steers, backgrounding Holstein steers, and feeding cull cows—or combination of these feeding enterprises, should a Utah cattle producer feed? The second question was does LRP insurance lower the volatility in the expected returns from these enterprises and should it be purchased?

The research answered these two questions by analyzing past sales data from 1990 through 2009, determining the historical returns of the cattle feeding enterprises, performing a simulation analysis to project future returns and determine risk, using portfolio theory to set up various portfolio options, and finally using stochastic dominance to determine the best options under various Arrow-Pratt Absolute Risk Aversion Coefficient (ARAC) values.

According to the results, the majority of Utah cattle producers preferred to finish Holstein yearling steers or feed cull cows. These two enterprises performed the best during the 19 year time period and according to the simulation that was run, are expected to perform the best in years to come.

The study also showed that LRP insurance did lower the volatility of expected returns for the four eligible feeding enterprises. It was determined that on average, adding LRP insurance lowered volatility by 10.8 percent across the four feeding enterprises.

One surprising result from this study deals with whether LRP insurance should be purchased. The results show that the majority of Utah cattle producers were better off to finish Holstein yearling steers without LRP insurance. Yet, if the producer were highly risk averse, then he or she may prefer to purchase LRP insurance coverage.

CHAPTER 7

SELF REFLECTION

I have always had an interest in cattle production. I grew up on a small family farm in Castle Dale, Utah where we raised Simmental cattle. On the farm we also had a few dairy cows that I would milk. With the surplus milk that my family did not consume, we would purchase and raise dairy steers. Raising both beef and dairy steers on the family farm got me interested in comparing the two enterprises to each other. When Dr. Feuz suggested researching the returns of feeding beef breeds versus dairy breeds, I immediately knew that was the topic that would be of most interest to me for it was a topic of which I was very familiar.

Researching and writing this dissertation was a true learning experience for me. It was both extremely time consuming and difficult to complete. Perhaps the most tedious of tasks in the research process was that of collecting the Utah sales data. Finding sales data on Holstein steer calves proved to be the most difficult to collect. Reports on the AMS website only went back to 2005. Before that time period, the only way I was able to collect any information was to go directly to the Smithfield, Utah Livestock Auction and ask for the data. Their records were handwritten and incomplete. As a result, a great deal of Holstein steer sales information was missing in this work.

The rest of the research proved to be extremely difficult for me as well. I learned new techniques to analyze and compare data and as a consequence, I came across information that was difficult for my simple mind to comprehend. It was a huge

challenge for me to grasp the information and interpret it. After over 600 hours of immense researching, struggling, writing, and rewriting, this dissertation finally unveiled itself.

I hope that this research proves to be helpful for the farmers out there who are looking to improve their cattle feeding operations. I believe that it made it clear where cattle producers should be focusing their efforts right now. If the suggestions in this research are followed, greater profits should come as a result. Also, a great amount of uncertainty can be absorbed by following these recommendations.

I hope you enjoyed reading this dissertation for I truly enjoyed writing it. I learned much more on the subject then I ever expected to learn. It was a very worthwhile and rewarding experience for me, though I do not intend to tackle another project like this one for a very long time.

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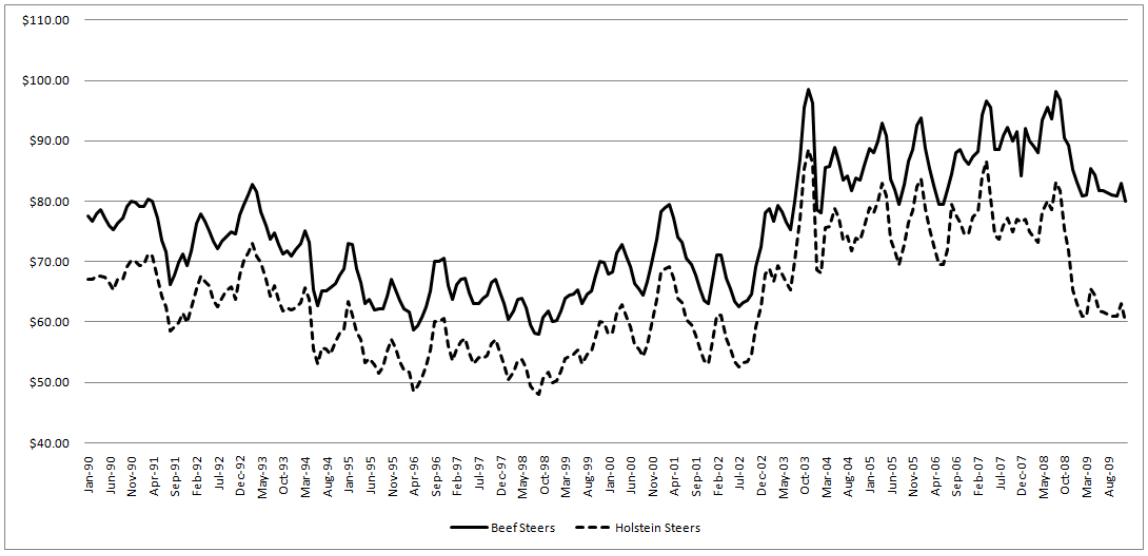
APPENDIX A

CHAPTER 4 SUPPORT

Monthly Average Prices for Beef Slaughter Steers versus Holstein Slaughter Steers

Prices for beef breeds have always been higher than prices for dairy breeds. In recent years the difference between the price of beef breeds and the price of dairy breeds (Holsteins) has been larger than in the past.

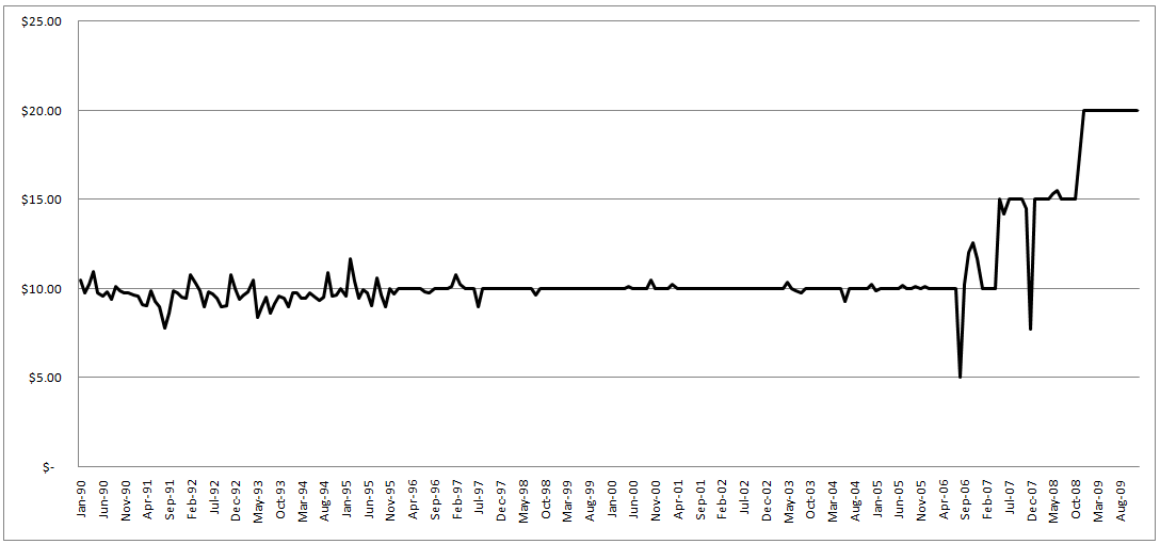
Figure A-1: Average Monthly Price for Beef Slaughter Steers versus Holstein Slaughter Steers



As can be seen from figure A-1, Holstein steers followed the same price pattern as beef steer prices. When the price of a beef steer increased, then the price of a Holstein steer increased. The overall prices for each enterprise had a positive price increase overtime. The difference between beef prices and Holstein steer prices from 1990 to

2009 was on average $10.82/cwt (beef breeds selling for more than dairy breeds). In the last five years of the time period, this difference in price increased to $14.26/cwt. In the past two years, the difference increased to $17.16/cwt on average. In fact, from December 2008 through December 2009, Holstein steers sold for $20.00/cwt per head less than beef breeds. This shows that relative to beef breed prices for slaughter steers, Holstein prices decreased overtime. Figure A-2 shows the recent widening of this price spread.

Figure A-2: The Difference in Price between Beef and Dairy Slaughter Steers



The OLS Regression

In order to estimate monthly average sales prices for the sales data that were missing, the price of Holstein steers was assumed to be a function of the following variables:

$$P_{HFS} = f\,(F_{LC}, F_{FC}, P_{HSS}, P_{SS}, P_{FS}, P_{CC}, P_{C}, P_{A}, Seasonality)$$

where $\boldsymbol{P_{HFS}}$ was the price of Holstein feeder steers, $\boldsymbol{F_{LC}}$ was the futures price for live cattle, $\boldsymbol{F_{FC}}$ was the futures price for feeder cattle, $\boldsymbol{P_{HSS}}$ was the price for Holstein slaughter steers, $\boldsymbol{P_{SS}}$ was the price for slaughter steers, $\boldsymbol{P_{FS}}$ was the price for feeder steers, $\boldsymbol{P_{CC}}$ was the price for cull cows, $\boldsymbol{P_C}$ was the price for corn, and $\boldsymbol{P_A}$ was the price for alfalfa.

Using Ordinary Least Squares (OLS) regression, $\boldsymbol{P_{HFS}}$ was written as a dependent variable in the following manner.

$$\boldsymbol{P_{HFS} = \beta_0 + \beta_1 F_{LC} + \beta_2 F_{FC} + \beta_3 P_{HSS} + \beta_4 P_{SS} + \beta_5 P_{FS} + \beta_6 P_{CC} + \beta_7 P_C + \beta_8 P_A + \beta_9 Spring + \beta_{10} Fall + \beta_{11} Winter + \mu}$$

In this formula, $\boldsymbol{\beta_0}$ was the intercept, $\boldsymbol{\beta_1}$ through $\boldsymbol{\beta_{11}}$ represented the coefficients for each independent variable, and ***Spring***, ***Fall***, and ***Winter*** were dummy variables representing the seasons. Summer was left out because it was represented in the intercept.

Table A-1: Regression Statistics

Regression Statistics	Coefficients	t Stat
Intercept	14.60225737	5.32993895
P_{HSS}	0.649991601	2.51124315
P_{BS}	0.863148603	7.510398651
P_{BSS}	-0.771937602	-2.888150043
P_{CC}	0.369878339	4.347972917
F_{LC}	0.033375622	0.257872717
F_{FC}	-0.125313593	-1.157273961
P_{C}	-2.132573506	-3.123409272
P_{A}	-0.072598841	-2.255007435
Spring	-0.757581487	-0.868220879
Fall	-1.001536085	-1.501301345
Winter	-2.909581929	-3.815716533
Adjusted R Square	0.926700809	
Observations	139	

Table A-1 is a summary of the OLS coefficients. By applying the coefficients in the table above to the equation above, P_{HFS} was determined.

Monthly Average Prices for Beef Steers versus Holstein Steers

Another comparison was done with feeder steers. When the average price of beef feeder steers (average price of 500 to 600, 700 to 800, and 800 to 900 pound weight groups combined into one group) was compared to the average price of Holstein feeder steers (500 to 700, 700 to 900, and 900 to 1100 pound weight groups combined into one group), the following was recorded.

Figure A-3: Average Price of Beef Steers versus Average Price of Holstein Steers

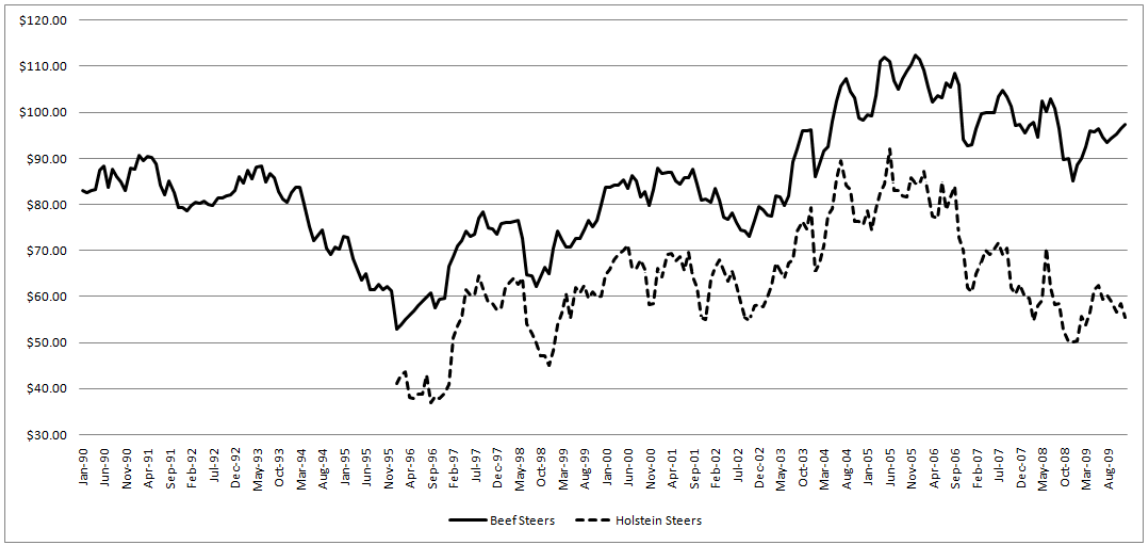
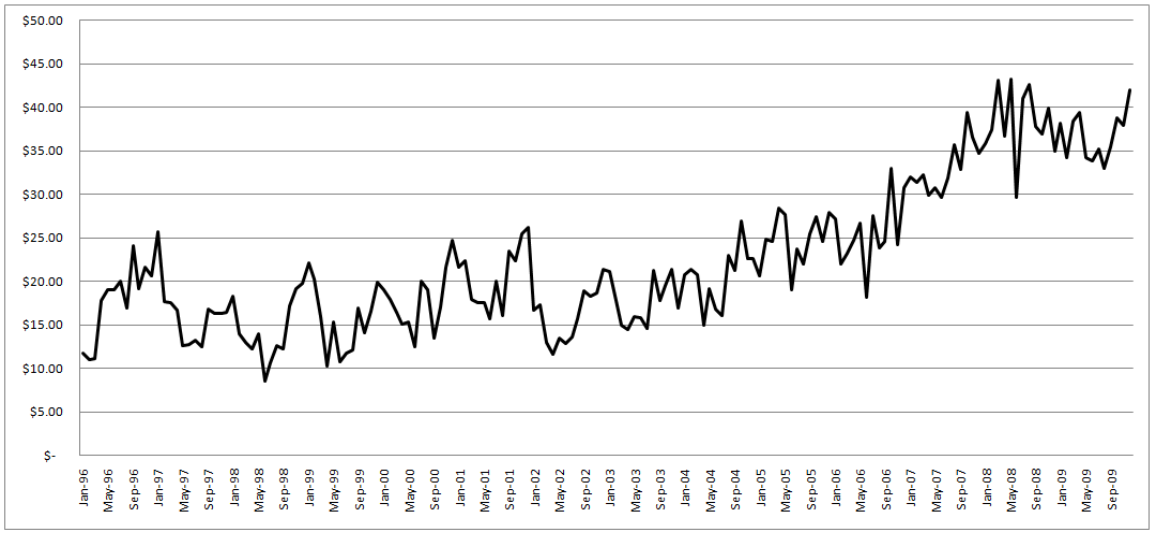


Figure A-3 shows that the price of Holstein steers flowed in the same direction as the price of beef steers. When prices for beef breeds increased, the prices for dairy breeds increased and vice versa. From 1996 to 2009, the average price difference between the two groups was $22.78/cwt. In the last five years of the time period, the average price difference was $32.85/cwt. In the past two years, the difference was $37.26/cwt. This indicates that the prices of Holstein feeder steers decreased in respect to the price of beef breeds, especially in the most recent years of the time period. Figure A-4 shows the steady widening of this price spread overtime.

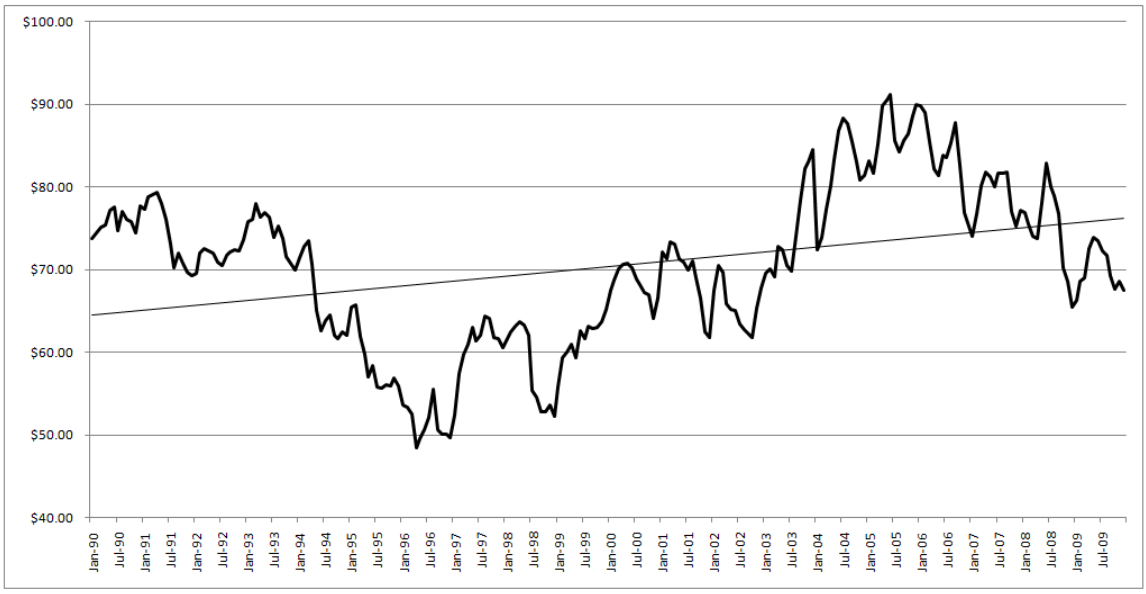
Figure A-4: The Difference in Price between Beef and Holstein Steers



The Overall Price of Cattle from 1990 to 2009

This section combines the price of cull cows, beef and Holstein steers, and beef and Holstein slaughter steers into one group to show the general trend in cattle prices between 1990 and 2009. Figure A-5 shows the combined price pattern.

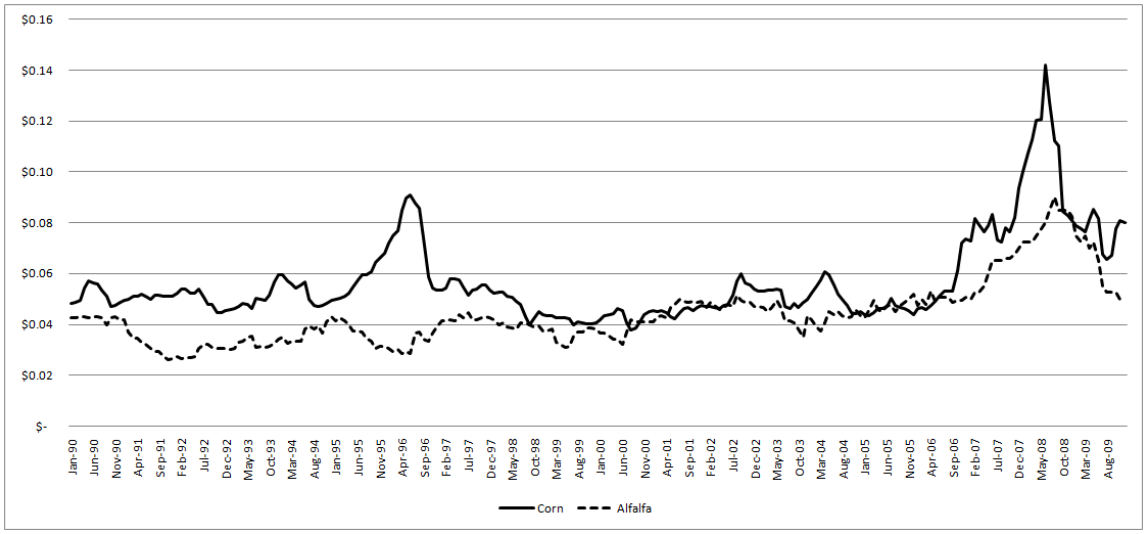
Figure A-5: Utah Average Monthly Cattle Price



Price of Corn and Alfalfa

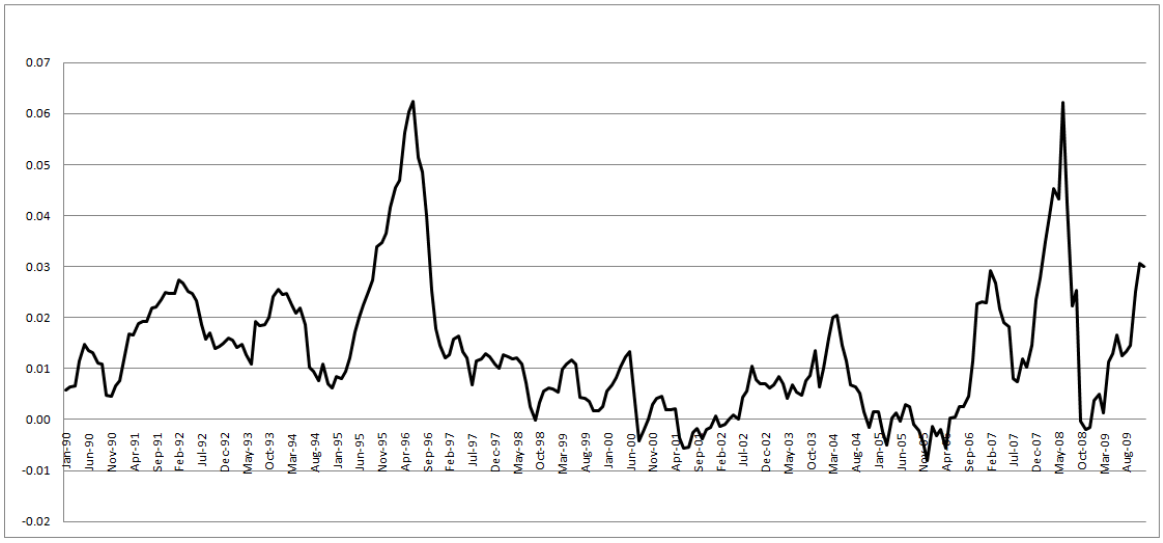
To compare the price of corn and alfalfa more closely, monthly prices were figured on a per pound basis. By taking the price of one ton of alfalfa and dividing by 2000 pounds, the per pound price of alfalfa was calculated. The per pound price of corn was found by taking the price of one bushel of corn and dividing by 56 pounds.

Figure A-6: Utah Monthly Price per Lb. for Corn and Alfalfa



As can be seen from figure A-6, the per pound price of corn and alfalfa followed a general pattern, where in most cases, the price of alfalfa increased with the price of corn and vice versa. As can also be seen on the chart, corn prices were almost always higher than alfalfa prices. On average, from 1990 to 2009, the price of corn was $0.01/pound higher than the price of alfalfa. In the last five years of the time frame, the average difference remained at $0.01/pound. In the last two years, the average increased to a $0.02/pound difference. The largest difference between corn and alfalfa prices occurred in 1996 and again in 2008 with the price of corn $0.06/pound higher than alfalfa. A few times throughout the years (22 times or 11.86 percent), alfalfa was slightly more expensive than corn but never more than $0.01/lb. Figure A-7 shows the spread between the two commodities.

Figure A-7: The Difference in Price per Lb. for Corn and Alfalfa



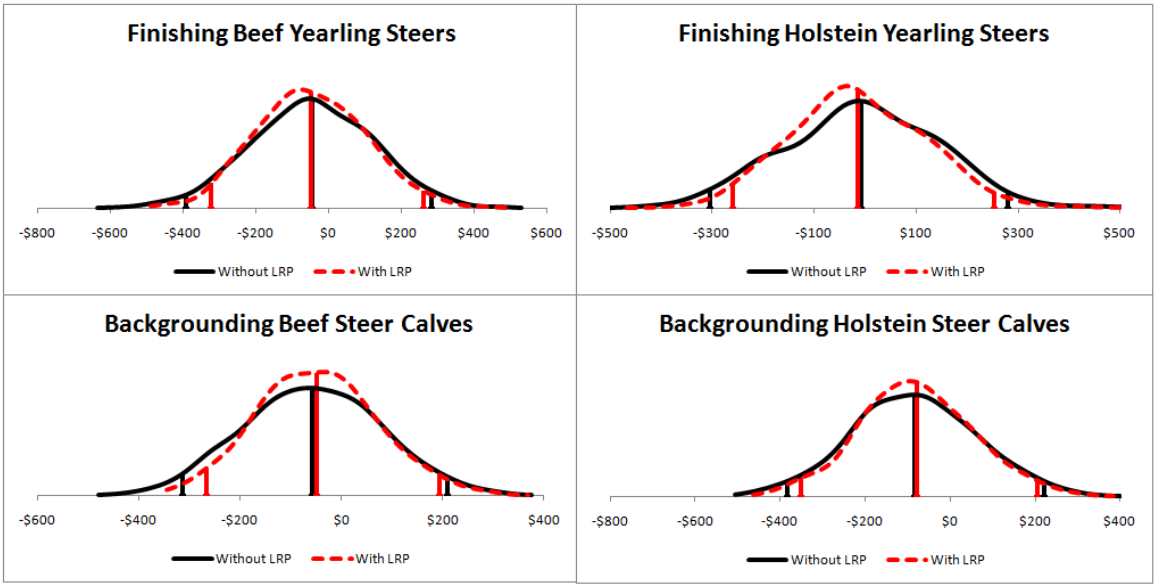
APPENDIX B

CHAPTER 5 SUPPORT

The Effects of LRP Insurance on Expected Returns

Using probability distribution functions (PDFs) to graph the effects of LRP insurance can make it easier to see the effects on volatility as is shown in figure B-1. Here, as compared to the CDF chart, the effect of LRP insurance is a bit more evident.

Figure B-1: PDFs for Each Feeding Enterprise with LRP Insurance

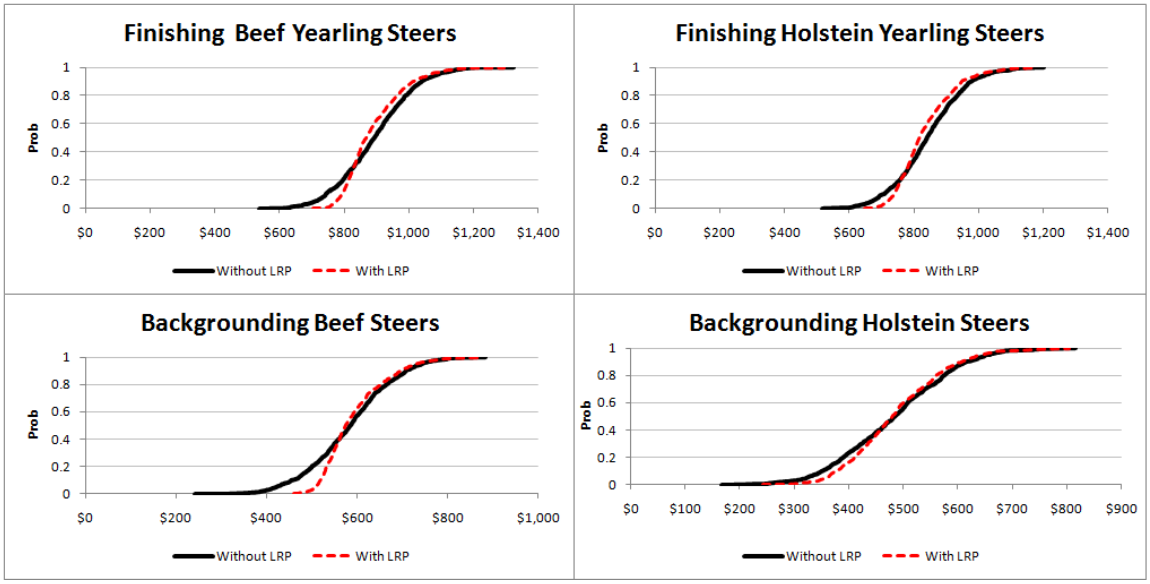


The Effects of LRP Insurance on Total Revenue

LRP insurance had no effect on the cost of feed, yardage, vet and medical supplies, death rate, or any other costs that were reflected in the profit or loss that was simulated. LRP insurance only affected total revenue. If the coverage value was greater

than the AEV, then an indemnity was paid. If the indemnity was larger than the premium cost, then an increase in total revenue occurred. If no indemnity was paid or if the indemnity was less than the premium cost, then total revenue decreased.

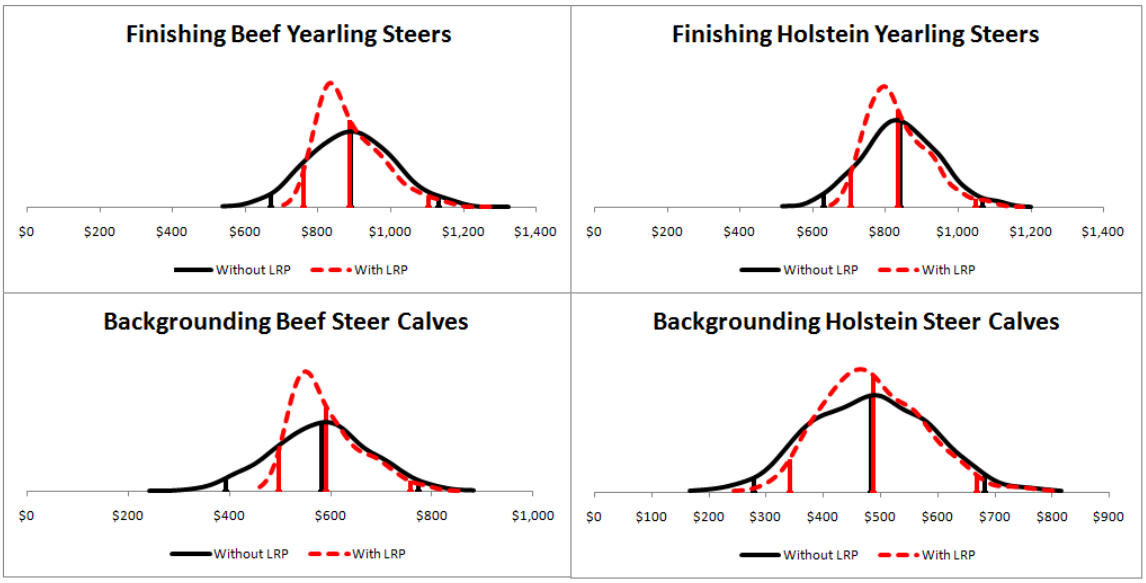
Figure B-2: CDFs for Total Revenue



When the effects of LRP insurance on total revenue were graphed as CDFs, the actual effect that LRP insurance had on the producer's cattle was much easier to see than the CDFs of expected return that are shown in chapter 5. This can be seen in figure B-2.

When looking at figure B-2, it is easy to see just how much LRP insurance truly affected total revenue. Perhaps this effect is even more evident when it is shown as a PDF as is revealed in figure B-3.

Figure B-3: PDFs for Total Revenue



Portfolio Possibilities

Several different possibilities existed for setting up a portfolio. For the five feeding enterprises without price protection, there were 31 possibilities. This was determined using the formula:

$$= \frac{n!}{r!\,(n-r)}$$

where *n* was the number of enterprises to choose from (in this case, five) and *r* was the largest number of enterprises in a portfolio (in this case, five). Hence, there were 31 possibilities from which to choose. Table B-1 shows every possibility. Note that this assumed that each combination of enterprises in the portfolio was allocated proportionately (i.e. 50/50, 33/33/33, 25/25/25/25, etc.).

Table B-1: Portfolio Possibilities without LRP Insurance

Option Number	Options without LRP	Options with 100% LRP
1	FB	FB_I
2	FH	FH_I
3	BB	BB_I
4	BH	BH_I
5	CC	FB_I+FH_I
6	FB+FH	FB_I+BB_I
7	FB+BB	FB_I+BH_I
8	FB+BH	FH_I+BB_I
9	FB+CC	FH_I+BH_I
10	FH+BB	BB_I+BH_I
11	FH+BH	FB_I+FH_I+BB_I
12	FH+CC	FB_I+FH_I+BH_I
13	BB+BH	FB_I+BB_I+BH_I
14	BB+CC	FH_I+BB_I+BH_I
15	BH+CC	FB_I+FH_I+BB_I+BH_I
16	FB+FH+BB	
17	FB+FH+BH	
18	FB+FH+CC	
19	FB+BB+BH	
20	FB+BB+CC	
21	FB+BH+CC	
22	FH+BB+BH	
23	FH+BB+CC	
24	FH+BH+CC	
25	BB+BH+CC	
26	FB+FH+BB+BH	
27	FB+FH+BB+CC	
28	FB+FH+BH+CC	
29	FB+BB+BH+CC	
30	FH+BB+BH+CC	
31	FB+FH+BB+BH+CC	

Abbreviation	Definition
FB	Finishing Beef yearling steers
FH	Finishing Holstein yearling steers
BB	Backgrounding Beef steers
BH	Backgrounding Holstein steers
CC	feeding Cull Cows
FB_I	Finishing Beef yearling steers with LRP Insurance
FH_I	Finishing Holstein yearling steers with LRP Insurance
BB_I	Backgrounding Beef steers with LRP Insurance
BH_I	Backgrounding Holstein steers with LRP Insurance

Table B-1 shows the 31 possibilities of feeding different combinations of the five feeding enterprises when LRP insurance was not considered. It also shows the 15 possibilities when only the four enterprises with LRP insurance were considered.

The final set of portfolios contained a combination of enterprises where LRP insurance was optional. For example, one could have a portfolio that includes FB+FB_I. Or one could do something as drastic as FB+FH+BB+BH+CC+FB_I+ FH_I+BB_I+BH_I. In fact, using the formula that was given above, there were 511 possibilities of how these nine options could be divided up into portfolios. Table B-1 includes 46 of these possibilities already. Because of the size of this number, all of the portfolio possibilities were not analyzed. Just those portfolios that were assumed to have the highest return were considered.