

CATTLE PRICE RISK MANAGEMENT STRATEGIES-USING COMPUTER SIMULATION  
TO EDUCATE IOWA PRODUCERS OF AVAILABLE TOOLS

by

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## **Abstract**

Risk is an inevitable part of production agriculture. Price risk is especially a concern for cattle producers in the Midwest. Producers can curtail profit volatility, to an extent, through the utilization of price risk management strategies such as forward contracting, hedging, using put and call options, Livestock Risk Protection Insurance (LRP), as well as Livestock Gross Insurance (LGM) for feedlot cattle.

Learning about such price risk management tools can be a daunting task. Kansas State University Extension created a computer based simulation workshop to assist them in teaching cattle producers about price risk management strategies. The simulation paralleled a lecture where participants learned of the price risk management strategies that are available. The simulation allowed the workshop participants to practice using the management strategies as they assumed the role of a feedlot or ranch manager in charge of marketing the operation's calves. In a cooperative effort with Iowa State University, Kansas State University presented the Cattle Risk Management Workshops across the state of Iowa. Participants were given pre-and post-tests to measure the effectiveness of the workshop. The overall post-test scores were 25 percentage points higher than the pre-test scores.

This research also discusses the interest and perceptions of cattle producers regarding price risk management strategies. The effectiveness of simulations as a teaching tool in helping producers learn about price risk management strategies is also reviewed. In addition, the various price risk management strategies available to producers, as well as seasonality of prices and basis are analyzed.

This research also explains and estimates the LRP Feeder Cattle Basis Model. The LRP Feeder Cattle Basis Model was developed with the objective of assisting producers in forecasting LRP basis. The model was developed using similar methodology applied in the creation of a CME basis forecasting model developed by Kansas State University Extension and Custom Ag Solutions, Inc. The LRP Feeder Cattle Basis Model automatically adjusts for the LRP price adjustment factor applied to beef steer calves weighing less than 600 pounds, and beef heifers weighing 600-900 pounds. The LRP Feeder Cattle Basis Model explains 71.37 percent of the variation of LRP basis.

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# CHAPTER 1 - Introduction

## 1.1 Motivation

There is something to be said for risk in production agriculture – it will always be a driving factor in producers' decision making. Risk associated with agriculture is found in every sector of the industry (e.g., production, processing, distribution) because it originates from a wide variety of sources (e.g., production, market price, legal, financial). Farmers and ranchers are especially affected by these risks and must primarily deal with production risk resulting from adverse weather and/or livestock performance, variability of input and commodity prices, domestic and international market events, and the repercussions of changes in government policy.

It is important to note that there is a distinct difference between risk and uncertainty because agricultural producers can manage risk, but not uncertainty. Risk is defined as a situation where it is possible to quantify the probability of an event occurring. Generally, the numerical probability estimate is derived based on past experience with similar situations and circumstances. Runde cites an example given by Knight in his work, *Risk, Uncertainty, and Profit*, of a champagne production line. From past experience it is known that one out of every three hundred bottles of champagne burst. Therefore, a probability of 1/300 can be assigned to the event of a bottle bursting on the production line (Runde).

However, when dealing with uncertainty, it is not possible to assign a numerical probability to a certain event happening because there are no other instances or similar situations in which to compare. Runde cites Keynes who used the example of trying to assign a probability of a European war in his 1937 work, *QJE Defense of the General Theory*. In his mind, there was

no scientific basis that could be referenced that would assist in assigning a probability to the event (Keynes).

Because price risk can be quantified, it can be managed. In production agriculture there are a plethora of price risk management tools available for grain and livestock operators. Not all producers manage risk using the same tools, and not all producers choose to manage price risk on similar percentages of their production. In fact, it is quite likely that if two producers were each given the exact same operation to manage, they would each focus on different risks as well as use different contracts and tools to manage risk simply because they view risk differently and they have varying risk tolerances.

Generally, risk has a negative connotation associated with it as risk averse people try to minimize their exposure. However, individuals' perceptions of risk can vary depending on the circumstances surrounding the risk, resulting in people having different attitudes toward risk. There are three classifications of risk attitudes: risk averse, risk seeking and risk neutral. A risk averse individual, given the opportunity to choose, would be willing to accept a lower return in exchange for a low level of risk. They will even pay to avoid risk, implying a positive risk premium (Barry). Risk averse individuals perceive the utility they derive from the risky action as being less than the utility of the expected value (Langemeier, 2006).

A person that is considered to be risk preferring is more inclined to do just the opposite of a risk averse individual. A risk preferring person will actually pay to partake in risk. Risk seeking individuals are inclined to pay a price to take on risk that exceeds the utility they derive from the risky event. In essence, they would pay to be involved with risk (Barry).

A risk neutral individual is indifferent to risk. They neither desire nor wish to pay anything to avoid risk, or to partake in risk. Risk neutral individuals view the utility they will receive from the risk as being equal to the utility the risk is expected to yield.

Recognizing a producer's risk attitude is a strong indicator as to how a producer may approach risk management. A risk averse producer will be more apt to pay more for a risk minimization strategy than a risk preferring or risk neutral individual. Likewise, a risk preferring or risk neutral individual may be comfortable with greater risk exposure than a risk averse person.

## **1.2 Variability in Cattle Feeding and Cow-Calf Operations**

While risk is inherent to all areas of agriculture, the focus of this thesis is limited to cattle production, specifically the marketing of feeder and fed cattle. Therefore, research discussed will pertain primarily to cow-calf, stocker/background<sup>1</sup> and finishing enterprises. Cattle feeding is renowned for narrow margins and high risk (Lawrence, Wang, and Loy). Cattle feeders must contend with numerous sources of risk, driven specifically from the price of feeder cattle, fed cattle, and inputs, as well as cattle performance. These factors will be discussed in greater detail in Chapter 2. While any one of these factors can impact the profitability of a cattle feeder, Mark, Schroeder and Jones and Langemeier, Schroeder, and Mintert generally found that feeding profits are most influenced by fed cattle prices, feeder cattle prices, and corn prices. Each of these market prices can be hedged using various risk management tools available to producers.

Just as cattle feeders contend with a large amount of price risk, so do cow-calf operators. Cow-calf operators must especially contend with the biological aspects of cattle production as a cow produces only one calf per year, yet the producer must maintain the cow year round. This

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<sup>1</sup> The terms stockers and backgrounders are used interchangeably throughout this thesis. Both refer to the enterprise of growing calves post weaning, but prior to being placed in a feedlot for finishing.

poses a unique set of challenges for cow-calf operators and the factors they must take into account when evaluating the profit variability of their herds and price risk management strategies. These factors will be further evaluated and discussed in Chapter 2.

### **1.3. Objectives**

The objective of this thesis is to examine risk management tools available to cattle producers. Topics of basis and seasonal pricing will be discussed as these concepts must be considered and understood before utilizing price risk management strategies. Next, a sample of price risk management tools will be discussed. A model to forecast LRP basis will also be analyzed as a tool to assist producers in estimating future LRP basis.

The educational component of teaching price risk management strategies to producers will also be explored. Special emphasis will be placed on determining the effectiveness of a computer simulation as a means to teach price risk management and how it may contribute to enhancing and making the most of the educational experience. Finally, Kansas State University Extension developed a computer simulation to educate cattle producers about price risk management tools. The simulation had two versions, the Cow-calf version and the Feedlot version. During the winter of 2008, Kansas State University in a cooperative effort with Iowa State University, presented a series of the Cattle Risk Management Workshops in Iowa. The effort was made possible by a grant from USDA's Risk Management Agency. This thesis will further explain the workshops through the discussion and evaluation of their effectiveness.

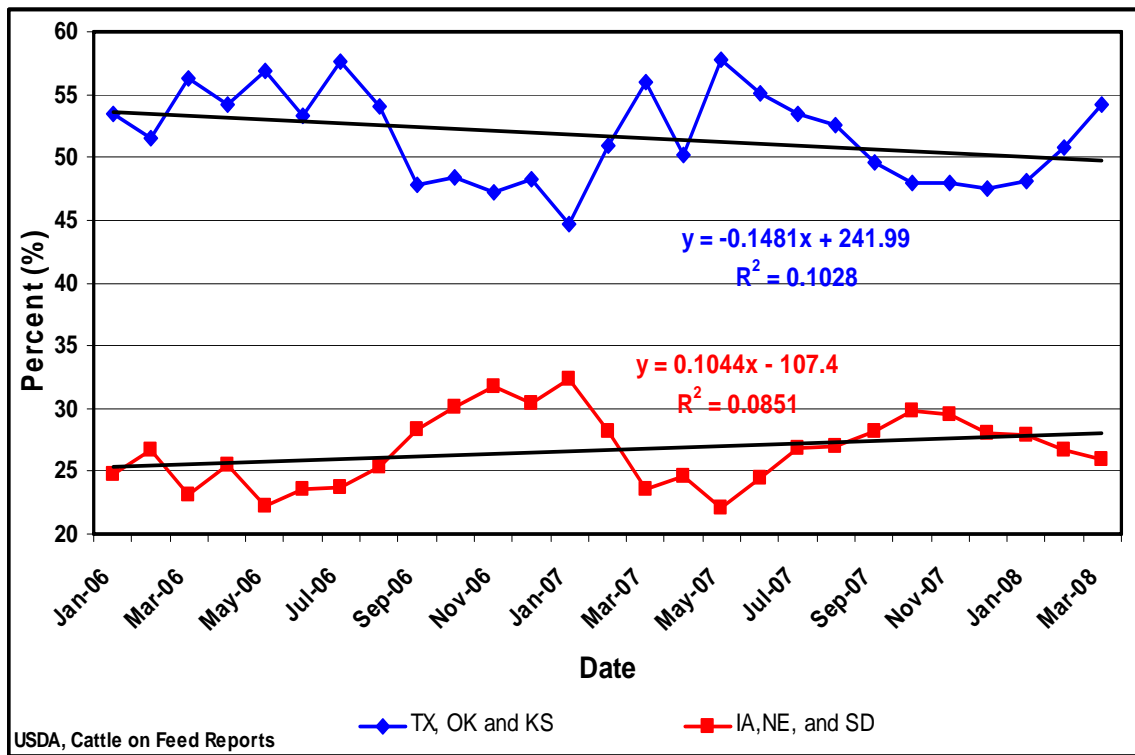
### **1.4. Motivation for Using Iowa as the Setting for the Workshops**

The primary focus of data collection and discussion in this thesis will be for the state of Iowa. There are several reasons for using Iowa as the main setting of this thesis. First, the Northern Plains (Iowa, Nebraska, and South Dakota) have seen an increase in the quantity of



cattle placed on feed, especially from January 2006 through March 2008, while the Southern Great Plains (Kansas, Oklahoma and Texas) have experienced a decrease (Figure 1.1). The slope indicates the percent of cattle placed on feed in the Southern Plains has been decreasing .1481 percent per month, while the slope indicates the percent of cattle placed on feed in the Northern Plains has been increasing .1044 percent per month from January 2006 through March 2008. As of January 1, 2008, Iowa had the fifth largest cattle on feed inventory in the U.S. with 860,000 head (USDA NASS).

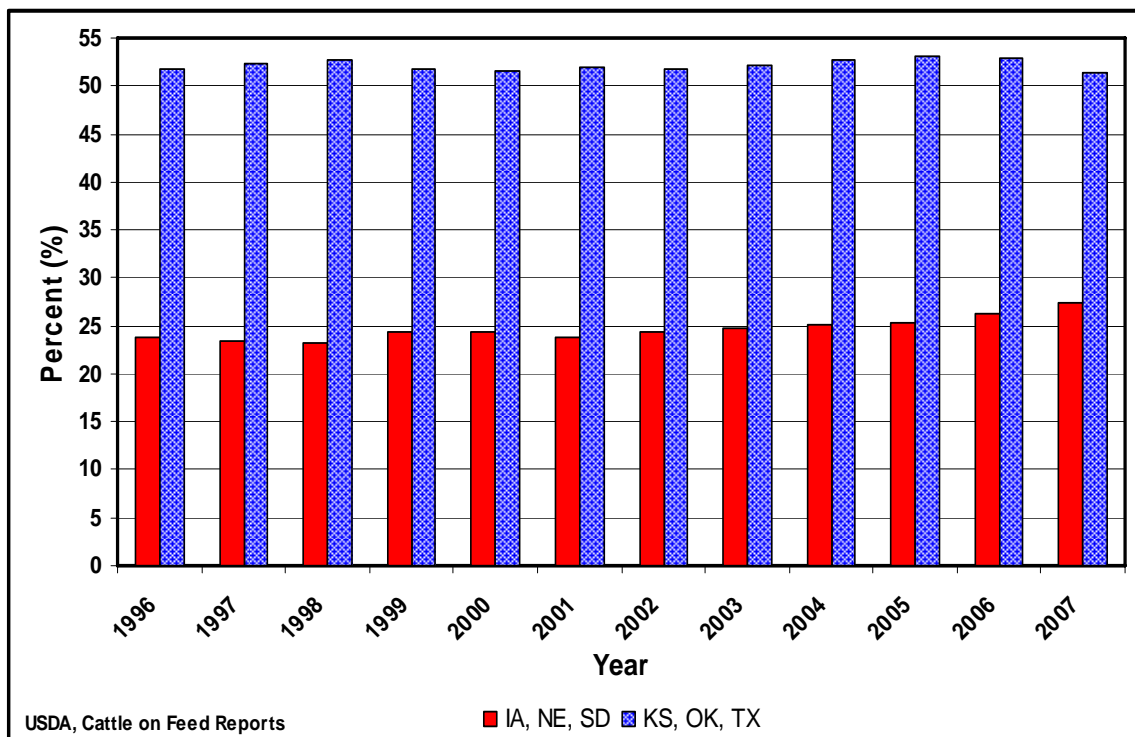
**Figure 1.1 Monthly Regional Cattle Placements as a Percentage of Total U.S. Cattle Placements, January 2006 – March 2008**



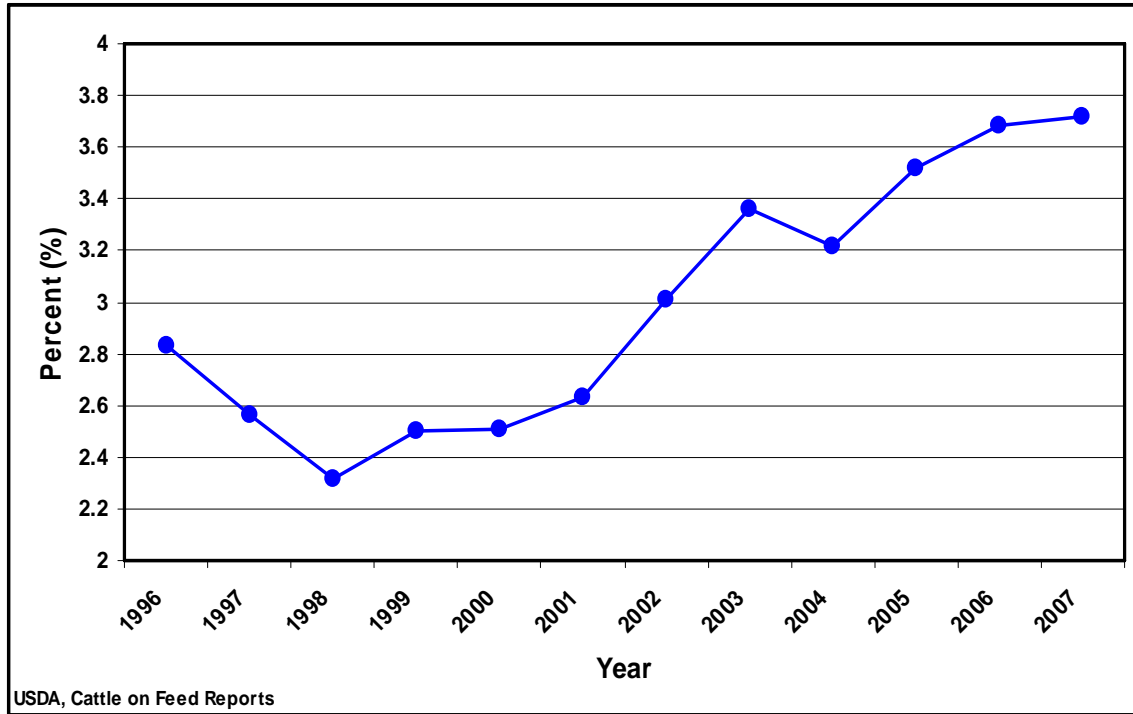
The growth of the cattle feeding industry in the Northern Plains can be illustrated by also observing the changes in the percentage of marketings for the Northern Plains and Southern

Great Plains (Figure 1.2). A subtle, yet noticeable, increase in the percent of marketings for the Northern Plains as a total of U.S. marketings occurred in 2005 through 2007. Figure 1.2 shows from 2006 to 2007 there was a noticeable decrease in the percent of marketings for the Southern Great Plains. Iowa has been gradually increasing their share of marketings since a decline in 1998 (Figure 1.3).

**Figure 1.2 Yearly Marketings as a Percentage of Total U.S. Marketings, 1996-2007**



**Figure 1.3 Iowa Yearly Marketings as a Percentage of Total U.S. Marketings, 1996-2007**



It is hypothesized that this increase of cattle feeding in Iowa has been motivated by, and will be maintained by, the ample availability of distillers grains in Iowa. Distillers grains are a byproduct from the production of ethanol. Compared to corn, distillers grains are very high in protein and energy. Because of the high energy levels in distillers grains, they are commonly added to feed rations significantly enhancing cattle performance (Vandor Pol, 2006b). The impact of feeding distillers grains on cattle performance and economic returns will be discussed in the following chapter.

As of January 2008, Iowa was the top ethanol producing state in the United States with 3,439 million gallon capacity representing 24.6 percent of the nation's ethanol production (<http://www.neo.ne.gov/statshhtml/121.htm>). Iowa is also the largest corn producer in the nation. In 2007, Iowa harvested 2.37 billion bushels of corn (USDA NASS).

## **1.5 Thesis Overview**

Chapter 2 will explore the literature pertaining to the factors that contribute to the profit variability of cattle feeding and cow-calf operations. The possibility of the cattle feeding sector shifting back to the north is further discussed as the positive attributes of distillers grains and other competitive advantages of feeding cattle in the Northern Plains are discussed. The current marketing practices of cattle producers and feeders will be considered as their perceptions of marketing strategies, and their desire for further risk management education is analyzed. The educational literature will also be reviewed to determine the components of an effective educational program/workshop that allows for a meaningful learning experience using technology, specifically computer simulations.

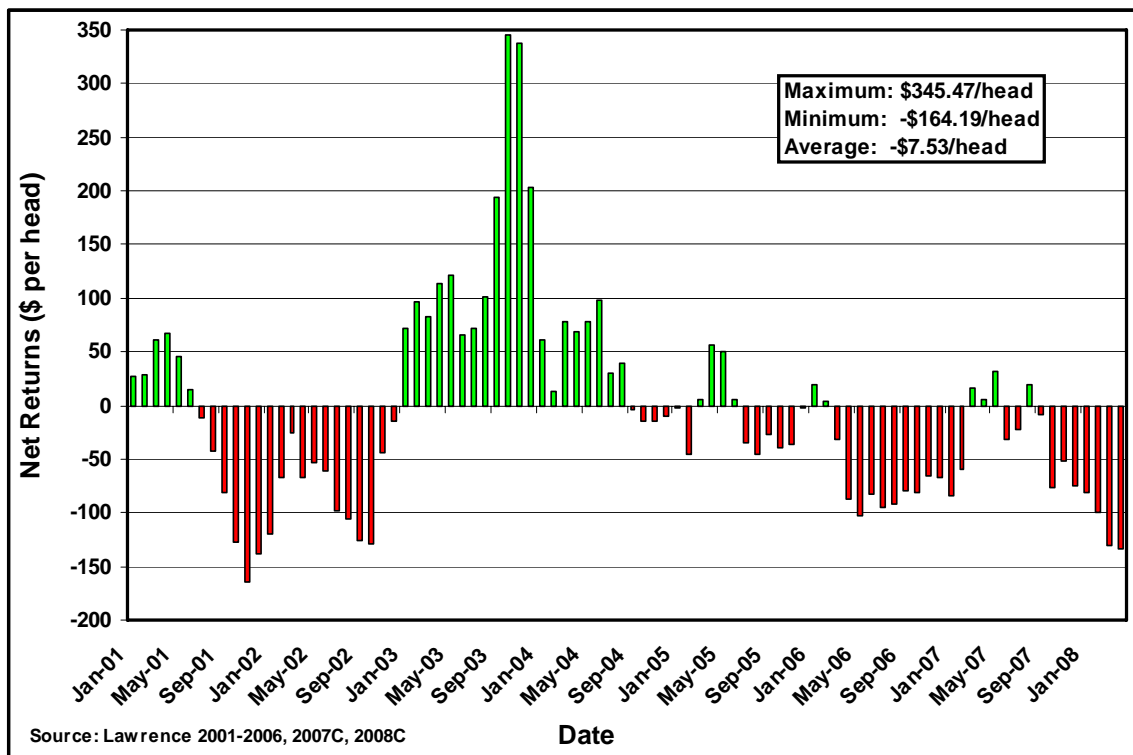
Chapter 3 will explain basis and seasonal pricing for different classifications of cattle. Basis and seasonal pricing are discussed because they are two components that need to be understood to effectively employ price risk management strategies. Chapter 4 will introduce and explain basic price risk management tools and strategies. The advantages and disadvantages of the price risk management tools and strategies available to cattle producers will also be included. Chapter 5 explains an LRP Feeder Cattle basis forecasting model that has been developed based off existing models for forecasting basis relative to the CME futures price. Chapter 6 will explain the Cattle Risk Management computer simulation developed by Kansas State University Extension, and the results of the workshops presented in Iowa to producers during the winter of 2008 will be reviewed. The effectiveness of their efforts will be evaluated as the results of pre- and post-tests are summarized. Finally, Chapter 7 will summarize conclusions of the thesis as well as the implications for cattle producers and future educational projects.

## CHAPTER 2 - Literature Review

### 2.1 Cattle Feeding Profit Variability

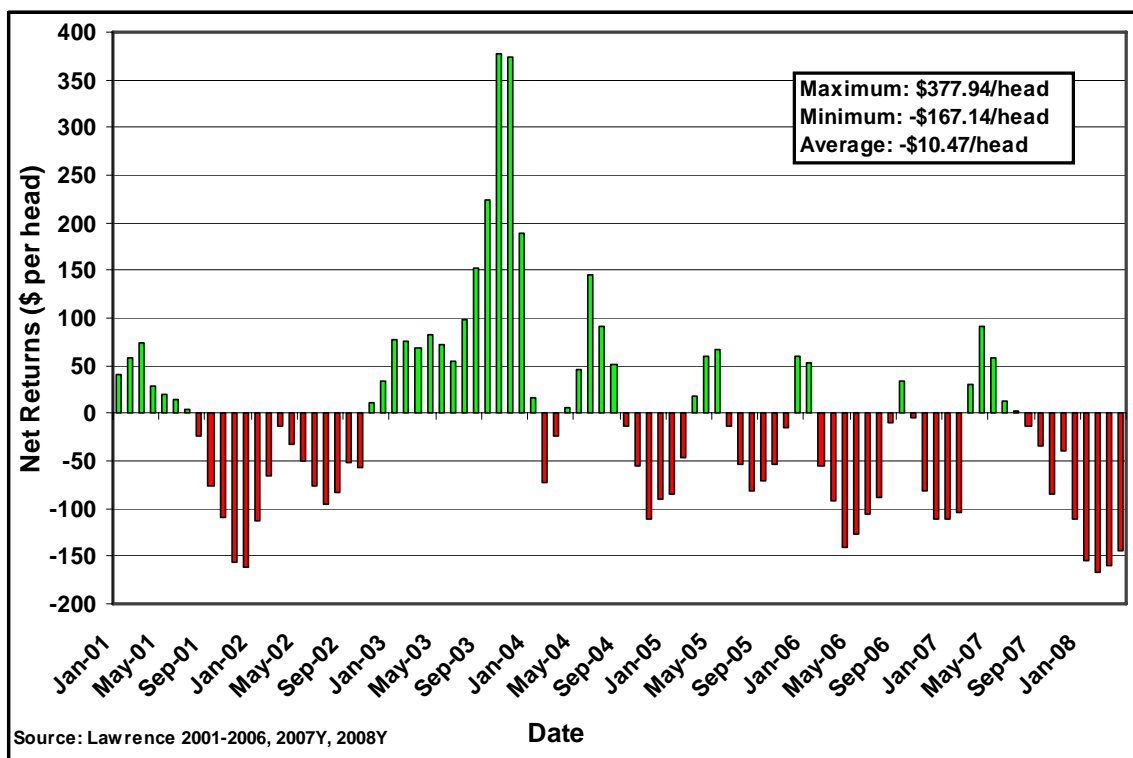
Cattle feeding is a business known for its volatility. To illustrate the variability of cattle feeding profits, Dr. John Lawrence of Iowa State University maintains a series of monthly economic returns to feeding cattle (for both yearlings and calves) in Iowa. From January 2001 to April 2008, the calculated net return (before hedging) of finishing calves has varied over \$500 per head (Figure 2.1). The maximum return occurred in October 2003 when net return was calculated to be \$345.47 per head. The maximum loss per head was -\$164.19 in November 2001 (Lawrence 2001-2006, 2007C, 2008C).

**Figure 2.1 Iowa Monthly Net Returns of Finishing Steer Calves, January 2001-April 2008**



Similar profit variation is also found in finishing yearlings, where the difference between the maximum and minimum return (before hedging) was almost \$550 (Figure 2.2). The maximum return again occurred in October 2003 with \$377.94 per head, and the maximum loss of -\$167.14 per head occurred in February 2008 (Lawrence 2001-2006, 2007Y, 2008Y).

**Figure 2.2 Iowa Monthly Net Returns of Finishing Yearling Steers, January 2001-April 2008**



### ***2.1.1 Factors Contributing to Cattle Feeding Profit Variability***

What factors contribute to the variability of cattle feeding? This is a necessary question to answer because the factors must be identified before the risk can be effectively managed. Several studies have been conducted to identify the variables that contribute to the profit risk cattle feeders experience. Schroeder et al. (1993) investigated the impact of several factors

affecting the variability of cattle feeding profitability, namely: feeder and fed cattle prices, corn prices, cattle performance, and interest rates. Closeout data from 6,696 pens of steers placed on feed between January 1980 and May 1991 from two custom feedlots in western Kansas were analyzed. The pen level data were organized into three different placement weights: 600-699 pounds, 700-799 pounds, and 800-899 pounds. Regressions for each weight placement were estimated and coefficients of separate determination were calculated for the explanatory variables. Schroeder et al. found that fed cattle price, feeder cattle price, corn cost, interest rate, feed conversion, as well as average daily gain explained 93 to 94 percent of profit variability for the three weight groups of cattle. Cattle feeding performance minimally impacted total profit variability as it accounted for only 5 to 10 percent of profit variability. It was also observed that as placement weight increased the impact of feeder cattle prices on profit variability became greater. For example, feeder cattle price contributed 16.9 percent of the profit variability for cattle placed on feed from 600 to 699 pounds, while it accounted for 41.6 percent of profit variability for cattle placed on feed at 800-899 pounds. The impact of corn price on profit variability decreased from 16 percent for cattle placed on feed at 600-699 pounds, to six percent for cattle placed on feed at 800-899 pounds. Consequently, the price of feeder cattle became more important than corn price for heavier weight placed cattle. Fed cattle price explained more than 50 percent of profit variability for lightweight cattle and 38 percent for the heaviest weight cattle. Feeder cattle price influenced the total profit variance 42 percent for heavyweight placed cattle, 25 percent for the middle placement weight group, and 17 percent for the lightest placement weight cattle. Consequently, cattle feeders, especially those who place cattle on feed at lighter weights cattle should place special emphasis on managing the price they receive for fed cattle. Cattle placed on feed at a light weight will be on feed longer than heavier weight placed

cattle. As a result of the longer time frame, there will be opportunity for greater variability of fed cattle price for the light weight placement cattle compared to the heavier weight placed cattle.

More recently Lawrence, Wang, and Loy conducted a study using data from cattle placed on feed between January 1987 and December 1996 involving more than 1,600 pens of cattle from over 220 feedlots in the upper Midwest. The panel data were organized into four different placement weights: less than 600 pounds, 600-699 pounds, 700-799 pounds, and 800 pounds and over. Ordinary least-squares regression was used to identify the impact of each variable on cattle feeding profitability. The variables considered were fed cattle price, feeder cattle price, corn price, feed efficiency, average daily gain, and interest cost. It was found that the animal performance in the upper Midwest was slightly more important in explaining profit variation than the price of corn when compared to the Schroeder et al. Kansas study. Lawrence, Wang, and Loy found cattle performance variability explained six to 15 percent of total feeding profit variability, while the impact of corn price was smaller. This finding was attributed to harsher, more variable weather found in the Midwest compared to western Kansas. They found that steer feeding programs were more profitable than heifer programs and the season of placement had little impact on profitability. Due to the different types of feedlots in the dataset, Lawrence, Wang and Loy were able to evaluate the profitability of open lots compared to partial and full confinements. They determined that open lots were more profitable than total confinements, but statistically no more profitable than partial confinements. The study emphasized the importance of price risk management because over 50 percent of profit variability was attributable to fed cattle price while 20 percent was due to feeder cattle price.

These studies not only underscore the importance of managing the price risk of fed cattle and the input prices for feeder cattle and corn, they also provide insight from a budgeting

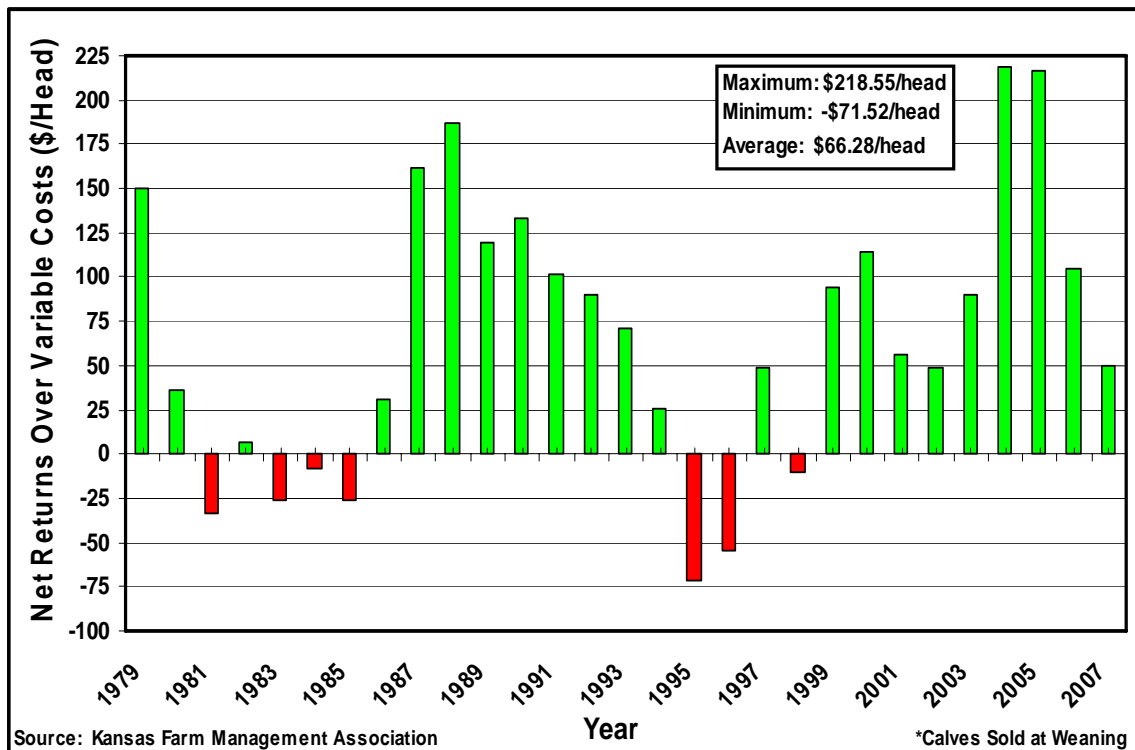


perspective. Due to the fact that these variables influence profit, breakeven prices should be calculated for a range of fed cattle, feeder cattle, and corn prices. This information can then be incorporated into production and marketing plans (Langemeier, Schroeder, and Mintert).

## 2.2 Cow-Calf Profit Variability

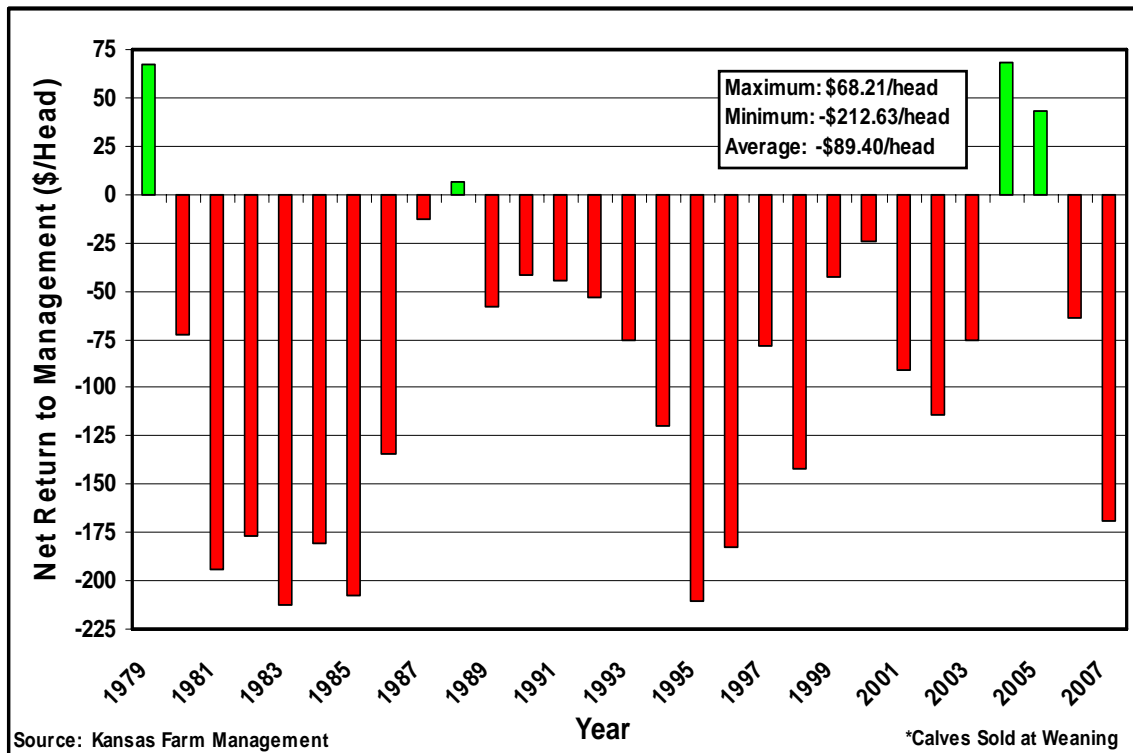
A yearly historical series of economic returns for Kansas cow-calf producers was available from 1979 through 2007 and reveals a great amount of variability. For cow-calf producers the range of net returns over variable costs was almost \$290 per head from 1979 through 2007 (Figure 2.3). The greatest net return over variable costs was \$218.55 per head in 2004, while the lowest return over variable costs was -\$71.52 per head in 1995. The average net return over variable costs for the given timeframe was \$66.28 per head.

**Figure 2.3 Kansas Yearly Net Returns Over Variable Costs for Cow-Calf Operations 1979-2007**



The historical economic returns data also provided the net return to management for 1979-2007. The analysis considered net returns to management to be gross income less variable and fixed costs. Fixed costs were considered to be depreciation, real estate tax, unpaid labor, and interest. The range of yearly net return to management during this time period was almost \$280 per cow (Figure 2.4). The largest net return to management was \$68.21 per cow in 2004, while the greatest loss was -\$212.63 per cow in 1983. The average return to management for Kansas cow-calf producers during the given timeframe was -\$89.40.

**Figure 2.4 Kansas Yearly Net Returns to Management for Cow-Calf Operations 1979-2007**



### ***2.2.1 Factors Contributing to Cow-Calf Profit Variability***

To identify the practices used by profitable cow-calf producers, USDA's National Animal Health Monitoring System (NAHMS) (USDA, 1996) reviewed the records of 35

producers who participated in the NAHMS 1993 Cow/Calf Health and Productivity Audit and completed a Standardized Performance Analysis (SPA). The 35 producers were divided into two groups: those with positive net returns and those with negative net returns. The number of cows was similar for all producers in the study. It was determined that operations with positive returns tended to focus on optimum production levels as opposed to maximum production. These operators were more apt to recognize the point of diminishing returns and produce where the marginal return per unit were the greatest. For example, they would rather wean slightly lighter weight calves per exposed cow, rather than spend the extra money to ensure they wean heavier weight calves if the marginal return would be less than weaning light weight calves. Also, it appeared that operations with a positive return had no differences in productivity and acquired those higher returns by way of increased efficiency, cost containment and obtaining better market prices. In the NAHMS study, 31 percent of positive return operators used price as the most important factor for determining when to sell their calves, compared to five percent of producers who had negative returns. Plus, producers with positive returns were twice as likely, compared to producers with negative returns, to use a computerized record keeping system (USDA, 1996).

Bruce, Torell, and Hussein discussed the management and marketing complexities of managing a cow-calf herd and identified several factors that impact those management decisions. To assist in determining the impact on an operation's profit or loss (often the most important management issue), Bruce, Torell and Hussein used a computer simulation. The computer simulation took into account various management factors and used them to generate 50,000 different management scenarios. Factors included in their model were the purchase price of the cow, interest, salvage value, weaning rate, weaning weight, and yearly cow maintenance costs.

The factors used in the model were completely randomized, but no extreme values were used, as all values were within a realistic value range. The model was based on the assumptions that all calves would be sold at weaning, the cows were assumed to produce calves for eight years, and then be sold at an assigned salvage value.

Bruce, Torell and Hussein found the costs required to maintain a cow for one year had the most influence in determining an operation's profitability, as it explained 41.3 percent of the profit variation. They also found that the price received for the calf, average weaning weight, and the percentage of calves weaned explained 27.2, 17.7, and 8.7 percent of the profit variation, respectively. Bruce, Torell and Hussein concluded the purchase price of the cow, salvage value of the cow, and the interest on borrowed money had substantially less impact on a producer's profitability. All factors mentioned were statistically significant ( $P < .01$ ) except for the interest on borrowed money.

In an attempt to determine the driving force behind the variability of profit amongst cow-calf operations, Miller et al. conducted an economic and financial analysis of cow-calf operations in Iowa and Illinois. The financial analysis used costs that were considered to be "cash-flow" costs, including debt and hired labor. The economic analysis assigned opportunity cost for inputs, invested capital, as well as family and operator labor. They analyzed data from Iowa and Illinois cow herds who kept records in accordance with Integrated Resource Management and Standardized Performance Analysis (IRM-SPA) guidelines. The records were collected from 225 commercial herds, ranging in size from 20 to 373 cows during the years 1996 to 1999. The dependent variable for both the economic and financial analyses was return to unpaid labor and management per cow (RLM). Eight independent variables were determined to be significant in

the two analyses: feed cost, depreciation cost, operating cost, calf weight, capital charge, calf price when sold, weaning percentage, and herd size.

The financial model, using the eight variables above, explained approximately 82 percent of the variability in profit, while the economic model accounted for 79 percent of the profit variability. In both models feed cost accounted for more than 50 percent of the variation. Depreciation was the second largest contributor (7 percent and 12 percent in the financial and economic models, respectively), followed by operating cost (4.9 percent and 5.1 percent in the financial and economic models, respectively). In the financial model, calf weight at the time of sale was the fourth most important factor as it explained 4.6 percent of the variation of return and calf price, the fifth contributor, explained 2.6 percent of the profit variation.

The results of the economic model were similar to the financial model. Calf price received contributed 3.2 percent and calf weight was responsible for 2.4 percent of the variation in profit across cow-calf operations. The other three factors, capital charge, weaning percent, and herd size each contributed 2.6 percent or less to the variance in the economic model. Miller et al. concluded that costs contributed the most to profit variability of the herds analyzed. While other explanations of profit variability, production as well as reproduction factors and “producer-controlled marketing factors” such as deciding when to market calves, contributed to a lesser extent (Miller et al., pp.295). It is possible that prices received by the producers involved very little differentiation, and hence did not contribute much to the profit variability.

These findings imply the risk faced by producers differs from feeders in that cow-calf producers face risk that is associated with the same animal for multiple years. A cow-calf producer will invest resources into a retained heifer calf for over two years until any sort of return is realized when the producer sells her first calf. The producer will then continue to invest

in that cow for the next several years. Cow-calf producers would be more ideally served by a price risk management strategy than insures producers against price risk for multiple years out. Cattle feeders can make multiple marketing decisions throughout a year, depending on the turnover and capacity of their feedlot.

If costs play the largest role in explaining profit variability of cow-calf operations, producers must place emphasis on being a low cost and efficient producer. Featherstone, Langemeier and Ismet concluded, based on a study of Kansas beef cow operations, that enterprise profitability was correlated positively with technical, allocative, scale and overall efficiency. Technical efficiency was defined as “the distance the operation was off the production function under variable returns to scale” (Featherstone, Langemeier and Ismet, pp. 177). Allocative efficiency was calculated to evaluate if the operation used the optimal input mix, while scale efficiency determined if the operation was sized the most efficiently. Feed, labor, and capital cost composed 91 percent of all costs, and explained overall efficiency more so than the other costs consisting of utilities, fuel, veterinary expenses, and miscellaneous costs. Feed costs were also very influential in explaining technical efficiency. The authors found a majority of operations (approximately 84 percent) were scale efficient. A large contributor of overall inefficiency was producers operation above the cost frontier, rather than operations that were scale inefficient.

Ramsey et al. conducted a study using SPA records of herds located in Texas, Oklahoma, and New Mexico and identified economic factors and management decisions within an operator’s control that significantly impact herd costs, production, and profitability. To determine these economic factors, models were specified for costs, production, and profit. Cost was defined as the economic pretax cost before non-calf revenue adjustment per hundredweight.

The cost model took opportunity costs on owned assets and raised inputs into account.

Production was defined as pounds weaned per exposed female and profit was considered to be a percent return on assets calculated on a cost basis, and was chosen to be a long-run measure of profitability. In all three models, the same independent variables were used: herd size and herd size squared; investment in real estate, machinery, and livestock; pounds of feed fed; calving percentage, calving death loss, and length of breeding season.

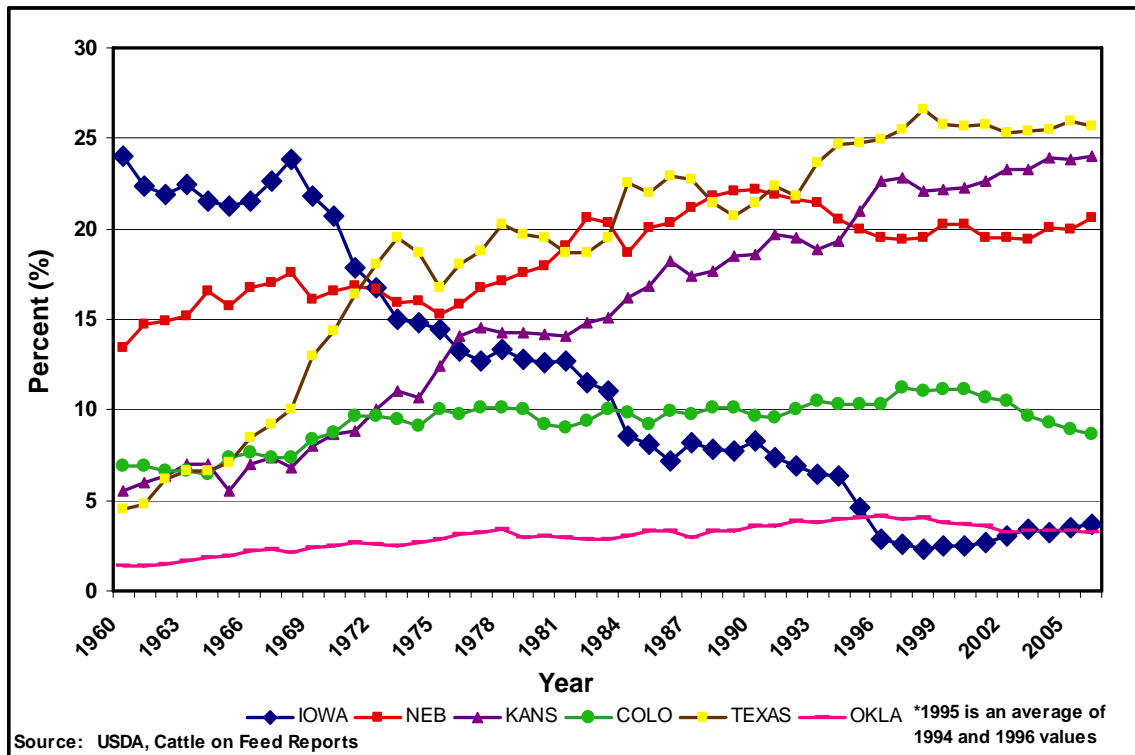
All independent variables were found to be significant in the cost model and explained almost 31 percent of the variation in cow herd costs. Investment in livestock, calving percentage, calving death loss based on exposed females, and length of breeding season were all significant in the production model and explained 50 percent of the variability of production. The profit model had three significant variables: herd size, pounds of feed fed, and calving percentage. The model explained only 11 percent of the variation of profit across cow herds. As expected, productivity impacted costs as well as profit. The results emphasized the impact financial and physical management can have on an operation (Ramsey et al.).

### **2.3 Cattle Feeding in Iowa**

Iowa has traditionally been a major cattle feeding state. Mintert cites the history of the Iowa cattle feeding industry back to the post-Civil War era when depressed corn prices motivated farmers to feed their corn to livestock. As a result, during the mid to late 1800's, constant supplies of fed cattle were shipped from Iowa to eastern markets. Consequently, Iowa became the nation's largest marketer of fed cattle. In 1960, Iowa fed 24 percent of the slaughter cattle from the 13 major cattle feeding states, the most of any state (Figure 2.5). The states considered to be major cattle feeding states at that time were: Arizona, California, Colorado,

Idaho, Illinois, Iowa, Kansas, Minnesota, Nebraska, Oklahoma, South Dakota, Texas, and Washington (Mintert). Iowa remained in the top position until 1970 (Figure 2.5).

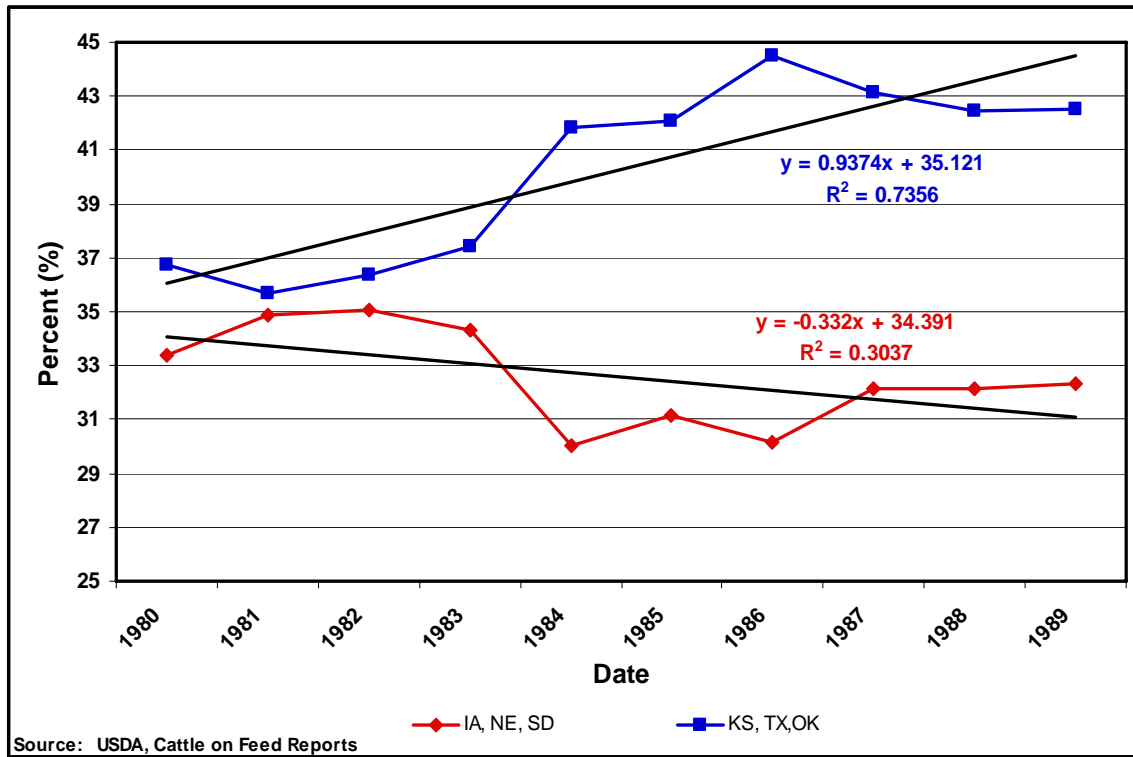
**Figure 2.5 Percent of Total Annual Fed Cattle Marketings for 13 State Area, 1960-2006\***



During the 1980's the cattle feeding industry that had once flourished in the Corn Belt shifted south to the Great Plains. Between 1980 and 1989 Iowa lost 34 percent of its cattle on feed inventory; Iowa went from feeding 13 percent of the 13 state area's fed cattle to only eight percent (Figure 2.5). During that same time Texas, Oklahoma, and Kansas increased their cattle on feed inventory 25 percent, enabling them to increase their share of the fed cattle in the 13 state area from 37 percent to 42 percent (Figure 2.6) (USDA NASS).



Figure 2.6 Percent of Total Annual Fed Cattle Marketings for 13 State Area, 1980-1989



Less severe weather and fewer environmental regulations contributed to the Southern Great Plains cattle feeding competitive advantage. For years, transportation costs of relatively cheap corn from the Corn Belt minimally impacted the profit margin of Great Plains feeders as value was added to the corn through steam flaking. However, the impact on the profit margin has become much more substantial as corn, transportation, and energy costs have increased (Mark 2008). Mark analyzed closeout data from Kansas State University’s Focus on Feedlot Survey and Iowa, Minnesota, South Dakota closeouts from Land O’Lakes and found performance advantages for cattle fed in Kansas. During 1999-2006, cattle fed in Kansas gained 0.25 pounds more per day and had a feed conversion of 1.2 pounds lower. However, feedlots in the Northern Plains paid an average of \$0.40 per bushel less for corn than Kansas feedlots and had lower death loss. These factors resulted in a total cost of gain that averaged \$5 per

hundredweight less for Northern Plains feeders compared to Kansas feeders from 1999-2006 (Mark 2008).

On a dry matter basis, when wet distillers grain (WDG) makes up to 40 percent of a ration, notable performance improvements have been realized. When WDG composes 40 percent of the ration, cattle have been found to gain 0.6 pounds more per day and use 0.8 pounds less feed per pound of gain compared to a control ration where no distillers grain was fed. When WDG made up 50 percent of the ration, the performance advantages decreased, but were still higher than the control ration (Vander Pol et al., 2006b).

Due to the enhanced cattle performance, there are economic advantages to feeding distillers grain, even when the expense of transportation is factored into the returns. Vander Pol et al. (2006a) modeled the expected returns of feeding WDG when it was included in the feed ration at 10, 20, 30, 40, and 50 percent. The model also considered the distance between the feedlot and ethanol plant. The analysis considered the scenario of the feedlot being adjacent to the plant, as well as 30, 60, and 100 miles apart. The assumption was made that WDG was priced at 95% of \$2.30 per bushel corn, the cost of yardage was \$0.31 per head per day, and transportation was \$2.50 per mile. Because average daily gain was the highest with WDG included at 30 percent of the ration, it was found to be the optimal inclusion rate when the feedlot was located 30 to 100 miles from the plant. The returns ranged from \$25.27 to \$15.43 per head when the feedlot was located 30 and 100 miles from the plant, respectively, compared to a ration containing no distillers grain. Of course, the economic optimum inclusion level decreased the farther apart the feedlot and plant were located (Vander Pol et al., 2006a).

## 2.4. Current Marketing Practices

Few surveys have been conducted to determine the use of futures markets or options in the marketing of fed cattle. However, a recent study conducted by Muth et al. summarized the use of cash market arrangements and alternative marketing arrangements (AMAs) in the fed cattle sector. The study used daily fed cattle data collected by RTI International under contract with the Grain Inspection, Packer and Stockyards Administration from October 2002 through March 2005. The dataset represents almost 85 percent of the fed cattle slaughtered in the United States during the corresponding time period. The authors pointed out that this time period encompassed considerable volatility in the cattle market, as exports were brought virtually to a standstill when BSE was discovered in the United States in December 2003.

Muth et al. found a total of 61.7 percent of the fed cattle were marketed using cash market arrangements consisting of the following: 4.2 percent marketed through auction barns, dealers, and brokers and 57.2 percent were sold via direct trade, which was defined as an agreement negotiated between the buyer and seller. The remaining fed cattle were marketed using AMAs. Forward contracting, an AMA, was used to market 4.5 percent of the fed cattle. Forward contracting was defined as an agreement to purchase a specific quantity of cattle two or more weeks in the future, which shifts the price risk to the purchaser. The other AMA, marketing agreements, were used in the transaction of 26.8 percent of the fed cattle within the dataset. Muth et al. considered marketing agreements to be used “for the future purchase of cattle under a long-term ongoing agreement” (pp. 119). Finally, the authors found that 5.0 percent of the fed cattle marketed were placed in the packer fed/owned, other, or missing category. Packer ownership was considered to be when the packer owns the cattle two or more weeks before slaughter. The objective of the Muth et al. study was to determine the differences

in price and price risk when AMAs and cash market arrangements were used. A portion of their findings will be shared later in this chapter.

The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service published a summary in June 1997 that reported cow-calf producers' marketing practices for their weaned calves in 1996 (USDA 1998). Eighty-five percent of respondents or producers marketed their calves via auction, 10 percent by private treaty, two percent on a carcass basis, while approximately two percent utilized forward pricing as a market vehicle. Large herds, those consisting of 300 or more beef cows, were most likely to use forward pricing. The study reported that roughly 13 percent of large herds used forward pricing, marketing only 54 percent of their calf crop. Of the forward pricing alternatives employed, almost 50 percent used forward contracting, 29 percent used futures contracts, 11 percent used options, and 14 percent used other types of forward pricing (USDA 1998).

Producers' perceptions of various marketing strategies, whether correct or not, will influence their decision to use these contracting tools and strategies. Schroeder et al. (1998) surveyed producers to determine their perceptions of marketing strategies (i.e., futures markets, price forecasting, market risk management, and market timing signals). Additionally, from the survey results they hoped to discern the extent producers' perceptions are consistent with published research of extension economists' perceptions. The survey sample included two groups of producers attending two different Kansas State University extension conferences, the "Agricultural Land Value" conference held in August 1996 and the "Cattle Profit" conference during August 1997. Categorical responses to each question were coded on a 1-5 scale, where 1=strongly agree, 2=agree, 3=indifferent, 4=disagree, and 5=strongly disagree.

When asked to reply to the statement, “Hedging reduces risk and lowers expected returns,” approximately 35 percent agreed, while roughly 34 percent disagreed; the average response was 2.857. The statement “My primary marketing strategy is to reduce risk,” evoked an average reply of 2.297, implying producers tended to agree. Another statement, “The goal of a marketing strategy should be to decrease long-term risk over marketing years rather than to focus on an individual year,” solicited a similar average producer response of 2.341, again suggesting agreement.

The survey posed other statements to participants, but the statements highlighted above primarily provide insight regarding what producers believe hedging can do and the objectives marketing strategies should fulfill. There seems to be a disagreement amongst producers regarding hedging. Some feel it is a marketing alternative that will reduce risk as well as returns, while just as many of those surveyed disagreed. Some thought that hedging could reduce risk and increase returns. According to the study, producers view the objective of a marketing strategy as reducing risk over a long term time frame.

For the objectives and focus here, the results of the “Cattle Profit” conference are most relevant because those individuals’ responses will coincide primarily with their beef enterprises. There were a total of 36 usable responses for the study conducted by Schroeder et al. (1998). Of those, 16 were either stockers and/or feeders. Of the stockers/feeders, 37 percent had, at some time, used hedging to market their cattle, while 32 percent had used options.

Of both cow-calf producers and stockers/feeders, 18 percent forward contracted, while 21 percent used formula contracting. Of all the cattle producers surveyed, 74 percent reported their production was priced using cash sales only, five percent used forward contracting, six percent options, five percent futures hedging, and nine percent formula pricing. It should be noted that

the demographics of the producers surveyed were 10 years younger, had three years more formal education, and had much larger sized operations than that of an average Kansas producer, at the time.

Hall et al. conducted a mail survey of beef cattle producers in Texas and Nebraska to determine their perceptions of risk sources, effectiveness of risk management strategies, and interest in risk management education. Of the 1,313 respondents, five percent had used forward contracts and seven percent had used futures and options. The results were not reported allowing a distinction between cow-calf producers and feeders. On average, of those surveyed, cows made up 78 percent of the producers' total head of cattle and stockers were 17 percent, while 61 percent of the producers' average gross income came from beef production.

## **2.5 Desire for Further Risk Management Education**

Based on these various surveys, it appears that a relatively small portion of producers use forward pricing strategies. A potential reason could be that producers do not have the knowledge level associated with forward pricing strategies that would allow them to comfortably use these tools. They may not be aware of the extent to which forwarding pricing strategies could decrease price risk. The survey conducted by Hall et al. of Texas and Nebraska cattle producers asked participants to rank 12 listed sources of risk that they felt would affect ranch/farm income using a 5 point Likert scale (low of 1 to high of 5). The list consisted of production and price risks. Respondents considered severe drought (4.4), cattle price variability (4.3), variability of non-feed input prices (3.0), changes in government environmental programs (2.8), and extremely cold weather (2.7) to be the top five sources of risk affecting income.

Participants were then asked to rank nine risk management strategies using the same Likert scale according to how effective they believed each strategy to be in reducing risk.

Producers considered maintaining herd health (4.2), being a low cost producer (3.8), maintaining financial or credit reserves (3.6), off-farm investments (3.6), specializing in a phase of cattle production (3.1), off-farm employment (3.0), and diversifying enterprises (2.9) to be the seven risk management strategies to affect farm/ranch income. Rounding out the bottom of the list were forward contracting (2.2) and futures and options (2.0).

There is a certain element of irony in these results. Clearly producers saw maintaining herd health as the top risk management strategy, however, disease was listed eighth (2.6) out of 12 risk factors perceived as affecting their operation's income. Hall et al. noted this occurrence and considered it to be "a paradoxical finding." It could also be that producers actually deal with and maintain animal health on a regular basis (i.e., checking herd health, administering vaccination programs, feeding, etc.). Therefore, because they are more familiar with the concept and see the cause and effect on a regular basis, they consider it to be more effective than something they may not understand or be forced to use, such as price risk management strategies.

To determine producers' desire for further risk management education, participants were classified into four age groups: younger than 41 years of age, 41-50, 51-60, and more than 60 years of age. Participants' past attendance at educational seminars was measured, where seminar information was classified as pertaining to Futures/Options and Forward Contracting, Financial Management, or Herd Health. Approximately 35 percent of those younger than 41 years had attended Futures/Options and Forward Contracting seminars, compared with 10 to 15 percent from the other age groups. Hall et al. used the Ben-Porath model of human capital investment to explain these and other findings in their study. Hall cites that Ben-Porath argued that investment in human capital (education) will occur primarily in the first third of a person's life. The earlier

in life the individual makes the investment, the longer they have to obtain a return, hence encouraging participation in educational seminars earlier in life as opposed to later. Goodwin and Schroeder also used this model and found that for every year of experience (age) producers were 0.5 percent less likely to participate in educational programs.

Hall et al. questioned participants regarding their interest in further education in specified areas of risk management. Fifty-seven percent had a strong interest in learning more about herd health management, 38 percent for financial management, and 25 percent were strongly interested in futures/options and forward contracting. Ironically, when participants were asked as to why they did not use futures and options, 51 percent claimed they lacked adequate knowledge. Yet, only half of that amount had interest in learning. Hall et al. cited a possible reason for this is that producers may perceive futures and options to be an ineffective risk management tool, as reported earlier, and as a result do not care to spend time learning about them. Another reason the authors hypothesized was that producers may honestly have no desire to learn.

Hall et al. used a probit model to determine factors that would indicate interest in further education. Age of the participant, previous attendance at educational seminars, and past experience using the management tool were all significant indicators of desire for additional risk management education. Specifically pertaining to further education in subject matter of futures and options, for every year of age, an individual was 0.64 percent less likely to desire further education. However, if they had attended an educational seminar in the past, they were 14 percent more likely to seek more education, and if they had used futures and/or options they were 22 percent more likely to attend further education on the subject. Those who considered



themselves to be risk averse were 10 and 12 percent more likely to express interest in attending additional training in forward contracting as well as futures and options, respectively.

Goodwin and Schroeder surveyed 509 Kansas producers. Those surveyed included wheat, corn, grain sorghum, soybean, cattle and hog producers. Goodwin and Schroeder found when it came to the results of a discrete adoption model, those who indicated they had a preference for risk were 11.2 percent more likely to employ forward pricing. When continuous levels of adoption were analyzed, it was found that risk preferring cattle producers were more likely to adopt forward pricing than their risk averse peers. This could imply that producers ultimately saw forward pricing as riskier than other marketing alternatives. Also, risk preferring individuals may have been financially extended to the point that their creditors required them to implement a forward pricing strategy. Several studies have found there to be a positive relationship with producers use of forward contracting and the leverage position of their operations (e.g., Asplund, Forster, and Stout; Shapiro and Brorsen).

Analyzing fed cattle transaction data from October 2002 through March 2005, Muth et al. concluded that cattle marketed through sale barns resulted in the highest price, but also had the highest price risk compared to forward contracting and AMAs. However, forward contract prices were lower and price risk was higher, compared to direct trade or marketing agreements. This is due in part to the fact that forward contract prices were set so far ahead in the future, producers were not able to benefit from an increasing fed cattle market. Cattle sold through the sale barn sold for an average price of \$0.156 per pound more compared to cattle that were marketed using a forward contract. However, at the same time selling cattle through the sale barn was considered to have 46 percent more price variance than marketing cattle using a

forward contract. Consequently, the \$0.156 per pound could be considered the risk premium paid to those who accepted the price risk by selling their cattle through the sale barn.

## **2.6 Simulations**

The advancement of technology has allowed educators to incorporate the use of computers as teaching tools. Educators are now able to incorporate computer games, simulations, and tutorials into their curriculums. It is possible that these ‘hands-on’ learning methods may be better suited for cattle producers who, as discussed above, had little interest in learning about marketing strategies. However, among the education community there is not a clear consensus regarding the effectiveness of such teaching tools. This portion of the literature will focus on the effectiveness of simulations as a teaching tool. Computer simulations will be defined, including their characteristics, perceptions of computer simulations for educational purposes, effectiveness, and associated concerns regarding the use of computer simulations. Plus, ways to improve the utilization of computer simulations in an educational environment will be explored.

### ***2.6.1 Computer Games verses Computer Simulations***

A portion of the literature refers to computer games and simulations synonymously, as simulations are considered to be a subset of games. However, a strong portion of the educational community considers there to be clear distinction between computer games and computer simulations. The objective of a computer game is to win. It is a competitive environment where participants apply their previous knowledge which is relevant to the subject matter, in order to advance through the game and win (Gredler). Games involve “chance and an imaginary setting” where the success of the game player is determined by the player’s level of skill (Randel et al.,

pp. 262). Typically, if the player of a game makes a wrong decision, they do not advance or they lose points as there is only one correct answer or one winner.

Computer simulations are considered to be more of an “evolving case study” that evolves in a manner similar to the real life situation (Gredler, pp. 573). The participant assumes a role in the simulation along with the corresponding responsibilities and boundaries. They, in essence, role-play the position dealing with similar challenges, limited resources, and issues that people in the real world deal with in their positions (Gredler).

There is a great deal of cause and effect involved in a simulation which is motivated by the interaction of multiple variables. It is this element of the simulation that allows the participant to learn from the simulation. The user confronts challenges brought before them by the simulations. In response, the user deals with the issue by thinking through the scenario, making decisions, and inputting those decisions into the simulation. The participant is then able to observe the results of their actions, which would be similar to those they make in the real world.

### ***2.6.2 Characteristics and Advantages of Computer Simulations***

There are specific characteristics of a simulation. The simulation should be an adequate model of a complex real-world situation. The simulation should outline a definite role for the user and explain the constraints and limitations of their positions and the scenario. The individual should be supplied with a data-rich environment that allows them to have a multitude of potential strategies (Gredler). Finally, participants should be provided with feedback regarding their actions in the “form of changes in the problem or situation” (Gredler, pp. 571).

Simulations provide several advantages compared to other instructional methods. First, because simulations are considered to be an imitation of reality where the participant is exposed

to the situation in a more controlled and possibly cost-effective manner, versus placing the individual in the real-world scenario (Cannon-Bowers and Bowers). The simulation makes the connection between the classroom and the real world. By assuming the role in the simulation, participants experience some of the same potential frustrations, emotions, and questions a person in the actual role may experience. It also allows the participants to apply the concepts they are learning to a real-life scenario. By allowing the participant to exercise the concepts they have learned, they realize misunderstandings they may have regarding the information. It is also possible for participants and their instructors to observe their thought processes and problem solving strategies, allowing them to identify associated strengths and weakness (Gredler). Participants in a computer simulation are also engaged learners. They are not passively listening to a lecture. They are proactively participating in an exercise to further advance their knowledge base pertaining to the subject matter.

### ***2.6.3 Perceptions of Computer Simulations in Education***

While there may be advantages of using computer simulations as a teaching tool, their acceptance by learners, as well as their actual use, is less clear. Evert and Drapeau sought to determine which instructional methods were perceived as being the most effective and widely used in business and industry training. They surveyed 127 members of the American Society for Training and Development (ASTD), which they considered to be their expert panel. They asked their expert panel participants to rate 14 different instructional methods used in training. The different methods varied from lecture, to film/video, to case studies. Respondents replied by using a Likert-type scale in their rating. The respondents rated the effectiveness and how often they used each of the 14 instructional methods. The expert panel perceived simulations to be the most effective, followed by computer-assisted instruction (CAI). Though not statistically

significant in the results, the expert panel found simulations and CAI to be more effective than films/video, peer tutoring, coaching/mentoring, supervised on-the-job training, and seminars/workshops, in that order. The expert panel did perceive simulations and CAI to be significantly more effective than team teaching, programmed instruction, interactive video, case study, computer-based training, lecture and role playing, respectively. The expert panel was asked to describe how often the different instructional methods were used. The respondents cited that they felt simulations and lecture were used more often than films/video, peer tutoring, and seminars/workshops.

Evert and Drapeau also surveyed 130 representatives of the National Association for Business Teacher Education (NABTE). A majority of the respondents were full professors or teaching at a College or School of Business, having twenty or more years experience. Almost 73 percent of the respondents taught a teaching methods class. These individuals were asked the same questions as the expert panel.

The NABTE respondents indicated case studies and supervised on-the-job training were the most effective instructional methods. Though not statistically significant in the results, simulations, coaching/mentoring, CAI, lecture, seminars/workshops, and role playing followed. Evert and Drapeau found the perceptions significant in that the case studies and supervision on-the-job were more effective than films/video, peer tutoring, team teaching, and other instructional methods. They also found that lecture and films/videos were perceived to be the most widely used instructional method, ahead of case study, role playing, seminars/workshop, simulations, CAI, as well as coaching/mentoring, amongst the other methods. Lecture was perceived to be used significantly more often than any of the other 13 methods.

It should be noted that the expert panel participants were from a wide variety of business and industry. These results provide insight into the differing perceptions of simulations. Evert and Drapeau's expert panel perceived simulations to be the most effective instructional method, while the NABTE respondents perceived it to be third most effective, behind case studies and on-the-job training. However, when the educators identified how frequently they used the different instructional methods, it was determined lecture was used significantly more often than any of the other 13 methods.

#### ***2.6.4 Study Results Regarding the Effectiveness of Computer Simulations***

As mentioned earlier, the effectiveness of simulations as an instructional method is controversial in the educational community. Comparing studies is somewhat challenging with the current literature. Within the literature, the method by which the effectiveness of simulations is tested varies. Some studies test the effectiveness of simulations when the simulation is the main method of teaching versus when it is used as a supplemental tool to lecture. The method by which the simulation was implemented could affect the effectiveness of the simulation. In addition, due to technological advancements, the quality of simulations could have easily improved compared to those of years past. Again, this issue along with the others mentioned presents a challenge when analyzing the effectiveness of computer simulation.

Despite the challenges and potential inconsistencies, a study conducted by Dekkers and Sonatti attempted to examine the effect of simulations on participants' cognitive development, retention, and attitude. They conducted a meta-analysis on 93 empirical research studies involving the effectiveness of simulations as an instructional method. Dekkers and Sonatti made no distinction between simulations and games, simply referring to them both as simulations, nor did they distinguish how the simulations were integrated into the curriculum.

They concluded that simulation instruction does not result in increased cognitive knowledge or superior retention. Their study found significant improvements in attitude development when simulation instruction was used compared to when a lecture instructional method was used. Dekkers and Sonatti also found that the older the student, the more likely a positive attitude change would occur when simulation instruction was used.

From a cognitive and retention standpoint, they found simulations should not be used for an extended period of time, as benefits decrease the longer the simulation is used as a teaching method. Wentworth and Lewis further supported this particular finding as they concluded simulations to be most effective as supplements to other teaching methods.

Grimes and Willey conducted an experiment to test the effectiveness of using a textbook simulation on undergraduate students enrolled in an introductory economics class. The experiment involved two classes of introductory economic students: one class was the control and the other the experimental group. Both classes were conducted exactly the same in terms of how they were taught, tested, and graded. The only difference was students in the experimental class were required to complete the economic simulation. The students paced their advancement through the simulation so they were covering the same topics in the simulation as they were learning about in class.

Students in both classes were given standardized pre- and post-tests. The tests checked specifically for recognition and understanding, explicit understanding as well as implicit understanding. They were also able to use a standardized test to determine whether the simulation had an impact on the students' attitudes regarding economics.

The change in the pre-test and post-test exam scores for both classes were compared and found to be statistically significant at the 0.01 and 0.05 levels for recognition and explicit

application, respectively. The results indicated the overall score for the experimental class increased nine percentage points more than the control class. The experimental class's recognition and understanding score improved 18 percent over the control class, and the explicit application was nine percent higher. There was virtually no difference in the implicit application scores between the two classes. The students using the simulation were found to have a significantly more positive attitude toward economics than the control class. In fact, the control class attitude regarding economics became more negative, while the experimental class attitude was positive.

Carlsen and Andre conducted a study where undergraduate students were given material to learn about electric circuits. Most of the students were novices regarding their familiarity with electric circuits. They concluded those who used simulations did not score higher on the post-test. However, students were then asked to build a circuit model. Those who had used the simulation built much more advanced models and received higher scores than did the students who did not learn with a simulation.

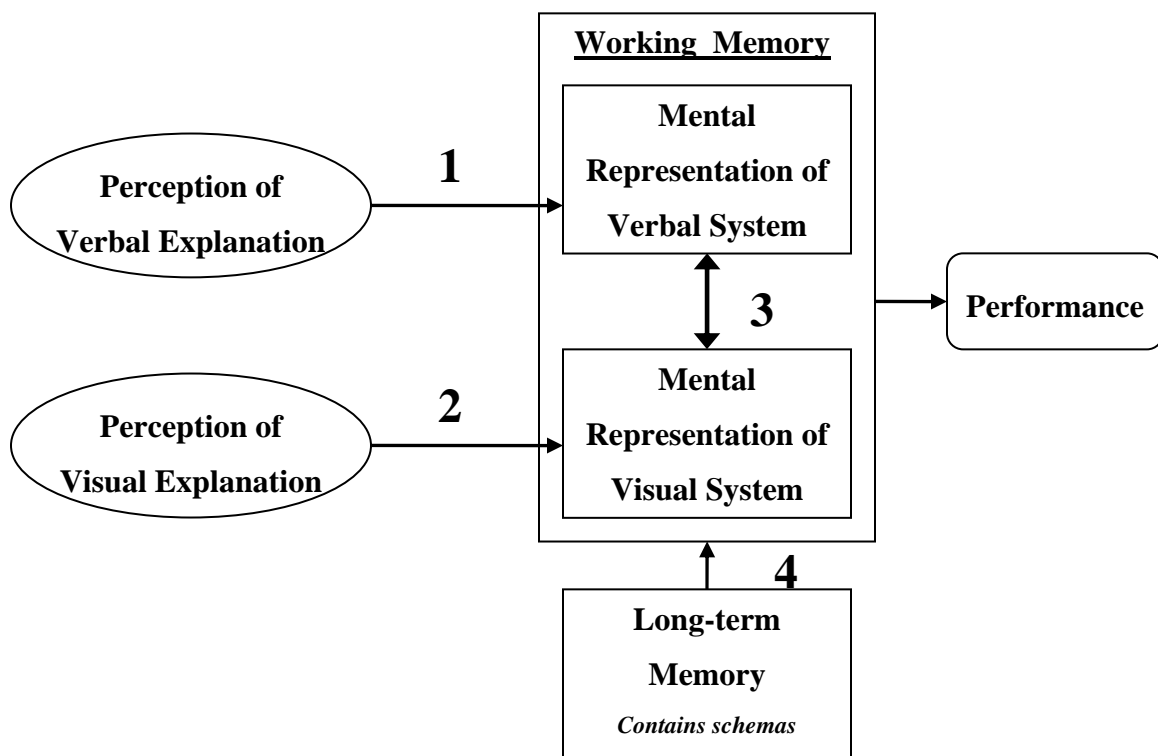
### ***2.6.5 Why Computer Simulations Work, In Theory...***

There is a portion of the education community that believes simulations can impact the user's learning ability greatly. They believe simulations are an effective instructional tool based on theories of how the human mind processes information. One such theory that has received a fair amount of attention is the dual coding theory. Rieber et al. cited Pavio (1990), the originator of Dual Coding Theory, as describing it as a method that provides a more effective learning experience when the connection is made between information that is encoded both verbally and visually. The dual coding theory divides the processing of information into two systems, visual and verbal. Dual coding theory assumes there are three different levels of processing that occur



via the visual and verbal systems (Figure 2.7). The first is representational connections. Representational connections are formed depending on whether the information is communicated visually or verbally (Mayer and Sims). If the information is communicated verbally, the information is encoded and will go into the “verbal memory store;” whereas, if the information is communicated visually the information is encoded and will go into the “visual memory store” represented by 1 and 2 in Figure 2.7 (Lohr and Gall, pp. 88).

**Figure 2.7 Dual Coding Model of Multimedia Learning**



Source: Mayer and Sims

The second level of processing is associative processing which allows connections to be made within the verbal memory store or visual memory store (Rieber, Tzeng, and Tribble). The

final level within dual coding is referential processing. Referential processing creates connections between the visual memory store and verbal memory store, represented by 3 in Figure 2.7 (Rieber, Tzeng, and Tribble). In other words, the visual and verbal memory stores can “activate” one another, or convert information from one store’s encoding to the other store’s encoding to help an individual understand and remember the information (Lohr and Gall). Number 4 in Figure 2.7 shows that the mind will incorporate any prior knowledge the individual may have into the processing of new information. When the long-term memory is able to assist the working memory in processing new information the workload on the working memory is reduced (Pass, Renkl, and Sweller). Consequently, the working memory can process more information. More information pertaining to how the long-term memory contributes to the cognitive process will be presented later in Chapter 2.

Mayer and Sims extend the dual-coding theory and applied it to multimedia learning (Figure 2.7). They state that if the associative processes occur for both the visual and verbal systems and the referential connection is made, an individual is more apt to be able to solve problems with the information. The dual-coding theory proposed by Paivio does not make this assumption.

It is the two processing systems that lead to the *dual* coding theory (Rieber, Tzeng, and Tribble). Therefore, according to this theory, the manner in which information is presented impacts the individual’s ability to learn. Clark and Pavio (pp. 173) state, “...lessons containing concrete information and evoking vivid images will be easier to comprehend and remember than lessons that are abstract and not image-arousing.”

Generally, information that is presented graphically and in an audio manner simultaneously has a higher likelihood of being retained and easier to recall. A study conducted

by Mayer and Sims support this hypothesis. In fact, Kobayashi goes as far as to imply that the dual coding theory predicts that if information is presented in both systems, it is twice as likely to be retrieved and used due to the information's dual association.

Rieber, Tzeng and Tribble conducted a study to find methods that would facilitate learning with computer simulations. The study was conducted with college students studying Newton's law. The study was built upon the theoretical framework of dual coding. They outlined the criteria to what they hypothesized would set the stage to an effective simulation experience for the user. They focused a great deal on the simulations interface design and how the simulation provided feedback to the user. It is the feedback that provides the simulation user with the information needed to learn (Bransford, Brown, and Cocking).

Students in the Rieber, Tzeng, and Tribble study were asked to complete the simulation pertaining to Newton's Law. Half of the students were provided graphical feedback, while the other half was supplied feedback in textual form. Upon completing a task, students were given an explanation as to why they got the results they did. Then, randomly, half of the students were given textual as well as animated explanations or helpful hints after an attempt at a task. The other half of the students received no explanations.

All participants were given a pre-test and a post-test. There were significant interactions found in the results. The difference in the pre-test and post-test results was greatest when students were provided with graphical feedback verses textual feedback. The authors concluded the students' implicit learning was enhanced more with the graphical feedback compared to those who received only text feedback. The difference in the scores was the greatest when students were supplied with explanations, compared to those who were not. The authors argued that this showed explicit understanding increased among those provided with explanations.

Additionally, students who were given both explanations and graphical feedback scored significantly higher than all other students. The authors viewed this as further evidence of dual coding theory at work. The explanations simultaneously presented with the graphical feedback appeared to have promoted representational, associative, and referential processing. Plus, those who received graphical feedback were significantly less frustrated than students who received feedback in a text manner.

Rieber, Tzeng, and Tribble concluded students with little previous knowledge of the content benefited from instruction of a ‘master-teacher’ when provided at opportune moments. It was found the instruction did not take away from the experimental nature. Additionally, a good instructor will encourage adequate time for reflection.

### ***2.6.6 Risks of Computer Simulations***

Cognitive load theory pertains to the limitations of the human memory capacity, and how, on an instructional basis, the working memory capacity can be expanded (Barron). Simply stated, a person’s working memory has limitations on how much it can effectively absorb at one time. A person that is trying to absorb material that is complex, hard to understand, and unorganized will absorb less than a person who is learning material that is simpler to understand and is presented in a more organized fashion. The reason is because the cognitive load is less for the simpler material than for the more complex material. If a person is exposed to more information than they can absorb, they will experience cognitive overload and learning will be strained or possibly become non-existent.

An element of cognitive theory pertains to the concept of interactivity. Some concepts can be learned independently of any other knowledge. Paas, Renkl and Sweller give the example of learning how to use various tasks within a photo editing program. This task involves low-

element interactivity, because a person can learn how to increase the brightness of a picture without knowing how to crop the photo. However, if a person is asked to professionally edit a picture they will need to consider the effect of the picture's colors, contrast, and brightness because all three concepts are interconnected. This type of a task is considered to have high-element interactivity, as a change in one element will impact the other concepts. Generally, the topics involving high-element interactivity will be harder to understand.

There are several categories of cognitive load. Here, focus will be placed on intrinsic, extraneous, and germane cognitive load. Barron cites Sweller and others for the explanation of intrinsic cognitive load theory. Intrinsic cognitive load pertains to the subject matter itself; difficulty and level of interactivity. If a topic is very complex and has a high level of interactivity, it has a high intrinsic cognitive load. The intrinsic cognitive load cannot be decreased by the instructor. However, the instructor can present the information in such a manner where it is easier for the learner to understand.

In order to absorb high-element interactivity, the brain uses both its working memory and long-term memory. The working memory is where "all conscious cognitive processing occurs" and is able to handle a very limited number of interacting elements (Paas, Renkl, and Sweller, pp. 2). However, when compared to the working memory, the long-term memory's abilities are vastly larger. The long-term memory stores memories of past experiences and knowledge. The experiences and knowledge are organized into schemas. Schemas are "cognitive constructs that incorporate multiple elements of information into a single element with a specific function" (Paas, Renkl, and Sweller, pp. 2).

Schemas can assist the working memory in processing new information. If a learner can tie new information to existing knowledge (a schema), then that information can be processed

more efficiently with the help of the schema. As a result, a portion of working memory is freed up, allowing the individual to process more new information.

The second category of cognitive load, extraneous cognitive load, pertains to the way in which the information is presented to the audience (e.g., modalities used, organizational approach, pace). Extraneous cognitive load are the distracting elements included in the presentation of new information. If the mind has to filter through irrelevant information or attempt to follow vague instructions, then cognitive resources are used and wasted, as opposed to helping the person process the new relevant information. Unlike intrinsic cognitive load, an instructor has more control over extraneous cognitive load.

The final category of cognitive load is germane cognitive load. Instead of extraneous cognitive load where the student is distracted from learning, germane cognitive load actually assists with learning. Germane cognitive load refers to the creation or retrieval and then application of new information to old schemas. Therefore, if the presentation of the new subject matter is formatted in such a manner where germane cognitive load is increased then potentially greater learning will occur.

Graf and Kinshuk state the dual coding theory inherently reduces the cognitive load. If the instructor implements presentation methods consistent with the dual-coding theory, the information will be presented using both visual and verbal means. Therefore, the information will be processed more efficiently and with greater ease. Consequently, the learner will be able to absorb and learn more information in one setting than had the material been presented employing solely audio means.

### ***2.6.7 Methods to Improve the Computer Simulation Learning Experience***

De Jong and van Joolingen conducted a study using a computer simulation that utilized scientific discovery learning. Scientific discovery learning is a learning method where generally students are responsible for their own learning and receive little to no instruction. Users go through the simulation and implement the scientific method (i.e., state the hypothesis, design experiment to test hypothesis, test hypothesis, etc.), inferring knowledge from the simulation. However, students experienced problems learning from such a method. De Jong and van Joolingen described “regulative learning processes”; methods that help create a more effective learning experience (De Jong and van Joolingen, pp. 189).

While these suggestions were developed from the concept of scientific discovery learning, the application of such methods would be applicable to a scenario of computer simulation with instruction as well. Due to the complexity of the content within a simulation, a user can easily feel overwhelmed, leading the participant to experience cognitive load, which was discussed earlier. When model progression is implemented, the simulation is presented to the participant gradually. The participant is exposed to the simulation concept, subject by subject, gradually building in complexity as the simulation advances.

De Jong and van Joolingen recommended planning support. Participants are encouraged to investigate concepts within the simulation, rather than simply focusing on completing the simulation. Examples to enact planning support would be to create ‘assignments’ that coincide with the simulation, or during the simulation ask participants concept questions.

Swaak, van Joolingen, and de Jong conducted a study to determine the effectiveness of implementing model progression and providing assignments to students learning from a simulation. They found that incorporating model progression into the simulation experience resulted in students increasing their implicit knowledge. Students who incorporated assignments

along with model progression into their simulation experience also increased their implicit knowledge as well as their definitional knowledge.

Another concept, monitoring support, has been shown to assist simulation participants in organizing what they have learned or done within the simulation. Monitoring support can be provided simply by supplying participants with a notebook to record their thoughts and actions. Lewis, Stern and Linn had students who were learning about thermodynamics keep a notebook. They found it helped students to organize their findings, thoughts, formulate hypotheses, and encouraged them to reflect on their conclusions.

Another form of monitoring support is for participants to ask the instructor, assuming they are competent enough in the matter relating to the simulation, for advice or direction regarding the simulation. This action in turn, would then start a dialog between the student and instructor, resulting in knowledge being transferred.

The final process suggested by De Jong and van Joolingen was to structure the discovery process. An example of a structure discovery process would be to walk through a portion of the simulation with the participant. Another example would be to ask probing questions, such as asking students to predict the possible outcome of their action within the simulation, forcing them to consider 'what if' possibilities.

De Jong and van Joolingen pointed out that studies have found benefits when participants are provided with information pertaining to the content they are working on within the simulation. This is especially true when the information is provided on the concept at the exact time the participant is working on it within the simulation. If all the information were presented to them at once, there would be a risk of cognitive overload.



## 2.7 Summary

Cow-calf producers face profit variability. Net returns to management from 1979 through 2007 for Kansas cow-calf producers have varied by almost \$300 per head on a yearly basis (Kansas Farm Management Association). A study conducted by Miller et al. concluded feed costs to be the major influencer of profit variability for cow-calf producers as it contributed more than 50 percent of the profit variability. Bruce, Torell, and Hussein found that costs associated with maintaining a cow, which includes feed costs, had the largest impact on profit variability.

Like the cow-calf sector, cattle feeding is known for its narrow margins and profit variability (Lawrence, Wang, and Loy). Iowa cattle feeders net returns, on a monthly basis, have varied at least \$550 per head from January 2001 through April 2008 (Lawrence 2001-2006, 2007C, 2007Y, 2008C, and 2008Y).

Studies conducted by Schroeder et al. (1993) and Lawrence, Wang, and Loy (1999) found fed cattle price to be the largest contributor to the profit variability of cattle feeders. Schroeder et al. concluded fed cattle price had the largest influence on profit variability for cattle placed on feed at 600-699 pounds as well as 700-799 pounds. Feeder cattle price, by a small amount, was the largest influence on profit variability for cattle placed on feed at 800-899 pounds. Lawrence, Wang and Loy determined fed cattle price to be the largest influencer of profit variability for all placement weights.

The results concluded by Schroeder et al. and Lawrence, Wang, and Loy support implementation of price risk management tools, especially with regard to the price risk associated with fed cattle price. However, studies conducted by APHIS (1998), Hall et al., and Schroeder et al. (1998) found only a very small portion of cattle producers actually use price risk management strategies. Potential reasons could be lack of knowledge, producers perceive price

risk management tools to be ineffective, or consider them too risky from the perspective of risk averse producers.

Kansas State University Extension developed a computer simulation to assist them in educating producers about price risk management tools. A computer simulation is considered to be an “evolving case study” that evolves in a manner similar to the real life situation (Gredler, pp. 573). The user of the simulation assumes the role in the simulation along with similar boundaries and constraints faced by a person in real life who holds a similar position. Computer simulations allow the user to be confronted with a real life situation, forces them to make a decision, and input their decision into the computer. The user can then observe the effects of their decision. Simulations also encourage users to be actively engaged in the learning process.

Some believe computer simulations are an effective instructional tool based on theories of how the human mind processes information. One such theory is the Dual Coding Theory. Rieber et al. cited Pavio (1990), the originator of Dual Coding Theory, as describing it as a method that provides a more effective learning experience when the connection is made between information that is encoded both verbally and visually. The dual coding theory divides the processing of information into two systems, visual and verbal. Dual coding theory assumes there are three different levels of processing that occur via the visual and verbal systems. The hypothesis is that information presented graphically and in an audio manner has a higher likelihood of being retained and easier to recall.

At the same time there are some concerns with using computer simulations, as they can contribute to cognitive overload. The cognitive overload theory pertains to the limitations of the human memory capacity, and how, on an instructional basis, the working memory capacity can be expanded (Barron). A person’s working memory has limitations on how much it can

effectively absorb at one time. If material is complex and presented in a poorly organized manner, the mind will be able to absorb less than had the material been simpler and/or better organized. De Jong and van Joolingen suggested several ways to create a more effective learning experience. These suggestions include presenting the information in a gradual manner, create assignments for the learner to motivate further investigation of concepts, using monitoring support, providing a structured environment that encourages discovery, and supplying supporting, relevant information.

## CHAPTER 3 - Basis and Seasonal Cattle Prices

### 3.1 Basis

Basis is the difference between the cash price at a specific location and a particular futures contract price for a specific commodity (Leuthold, Junkus, and Cordier). Basis is generally expressed as: ***Basis = Cash Price – Futures Price***. Basis is a fundamental element in understanding and using price risk management tools.

Being aware of the basis for a commodity at a particular location can assist a producer in determining the expected sale price at a specific point in the future. This relationship becomes clear when the equation is rearranged in the following manner: ***Cash Price = Basis + Futures Price***. While another method to calculate cash price will be explained later in this chapter, emphasis will be placed on using basis to calculate an expected cash price.

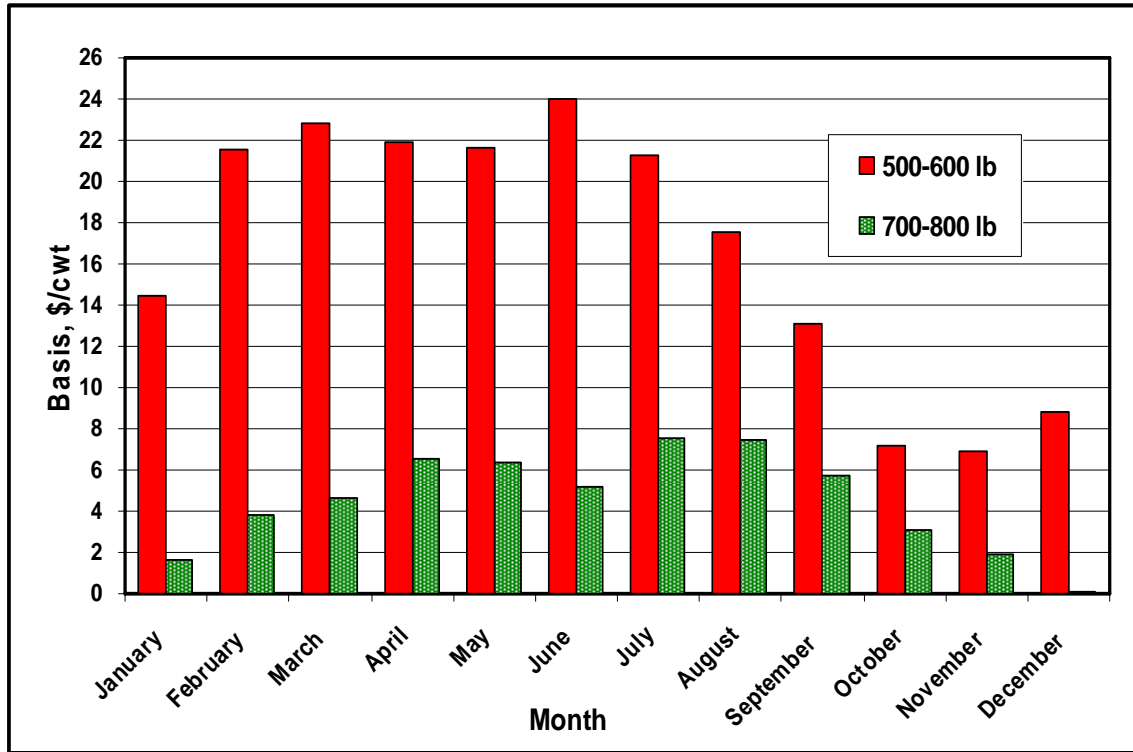
Basis is a key component producers use when calculating their expected sale price and when evaluating various price risk management tools. The basis level and changes in the basis level can be indicative of changes in local product supply or demand, providing producers with potential insight to local market fundamentals (Purcell and Koontz). It is critical producers comprehend basis, how it can be used to forecast cash price, and the determinants that influence basis, because some hedging techniques (e.g., short futures hedging) do not protect against adverse changes in basis. An adverse basis move will result in a producer receiving an actual cash price that is lower than what was expected.

As one evaluates the basis equation above, it should be kept in mind that the futures contract price of a commodity is today's prediction of that commodity's value for a certain point

in the future. At the expiration of a futures contract, the futures price and the cash price at the delivery point will almost be equal, resulting in a basis close to zero. The small difference is attributed to the cost of delivery (Mark 2004). Because CME feeder cattle contracts are cash settled, the feeder cattle futures price will be equal to the CME Feeder Cattle Index at expiration (CME Group). The CME Feeder Cattle Index is a 7-day moving average of cash prices from cattle auctions (including sale barns, direct trades, video, and internet sales) from a 12 state region (Petty). The CME Feeder Cattle Index is calculated using transaction data from steers weighing 650 to 849 pound, Medium and Large Frame #1-2 (CME Rulebook).

A majority of people interested in cattle basis will purchase or sell the physical livestock at a cash location other than a delivery point, and at a time other than the expiration of the futures contract (Tonsor, Dhuyvetter, and Mintert). Therefore, it is quite likely that the futures price will not equal the local cash price. Likewise, people with feeder cattle will not sell them at a price equivalent to the CME Feeder Cattle Index. The difference is representative of the local supply and demand situation relative to the aggregate supply and demand circumstances of the futures market as represented by the futures contract price (Mintert et al.). The basis could be affected by the geographical location of the local market, differences in transportation costs, as well as location relative to key feeding and processing locations. Also, the basis amount could be the result of differences in cattle characteristics such as sex, weight, breed and the quality of the cattle. Figure 3.1 shows the 2004-2006 average basis for steer calves (500-600 pounds) and feeder steers (700-800 pounds) by month for auctions in Iowa. It can be seen that basis clearly depends on both weight and season.

**Figure 3.1 Monthly Basis Averages for Iowa Steers, 2004-2006**



Basis can be negative or positive. If the basis of a commodity is negative, that indicates the futures price is greater than the cash price, and vice versa if the basis is positive. The basis for a particular commodity will vary throughout the year, but will typically move with cash price. Like prices, basis is considered to be seasonal.

A common practice of forecasting basis is to determine when the cattle will be sold and then average that week's basis from previous years. Tonsor, Dhuyvetter and Mintert concluded for feeder cattle it is optimal to use a historical three-year average, and a four-year historical average for live cattle. In addition, they found that a historical average basis forecast could be improved upon by including current basis information. Specifically, when forecasting basis for feeder cattle four to twelve weeks prior to expiration, they found significant improvements in their results when they incorporated current basis information into their calculations. Likewise

when calculating a historical average basis forecast for live cattle, they found that including current basis information was beneficial, particularly when forecasting basis four and eight weeks prior to expiration. Incorporating current basis information into the basis forecast any further in the future than noted above resulted in no statistical advantage, compared to a forecast based on historical information alone (Tonsor, Dhuyvetter and Mintert).

Bailey, Gray and Rawls examined feeder cattle basis and the influence that different market conditions have on the basis level. They analyzed the basis for two different weight groups of steers, 500-600 pounds and 700-800 pounds at four different locations, Oklahoma City, Oklahoma; Billings, Montana; Alabama; and a composite price for the states of Washington, Oregon, and Idaho. The data were collected from January 1, 1990 through October 7, 2000.

In their model, they assumed several specific variables impact local basis. They evaluated the local three-year basis history, recent profitability of cattle feeding, local basis trend, the position of the cattle cycle, the basis from the previous week, the changes in specifications to the Chicago Board of Trade feeder cattle contract, and finally seasonality.

Their models explained a greater amount of basis variability for the 500-600 pounds steers (84.3 to 92.8 percent) than the 700-800 pound steers (13.3 to 47.4 percent) across the locations. The profitability of cattle feeding, seasonality, and the basis from the previous week significantly impacted basis for the 500-600 pound steers. Changes in the Chicago Board of Trade feeder cattle contract, seasonality, and the basis from the previous week significantly impacted the basis for 700-800 pound steers. Bailey, Gray and Rawls also concluded the variability of basis was less than the variability of the corresponding cash price. Comparatively,

the variability for 700-800 pound steer basis was less than the variability for the 500-600 pound steers (Bailey, Gray and Rawls).

Parcel, Schroeder, and Dhuyvetter created a model to identify and quantify factors that affect live cattle basis. Monthly data from the states of Colorado, Kansas, and Texas were used from January 1990 to July 1997. Variables assumed to impact live cattle basis were the previous month's basis, average weight of marketed cattle, quantity of live cattle marketed via forward contract, nearby corn futures price, Choice-to-Select price spread, the ratio of cattle on feed at a specific location to the seven state cattle on feed, cold storage stocks, as well as a binary variable pertaining to the 1995 change in the specifications for the live cattle contract and seasonality dummy variables.

The model used by Parcel, Schroeder, and Dhuyvetter explained approximately 85 percent of the variation in the live cattle basis for each state. As expected, they found that the nearby corn futures price was significantly negatively correlated to the live cattle basis. They concluded a \$1 per bushel increase would cause live cattle basis to decrease \$0.75, \$0.82, and \$0.90 for Colorado, Kansas, and Texas, respectively. Parcel, Schroeder, and Dhuyvetter also found live cattle basis to be significantly positively related to the Choice-to-Select spread. The previous month's basis was found to be significant in impacting Colorado's live cattle basis. The cattle on feed ratio significantly impacted the live cattle basis in Kansas.

Many consider basis to be seasonal. Parcel, Schroeder, and Dhuyvetter evaluated whether or not incorporating seasonal variables into the model was statistically important in determining the basis. They found that market fundamental variables added more information than what seasonal dummy variables solely provided. They determined there was significant value to incorporating market fundamental information into the model with explicit variables.



The math and concept of basis is straight forward, but understanding the variability of basis is a bit more challenging. Understanding basis and being able to accurately forecast basis is essential to calculating an accurate expected cash price. There are other methods to forecast prices, which will be discussed in the following section.

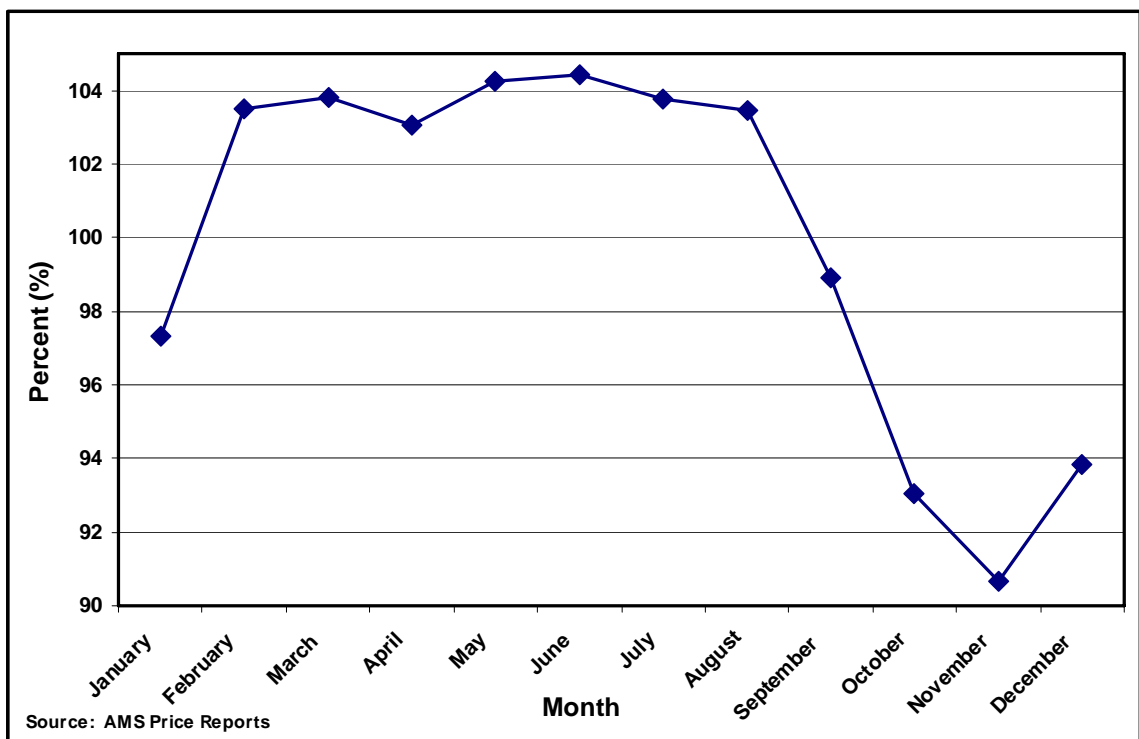
### **3.2 Seasonal Prices**

To effectively manage price risk producers need to have an understanding of the cattle market, including factors that drive the market and the impact external factors can have on cattle prices. Factors such as the time of year, location, and supply in the market have a fairly consistent and reoccurring impact on the market. Producers can use this information to assist them in making production decisions as well as assisting them in forecasting prices. Cattle producers use several methods to forecast cattle prices. As discussed in the previous section, producers can look to the futures markets and adjust for their local basis expectation. Additionally, producers might consider local cash forward prices and/or incorporate seasonal price indices for forecasting prices.

Within a given year, it is normal for cattle prices to fluctuate. Generally, these cattle price fluctuations take place during the same time each year, resulting in seasonal price patterns. Being aware of seasonal price trends can assist producers in anticipating price changes, thereby allowing them to adjust production or formulate a marketing plan to account for the seasonal changes in prices. However, even though producers may be aware of such price changes they do not always alter production to capitalize on the seasonally high prices. Some producers may experience constraints which prohibit them from adjusting their production to capitalize on seasonally high prices. For example, cull cows experience low prices during the fall due to the large supply of culls entering the market and then prices increase seasonally through the winter

and summer months (Figure 3.2). Thus, a producer could retain ownership of the cows in the fall and sell them later in the year to capture a higher price; however, the cattle producer may not have the facilities or feed resources to implement such management changes. The producer may see the potential marginal costs, of implementing such changes, as outweighing the potential marginal gains.

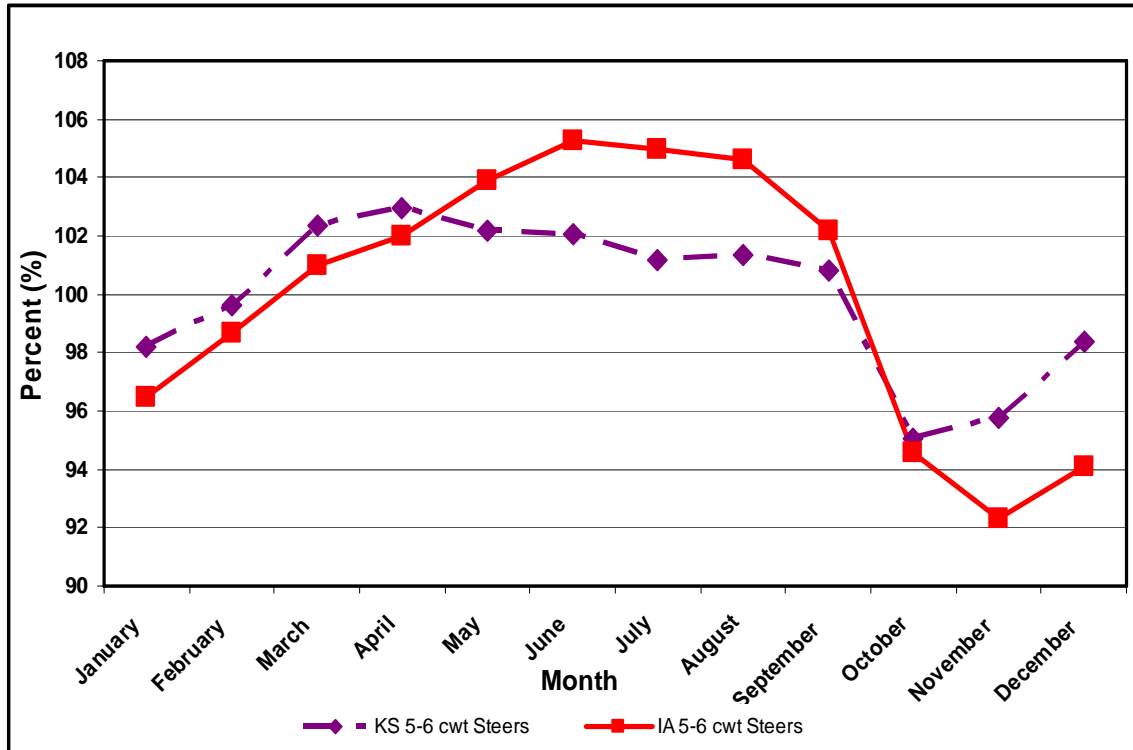
**Figure 3.2 Seasonal Price Index of Kansas Cull Cows, 1990-2004**



There are several causes behind seasonal cattle prices. Cattle production is motivated by climatic and biological factors. Calving and weaning generally coincide with weather and resource availability. Hence, a majority of calves are born in the early spring and weaned in the fall. The calf, along side the cow, grows on summer pasture and as grasses go dormant in the fall, the calves are sold. As a result, the price for weaned calves decreases seasonally in the fall

due to the larger supply on the market (Peel and Meyer). Figure 3.3 shows the seasonal price indices for 500-600 pound steers calves in Iowa and Kansas from 1997-2005. It can be seen that seasonal indices can vary across geographical areas.

**Figure 3.3 Seasonal Price Index 500-600 Pound Steers, Calf Crops 1997-2005**



In addition to varying geographically, seasonal prices differ with the classification and weight of the cattle. Seasonal price patterns are subject to change due to alterations in production technology, the industrial structure, and/or changes in demand, among other factors (Lawrence, 1998). For example, the seasonal prices for a specific area can be altered by the closing of a major nearby packing plant or the unexpected closing of export markets.

Before a seasonal cattle price pattern can be determined, a price index must be created. Typically, the average price for each week or month is calculated and its percentage of the

average price for the year (or other timeframe being referenced) is calculated. As a result, an index is created for each week or month, relative to the average price for the entire year. The average prices are calculated from historical prices and should cover at least the span of an entire cattle cycle (Peel and Meyer). When several years of data are used it allows for a more accurate representation of the variability of seasonal prices. If a producer were to use just one year of data to determine the seasonality of prices, there is a possibility that year could have been atypical due to unique market conditions. Consequently, it likely would not be representative of the following year's conditions or prices.

Typically, price indices are calculated January through December. However, another possible calculation method would be to calculate seasonal price indices, especially for feeder calves, from October through September. If seasonal price indices were calculated using such method it would be similar to how grain price indices are typically calculated; using a crop year. If cattle price indices were calculated beginning with the month of October it would be assumed the calf crop harvest began in October. This assumption is based on the fact that 70 percent of herds in the United States calve in the spring and a strong portion of those herds market their calves in the fall (Peel and Ward). Using the calf crop method accounts for the fact that some producers retain their calves into January for tax reasons and the ability to add weight by capitalizing on compensatory weight gain.

Calculating the cattle price index from October to September will be referred for the purpose of this thesis as the *calf crop method*, while calculating the cattle price index from January to December will be referred to as the *calendar method*. Figure 3.4 shows the seasonal price patterns for the two calculation methods. Figure 3.5 shows the difference in the seasonal index value between the two methods as shown in Figure 3.4. The difference between the two

calculation methods is minimal, at most for a majority of the year, except during the fall when a large number of producers market their calves. The difference between these two values is the result of trending data over the time period analyzed. The implication of the difference in the calculation methods will be discussed later in the chapter.

**Figure 3.4 Differences in Seasonal Price Index Calculation IA 5-6 cwt Steers 1997-2006**

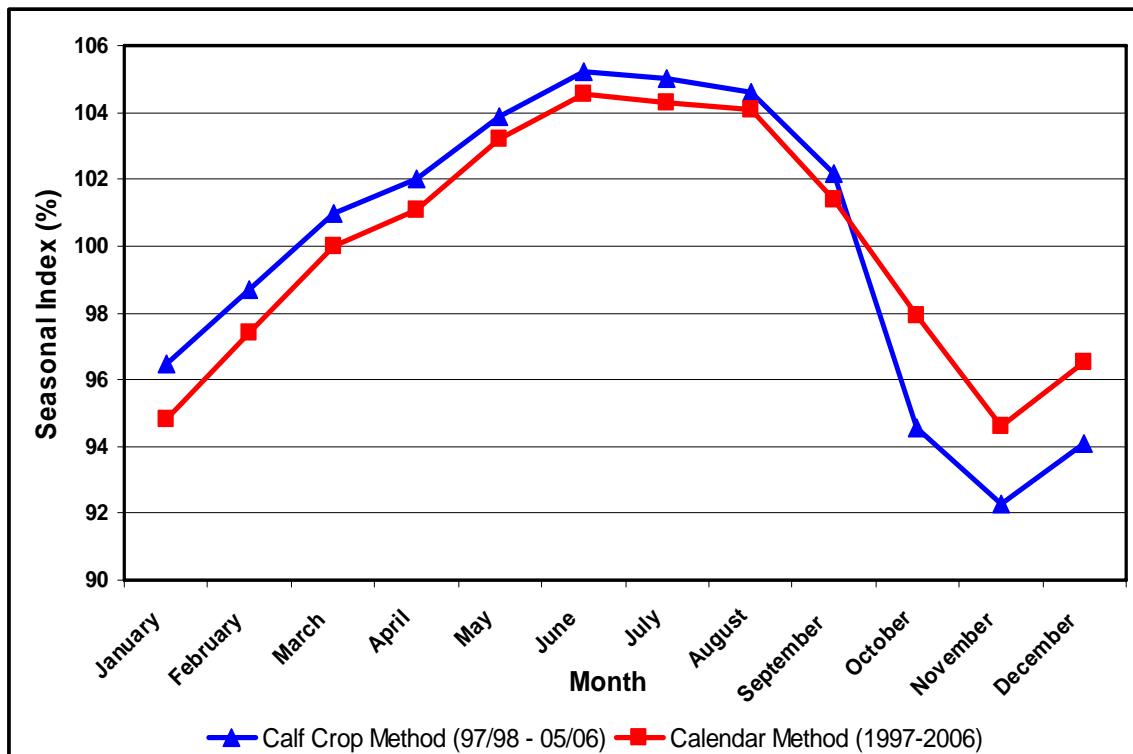
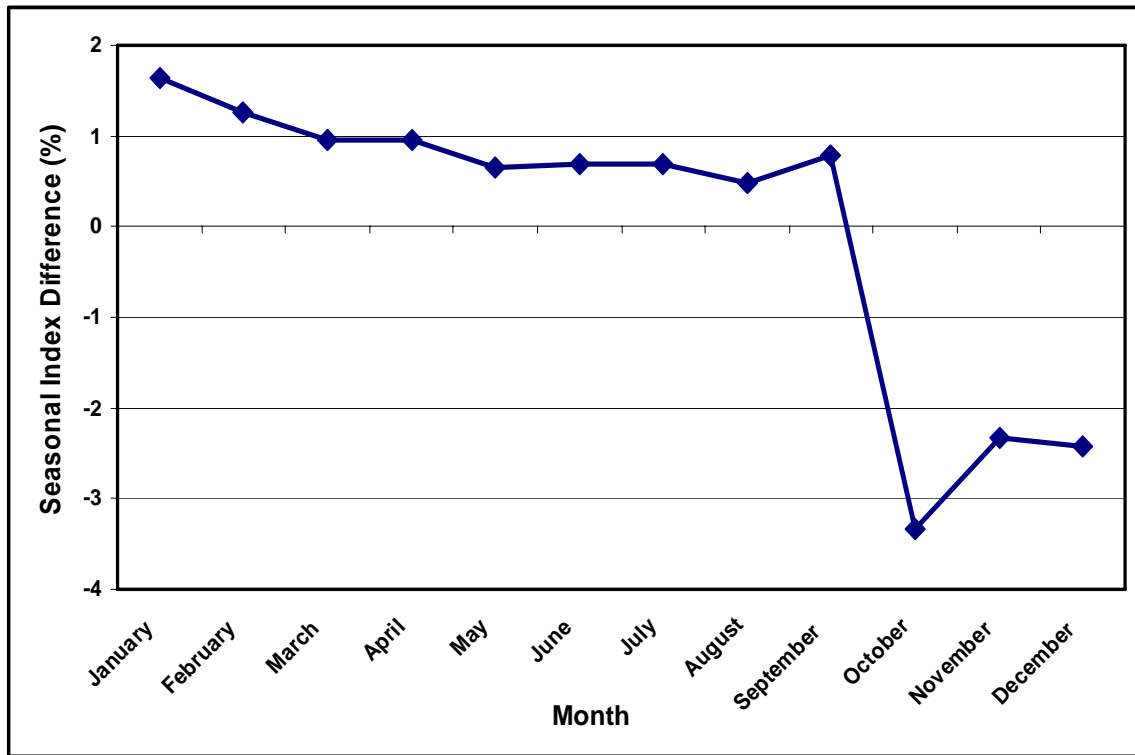


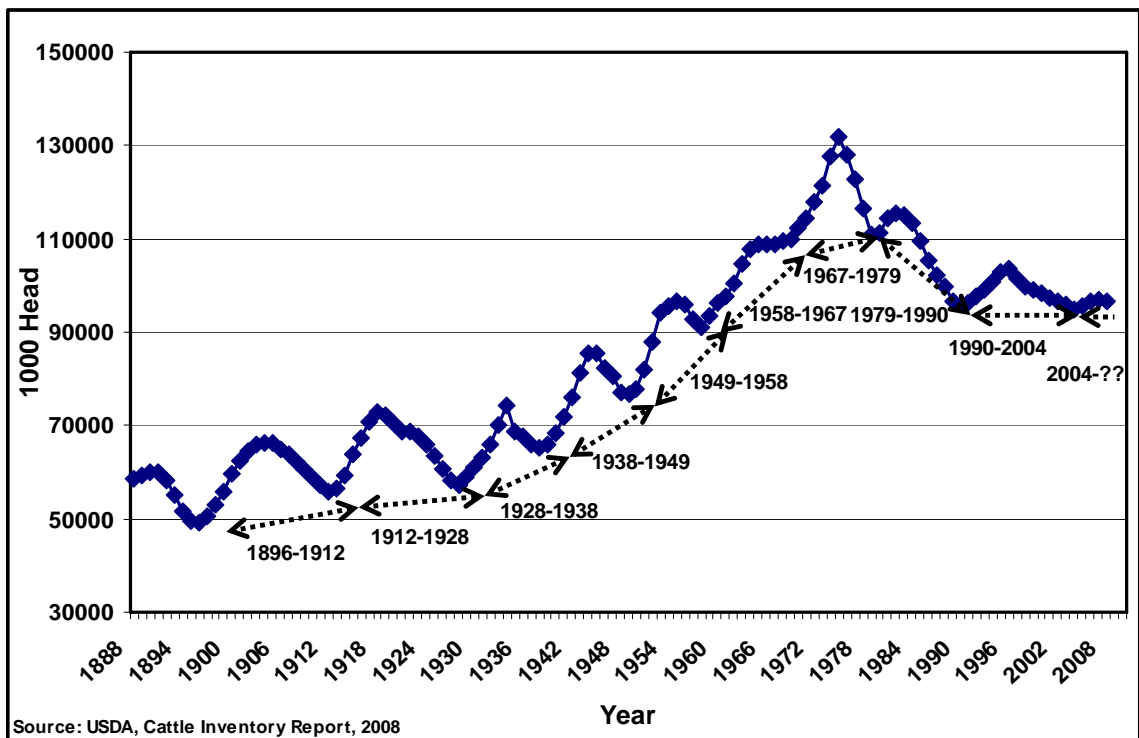
Figure 3.5 Difference in Seasonal Price Index Calculations IA 5-6 cwt Steers 1997-2006



When studying seasonal prices another concept that should be considered are cattle cycles, which are a reoccurring aspect of the cattle industry. Cattle cycle is simply a term used to describe the systematic inventory fluctuations across years. A cattle cycle is composed of a period of time with years of growing numbers followed by years of liquidation. These fluctuations in inventory are driven by the profitability of the industry. During years when profits are being made (perhaps because of sales prices being above the long run equilibrium price), producers will expand their cattle herds to capitalize on the opportunity to increase their profits. Additionally, presence of profits in the cattle market will also attract new cattle producers into the market. The increase in production will eventually shift the supply to a point where the cattle price received by producers is no longer profitable. As a result, producers will decrease their herd sizes to reduce their losses and some producers will exit the market due to the

lack of profitability in the cattle market. The decrease in the size of the United States' cow herd will continue until the smaller supply drives prices higher again to the point where the cattle industry is once again profitable. As soon as profitability is restored, the cycle will begin once again. Due to the climatic, biological and other resource influences the cattle cycle takes a number of years to complete. As shown in Figure 3.6 the length of a cattle cycle varies. As of 2008, the industry appears to be in its tenth cattle cycle since 1896 (Figure 3.6).

**Figure 3.6 U.S. Cattle Cycles Since 1896**



### 3.2.1 Using Seasonal Price Information to Forecast Cash Price

Producers can use their knowledge of seasonal cattle price patterns to anticipate changes in price and even forecast prices. To forecast price a producer must multiply the current month price by the desired sale month's index percentage, then divide the product by the current month index percentage (Iowa Beef Center). It can also be shown as:

$$(3.1) \text{ Forecast}_j = (\text{Price}_k * \text{Index}_j) / \text{Index}_k$$

where  $\text{Forecast}_j$  is the cash price being forecasted for month  $j$ ;  $\text{Price}_k$  is the current cash price for month  $k$ ;  $\text{Index}_j$  is the index month percentage for month  $j$ ;  $\text{Index}_k$  is the current month index percent;  $j$  is assumed to be the selected sale month cattle will be sold; and  $k$  is assumed to be the present month. For example, assume a producer in July uses the seasonal price index, among other methods, to forecast the price of his calves in October. Table 3.1 shows the calculated prices for October using both the calf crop and calendar methods using equation 3.1.

**Table 3.1 Comparison of Price Forecasts Using the Calf Crop Method and Calendar Method**

	Calf Crop Method	Calendar Method
July month Price:	\$106.00	\$106.00
October month index %:	94.57	97.90
July month index %:	104.99	104.30
Forecast Price for October:	\$95.48	\$99.50

### 3.3 Evaluating Other Price Forecasting Methods

There are other methods of forecasting price. Kastens, Jones, and Schroeder analyzed various price forecasting methods including naïve and futures-based methods. They concluded the method of adding historical basis to the deferred futures was the most accurate price forecasting method across livestock and grains, except for lightweight cattle (400-500 pounds). The authors concluded, in the dataset they used with prices from 1987-1996, using a regression price forecast may ultimately be more accurate for the lightweight calves. However, the prices of other cattle classifications, including 700-800 pound cattle, slaughter steers, and cutter cows were more accurately predicted by simply adding historical basis to the deferred futures.



## **CHAPTER 4 - Price Risk Management Tools**

There are various price risk management tools available to cattle producers. These tools can be used to create innumerable price risk management strategies. The objective of implementing price risk management strategies is not to enhance profits, but rather to minimize losses or reduce the risk of an undesirable outcome (Lawrence, 2000a). Financial lenders view this favorably as producers who use price risk management strategies are able to realize a more predictable return compared to producers who do not use price risk management tools (Lawrence, 2000a). Consequently, producers who hedge are seen as a more favorable credit risk and generally have more credit available. This added credit allows them to expand their operation at a more consistent rate than had they not used price risk management tools.

The price risk management tools that are discussed here are those used in the Iowa Cattle Risk Management Workshop: cash forward contracting, futures hedging, put and call options, Livestock Risk Protection Insurance (LRP), and Livestock Gross Margin Insurance (LGM). The purpose, as well as the advantages and disadvantages of each tool will be discussed in this chapter. Additionally, the concept of basis will be integrated into the discussion of each management tool. Finally, the method used to evaluate the (minimum) expected sale price and actual sale price resulting from the implementation of the given tools will be provided.

### **4.1 Forward Contracting**

The first tool, forward contracting, is a cash contract that allows purchasers to create contracts with sellers that state they will purchase and take physical delivery of a certain quantity of cattle (on a number of head or pounds) at a specific point in time for a specified price. It

depends on the individual contract, but usually the specified price is independent of the cattle market price when they are delivered at the expiration of the contract. In fact, the specifications of the contract are made strictly between the buyer and seller and will expire upon fulfilling the contract with delivery.

There are advantages and disadvantages to forward contracts from the purchasers' perspective, including having the purchase price locked in, which from a budgeting or risk management perspective can be viewed as being beneficial. This is especially true if the market price for comparable cattle increases by the time the transaction is completed. This assumption presumes the purchaser would have had to buy cattle in the market had they not forward contracted cattle. The agreed upon price in the contract will not vary despite what occurs in the spot market. So, there is risk to the purchaser that the market price will be lower when the contract is executed.

There are also pros and cons to forward contracting from the seller's perspective. For the seller, just as for the purchaser, locking in the price from a budgeting standpoint is generally beneficial. Fixing the price may allow a producer to secure financing for an investment or operating note because they are able to show the lender they have managed price risk. If the market price decreases, the seller will benefit because the contracted price has been locked in at a higher level relative to the spot market price they would have received without forward contracting. The disadvantage is that the spot market price could increase and the contracted seller would be excluded from realizing the higher price.

Another item to point out regarding forward contracting is the issue of contract size. There are no regulations or specs the contract has to meet other than what the buyer and seller agree to between themselves. Generally, the contract size is equal to truck load lot size, in a

relative sense, so that the buyer will not need to contend with the inefficiency of handling partial loads of cattle.

Forward contracts are generally straightforward. The conditions of the forward contract can be simple or complex, but the buyer and seller must agree to the specified terms. There are multiple forms of forward contracts. A forward contract can simply be between two parties, or involve a third party intermediary. An example of a third party being involved in a forward contract is Superior Livestock Auction. Superior is the largest livestock auction in the United States. Superior is known for conducting consignment auctions via nationwide satellite and internet broadcast. In addition to providing the marketing network, they act as a broker in the transaction of money between buyer and seller. Upon delivery of the cattle the seller is issued a check on Superior's bonded custodial account. The buyer then issues a check to Superior to complete the transaction (Superior). All other terms, conditions, and guarantees are strictly between the buyer and seller as Superior does not act as a representative for either party.

Forward contracting locks in a flat price for the cattle; both price and basis are established and there is no upside or downward price potential. A risk that must be considered is the possibility of either party defaulting on their obligations, by not paying or supplying cattle that do not meet the contract's previously agreed upon specifications. However, there are ways to reduce such risks. A third party can reduce the likelihood of default, and there can be penalties in the contract that discount cattle which deviate from contract specifications. This is especially common regarding weight deviations. A common method of accounting for weight deviation is the inclusion of a price slide in the forward contract.

### ***4.1.1 Price-Weight Slides***

Price slides are included to account for differences in the expected and actual pay weights, allowing the price (\$/cwt) to vary inversely with weight according to an amount determined in the contract. Pay weight is the actual weight of the cattle when they arrive less a predetermined shrink. There are three variations of a price-weight slide: up, down or two-way (Machen and Gill).

An up slide is used when cattle arrive heavier than initially agreed upon. The up slide decreases the amount a purchaser pays per hundredweight. The heavier the cattle are than initially agreed upon, the more impact the slide will have on the price paid. If the cattle arrive lighter than expected, there is no adjustment made with an up slide. A down slide operates just the opposite. A down slide is used when the cattle's pay weight at arrival is lighter than contracted. The slide allows the price to increase accordingly. The final slide variation, the two-way slide, implements both the up and down slides. The one-way up slide is the most commonly used (Brorsen et al.).

## **4.2 Hedging**

Price risk exposure can be managed through the use of futures contracts. A futures hedge involves taking a position in the futures market as a temporary substitute for an intended action that will occur in the cash market at a later date. Most commonly, producers will place a hedge in the futures market in a quantity that is equal to their intended cash market sale. It is best if producers sell a futures contract for the month in which they plan to complete their cash transaction (Lawrence, 2006). If a futures contract does not exist for the month of the intended cash transaction, it is best to sell in the next successive futures contract. Hedging allows a producer to lock in a price level, in essence creating both a floor price and a price ceiling, but

still be subject to basis risk. By implementing a short (sell) futures hedge, a price decrease in the cash market will be offset by an increase in the value of the futures market position, and vice versa (Lawrence, 2006). Once the producer completes the intended transaction in the cash market, the futures position is offset by buying the contract(s) back.

There are two types of hedges producers commonly use. The first is a short hedge where a seller uses the futures market as a temporary substitute for an intended cash market sale. A long hedge is utilized by a producer who plans to purchase a commodity in the future, but would like to lock in today's price (Lawrence, 2006). Primary focus will be placed on the short hedge as the emphasis for this thesis is placed on output price risk management.

Producers may place a short hedge on their spring calves that will be weaned and sold in the fall by selling the October feeder cattle futures sometime prior to when the calves are weaned (e.g., July). When producers sell their calves in October at weaning, they will offset this position in the futures market. If the cash price is higher than the futures price on the day the hedge is offset, the producer will benefit from a stronger basis if it is higher than originally forecasted.

#### ***4.2.1 Advantages and Disadvantages of Hedging***

There are several advantages to employing a futures hedge. First, once a hedge has been put in place, the producer has eliminated futures price risk and is subject only to basis risk. This can be seen as a positive attribute because the volatility of basis risk is generally much less than the volatility of the cash and futures market price level. Hedging in the futures market essentially transfers risk from a producer to another individual (Leuthold, Junkus, and Cordier). Producers lock in their price, providing protection from price fluctuations.

However, hedging is not without its drawbacks. Producers who use futures hedging are subject to margin calls (i.e., payments provided to the trader opposite of the futures position to

fund their gain and the producers' loss) if the market moves in a manner adverse to their futures position (Mark, 2004). This characteristic of hedging can be troublesome to producers and financial lenders, especially if they do not understand how hedging works. The possibility of margin calls associated with a hedge can make planning a cash flow budget challenging.

Another potential drawback of hedging can be the fact that because the producers have locked in their price on the board, they cannot take part in any price rallies. There is also the issue of basis risk. If basis is weaker than expected, the producer would receive less than their expected selling price. However, if the basis is stronger than expected, the producer would receive more than their expected selling price.

One final issue a producer must consider prior to hedging their cattle is that of the fixed quantity size of futures contracts. For example, a CME Feeder Cattle contract is 50,000 pounds, while a CME live cattle contract is 40,000 pounds. If producers do not own the pounds equivalent to these respective contracts or do not wish to hedge that much production (roughly 66 head of 750 lb. feeder cattle or 29 head of 1350 lb. fed cattle), they will essentially be over-hedged and as a result will have a partial speculative position within the market. As a result, instead of the hedge reducing price risk, as originally intended, the hedge could actually increase price risk depending on the magnitude of the over-hedge position.

#### ***4.2.2 Calculating the Expected and Actual Selling Price***

It is important for a producer to be aware of how to effectively evaluate a potential hedge. First the producer should determine the expected selling price associated with a given hedge. The expected selling price is calculated in the following manner:

$$\begin{aligned}
 & \text{Futures price } (\$/\text{cwt}) \text{ at the time the futures contract is sold} \\
 (1) \quad & + \text{Expected basis } (\$/\text{cwt}) \\
 & - \text{Total brokerage commission } (\$/\text{cwt}) \\
 & \textbf{Expected selling price } (\$/\text{cwt})
 \end{aligned}$$

Before the actual sale price can be calculated, the producer must determine the net gain or loss on the futures transaction in the following manner:

$$\begin{aligned}
 & \text{Price of the futures contract } (\$/\text{cwt}) \text{ when sold} \\
 (2) \quad & - \text{Price the futures contract } (\$/\text{cwt}) \text{ at offset} \\
 & \textbf{Net gain on futures transaction } (\$/\text{cwt})
 \end{aligned}$$

Upon the conclusion of the hedge, the producer will evaluate the hedge by calculating the actual sale price by using one of the two following methods:

$$\begin{aligned}
 & \text{Price received in the cash market } (\$/\text{cwt}) \\
 (3) \quad & + \text{Net gain or loss on futures transaction } (\$/\text{cwt}) \\
 & - \text{Brokerage commission paid } (\$/\text{cwt}) \\
 & \textbf{Actual sale price } (\$/\text{cwt})
 \end{aligned}$$

Alternatively, actual sale price can be calculated in the following manner:

$$\begin{aligned}
 & \text{Expected selling price } (\$/\text{cwt}) \\
 (4) \quad & + \text{Change in basis } (\$/\text{cwt}) \text{ (the difference between forecasted and actual basis)} \\
 & \textbf{Actual sale price } (\$/\text{cwt})
 \end{aligned}$$

Based on (4) it can be seen that the expected sale price and the actual sale price differ only by the difference between the expected and actual basis. Hence, this is why accurately predicting basis is so crucial.

## **4.3 Options**

Options are another risk management tool commonly used by cattle producers to reduce price variability. There are two types of options, puts and calls. Both put and call options will be discussed below; however, for the given purpose of output price risk management, emphasis will be placed on the put option.

### ***4.3.1 Put Option***

A purchaser of a put option earns the right, but not the obligation, to sell the underlying futures contract for the specified price (strike price) at any point during the life of the option (Borchart et al.). A put can be used to protect producers from a decrease in price level by establishing a minimum expected selling price (or floor price). The producer pays a premium, similar to an insurance policy, to acquire a put option. Similar to hedging with futures, producers are still open to basis risk when using put options.

Buying a put option mirrors the scenario of an individual purchasing a fire insurance policy. An individual may purchase a fire insurance policy every year, but never have a fire and therefore never file a claim. The price the individual pays for the insurance protection, the premium, is the amount they are willing to pay for someone else to assume their risk of having a fire. Granted, the individual may never have a fire, but if they did have a fire and file a claim, the insurance would limit their financial losses.

The option premium a producer pays is influenced by several factors and can be decomposed into two main components: intrinsic value and time value. Intrinsic value is the value of the option if it were to expire immediately. The time value of the put option is the amount the premium exceeds the option's intrinsic value. In the case of a put option, the higher the strike price is compared to the futures price, the greater the intrinsic value. The farther away



a put option is from expiring, the greater its time value because there is a greater chance the option will gain intrinsic value over the course of time (Mark, 2004).

An option is classified as ‘out-of-the-money’, ‘in-the-money’, or ‘at-the-money’ depending on its intrinsic value. If the strike price of a put option is below the futures market price, the option is considered to be ‘out-of-the-money.’ Such put options have no intrinsic value, only time value. ‘In-the-money’ put options have strike prices above the underlying futures price, and consequently have intrinsic value and will have time value remaining as well, until the put expires. Finally, ‘at-the-money’ put options have a strike price that is relatively close to the underlying futures market price. The highest premiums will be associated with ‘in-the-money’ puts. Premiums for ‘at-the-money’ puts will be less expensive than ‘in-the-money’ puts, but will be greater than the premiums for ‘out-of-the-money’ puts. A put option that is the farthest away from expiring has the greatest time value.

If the futures price drops below the strike price of the put option, the producer has two choices. The producer can choose to exercise the put, which results in a short futures position being established in the futures market valued at the option’s strike price. Should the producer, who is now short in the futures market at the strike price of the option, find that the futures market price is above the established short position’s price, the producer would realize a loss on the trade and potentially be subject to paying margin calls. Thus, it is obvious a producer would not exercise a put option that has a strike price lower than the current futures market price. If the futures market price is lower than the put’s strike price, however, a producer may elect to exercise the option. Receiving the futures contract established at the strike price higher than the current futures market price can be a realized gain for the hedger. The producer will receive the difference between the strike price and futures price level when the option was exercised. This

net gain can then be added to the cash price received for the cattle, which is the actual sale price before it is adjusted for basis and before the premium cost and commission are deducted.

Exercising an option will include paying another commission fee to offset the futures contract.

Instead of exercising the option, the producer could offset the put option by selling it back. Originally, as the purchaser of the put, the hedger had the right to sell the underlying futures contract. By selling the option back, the hedger no longer has that right. In cases when the market price declined to a level below the put's strike price, the premium on the put option would have increased. Thus, this 'in-the-money' put could be sold back in the option's market and collect a premium. If the market price dropped sufficiently during the time the put was held, the put would be sold back for more than it was purchased. Offsetting an option will capture its intrinsic value, similar to exercising the option. This strategy also allows the producer to capture any remaining time value built into the option's premium. Exercising an option does not allow the option owner to recoup any remaining time value.

A third outcome also exists in the case when the put option has no intrinsic value or time value. This would occur when the futures market is higher than the put's strike price and is near expiration. In this case, the producer would simply allow the option to expire. This is similar to purchasing fire insurance for protection and not having a fire. The producer loses the premium paid for the put option, but gains from a higher price in the cash market.

#### ***4.3.2 Advantages and Disadvantages of Put Options***

There are a number of features that make put options an attractive price risk management tool for producers. Unlike futures hedging, there are no margin calls associated with purchasing options. This is a favorable attribute from the perspective of planning cash flow. The only money that will go toward owning a put option is commission and the premium, which can be

easily projected. In some respects, any margin call that would result from a loss of the option's value is implicitly built into the premium cost because the premium cost covers the maximum loss that could occur.

If the futures market price decreases to the point where the producer chooses to exercise or offset the put, they will have locked in a minimum expected selling price (unless basis changes unexpectedly). Regardless of how far the futures market drops, the producer will receive a price that is equivalent to the put option's strike price, less the costs of the premium and commission and adjusted for basis. If the futures market increases, the producer will allow the put option to expire worthless, losing only the price of the premium. However, because the hedger has the cash commodity to sell, the potential upside financial benefit is unlimited. It should be noted this assumes the producer holds the put option until near to expiration and there is no time value.

There are a couple of issues a producer should consider before using put options. First, as mentioned earlier, the fixed size of the future contracts applies to options hedging and care should be taken to avoid creating additional price risk. While this issue is not as great of a concern as it is with hedging, it is still an issue a producer should consider. It is possible for a producer to purchase more contracts than physical commodity being hedged and would therefore take on a speculator position. Likewise, a producer would have a speculative position in the cash market if they hedged less than the actual amount of commodity they own, as they would be 'under hedged.'

Another issue to consider when creating a floor price with a put includes basis risk. If the actual basis turns out to be weaker than forecasted, the producer's actual selling price could be less than the projected minimum selling price. However, if the basis is stronger than expected at

the conclusion of the put the producer's actual selling price may be higher than their minimum expected selling price.

One of the largest contentions producers have with put options is if they purchase a put option and the market never decreases to the point where they need to offset or exercise it. As a result, they feel as though they wasted money; had they not purchased the put they would have had a greater profit. This is a true statement; however, reflect on the parallel of purchasing a put option to purchasing fire insurance. Most individuals purchase fire insurance, but rarely use it and hope they have no need to. However, if a fire does occur the insurance will limit the losses of the party holding the insurance policy. The same principle applies with purchasing an option and it expires worthless. It was not needed because the bad event did not occur (prices did not decline), but if the futures market were to have declined, the put limits the losses that otherwise could have been catastrophic.

#### ***4.3.3 Calculating the Minimum Expected Selling Price and Actual Selling Price***

Evaluating a put option involves calculating the minimum expected selling price and the actual selling price. First, the producer determines the minimum expected selling price according to:

$$\begin{aligned} & \text{Put option strike price } (\$/cwt) \\ (5) \quad & - \text{Premium } (\$/cwt) \\ & + \text{Expected basis } (\$/cwt) \text{ when cattle are sold in the cash market} \\ & \underline{- \text{Maximum possible commission } (\$/cwt)} \\ & \textbf{Minimum expected selling price } (\$/cwt) \end{aligned}$$

The maximum possible commission should be used to calculate the minimum expected selling price in the anticipation of needing to exercise or offset the put, should the opportunity arise. If the put is not offset or exercised the associated commission, which was figured into the

minimum expected selling price, will not be used allowing the original minimum expected selling price to increase accordingly.

To calculate the actual selling price, the producer needs to calculate the net on the option trade. If the option was allowed to expire worthless, then the net on the option trade will be the negative of the premium paid for the option. However, if the put option was exercised or offset, the net on the option trade would be calculated as follows:

$$\begin{aligned} & \text{Strike price } (\$/\text{cwt}) \text{ of the put option} \\ (6) & \quad - \text{Actual futures price } (\$/\text{cwt}) \text{ upon option being exercised} \\ & \quad \textbf{Net on the option trade } (\$/\text{cwt}) \end{aligned}$$

Upon the conclusion of the option hedge, a producer will calculate the actual sale price of the cattle using the put option as:

$$\begin{aligned} & \text{Cash market price } (\$/\text{cwt}) \text{ received for cattle} \\ (7) & \quad + \text{Net on option trade } (\$/\text{cwt}) \\ & \quad - \text{Actual commission paid } (\$/\text{cwt}) \\ & \quad \textbf{Actual sale price } (\$/\text{cwt}) \end{aligned}$$

If the actual sale price is greater than the expected sale price, the price rallied and the producer benefited from the higher cash market and the loss on the hedging instrument was limited to the original premium paid. If the actual sale price is equal to the expected sale price, the futures market price level declined below the option's strike price and the losses in the cash market were offset by the gain in the put option's value. The actual sale price can deviate from the expected sale price with either higher or lower market price levels if the actual basis is different than what it was forecasted to be.

#### ***4.3.4 Call Option***

A purchaser of a call option earns the right, but not the obligation, to buy the underlying futures contract at the specified price (strike price) at any point during the life of the option (Borchart et al.). Producers generally purchase a call option for one of two reasons. One reason would be to participate in a market price rally for a commodity they have already sold in the spot market, or locked in using a forward contract or hedge. This marketing strategy will be discussed in further detail later in the chapter. The other possible reason a producer would consider using a call option would be to place a maximum purchase price on inputs that will be purchased at some future date. In both cases, producers are required to pay a premium to obtain the call option, and in the second case will be open to basis risk as well.

When discussing puts in the previous section, they were compared to purchasing an insurance policy against prices going down. A call can also be compared to purchasing an insurance policy, only with a call a producer is insuring against prices increasing. Should prices surpass the strike price, the call will provide protection to the producer by limiting their losses.

Similar to a put option, a call option can be classified as ‘out-of-the-money’, ‘in-the-money’, or ‘at-the-money’ depending on its intrinsic value. If the strike price is above the futures market price, the call option is considered to be ‘out-of-the-money’ and will have no intrinsic value. The total premium is time value. ‘In-the-money’ call options have strike prices below the underlying futures price, and consequently have intrinsic value and will have time value remaining as well. Finally, an ‘at-the-money’ call option has a strike price that is relatively close to the underlying futures market price.

As with a put option, the purchaser of a call option has three methods by which to manage a call. First, if the futures market rises above the strike price (becomes ‘in-the-money’), the producer can offset the position. Offsetting the call option is merely reselling the same call

option. The benefit to this method is that it allows the producer to collect a premium that includes both the intrinsic and time value of the option.

Instead of offsetting the call option, producers can instead choose to exercise their ‘in-the-money’ call options by assuming a long position in the underlying futures market valued at the option strike price. Consequently, if the futures market price is higher than the strike price of the call option by more than the premium paid, producers will financially benefit because the long futures position established at the call strike price could be offset (sold) at the higher futures price level. Additional commission charges will be applied when exercising a call and no time value will be recovered.

Finally, if the call option is ‘out-of-the-money’, the producer has really only one logical choice. The producer will simply allow the option to expire worthless, as it has no intrinsic value or time value when it expires. By allowing the option to expire, the producer loses the premium paid; however, there are no further commission charges to be paid. More importantly, the producer can participate in the more favorable (lower) cash market price. Other uses of call options pertaining to more complex price marketing strategies will be discussed later in the chapter.

#### ***4.3.5 Calculating the Maximum Expected Purchase Price and Actual Purchase Price***

Using a call option allows producers to establish a ceiling on the purchase price of any commodities they plan to purchase in the future. The maximum purchase price is calculated in the following manner:

$$\begin{aligned}
 & \text{Call strike price } (\$/\text{cwt}) \\
 (8) \quad & + \text{Call premium } (\$/\text{cwt}) \\
 & + \text{Forecasted basis } (\$/\text{cwt}) \\
 & + \underline{\text{Commission paid } (\$/\text{cwt})} \\
 & \textbf{Maximum Expected Purchase Price } (\$/\text{cwt})
 \end{aligned}$$

To calculate the actual purchase price, the producer needs to calculate the net on the option trade. If the option was allowed to expire worthless, then the net of the option trade will be the negative of the premium and commission paid. However, if the call option was exercised or offset, the net gain or loss of the option purchased is calculated as shown below. The commission involved with offsetting or exercising the option will be included in equation 10.

$$\begin{aligned}
 & \text{Premium received } (\$/\text{cwt}) \text{ from selling call option (if offset)} \\
 (9) \quad & - \underline{\text{Premium paid } (\$/\text{cwt}) \text{ to purchase call option}} \\
 & \textbf{Net on the option trade } (\$/\text{cwt})
 \end{aligned}$$

At the conclusion of the option hedge, a producer will calculate the actual purchase price of the cattle using the call option as:

$$\begin{aligned}
 & \text{Cash market price paid for cattle } (\$/\text{cwt}) \\
 (10) \quad & - \text{Net on option trade } (\$/\text{cwt}) \\
 & + \underline{\text{Actual commission paid } (\$/\text{cwt})} \\
 & \textbf{Actual purchase price } (\$/\text{cwt})
 \end{aligned}$$

#### **4.4 Note Regarding the Following Information Pertaining to LRP and LGM**

Sections 4.5 and 4.6 will pertain to livestock insurance policies. The reader should note the following material is not fully encompassing of the information needed by a producer to make a fully informed and rational decision regarding their participation, or potential participation with either Livestock Risk Protection Insurance (LRP) or Livestock Gross Margin



Insurance (LGM). The information contained within the following sections pertains only to the limited aspect of this thesis. For more complete information, contact an LRP or LGM approved insurance agent and/or go to: <http://livestockinsurance.unl.edu/> as well as <http://www.rma.usda.gov/livestock/>.

## **4.5 Livestock Risk Protection Insurance (LRP)**

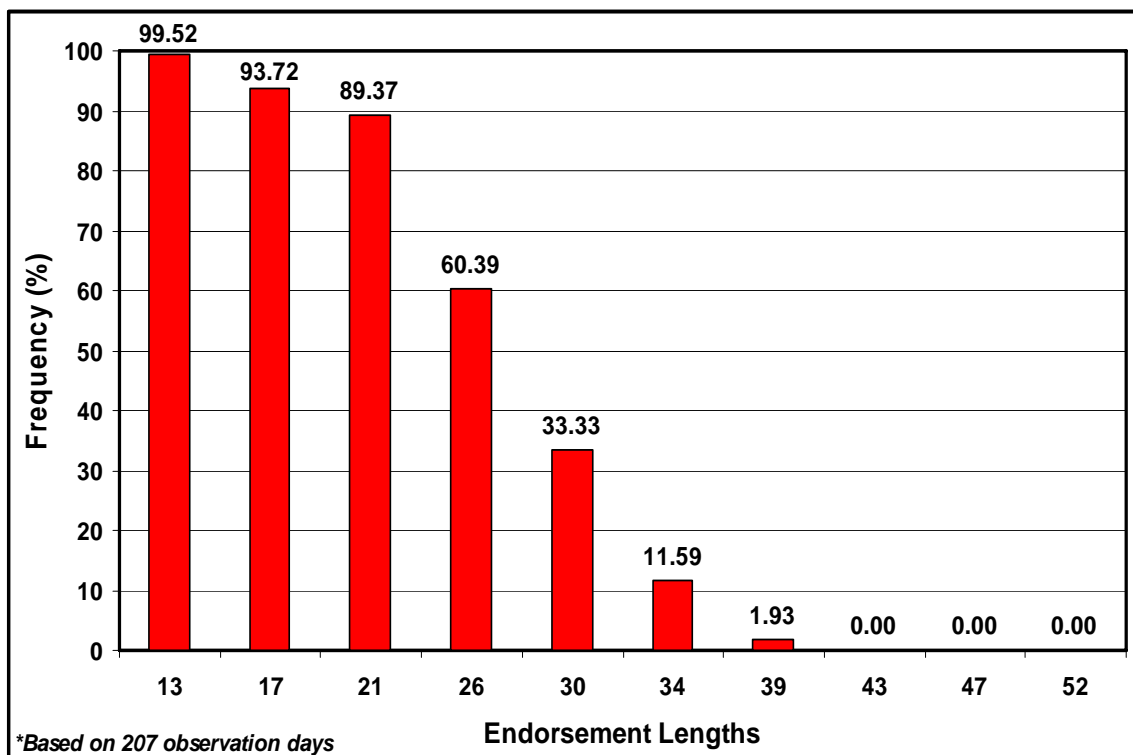
Livestock Risk Protection Insurance (LRP) is a single-peril insurance product that insures producers against declines in cattle market prices below an established coverage level selected by the producer (USDA 1667-09). The established coverage level insured is based on a regional or national cash price average, so, unlike futures and options hedging, LRP indemnifies losses based on cash market prices. However, the cash market price insured is not the individual producer's cash price received, so the producer is also open to a type of basis risk that will be discussed in the later sections. The concept of LRP is similar to that of a put option in that it allows the producer to establish a floor price for their cattle, but allows the producer unlimited upside potential. There are notable differences between LRP and a put option, some of which will be discussed in the following sections. LRP is a product of the United States Department of Agriculture's Risk Management Agency (RMA) and receives a 13 percent subsidy from the government to help lower expenses of the program.

### ***4.5.1 How LRP works***

LRP is available for both feeder and fed cattle. Feeder cattle should weigh no more than 900 pounds at the conclusion of the insurance policy, while fed cattle should be of finished weight 1,000-1,400 pounds and produce a carcass of at least select quality with a yield grade of 1-3 (Lawrence, 2003). Steers, heifers, bulls, as well as cattle of predominantly Brahman and dairy influence are eligible for coverage. LRP is available for sale every weekday through a

licensed insurance agent after the Chicago Mercantile Exchange closes and before the next day's session begins, generally 5 p.m. to 9 a.m. (Central Standard Time). LRP is available for 13, 17, 21, 26, 30, 34, 39, 43, 47, and 52 week endorsement lengths, but not all the endorsement lengths are made available for sale everyday because insurance offerings are based on (and premiums are rated on) the related options market. In fact, LRP policies offered on the RMA website for the dates of July 2, 2007 through April 30, 2008 for Iowa steers, 600 to 900 pounds indicate that endorsement lengths greater than 30 weeks were rare (Figure 4.1). Actually, the only endorsement lengths consistently offered (greater than 80% of the time) were 21 weeks or less.

**Figure 4.1 Percent of Time Different Endorsement Lengths were Made Available between July 2, 2007 and April 30, 2008**



Source: Risk Management Agency website-“LRP Coverage Price, Rates, and Actual Ending Values.” Reports-Based on 96 observation days from July 2, 2007 – April 30, 2008.

While it may be challenging, it is advised that producers select an endorsement length that will expire on the same day, or very close to the day they plan to sell their cattle. If time is allowed to accumulate between the LRP expiration date and the day the cattle are sold, a risk factor associated with basis is created. This issue will be discussed later the chapter.

When producers apply for an LRP policy, they must provide information about the cattle and select an endorsement length and coverage price (similar to a strike price for a put) and the coverage level, which is simply the percent of the expected ending value of the beef animal the producer wishes to insure. The expected ending value (EEV) is the expected value of the animal at the conclusion of the policy and represents an expectation of the actual ending value (AEV) at the end of the policy. While the AEV is equivalent to the CME Feeder Cattle cash price index, the EEV is calculated daily by RMA and is likely based on deferred futures prices and a possible basis adjustment. The CME Feeder Cattle cash price index, or AEV, is a 7-day moving average of cash prices from cattle auctions (including sale barns, direct trades, video, and internet sales) within a 12 state location (Petry).

Currently, 70-100 percent of the EEV can be insured. This selected amount is called the coverage level. The coverage level times the EEV equals the coverage price. Each coverage price has an associated coverage rate, similar to a premium, which declines as the corresponding coverage level decreases. RMA posts the EEV, coverage price, coverage level, cost per cwt, end date, amongst other information daily on their website as soon as LRP is available for sale. The AEV is posted upon a policy's expiring date. A portion of an LRP report is shown in Figure 4.2.

**Figure 4.2 Sample of Daily LRP Coverage Prices, Rates and Actual Ending Values Report**

**USDA subsidizes 13 percent of total LRP premium**

\* See notes at bottom of page

State	County	Endorsement Length	Commodity	Type	Practice	Crop Year	Exp. End Value	Coverage Price	Coverage Level	Rate	Cost Per CWT	End Date	Actual End Value
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$109.910	0.993000	0.038632	4.246	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$105.910	0.956800	0.022746	2.409	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$103.910	0.938800	0.018293	1.693	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$101.910	0.920700	0.011805	1.203	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$99.910	0.902600	0.009619	0.981	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	110.689	\$93.910	0.848400	0.004014	0.377	08/11/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	112.084	\$109.230	0.974500	0.037133	4.056	09/08/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	112.084	\$107.230	0.956700	0.030262	3.245	09/08/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	112.084	\$99.230	0.885300	0.012919	1.282	09/08/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	113.281	\$111.640	0.985700	0.047331	5.284	10/06/2008	
19	IOWA	998 ALL COUNTIES	0801 FEEDER CATTLE	810 STEERS WEIGHT 2	997 NO PRACTICE SPECIFIED	2008	113.281	\$109.640	0.968000	0.035279	3.868	10/06/2008	

At the conclusion of a feeder cattle LRP policy, the AEV is compared to the coverage price selected by the producer. If the AEV is less than the coverage price, an indemnity will be paid to the producer. The indemnity will be equal to the difference between the AEV and the coverage price.

The CME feeder cattle cash index price, and hence the AEV, is determined from a weighted average price for 650-849 pound Medium 1 and Medium and Large 1 steers (Mark, Prosch, and Smith). For cattle outside of this range of specifications, some adjustments to the EEV, AEV, and rates are made, as shown in Table 4.1:

**Table 4.1 LRP Price Adjustment Table**

<b>Weight Range</b>	<b>Steers</b>	<b>Heifers</b>	<b>Predominantly Brahman Influenced</b>	<b>Predominantly Dairy Influenced</b>
<b>Less than 600 lbs</b>	110%	100%	100%	85%
<b>600-900 lbs</b>	100%	90%	90%	80%

**Source: USDA FCIC Livestock Risk Protection Policy Specific Coverage Endorsement-Feeder Cattle.**

These adjustments are made to acknowledge the fact that the AEV are based on a 650-849 pound steer, while LRP insures a broader variety of cattle, including differing sexes, weights and types. A price adjustment factor from Table 4.1 is applied to the EEV, AEV, and premiums for cattle outside of the 600-900 pound steer category, which is considered the base. It is assumed steers weighing 600-900 are most representative of the AEV price. Cattle outside the specifications of the 600-900 pound steer category are still insurable with LRP at 100 percent of the AEV. The price adjustment helps to reduce basis risk and helps to adjust the insured price to the par value of the animal being insured. It is not clear that the adjustments actually help, as there are varying opinions within the industry. Compared to the base, it is assumed lightweight, predominately dairy steers; heavyweight heifers; predominately Braham and dairy cattle will sell at a discount. As a result, their price adjustment factor lowers the index values to allow for a more representative price. Similarity, it is assumed lightweight steers will sell at a premium compared to heavyweight steers, so their adjustment factor increases the index (Mark, Prosch, and Smith).

The indemnity for fed cattle is calculated the same; however, the AEV is determined differently. At the conclusion of the LRP policy, the AEV is calculated using the Five-Area Weekly Weighted Average Direct Slaughter Cattle Report Price reported by USDA-AMS and involves no price adjustment factor. Consequently, if the Five-Area Weighted Average Price

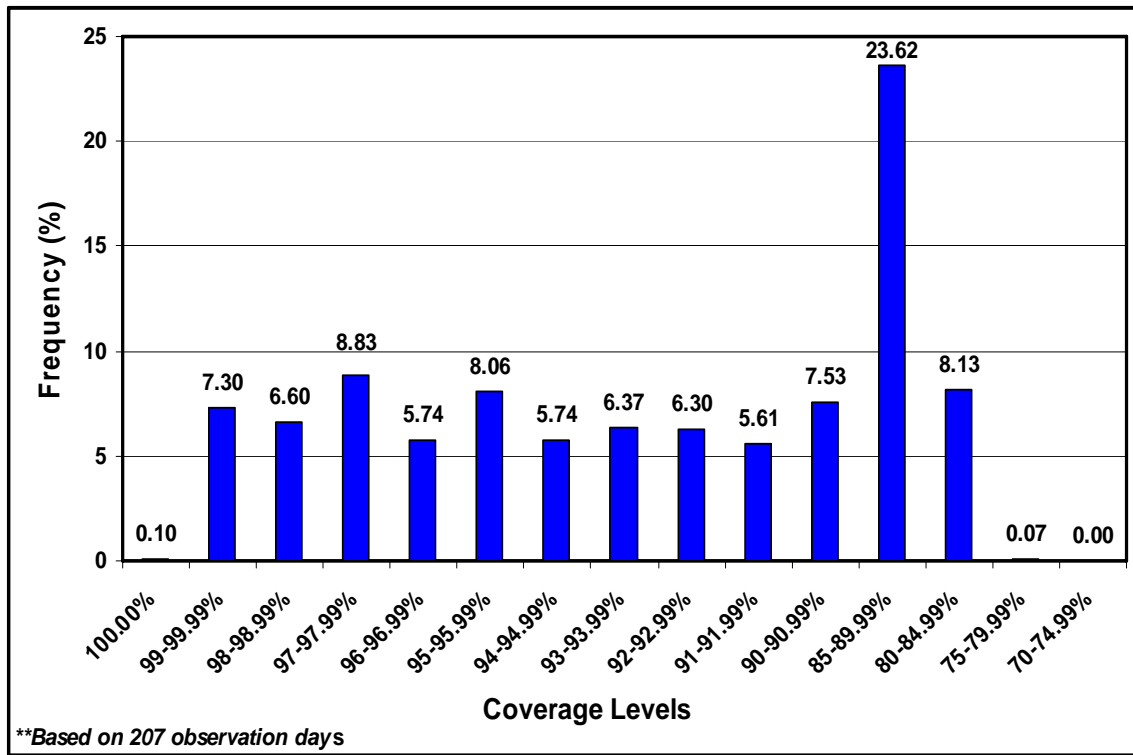
(AEV) is below the EEV, an indemnity will be paid. The Five-Area Weighted Average Direct Slaughter Steer Price is a volume weighted average of sales compiled from Texas/Oklahoma, Kansas, Nebraska, Colorado, and Iowa/Minnesota, and based on 35-65% Choice Steers on a live weight basis (Mark, Prosch, and Smith).

#### ***4.5.2 Advantages and Disadvantages of LRP***

LRP is similar to the concept of a put option as it allows a producer to set a floor price for future cattle sales. However, unlike a put option which is based on a 40,000 lb (fed cattle) or 50,000 lb (feeder cattle) contract size, LRP can be purchased on a per head basis. Producers can use LRP to insure from one head to 4,000 head of fed cattle, and up to 2,000 head of feeder cattle per crop year (July 1 to June 30). This is a major positive attribute, especially for small producers who cannot or do not wish to contract with the larger, fixed proportion sizes as required for one futures or put option contract.

Even though RMA states it offers a 100 percent coverage level, between July 2, 2007 and April 30, 2008 it was offered only three times in Iowa for steers weighing 600-900 pounds. Coverage levels of 99.00 to 99.99 percent composed 7.30 percent of the total offerings (Figure 4.3). For example, a coverage level of 99.00 to 99.99 percent was offered approximately 8 percent of the time for an endorsement length policy of 13 weeks. As a result, while not always exactly equal to a put option's strike price, the LRP offerings can occasionally be considered to be 'at-the-money'. As a result, some of the LRP offerings are close enough in value that they can provide an alternative to put options, especially for small producers because they can insure as few as one head or as many as 2,000 head per crop year.

**Figure 4.3 Frequency of Coverage Level Offerings as a Percent of Total Offerings**



LRP can be advantageous for a producer who would like to establish a minimum price for their cattle. If they would like to purchase a put option far in advance, they may have a hard time finding a seller of a put and be forced to pay an expensive premium as puts are generally thinly traded far in the future. However, producers may face similar challenges if they wish to purchase LRP any farther out than 21 weeks. The LRP coverage levels, premiums, etc., once posted, will not change until the next day’s LRP offerings are posted. This allows producers time to analyze the data and contact their agent to make a purchase that evening or early morning before the market opens. This could be seen as an advantage for individuals who cannot monitor the markets during the day or react quickly to the changes within the market during the day. Granted, the posted offerings may not be as desirable as what was traded during the day in the

futures trading session, but at least LRP provides them with an opportunity to participate in a form of hedging.

Once an LRP policy is purchased, it cannot be offset or exited. This can be reassuring to a creditor who wants to be sure the collateral asset is hedged and to producers who do not wish to monitor the market constantly or pay additional commission to offset a futures/options contract should the circumstances warrant such action. Purchasing an LRP policy is straightforward. The amount the producer pays up front for the premium will be the only expense associated with the policy, so from a budgeting perspective it is quite convenient. However, because the LRP position cannot be offset or exited, it might be limiting to a producer.

Upon purchasing an LRP policy, producers must maintain ownership of the cattle until thirty days prior to the selected ending date of the policy. If producers decide to sell the cattle more than thirty days before the LRP contract ends, the contract is declared void and producers lose the right to collect any indemnities. Producers can keep the livestock for as long as they wish once the contract expires, but the contract will still end on the listed date. The indemnity, however, is determined only on the end date—not on the date the cattle are actually marketed. So, if the cattle are not sold close to the same time the LRP contract expires, producers encounter basis risk. For example, the contract could expire on a day when the market is above the insured coverage level, and then days later when producers sell the cattle the market could decline below the insured coverage level. As a result, producers lose out on the benefit of having the LRP contract as they will not receive an indemnity and still received a low price for the cattle (Mark, Prosch, and Smith).

Basis risk must be considered when evaluating LRP. It must be emphasized that for feeder cattle, basis will be the individual's cash price less the CME Feeder Cattle Cash Index



price. For fed cattle, LRP basis will equal the fed cash price less USDA's Five-Area Weekly Weighted Average Direct Slaughter Cattle Report Price. Therefore, it should not be assumed the basis calculated from the CME feeder and fed cattle futures can be used to forecast LRP basis. Compared to the basis of the CME feeder cattle and live cattle contract price levels, fed cattle LRP basis is less volatile especially for producers located in the Midwest. Because the reports used in calculating the LRP basis include weighted prices from Midwestern states, the prices should be especially reflective of markets within the given area of interest for this thesis, the state of Iowa (Mark, Prosch, and Smith).

#### ***4.5.3 LRP Basis Model***

As mentioned above, the basis associated with LRP differs from the basis associated with the CME feeder and fed cattle contracts. Producers interested in forecasting LRP basis could do so by observing a 3-year historical average using either the Feeder Cattle Index or Five-Area Weekly Weighted Average Direct Slaughter Cattle Price. However, many producers question how live prices and recent high corn prices will influence future LRP basis. Using the historical average will not fully incorporate the recent corn prices the industry has experienced, and therefore may not be as accurate had the recent information been incorporated into the forecast. To assist producers in forecasting LRP basis, a model has been developed which explicitly takes into account the impact of corn, live cattle price, and other applicable variables, all while appropriately applying the associated price adjustment factor. Further details of the model will be discussed in Chapter 5.

#### 4.5.4 Evaluation of LRP

As with a put option, the minimum expected selling price is calculated for LRP to evaluate the performance. The minimum expected selling price is calculated in the following manner:

$$\begin{aligned} & \text{Selected coverage price } (\$/cwt) \\ (11) \quad & - \text{Producer paid premium } (\$/cwt) \\ & + \text{Expected LRP basis } (\$/cwt) \\ & \textbf{Minimum expected selling price } (\$/cwt) \end{aligned}$$

At the expiration of the LRP contract, the net from the LRP policy purchase is:

$$\begin{aligned} & \text{MAX}[\text{Coverage Price } (\$/cwt) - \text{AEV } (\$/cwt), 0] \\ (12) \quad & - \text{Producer paid premium } (\$/cwt) \\ & \textbf{Net from LRP policy purchase } (\$/cwt) \end{aligned}$$

The actual sale will then be calculated:

$$\begin{aligned} & \text{Cash market price } (\$/cwt) \text{ received} \\ (13) \quad & + \text{Net from LRP policy purchase } (\$/cwt) \\ & \textbf{Actual sale price } (\$/cwt) \end{aligned}$$

The actual sale price could be greater than the minimum expected sale price for two potential reasons. First, it may be that the cash price and the CME Feeder Cattle price index increased above the selected coverage price level and the producer was able to participate in the price rally. Also, the basis may have turned out to be more positive than what was originally forecasted. If the actual sale price is less than the minimum expected sale price, the basis was weaker than originally forecasted.

## **4.6 Livestock Gross Margin Insurance (LGM)**

Livestock Gross Margin Insurance (LGM) is an RMA product that insures cattle feeders against a decline in feeding margins. The policy allows producers to hedge feeder cattle and corn input prices while simultaneously hedging fed cattle sales price as a sort of bundled option. The producer does not personally take a position in the futures market even though the protection offered is similar to having futures market positions and the LGM insurance prices are based on futures market prices (Mark, Waterbury and Small). LGM is available for sale on the last trading day of each month, and can be purchased for feeder calves and/or feeder yearlings. LGM pays producers an indemnity if the margin between the input prices (feeder cattle and corn) and output price (fed cattle) narrows beyond the selected insured margin level as a response to changing market conditions (i.e., the price of fed cattle decreases, the price of corn or feeder cattle increase, or some combination of these). The indemnity is based upon the gross margin guarantee (GMG), the margin the producer elects to insure when the policy is purchased, and the actual gross margin (AGM), the margin calculated at the expiration of the policy. Both the GMG and AGM have state and month-specific basis levels applied, but the same fixed basis is used in calculating both. If the AGM is smaller than the GMG, then an indemnity will be paid that is equal to the difference. There is an inverse relationship between the margin and indemnity; the narrower the margin becomes the larger the indemnity paid. This relationship is analogous to how one would expect insurance to operate.

### ***4.6.1. Advantages and Disadvantages of LGM***

Producers can insure from one head up to a maximum of 10,000 head of cattle every crop year (July 1-June 30). This allows producers to apply a bundled option approach to a very small number of cattle. Without LGM, this strategy would probably not be considered feasible, as one

feeder cattle contract is 50,000 pounds, a fed cattle contract is 40,000 pounds, and a corn contract is 5,000 bushels. For a feeder, especially a small feeder, these amounts would likely be too great and the number of contracts needed to hedge in the proper ratio may be too large to effectively manage financial risk. In fact, small feeders could acquire greater financial risk as they would be hedging a greater quantity than they actually possess or plan to purchase, resulting in a speculative position. When producers purchase LGM, they are hedged in the feeder cattle, corn, and fed cattle markets at levels that closely correspond with actual feeding situations based on RMA projections.

LGM does not cover losses due to performance, mortality or morbidity. LGM is intended to insure against substantial or devastating market shifts, usually not minimal margin losses (Mark, Waterbury, and Small). To net a positive indemnity from LGM, the producer would need to collect an indemnity greater than the premium. In addition, due to the potential differences that may occur between the actual basis and fixed basis in each market, a producer still assumes a certain level of basis risk (Mark, Waterbury, and Small).

LGM for cattle is a relatively new product as it was first introduced in January 2006. As a result, very little analytical work has been done regarding the financial feasibility of LGM. Another reason as to why there has been limited research on LGM is the indemnities may not be paid until a year after the policy was purchased, due to the purchase rules of LGM, which would lead to a limited number of data points.

RMA posts the GMG and AGM of every policy offered for every month, beginning in 2006 on their website. However, the net indemnity actually paid to the producers is not possible to establish because the premiums paid for the policies are not listed. Assuming a \$0 deductible, the RMA website reported the actual gross margin for 2006 was less than the gross margin

guarantee for 35 percent of its offered LGM policies for yearling fed cattle with an average difference of approximately \$28 per head. As of April 2008, the actual gross margin was less than the gross margin guarantee on 40 percent of the offered 2007 policies, with an average difference of approximately \$44 per head for yearling steers. As stated before, even though the indemnities are based off the difference between the GMG and the AGM, the premiums would still need to be subtracted from the given differences to determine the net indemnity paid to producers.

## **4.7 Complex Marketing Strategies**

The marketing strategies described in this section are not necessarily complex in regard to how they work, more so that they require the implementation of more than one price risk management tool. The few marketing strategies described here are a meager sampling of the vast number of possible marketing strategies that can be used by producers. The strategies described here are several of the more easy to understand and to implement for most producers not well versed in marketing strategies.

### ***4.7.1. Synthetic Put***

A synthetic put is used by producers who have already locked in the price of their cattle, but would like to participate in a later price rally. For example, a producer could lock in the cash price level and basis with a forward contract. The producer could then purchase a call option, often an ‘in-the-money’ or one with a strike price close to the price of the cash forward contract, which provides a higher level of price level insurance compared to an ‘out-of-the-money’ option. The call option would give the producer the right, but not the obligation, to buy the underlying futures contract, a valuable contract if prices were to increase. This strategy allows the producer

unlimited upside potential should the futures market surpass the strike price. This would result in a producer either offsetting or exercising the option.

Another form of a synthetic put would be for producers to lock in the price level of cattle by selling a futures contract and simultaneously purchase the call option. The short position in the futures market locks in a floor price for the cattle, but keeps producers open to basis risk. They could also experience margin calls with this strategy. However, the loss on the futures contract would be limited by the long call position. It allows producers to participate in a price rally and have unlimited upside potential. The call would enable a producer to capitalize on a price rally, should the futures market reach the selected strike price. At that time, producers would offset their position or exercise the option. However, should the futures market not rally, producers would lose their premium.

#### ***4.7.2. Evaluating a Synthetic Put***

A producer would calculate the minimum expected selling price by subtracting the cost of the call option premium and brokerage commission from the cash forward contract price (or short futures price plus basis). A price higher than the minimum expected selling price could be realized if the call option gains value. If the option does not and is allowed to expire worthless, then the net of the option trade will be the negative of the premium and commission paid. However, if the call option was exercised or offset, the net gain or loss of the option purchased would be calculated as shown below. The commission involved with offsetting or exercising the option will be included in equation 15.

$$\begin{aligned} & \text{Premium received from selling call option } (\$/cwt) \\ (14) \quad & - \text{Premium paid to purchase call option } (\$/cwt) \\ & \text{Net from call option purchase } (\$/cwt) \end{aligned}$$

Before the actual sale price can be calculated, the tool used to give the producer a short position in the market will need to be evaluated. Either the actual sale price from the futures hedge or the sale price from the cash forward contract is the base for the actual sale price, to which the call option gain is added and commission is deducted. It would be calculated as:

$$\begin{array}{r}
 \text{Cash forward contract sale price or actual sale price from futures hedge} \\
 \text{(15) + Net on call option purchase (\$/cwt)} \\
 \text{- Actual commission paid (\$/cwt)} \\
 \hline
 \text{Actual sale price (\$/cwt)}
 \end{array}$$

#### ***4.7.3. Building a Fence/Creating a Window***

Building a fence or creating a window refers to a price risk management strategy where producers simultaneously purchase a put and sell a call, thereby creating both a floor price and ceiling price. The assumption is made that the option is held to maturity. As mentioned earlier, when a put option is purchased, a premium is paid and a floor price is established at the option's strike price (less premium, commission, and expected basis). Producers have taken on basis risk and paid a commission, in addition to paying the premium for the put. At the same time, a call option would be sold, resulting in producers collecting a premium. The premium that was collected from selling the call option can be applied to the premium paid for the put option. This action would 'cheapen' the purchase price of the put option and raise the expected minimum selling price. However, care should be taken to sell a call with a strike price that allows for a desired price rally. Once the futures price surpasses the call strike price, the hedger will lose on the call position dollar for dollar with the futures price increase if they do not offset their futures position. The producer, because he sold the call, provided the purchaser the opportunity to buy from them at the strike price. Consequently, the strike price of the sold call option, adjusted for basis and the net premium, is the ceiling price. Producers should make sure to establish a

window that has sufficient width to allow for desired upside potential (McKissick and Shumaker).

Building a fence or creating a window provides producers a means to establish a higher floor price for less premium money compared to a stand-alone put because of the revenue generated by selling a call. The consequence of selling a call is that a ceiling price is created at the strike price adjusted by the net debit for the two option positions (McKissick and Shumaker).

#### ***4.7.4. Evaluating a Fence or a Window***

In order to evaluate an established fence or window the producer will need to evaluate the floor price (put) and ceiling price (call) separately. The floor price level can be evaluated by calculating the minimum expected selling price:

$$\begin{aligned} & \text{Put strike price } (\$/\text{cwt}) \\ (16) & - \text{Net premium } (\$/\text{cwt}) \\ & + \text{Forecasted basis } (\$/\text{cwt}) \text{ for when cattle are sold in the cash market} \\ & - \underline{\text{Maximum possible brokerage commission } (\$/\text{cwt})} \\ & \textbf{Minimum expected selling price } (\$/\text{cwt}) \end{aligned}$$

The maximum expected selling price would be evaluated by focusing on the call option and calculated as:

$$\begin{aligned} & \text{Call strike price } (\$/\text{cwt}) \\ (17) & - \text{Net Premium } (\$/\text{cwt}) \\ & + \text{Forecasted basis } (\$/\text{cwt}) \text{ for when cattle are sold in the cash market} \\ & - \underline{\text{Maximum possible brokerage commission } (\$/\text{cwt})} \\ & \textbf{Maximum expected selling price } (\$/\text{cwt}) \end{aligned}$$



The producer expects not to receive anything lower than the minimum expected selling price and nothing more than the maximum expected selling price, subject to basis risk. This strategy provides downside price protection, but places a limit on upside potential.

**Table 4.2 Summary Table of Price Risk Management Tools**

<b>Tool</b>	<b>Protect Against Price Decline</b>	<b>Unlimited Upside Potential</b>	<b>Limited Upside Potential</b>	<b>Protect Against Price Increase</b>	<b>Unlimited Downside Potential</b>	<b>Limited Downside Potential</b>	<b>Margin Calls Possible</b>	<b>Basis Risk</b>
<b><i>Forward Contract</i></b>	<i>Yes</i>	<i>None</i>	<i>None</i>	<i>Yes</i>	<i>None</i>	<i>None</i>	<i>No</i>	<i>No</i>
<b><i>Futures Hedge</i></b>	<i>Yes</i>	<i>None</i>	<i>None</i>	<i>Yes</i>	<i>None</i>	<i>None</i>	<i>Yes</i>	<i>Yes</i>
<b><i>Put Option</i></b>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>None</i>	<i>None</i>	<i>No</i>	<i>Yes</i>
<b><i>Call Option</i></b>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>
<b><i>LRP</i></b>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>None</i>	<i>None</i>	<i>No</i>	<i>Yes</i>
<b><i>LGM</i></b>	<i>Yes</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>None</i>	<i>None</i>	<i>No</i>	<i>Yes</i>
<b><i>Synthetic Put (forward contract and buy call)</i></b>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>None</i>	<i>None</i>	<i>No</i>	<i>No</i>
<b><i>Synthetic Put (futures hedge and buy call)</i></b>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>None</i>	<i>None</i>	<i>Yes</i>	<i>Yes</i>
<b><i>Fence or Window</i></b>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>None</i>	<i>None</i>	<i>Yes</i>	<i>Yes</i>

## **CHAPTER 5 - LRP Feeder Cattle Basis Model**

### **5.1 Introduction**

The LRP Feeder Cattle Basis Model was developed following an approach used to model CME feeder cattle basis. Currently, this CME feeder cattle basis model is available on the internet at BeefBasis.com and is available to producers, free of charge, to assist them in forecasting basis at 55 locations across 15 states. At the present time, there is not a tool similar to the BeefBasis.com website for assisting producers in forecasting LRP basis.

A separate tool or model is required to forecast LRP basis, apart from CME basis, because of the reasons discussed in Chapter 4. Unlike CME basis, LRP basis is the difference between the cash price and the CME Feeder Cattle Index. An adjustment factor of 110 percent is applied to the CME Feeder Cattle Index for steers weighing less than 600 pounds, while an adjustment factor of 90 percent is applied for heifers weighing 600 to 900 pounds. A more detailed explanation of LRP basis, and how it is applied, can be found in Chapter 4.

The main objective of developing the LRP Feeder Cattle Basis Model is to provide producers with a tool, similar to the CME feeder cattle basis models found at [www.BeefBasis.com](http://www.BeefBasis.com), to assist them in forecasting LRP basis. To forecast CME basis users of the BeefBasis.com model specify the sale date and location at which their cattle will sell, along with the sex, frame, grade, weight, and number of head within the lot. In addition, the user also inputs the price of the nearby CME feeder cattle futures contract and nearby CBOT corn futures price, relative to the sale date, as well as the nearby CME live cattle futures price, relative to when the cattle are projected to weigh 750 pounds.

The LRP feeder cattle basis model includes for most of the same factors as the CME basis model. However, the LRP feeder cattle basis is calculated basis subtracting the CME Feeder Cattle Index Price from the cash price. The model also takes into account changes in the calculation and specifications of the CME Feeder Cattle Index, rather than the CME Feeder Cattle futures contract. The LRP feeder cattle basis model automatically accounts for any price adjustment factor required. The LRP model allows users to forecast LRP basis, but also allows them the opportunity to quantify the impact corn and live cattle prices have on LRP feeder cattle basis.

This chapter will explain the LRP Feeder Cattle Basis Model. It will begin by describing the conceptual idea surrounding the model. The dataset will be described and summarized. Then, in the following section the empirical model will be specified. Finally, the chapter will conclude with the model results and implications.

## **5.2 Conceptual Model**

### ***5.2.1. Influencers of Cattle Price and Basis***

By definition, any factor that impacts the cash price of cattle will impact basis (Basis = Cash price – CME Feeder Cattle Futures Price). Therefore, this relationship obviously also holds true for the LRP basis (LRP Basis = Cash price – CME Feeder Cattle Index Price). Both the CME feeder cattle basis model and the LRP basis model are developed around this assumption. This chapter will focus on the LRP Feeder Cattle Basis Model.

Research conducted by Sartwelle et al. studied characteristics of cattle and other external factors that influenced the price of 300-599 pound calves, as well as the price of 600-899 pound feeder cattle at Kansas auctions. The most recent data collected for the studies occurred during the spring and fall of 1993 at eight sale barns. Kansas sale barns that participated in the study

were Oakley, Wakeeney, Dodge City, Pratt, Manhattan, Junction City, and Parsons. The other sale barn that participated was located in Joplin, Missouri. The results of the Sartwelle et al. study pertaining to 300-599 pound calves will be discussed first, followed by the results of the study regarding 600-899 pound feeder cattle.

Sartwelle et al. (1996b) found calf weight, lot size, health, condition, fill, muscling, frame size, breed, time of sale, market location, as well as futures prices of feeder cattle and corn significantly influenced the price bid for calves weighing 300-599 pounds. The data used in the study contained 23,516 lots (154,094 head). The physical characteristics of the cattle and external market conditions explained approximately 60 percent of the calf price variation.

Sartwell et al. (1996a) considered the influences of various characteristics on the price received for 600-899 pound feeder cattle. The authors determined that the same characteristics and influences that impacted price for calves weighing 300-599 pounds influenced the price of 600-899 pound feeder cattle. There were three additional characteristics that influenced price for the 600-899 pound cattle which included sex, weight uniformity of the lot, and the presence of horns. The dataset used for the 600-899 pound feeder cattle included 15,272 lots (189,566 head).

According to the authors cattle buyers place special emphasis on muscling due to the financial emphasis placed on carcass quality and characteristics. Large and upper-medium framed cattle were perceived to finish more efficiently and meet packer specifications of carcass weight, when compared to smaller framed cattle. Condition was considered significant as cattle that were too thin or overly fat were thought to have potential future feeding problems or be less efficient. Weight to price relationship was found to be influenced by the profitability of cattle feeding as well as corn and live cattle future prices.

Lot sizes that corresponded to trucks loads brought higher prices compared to smaller lot sizes. The authors cited three reasons for this occurrence: Buyers do not need to mix and mingle different lots of cattle to acquire a full load, which results in fewer health problems. It is more convenient to buy a load of cattle from one lot, as opposed to trying to piece together smaller lots to create a uniform load. Plus, there is added expense in sorting and handling cattle until enough small lots can be purchased to form a complete load.

Buyers consider fill to be an influencer of the price they will pay for cattle because if cattle have a large fill of water or forage, the cattle buyer will be paying for the temporarily added weight of the fill. However, if cattle are shrunk buyers know they will be able to take advantage of cheap compensatory gain. In the 300-599 pound study weight uniformity was not a significant influence on the price paid for the cattle, however for the heavier feeder steers, weight uniformity was significant. Finally, the point at which the cattle sold during the sale was, at times, a significant influencer of the price paid for cattle.

### ***5.2.2. Conceptual Model Composition***

It would be ideal if all factors that impact or contribute to cash price, hence LRP basis, could be included in the model. However, as with most models, because of data availability there are limitations as to what can be included in the model.

The following quantifiable factors are considered to impact LRP feeder cattle basis and are available in the dataset used to estimate the model: sale date, average weight, number of head in the lot to be sold, sex of the animal, fed cattle price, corn price, the phenotypical class of the lot (e.g., muscle composition and frame), changes made to the calculation or specification of the CME Feeder Cattle Index price, month of sale, and finally the location of the sale. This conceptual model can be shown as:

(5.1)  $LRP_{basis} = f(\text{sale date, sale weight, number of head in lot, sex, fed cattle price, corn price, class, frame, month of sale, sale location})$ .

As was shown in the Sartwelle et al. studies, there are other factors that LRP basis depends upon; however, they are not included in the model due to the fact that they are not available in the dataset.

### 5.3 Data

Transaction level data as reported by USDA AMS composed the cash price data used to develop the LRP model. The dataset consisted of 284,874 observations (lots) of beef feeder cattle sold at Kansas sale barns located in Dodge City, Salina, and Pratt from January 1996 through July 2007. CME Feeder Cattle Index data were obtained from the Chicago Mercantile Exchange (<http://www.cme.com>). Before estimating the model, outliers were eliminated from the dataset which corresponded specifically to excessively large or small basis, or any cattle type with less than five percent representation in the dataset (i.e., medium framed cattle and bulls). Outliers were eliminated to provide a more representative and robust dataset. Consequently, the final dataset used to develop the model consisted of 278,883 observations. Summary statistics of the data are listed in Table 5.1.

The variable *Price* is the average transactional cash price received by the producer per hundredweight, *Weight* is the average weight of the individual animals within the lot, and *Head* is the number of head per lot. *Basis* is the CME basis, the difference between the cash price and the CME feeder cattle futures price. *LRPBasis* is the LRP basis calculated as cash price less CME Feeder Cattle Price Index with adjustment factors applied to lightweight steers and heavyweight heifers. *LC750* is the average CME live cattle futures price, *CNO* is the average Chicago Board of Trade (CBOT) nearby corn price, and *FC0* is the average CME nearby feeder

cattle futures price. The futures prices were collected from the CRB Bridge for the corresponding time period, January 1996 through July 2007.

**Table 5.1 Summary Statistics for Model Data**

<b>Variable</b>	<b>Units</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>Continuous variables</i>					
<i>Price</i>	\$/cwt	86.44	19.45	28.5	199.00
<i>Weight</i>	pounds	652.54	139.61	300	900.00
<i>Head</i>	head	17.71	18.60	1.00	335.00
<i>Basis</i>	\$/cwt	1.83	9.54	-37.17	85.10
<i>LRPBasis</i>	\$/cwt	2.67	7.32	-43.99	74.16
<i>LC750</i>	\$/cwt	73.61	9.56	54.80	102.92
<i>CN0</i>	\$/bu	2.53	0.61	1.75	5.00
<i>FC0</i>	\$/cwt	84.62	15.57	47.65	119.57
<i>Binary variables</i>					
<i>Str</i>		0.53	0.50	0	1
<i>Hfr</i>		0.47	0.50	0	1
<i>LWS</i>		0.16	0.37	0	1
<i>HWS</i>		0.37	0.48	0	1
<i>HWH</i>		0.28	0.45	0	1
<i>LWH</i>		0.19	0.39	0	1
<i>Large</i>		1.00	0.00	1	1
<i>Class1</i>		0.74	0.44	0	1
<i>Class12</i>		0.17	0.38	0	1
<i>indchg1</i>		0.40	0.49	0	1
<i>indchg2</i>		0.42	0.49	0	1
<i>indchg3</i>		0.04	0.19	0	1
<i>indchg4</i>		0.10	0.30	0	1
<i>indchg5</i>		0.05	0.22	0	1
<i>Mo1</i>		0.11	0.32	0	1
<i>Mo2</i>		0.09	0.29	0	1
<i>Mo3</i>		0.12	0.33	0	1
<i>Mo4</i>		0.11	0.31	0	1
<i>Mo5</i>		0.07	0.26	0	1
<i>Mo6</i>		0.03	0.17	0	1
<i>Mo7</i>		0.05	0.22	0	1
<i>Mo8</i>		0.07	0.26	0	1
<i>Mo9</i>		0.06	0.24	0	1
<i>Mo10</i>		0.11	0.31	0	1
<i>Mo11</i>		0.11	0.31	0	1
<i>Mo12</i>		0.06	0.24	0	1



Also included in Table 5.1 are the various binary (dummy) variables included in the model. The data were close to being evenly divided between steers and heifers. A majority of the observations were from steers weighing 600-900 pounds (*HWS*), contributing 36.86 percent of the cattle lots observed. Steers weighing less than 600 pounds (*LWS*) made up 15.88 percent of the observations, heifers weighing 600-900 pounds (*HWH*) contributed 28.31 percent, and finally heifers weighing less than 600 pounds (*LWH*) made up 18.95 percent of the dataset. The summary statistics for key variables of each LRP adjustment factor weight group are listed in Table 5.2 through Table 5.5.

Notice there is very little difference between *Basis* and *LRPBasis* for the heavyweight steers (*HWS*) and lightweight heifers (*LWH*). However, where the price adjustment factor is applied, the difference between *Basis* and *LRPBasis* is much greater than the groups that are not adjusted for weight. This indicates the importance of calculating basis in the correct manner when considering LRP as opposed to simply assuming the CME futures-based basis is appropriate.

**Table 5.2 Summary Statistics of Key Variables for Heavyweight Steers, (*HWS*)**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>Price</i>	102,806	84.73	16.66	31.00	140.35
<i>Weight</i>	102,806	751.71	81.64	600.00	900.00
<i>Basis</i>	102,806	0.04	4.83	-34.70	32.68
<i>LRPBasis</i>	102,806	-0.19	4.82	-35.17	31.95

**Table 5.3 Summary Statistics of Key Variables for Lightweight Steer, (LWS)**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>Price</i>	44,279	99.83	22.52	30.00	199.00
<i>Weight</i>	44,279	494.86	72.56	300.00	599.00
<i>Basis</i>	44,279	14.92	11.55	-32.45	85.10
<i>LRPBasis</i>	44,279	6.18	10.97	-43.99	71.48

**Table 5.4 Summary Statistics of Key Variables for Heavyweight Heifer, (HWH)**

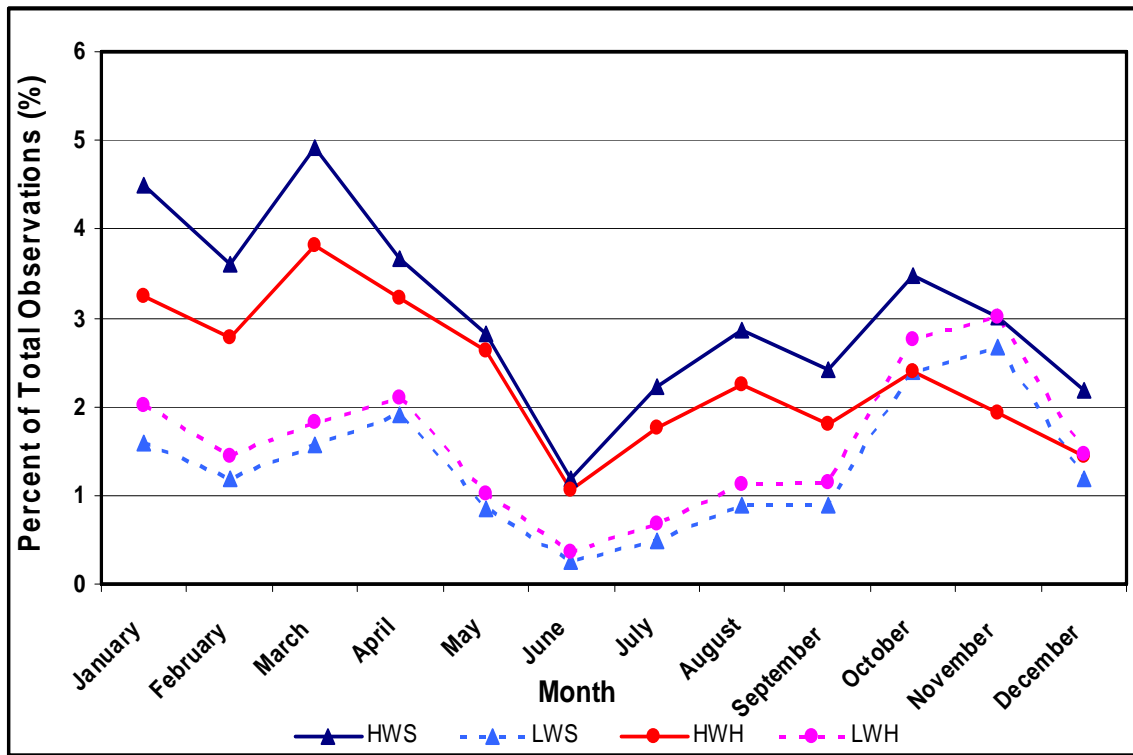
<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>Price</i>	78,956	80.17	15.95	32.25	135.50
<i>Weight</i>	78,956	719.22	72.22	600.00	900.00
<i>Basis</i>	78,956	-4.49	4.24	-37.02	20.20
<i>LRPBasis</i>	78,956	3.83	4.26	-30.19	31.06

**Table 5.5 Summary Statistics of Key Variables for Lightweight Heifer, (LWH)**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>Price</i>	52,842	87.91	20.83	28.50	184.00
<i>Weight</i>	52,842	492.09	73.11	300.00	599.00
<i>Basis</i>	52,842	3.76	9.13	-37.17	74.33
<i>LRPBasis</i>	52,842	3.56	8.98	-37.90	74.16

Figure 5.1 shows the monthly transactions as a percentage of the total observations grouped according to the price adjustment groups. As expected based on seasonal price patterns, the majority of heavyweight cattle are sold toward the beginning of the year, while the majority of lightweight cattle are sold closer to weaning in the fall. The lowest percentages of transactions for all cattle classifications are in June.

**Figure 5.1 Monthly Transactions as Percentage of Total Observations**



### 5.4 Empirical Model

The empirical model to estimate LRP basis includes a large number of independent variables, dummy variables, and interaction terms. The variables used to determine the LRP basis are based on the expected characteristics of the cattle at the time they are to be sold as well as current market conditions. In addition to cattle characteristics and market condition variables, the LRP basis model takes into account the interaction of corn prices, live cattle prices, and seasonality with weight, as well as the index changes with weight. In today's volatile market this aspect of the model is a very attractive feature. If a producer were to take a 3-year historical average to forecast basis, likely the volatility surrounding the current market would not be fully captured. Table 5.6 shows variables included in the model along with a brief description of each.

**Table 5.6 LRP Feeder Cattle Basis Model Variables and Associated Coefficients**

<b>Variable</b>	<b>Description</b>	<b>Coefficient</b>
<i>Intercept</i>	Constant	$\beta_1$
<i>Head</i>	Number of head in lot	$\beta_2$
<i>Head2</i>	Number of head in lot squared	$\beta_3$
<i>HeadWt</i>	Number of head in lot times Weight	$\beta_4$
<i>Head2Wt</i>	Number of head in lot squared times Weight	$\beta_5$
<i>Weight</i>	Average weight of cattle sold (lbs/head)	$\beta_6$
<i>Wt2</i>	Weight squared	$\beta_7$
<i>HfrWt</i>	Heifer dummy variable times weight	$\beta_8$
<i>HfrWt2</i>	Heifer dummy variable times weight squared	$\beta_9$
<i>Class1</i>	Cattle classified as No. 1 muscle thickness	$\beta_{10}$
<i>Class12</i>	Cattle classified as No. 1 and 2 muscle thickness	$\beta_{11}$
<i>Indchg1</i>	Feeder Cattle Index settlement weight changed to 700-849# from 700-799#--November 1999	$\beta_{12}$
<i>Indchg2</i>	Feeder Cattle Index Omitted Med.#1 and 'Calves'--January 2005 contract	$\beta_{13}$
<i>Indchg3</i>	Feeder Cattle Index Added Medium and Large 1&2 as well as increased weight to 650-849#--August 2005 contract	$\beta_{14}$
<i>Indchg4</i>	Feeder Cattle Index change-Allowed cattle sold on a delivered basis with a freight adjustment--October 2006	$\beta_{15}$
<i>Indchg1Wt</i>	November 1999 Feeder Cattle Index Change times Weight	$\beta_{16}$
<i>Indchg2Wt</i>	January 2005 Feeder Cattle Index Change times Weight	$\beta_{17}$
<i>Indchg3Wt</i>	August 2005 Feeder Cattle Index Change times Weight	$\beta_{18}$
<i>Indchg4Wt</i>	October 2006 Feeder Cattle Index Change times Weight	$\beta_{19}$
<i>Indchg1Wt2</i>	November 1999 Feeder Cattle Index Change times Weight squared	$\beta_{20}$
<i>Indchg2Wt2</i>	January 2005 Feeder Cattle Index Change times Weight squared	$\beta_{21}$
<i>Indchg3Wt2</i>	August 2005 Feeder Cattle Index Change times Weight squared	$\beta_{22}$
<i>Indchg4Wt2</i>	October 2006 Feeder Cattle Index Change times Weight squared	$\beta_{23}$
<i>LWH</i>	Heifers weighing 300-599 pounds	$\beta_{24}$
<i>LWS</i>	Steers weighing 300-599 pounds	$\beta_{25}$
<i>HWH</i>	Heifers weighing 600-900 pounds	$\beta_{26}$
<i>LC750</i> <i>(\$/cwt)</i>	Nearby Live Cattle contract price at the time when the feeder cattle are expected to weigh 750 pounds	$\beta_{27}$
<i>LC750Wt</i>	Nearby Live Cattle contract price times weight	$\beta_{28}$
<i>LC750Wt2</i>	Nearby Live Cattle contract price times weight squared	$\beta_{29}$
<i>CNO</i> <i>(\$/bushel)</i>	Price of nearby corn contract in relation to the sale date of the feeder cattle	$\beta_{30}$
<i>CNOWt</i>	Price of nearby corn contract times weight	$\beta_{31}$
<i>CNOWt2</i>	Price of nearby corn contract times weight squared	$\beta_{32}$
<i>Mo1</i>	January, dummy variable	$\beta_{33}$

**Table 5.6 continued**

<i>Mo2</i>	February, dummy variable	$\beta_{34}$
<i>Mo3</i>	March, dummy variable	$\beta_{35}$
<i>Mo4</i>	April, dummy variable	$\beta_{36}$
<i>Mo5</i>	May, dummy variable	$\beta_{37}$
<i>Mo6</i>	June, dummy variable	$\beta_{38}$
<i>Mo7</i>	July, dummy variable	$\beta_{39}$
<i>Mo8</i>	August, dummy variable	$\beta_{40}$
<i>Mo9</i>	September, dummy variable	$\beta_{41}$
<i>Mo11</i>	November, dummy variable	$\beta_{42}$
<i>Mo12</i>	December, dummy variable	$\beta_{43}$
<i>Mo1Wt</i>	January times Weight	$\beta_{44}$
<i>Mo2Wt</i>	February times Weight	$\beta_{45}$
<i>Mo3Wt</i>	March times Weight	$\beta_{46}$
<i>Mo4Wt</i>	April times Weight	$\beta_{47}$
<i>Mo5Wt</i>	May times Weight	$\beta_{48}$
<i>Mo6Wt</i>	June times Weight	$\beta_{49}$
<i>Mo7Wt</i>	July times Weight	$\beta_{50}$
<i>Mo8Wt</i>	August times Weight	$\beta_{51}$
<i>Mo9Wt</i>	September times Weight	$\beta_{52}$
<i>Mo11Wt</i>	November times Weight	$\beta_{53}$
<i>Mo12Wt</i>	December times Weight	$\beta_{54}$
<i>Mo1Wt2</i>	January times Weight squared	$\beta_{55}$
<i>Mo2Wt2</i>	February times Weight squared	$\beta_{56}$
<i>Mo3Wt2</i>	March times Weight squared	$\beta_{57}$
<i>Mo4Wt2</i>	April times Weight squared	$\beta_{58}$
<i>Mo5Wt2</i>	May times Weight squared	$\beta_{59}$
<i>Mo6Wt2</i>	June times Weight squared	$\beta_{60}$
<i>Mo7Wt2</i>	July times Weight squared	$\beta_{61}$
<i>Mo8Wt2</i>	August time Weight squared	$\beta_{62}$
<i>Mo9Wt2</i>	September times Weight squared	$\beta_{63}$
<i>Mo11Wt2</i>	November times Weight squared	$\beta_{64}$
<i>Mo12Wt2</i>	December times Weight squared	$\beta_{65}$
<i>Loc2</i>	Sale location - Pratt, Kansas, dummy variable	$\beta_{66}$
<i>Loc3</i>	Sale location - Salina, Kansas, dummy variable	$\beta_{67}$
$\varepsilon$	Error term	

*See section 5.3.2 model assumptions for further explanation*

The term *Head* is expected to have a positive impact on LRP basis. Typically, there is an expected positive correlation with the number of head in a lot and the associated price.

Consequently, as the number of head in a given lot increases, so too should the cash price, resulting in an increasing basis. However, the interaction term of *CNOWt*, the interaction term

between corn price and weight, must be discussed in relation to specific weight classes. Cattle considered to be in the lightweight category (less than 600 pounds) will be on feed for a longer period of time compared to cattle classified as heavyweights (600-900 pounds). As a result, the price difference between lightweight cattle and heavyweight cattle will become larger as the price of corn increases. Heifers are considered to be less efficient than steers; consequently the difference between heavyweight heifers and heavyweight steers is expected to increase as the price of corn increases.

It is very hard to predict the expected sign on the remaining variables. One aspect that makes it very challenging to know what signs will be on some of the variables is the price adjustment factors that must be taken into account, and the impact they ultimately have on the signs of the coefficients.

#### ***5.4.1 Model Assumptions***

As noted above, the live cattle futures price used corresponds to the nearby contract in relation to the month when the cattle are projected to weigh 750 pounds. In order to determine when the animal will weigh 750 pounds, several assumptions are made pertaining to the average daily gain. It is assumed that animals with a sale weight less than 500 pounds will gain 1.50 pounds per day until they reach a weight of 500 pounds, then animals weighing 500 to 799 pounds will gain 2.00 pounds per day (Table 5.7). The sale weight is the beginning weight from which the 750 pound end weight will be calculated to determine which live cattle futures contract price to use. For example, a lot of cattle weighing 490 pounds on the sale date, January 1, are assumed to gain 1.5 pounds for seven days (January 2<sup>nd</sup> through January 8<sup>th</sup>), resulting in a weight of 500.5 pounds. Because they have entered weight category B they will gain 2.0 pounds

per day until they reach 750 pounds. In mid-May the cattle will weigh 750 pounds and thus the live cattle price will come from the nearby contract at that time, i.e., the June contract.

**Table 5.7 Weight Grain Per Day Assumptions**

<b>Reference Weight Category</b>	<b>Weight Range, lbs</b>	<b>Pounds Gain/Day</b>
A	Less than 500	1.50
B	500-799	2.00

## 5.5 Results

The model results are reported in Table 5.8. The default animal is a heavyweight steer sold in October at Dodge City and thus other cattle classifications are relative to that. The model had an R-square value of 0.7137. As expected given the large sample size, almost all variables were statistically significant. Only four of the model's 67 variables were not significant at the one percent level and one of those was significant at the five percent level. The three variables not significant were: *indchg2*, the second index change; *indchg1wt*, the interaction between the first index change and weight; and *Mo4*, dummy variable for April.

**Table 5.8 LRP Feeder Cattle Basis Model Results**

<b>Variable</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>p Value</b>
<i>Intercept</i>	-10.5354**	3.3960	-3.1000	0.0019
<i>Head</i>	0.0748**	0.0060	12.4000	<.0001
<i>Head2</i>	0.0004**	0.0001	4.2800	<.0001
<i>HeadWt</i>	-0.0001**	0.0000	-8.3300	<.0001
<i>Head2Wt</i>	-0.0000**	0.0000	-5.3600	<.0001
<i>Weight</i>	0.1232**	0.0107	11.5300	<.0001
<i>Wt2</i>	-0.0002**	0.0000	-19.9300	<.0001
<i>HfrWt</i>	0.0517**	0.0010	50.8200	<.0001
<i>HfrWt2</i>	-0.0000**	0.0000	-37.0700	<.0001
<i>Class1</i>	7.4323**	0.0285	260.8100	<.0001
<i>Class12</i>	2.6881**	0.0318	84.5000	<.0001
<i>indchg1</i>	-13.7921**	1.1455	-12.0400	<.0001
<i>indchg2</i>	0.4514	1.0329	0.4400	0.6621
<i>indchg3</i>	5.7848**	1.1915	4.8600	<.0001
<i>indchg4</i>	5.3722**	0.9498	5.6600	<.0001
<i>indchg1wt</i>	-0.0065	0.0036	-1.7900	0.0732
<i>indchg2wt</i>	-0.0349**	0.0033	-10.6300	<.0001
<i>indchg3wt</i>	-0.0324**	0.0038	-8.5600	<.0001
<i>indchg4wt</i>	-0.0217**	0.0030	-7.1400	<.0001
<i>indchg1wt2</i>	0.0000**	0.0000	11.0600	<.0001
<i>indchg2wt2</i>	0.0000**	0.0000	17.7200	<.0001
<i>indchg3wt2</i>	0.0000**	0.0000	11.6100	<.0001
<i>indchg4wt2</i>	0.0000**	0.0000	8.1200	<.0001
<i>LWH</i>	-27.7417**	0.3357	-82.6300	<.0001
<i>LWS</i>	-6.98878**	0.0427	-163.8400	<.0001
<i>HWH</i>	-19.6143**	0.3478	-56.4000	<.0001
<i>LC750</i>	1.5915**	0.0335	47.5100	<.0001
<i>LC750Wt</i>	-0.0047**	0.0001	-44.3400	<.0001
<i>LC750Wt2</i>	0.0000**	0.0000	42.4600	<.0001
<i>CN0</i>	-15.8961**	0.3087	-51.5000	<.0001
<i>CN0Wt</i>	0.0246**	0.0010	24.5000	<.0001
<i>CN0Wt2</i>	-0.0000**	0.0000	-5.9800	<.0001
<i>Mo1</i>	5.2080**	0.6169	8.4400	<.0001
<i>Mo2</i>	8.5940**	0.6447	13.3300	<.0001
<i>Mo3</i>	11.4970**	0.6103	18.8400	<.0001
<i>Mo4</i>	0.8095	0.5939	1.3600	0.1729
<i>Mo5</i>	4.3366**	0.7093	6.1100	<.0001
<i>Mo6</i>	3.7206**	0.9663	3.8500	0.0001
<i>Mo7</i>	-8.1611**	0.7685	-10.6200	<.0001
<i>Mo8</i>	-15.9614**	0.6630	-24.0700	<.0001
<i>Mo9</i>	-16.0752**	0.6892	-23.3300	<.0001
<i>Mo11</i>	10.7736**	0.5993	17.9800	<.0001
<i>Mo12</i>	4.1867**	0.6944	6.0300	<.0001



**Table 5.8 continued.**

<i>Mo1Wt</i>	0.0081**	0.0020	4.0200	<.0001
<i>Mo2Wt</i>	0.0133**	0.0021	6.3200	<.0001
<i>Mo3Wt</i>	0.0208**	0.0020	10.4200	<.0001
<i>Mo4Wt</i>	0.0526**	0.0020	26.7300	<.0001
<i>Mo5Wt</i>	0.0352**	0.0023	15.3200	<.0001
<i>Mo6Wt</i>	0.0207**	0.0031	6.6700	<.0001
<i>Mo7Wt</i>	0.0453**	0.0025	18.3800	<.0001
<i>Mo8Wt</i>	0.0665**	0.0022	30.6200	<.0001
<i>Mo9Wt</i>	0.0598**	0.0023	26.3900	<.0001
<i>Mo11Wt</i>	-0.0296**	0.0020	-14.7300	<.0001
<i>Mo12Wt</i>	-0.0080**	0.0023	-3.4900	0.0005
<i>Mo1Wt2</i>	-0.0000**	0.0000	-11.2200	<.0001
<i>Mo2Wt2</i>	-0.0000**	0.0000	-18.1700	<.0001
<i>Mo3Wt2</i>	-0.0000**	0.0000	-28.0000	<.0001
<i>Mo4Wt2</i>	-0.0001**	0.0000	-42.4200	<.0001
<i>Mo5Wt2</i>	-0.0000**	0.0000	-26.5000	<.0001
<i>Mo6Wt2</i>	-0.0000**	0.0000	-11.6900	<.0001
<i>Mo7Wt2</i>	-0.0000**	0.0000	-21.1500	<.0001
<i>Mo8Wt2</i>	-0.0001**	0.0000	-32.3500	<.0001
<i>Mo9Wt2</i>	-0.0000**	0.0000	-26.9300	<.0001
<i>Mo11Wt2</i>	0.0000**	0.0000	12.7800	<.0001
<i>Mo12Wt2</i>	0.0000*	0.0000	2.2400	0.025
<i>Loc2</i>	0.5178**	0.0203	25.5000	<.0001
<i>Loc3</i>	1.3418**	0.0206	65.0100	<.0001
R-square	0.7137			
RMSE	3.9175			

\*\*Denotes significance at 1 percent level

\*Denotes significance at 5 percent level

As expected, *Head* is positive, implying a positive impact on LRP basis. Larger lot sizes result in higher cash prices and hence stronger LRP basis. Variable *CNOWt* had a positive coefficient suggesting that as the weight of an animal increases the negative impact of rising corn prices are negated, as heavier cattle will be on feed for shorter periods of time. However, because of the specific weight interaction involved, it is hard to tell the specific effects by only looking at this one variable.

Due to the nonlinear terms and all of the interactions, it is difficult to discern the effect weight has on basis simply by looking at the coefficients reported in Table 5.8. Figure 5.2

illustrates the impact weight has on basis for the different LRP weight categories for steers and heifers with all other values held constant. The gap at the 600 pound level is created by the adjustment factor that is applied to lightweight steers and heavyweight heifers. This impact was determined assuming \$4.00 per bushel corn and \$95.00 per hundredweight live cattle prices.

**Figure 5.2 Relationship between LRP Basis and Weight by Cattle Classification**

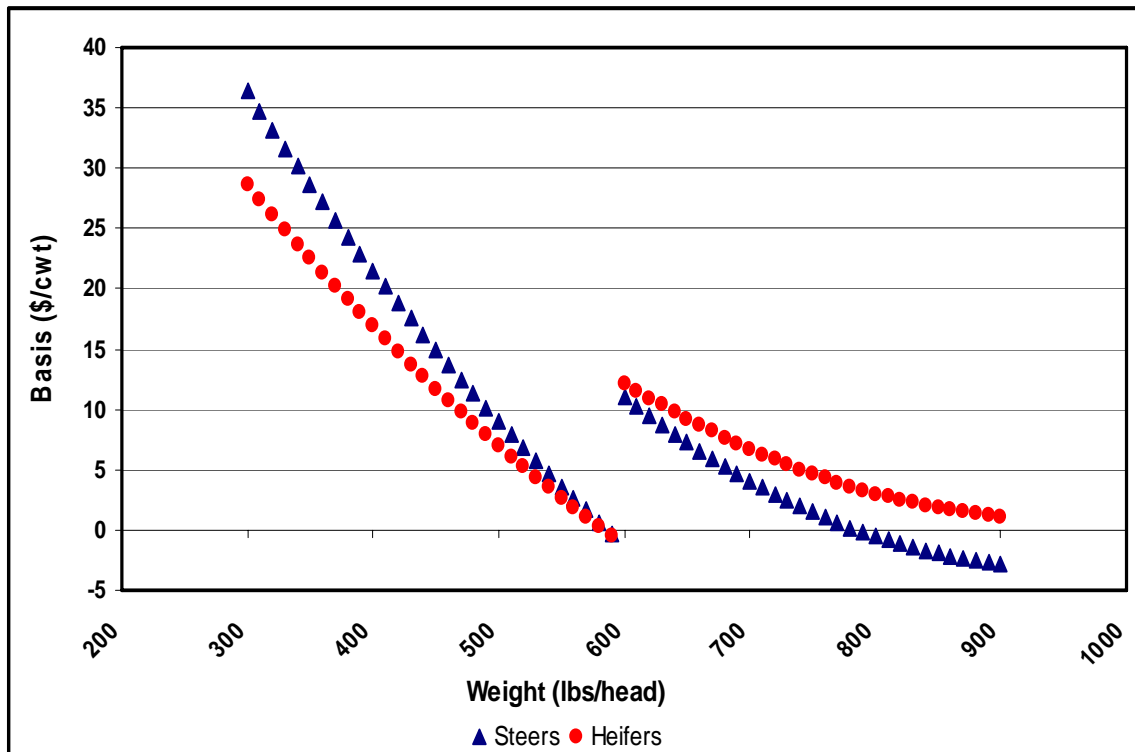


Figure 5.3 shows the effect corn price has on the LRP model predicted basis for two different weights of steers and heifers with all other variables held constant. The lightweight cattle are 500 pounds, while the heavyweight cattle are 700 pounds. This compares to actual average weights in the data set of 500 and 730 pounds for lightweight and heavyweight cattle, respectively. The actual average corn price in the dataset was \$2.53, with range of \$1.75 to \$5.00 per bushel. For the purpose of determining the impact corn prices have on LRP basis, live

cattle prices were held constant at \$95.00 per hundredweight in Figure 5.3. In the dataset live cattle price ranged from \$54.80 to \$102.92 per hundredweight.

As expected, the price of corn has a much larger impact on the basis for lightweight cattle than it does for heavyweight cattle. For example, the negative slope of the model-predicted basis for 500 pound calves is considerably steeper than the basis for 700 pound feeders. A \$0.25 per bushel increase in the price of corn results in a \$0.25 per hundredweight decrease in LRP basis for heavyweight cattle. At the same time, a \$0.25 per bushel increase in the price of corn leads to a decrease of \$1.19 per hundredweight in the LRP basis for lightweight cattle. This is not surprising, considering lightweight cattle will consume more corn as they will be on feed for more days than the heavyweight cattle.

**Figure 5.3 Relationship between Corn Price and LRP Basis**

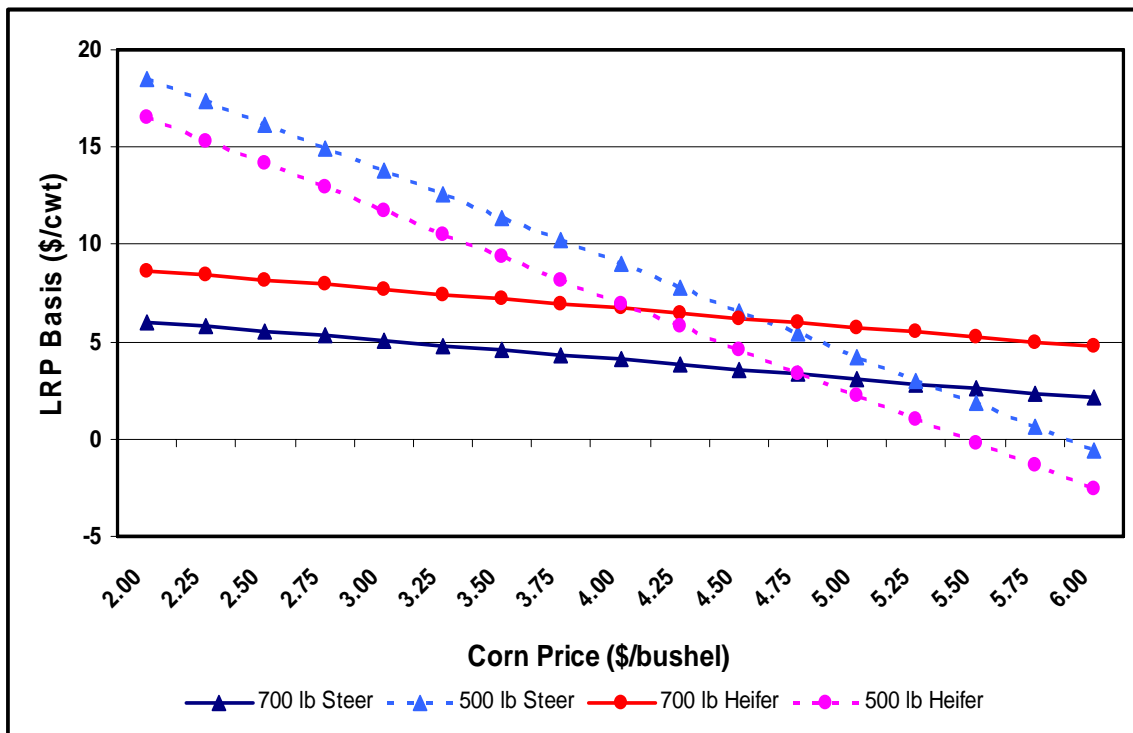
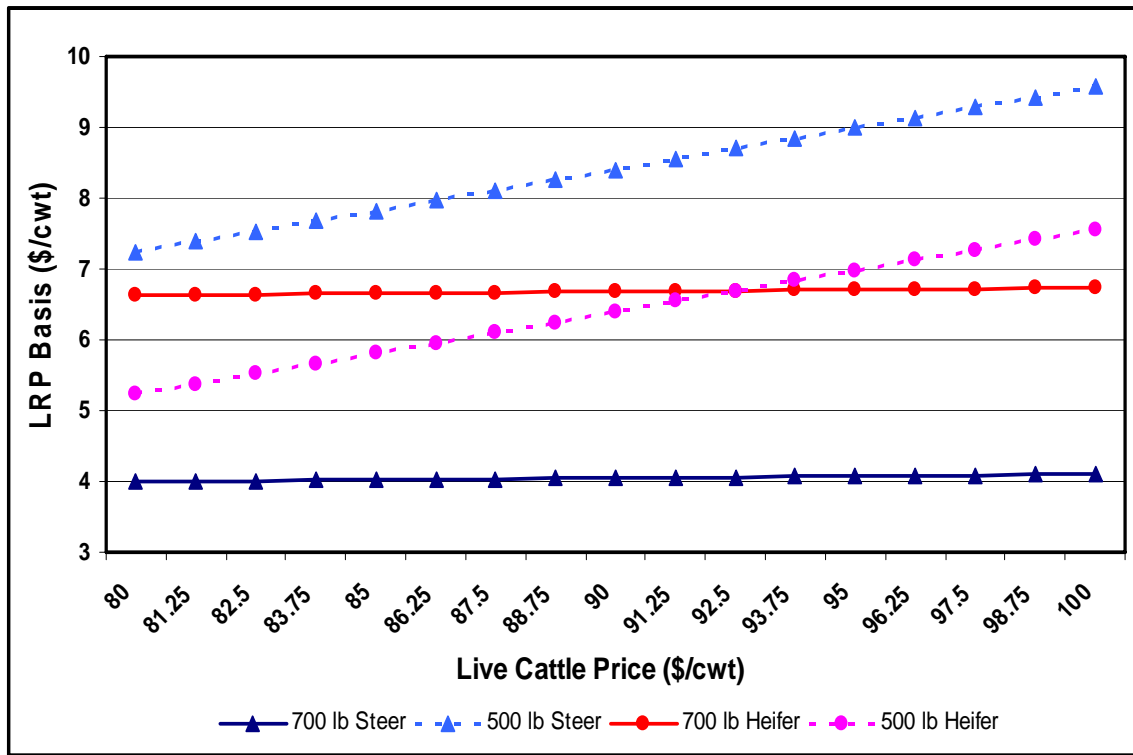


Figure 5.4 illustrates the effect of changing live cattle prices on LRP basis. For this illustration lightweight cattle were held constant at 500 pounds, while the heavyweight cattle were held at 700 pounds. All other variables were held constant, including corn at \$4.00 per bushel. As with corn price, a change in live cattle price creates a noticeable difference as to how it impacts the LRP basis of lightweight cattle versus heavyweight cattle. A \$1.25 per hundredweight change in live cattle price results in a greater change in LRP basis for lightweight cattle than heavyweight cattle. An increase of \$1.25 per hundredweight in the price of live cattle results in an increase of almost \$0.15 per hundredweight in LRP basis for a lightweight steer, while there is virtually no impact on the heavyweight cattle basis. The reasoning behind the minimal impact of LRP basis on heavyweight cattle may pertain to when live cattle prices are selected for the model. The nearby live cattle contract price is incorporated into the model when the animal reaches a weight of 750 pounds. Plus, the 700 pound heavyweight animal used as an example in Figure 5.4 is very similar to the specifications outlined in the CME Feeder Cattle Index. Consequently, the impact of a change in the live cattle futures contract will already be accounted for in the CME Feeder Cattle Index and will correspond to the 700 pound animal in the example.

**Figure 5.4 Relationship between Live Cattle Price and LRP Basis**



### 5.6 Implications and Limitations

The LRP Feeder Cattle Basis Model is not perfect as it has its limitations. The model must make assumptions, including those pertaining to animal performance. The same standard average daily gain is assigned for both heifers and steers, which is highly unlikely. There are also factors that impact feeder cattle basis that are not included in the model, due to the lack of availability. For example, such factors include fill, condition, and breed which Sartwelle et al. found to have a significant influence on the price of cattle.

However, while the model is not without its flaws, as with most models, the LRP Feeder Cattle Basis Model holds promise in being an effective price risk management tool Kansas producers can use to forecast LRP basis. Future plans are to apply the same methodology to various other states, which have similar data, and develop models that can be used by cattle

producers in these respective states. Ultimately, the goal is to place the models on the internet and make it available to producers, allowing them to forecast LRP basis correctly and accurately.

The LRP feeder cattle model captures the interaction of corn and live cattle prices. The forecasts are able to be specified for different locations within the state. Most notably it takes into account and applies the required price adjustment factors to the appropriate weight categories without being prompted by the user. Another advantage using the LRP Feeder Cattle Basis Model is the ability to evaluate weight as a continuous variable as opposed to 50 or 100 pound increments as is often done with historical average based forecasts. No other tool is available to assist producers in forecasting LRP basis, which allows them to specify the forecast according to the characteristics of their lot of cattle as the LRP Feeder Cattle Basis Model.

## **CHAPTER 6 - The Iowa Cattle Risk Management Workshop**

### **6.1 Iowa Cattle Risk Management Workshop Background Information**

The Iowa Cattle Risk Management Workshop is similar to the Kansas Cow-Calf Risk Management Workshop, an extension program initially developed by Dr. Dhuyvetter, Dr. Mintert, and Dr. Barnaby for Kansas producers. The workshop consisted of a cow-calf case study computer simulation based in Microsoft's Excel 2003. The workshop included a lecture regarding various price risk management strategies applicable to Kansas cow-calf producers. In 2007, Dr. Dhuyvetter and Dr. Mintert received a USDA Risk Management Agency (RMA) grant to present the cattle risk management workshop series in Iowa during the winter of 2008. This grant was a cooperative effort with Dr. John Lawrence and Shane Ellis of Iowa State University and the U.S. Department of Agriculture's Risk Management Agency (RMA). The Iowa workshop was planned to be conducted similar to the KSU Cow-Calf Workshop, with several alterations.

The workshop was adapted and revised for Iowa by creating new budgets for the Cow-Calf workshop, which will be discussed later in this chapter, and applying an Iowa cattle price series to the simulation. The prices and quantities of inputs were all reflective of the Iowa cattle industry. The number of decision points were decreased, compared to the Kansas workshop, to three pricing opportunities for calves sold at weaning and four pricing opportunities for the backgrounding enterprise. This alteration was made to better fit the time constraints of the workshop. A feedlot version was also created and will be discussed in the following section.

## **6.2 Iowa Cattle Risk Management Workshop Description**

Workshop participants were told they were to take on the role of manager for the Cyclone Ranch, a hypothetical commercial 250 beef cow operation. Workshop participants were provided a laptop computer to use that allowed them to make their own pricing and risk management decisions for the cow-calf operation using the tools they learned about in the lecture that paralleled the simulation. This teaching strategy allowed participants to apply material as they were learning it to a familiar setting: marketing calves on an Iowa cow-calf operation. Participants were able to use several price risk management tools, including forward contracting, futures hedging, put and call options, as well as LRP. The simulation was formatted in such a manner that the calculations pertaining to the price risk management tools were done automatically, which allowed participants to focus on the overall concept of the different management tools as opposed to the mathematical calculations.

The simulation period began in March with calving and progressed through the calendar year, with participants making decisions in May and August, before the calves were weaned at the end of October. Each decision point was a different Excel tab to help facilitate organization. Throughout the simulation, participants were told they could sell any portion of the 550 pound calves at weaning (October 31) and/or retain ownership of the remaining head and background the calves through February to a weight of 768 pounds. Consequently, participants were able to apply marketing strategies to the weaned calves, but also to the feeder enterprise if they chose to retain ownership. Marketing decisions were available for the feeder enterprise during the months of August, October, and December and then sold at the end of February.

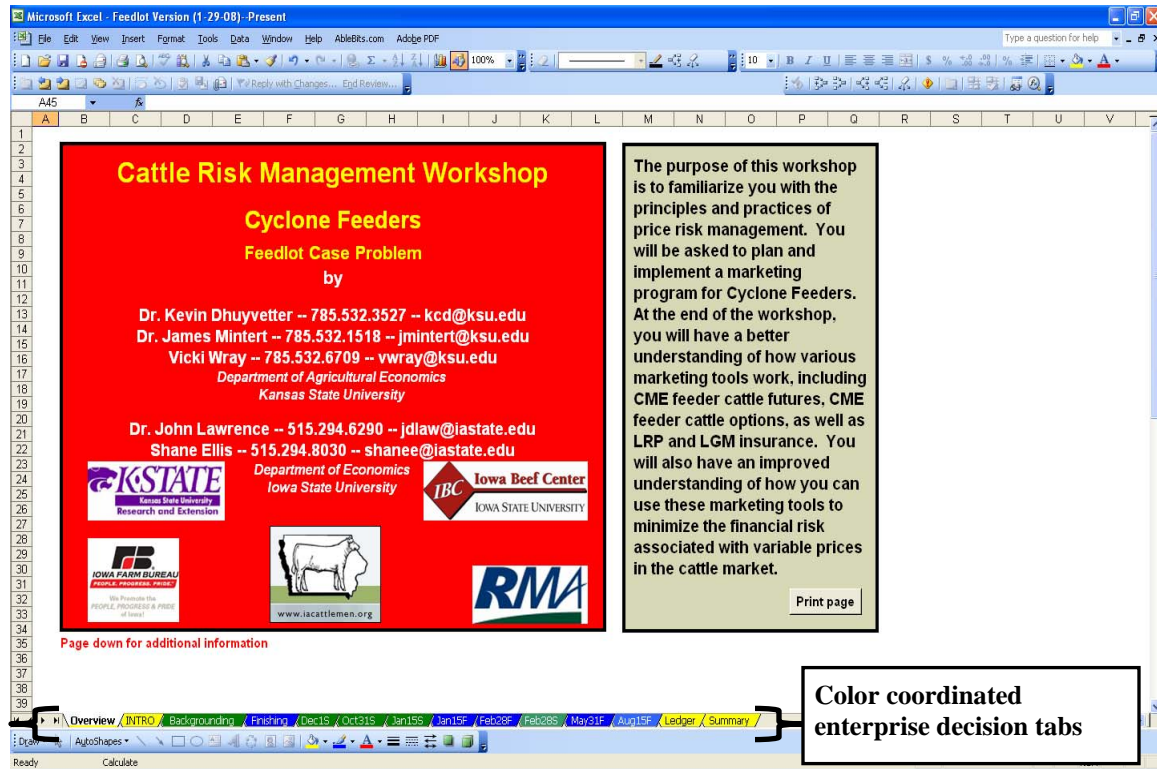
In addition to the Cow-Calf workshop, a feedlot version of the workshop was developed to better meet the demographics of the Iowa beef industry. The Feedlot workshop was based on a feeding case study simulation and lecture regarding various price risk management strategies



for cattle feeders discussed in Chapter 4. Feedlot workshop participants were told to assume the manager position of a hypothetical feedlot, Cyclone Feeders. As manager, they were in charge of managing 250 head of 550 pound steer calves, which were recently purchased on October 31<sup>st</sup>. As in the Cow-Calf workshop, participants were provided laptop computers to allow them for use to make their own pricing decisions in the simulation using the risk management tools they were learning about in the lecture. This teaching method allowed the feeders to immediately apply the price risk management strategies they were learning about in the lecture to a setting they were comfortable with, an Iowa feedlot. Participants were able to use price risk management tools that included cash forward contracting, futures hedging, put and call options, as well as LRP and LGM insurance.

The participants were required to feed the calves at least until the completion of the backgrounding phase, which concluded at the end of February when the calves would weigh 768 pounds. At that time, they could decide to sell any number of head and/or finish the remaining steers by feeding them until August when they would be sold as fed steers weighing approximately 1,320 pounds. The participants were given four decision points to forward price the calves for February sale as feeders: October, December, January, and February. They were also provided with four opportunities to forward price the calves as fed steers: January, February, May, and August, at which time the steers were sold as fed cattle. As in the Cow-Calf workshop, to assist with organization, each decision point had its own Excel tab (Figure 6.1).

**Figure 6.1 Initial Screen of Cattle Marketing Simulation**



In both workshops, each participant was charged the same for input costs and cattle performed identically, including death loss percentage and average daily gain. Thus, the comparisons between participants' results were due solely to their price risk management decisions. Upon the completion of the final decision point, workshop participants closed out any remaining open positions and were able to evaluate the effectiveness of individual price management tools they used. Participants were able to see how the different marketing strategies contributed to their overall profit or loss, and reflected upon how the tools worked. The decisions the participants made throughout the case study year were then simulated for a 21-year time period, and profits and losses for each of those years was calculated.

### **6.3 Iowa Cattle Risk Management Workshop Budgets**

Three set of budgets were created for the Cattle Risk Management Workshop Series. There were budgets created for the Cow-Calf, Background, and Finishing enterprises. During the workshop, the cost and quantity of expenses within the budgets were not altered so more focus could be placed on the marketing aspect of the simulation.

In addition to being created for use in the Risk Management workshops, another objective of the budgets was to create a series of budgeting tools that could be posted on the internet and be of use to producers. Therefore, the budgets were created with the purpose of being adaptable to a wide variety of cattle operations, as well as be informative, and easy to understand.

To assist participants in using the budgets, the formatting was constant throughout all the budgets. The user of the budgets entered inputs into only certain cells, which were distinguished by being blue in color. For illustrative purposes, the blue cell is marked with a star in Figure 6.2. The calculations, including revenue, expenses and profit were shown on a total value and per animal basis, or per cow basis in the Cow-Calf budget.

The budgets began with herd information and performance expectations. If a producer were to use these budgets for their own operation, they could enter the performance of their own herd. The budgets included a distinct area for revenue information (Figure 6.2). A producer could easily change the expected price, allowing them to see how it would affect their profitability. The revenue portion of the budget was followed by the expense portion. Livestock purchase costs were separated from the variable and fixed costs to allow for the calculation of total receipts in the case of the backgrounding and finishing enterprises.

**Figure 6.2 Screen Shot of Simulation Budget for Backgrounding Enterprise**

Backgrounding Budget - Wintered to Go to Feedlot, Bought in Fall and Sold in February <sup>1</sup>						
Total number of calves	250 head		2.50%	death loss		
Beginning weight, cwt	550 lbs		\$124.40	price, \$/cwt		
Average daily gain, lbs	2.08 pounds		120	days		
	Total Number of Head	Unit	Amount or Units per Head	Price or Cost/Unit	Value or Cost/Head	Total Amount
<b>1. Gross Receipts</b>						
Feeder steers	244	cwt	768	\$124.40	684.21	171,052
Less cost of calves	250	cwt	550			
<b>Total Receipts</b>						
<b>2. Variable Costs</b>						
Corn		bu	9.34	3.45	\$32.23	\$8,057
Modified distillers grain		ton	0.27	55.00	14.66	3,666
Supplement & minerals		ton	0.00	180.00	0.83	208
Forage - (hay & silage)		ton	0.86	50.50	42.04	10,509
Other			0.00	0.00	0.00	0
Veterinary, drugs, supplies		head	250	5.00	5.00	1,250
Marketing		head	244	3.00	2.93	732
Machinery & fuel		head	250	6.57	6.57	1,643
Transportation		\$/loaded mt	0	2.55	0.00	0
Manure hauling, bedding & misc.		head	250	5.00	16.85	4,213
Yardage		day	0	0.00	0.00	0
Interest-cattle & other costs		head	250	0.09	21.82	5,455
<b>Total Variable Costs</b>					<b>\$142.93</b>	<b>\$35,733</b>
<b>3. Income Above Variable Costs</b>						
<b>4. Fixed costs</b>						
Labor (including interest)		hours	267.6	14.00	\$15.24	\$3,809
Equipment, fences, etc.		head	250	9.58	9.58	2,394
<b>Total Fixed Costs</b>					<b>\$24.81</b>	<b>\$6,203</b>
<b>5. Total Costs</b>					<b>\$167.74</b>	<b>\$41,936</b>
<b>6. Return to Risk and Management</b>						
<b>Income over All Costs</b>						
Breakeven Steer Price to Cover Feed Costs						\$103.26

At times, producers lose sight of the difference between variable costs and fixed costs. However, the budgets were formatted to emphasize the distinction between variable and fixed costs for producers. The variable costs were itemized, grouping feed costs and other variable costs. The fixed costs pertaining to the respective enterprises were listed. All costs and quantities were designed to allow for alteration, based on the needs of the users.

The budgets were developed to assist workshop participants and cattle producers in making management decisions they commonly face. In an effort to effectively assist users with such decisions, the budgets were developed to be adaptable to any given operation and situation. Consequently, the budgets contain several appealing features. One such feature of the budgets is that a series of breakevens are automatically calculated for producers or the participants of the workshop. The budgets calculate the breakeven steer price to cover feed cost, the breakeven

steer price to cover feed and variable costs, the breakeven steer price to cover feed, variable, and non-labor fixed cost, and finally the breakeven steer price to cover feed, variable and all fixed costs.

Within the Cow-Calf budget, a producer could determine whether or not they would like to retain or purchase replacement heifers and the budgets will adjust accordingly. The budgets allow users to determine how they would like to allocate machinery, equipment, fences, replacement costs, interest, herd insurance, and the bull depreciation/replacement costs. However, in the workshop all of these choices were predetermined to focus discussion on price risk management.

An accessory that may make the feeding budgets more user-friendly to a wider demographic of cattle feeders was to allow users to choose the method of how they would like to calculate their variable costs. They could apply a yardage charge on a per head per day basis, or they could itemize the components that go into the yardage charge. The yardage charges, as well as the fixed costs are allocated according to the discretion of the user. In addition, the impact of shrink and its financial implications can be calculated in the cow-calf budget as well as the two feeding budgets.

## **6.4 Iowa Cattle Risk Management Workshop Data Compilation**

The budget guidelines and base parameters were derived from the 2007 Iowa State University Livestock Enterprise Budgets. Yardage, as well as the machinery, fuel, manure hauling, and bedding charges were based on the Iowa State University Extension “Beef Feedlot Systems Manual.” Calf prices were obtained from the BeefBasis.com website. The prices were pulled on a monthly basis from Iowa sale barn locations for the years 1997-2007. The Iowa monthly prices were then regressed on corresponding Kansas monthly prices to create prices for

missing and unavailable data from 1983 to 1996. The Iowa monthly fed steer price series was constructed from two different AMS-USDA reports over the time period. Missing Iowa prices were filled in by regressing the Iowa price series on weekly corresponding Kansas fed cattle price series.

## **6.5 Iowa Cattle Risk Management Workshop Lecture and Facilitation**

Facilitators anticipated that individuals with a variety of occupations would attend the workshops, including cattle producers (both current and semi-retired) and agribusiness professionals, as well as college students. This meant there would be varying familiarity with price risk management tools. As the workshop was developed and revised for Iowa, these issues were considered, along with the fact that there would be some participants who were very comfortable with computers and others whom had never operated a computer. This was given special consideration as the facilitation of the workshop was planned, especially because participants were supplied with a laptop computer to make their own marketing decisions within the simulation.

As one can interpret from the description of the workshop, there was a significant amount of information for participants to learn and comprehend. Not only were some participants learning about the risk management tools for the first time, but they also had to understand and comprehend the simulation well enough to apply the tools they were learning about in the workshop. Participants may have understood the storyline of the simulation; however, at first it was a bit challenging for participants to differentiate and keep the enterprises straight in each of the respective simulations. This was especially true for the Cow-Calf workshop where participants had to differentiate between the cow-calf enterprise and backgrounding enterprise. The Feedlot workshop participants needed to keep the stocker and fed cattle enterprises separate.

To assist participants with this task, data and corresponding tabs pertaining to each of the enterprises within each workshop were color coordinated. For example, budgets and decision points pertaining to a specific enterprise were colored the same, including the tabs and headings of each applicable worksheet. Plus, tabs were placed in order according to the progression of the workshop so it would be easier for participants to follow (Figure 6.1).

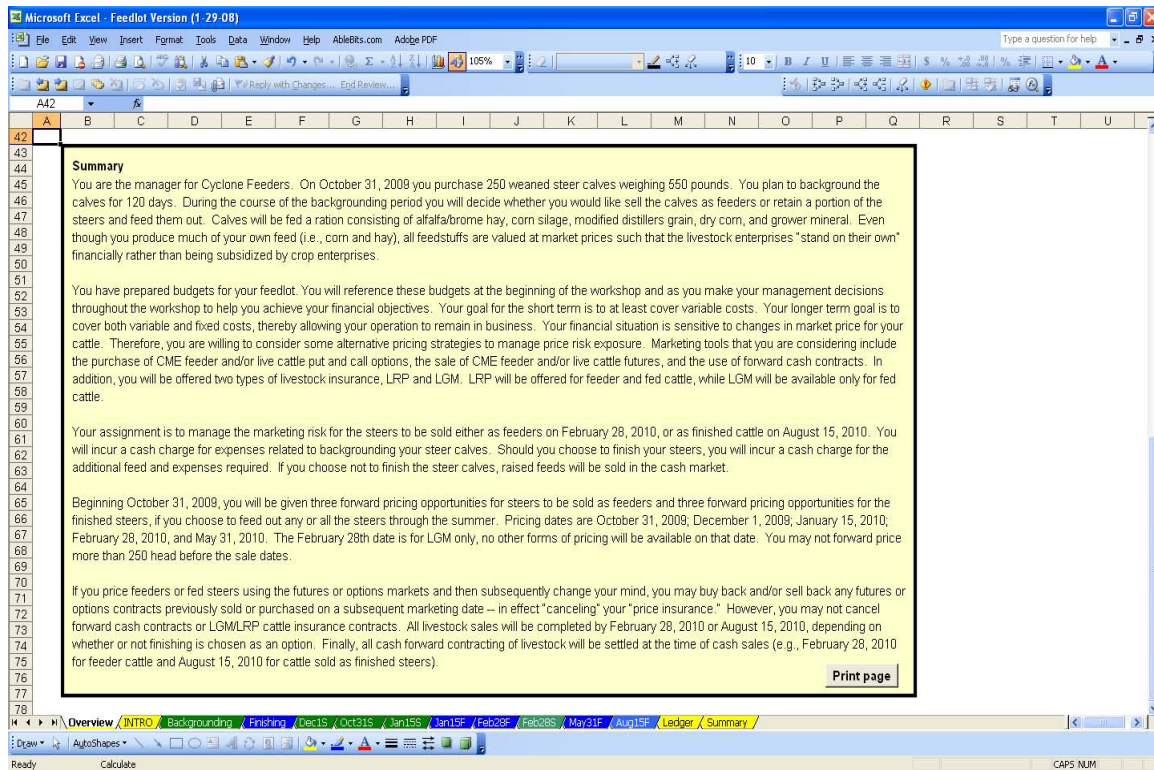
Keeping in mind workshop participants would have varying comfort levels with computers, the workshop was facilitated using two computer projectors and overhead screens. The one screen always showed lecture slides. When it came time to work through the simulation the other screen would show the Excel worksheet page on which the participants were to be focused and how to enter information into the worksheet.

The lecture that paralleled the simulation was presented in an attempt to gradually introduce participants to the simulation and the information regarding the price risk management tools. First, the facilitator explained a basic agenda for the workshop and how it would be presented. Next, the screen in the front of the room showed the tab of the simulation, which provided background information on the case study simulation (Figure 6.3).

The facilitator showed the participants how to navigate the worksheet, including how to use the mouse and provided them an opportunity to read about the scenario surrounding the simulation. After ensuring participants were comfortable with the simulation scenario and computer equipment, the participants were then introduced to the budgets they would use throughout the simulation. An electronic budget was created in Excel 2003 for each of the enterprises. The quantity and cost were itemized for each enterprise, in addition to herd performance expectations. All participants were given the same budget parameters. The budgets were intended to assist producers in obtaining breakeven prices. Producers were shown how to

enter expected cash prices, which would allow them to determine their profit or loss corresponding to the price they entered.

**Figure 6.3 Screen Shot of Simulation Background Summary**



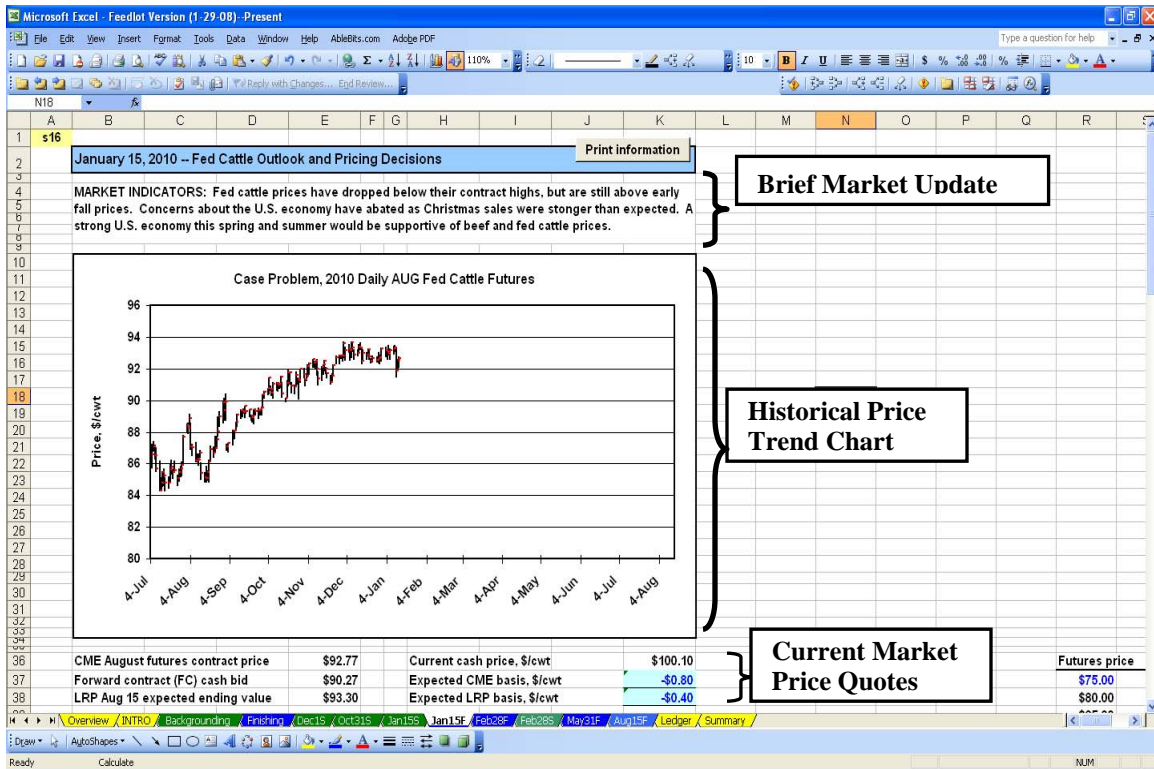
Once the participants became comfortable with operating the Excel simulation spreadsheets, the lecture began to focus on price risk management tools. The lecture was structured in a manner that would assist participants who were not familiar with price risk management as well as those who had some experience with such tools. Participants were first introduced to hedging. The slides visually outlined what the facilitator was teaching, thereby providing participants with both visual and audio means of absorbing information. The lecture then described foundation information, including defining and calculating basis as well as cash forward contracting. The lecture next explained how to evaluate a hedge where the concept of



basis was directly applied. A hedging example was employed to illustrate how the marketing tool worked. The example used numbers similar to those the participants would be using in the simulation. Once questions were answered pertaining to the material that had been covered, participants were introduced to put options. The same methods used to teach hedging were used to explain put options, including a put option example. At the conclusion of put options, participants are allowed to apply the information they had learned in the simulation's first decision point.

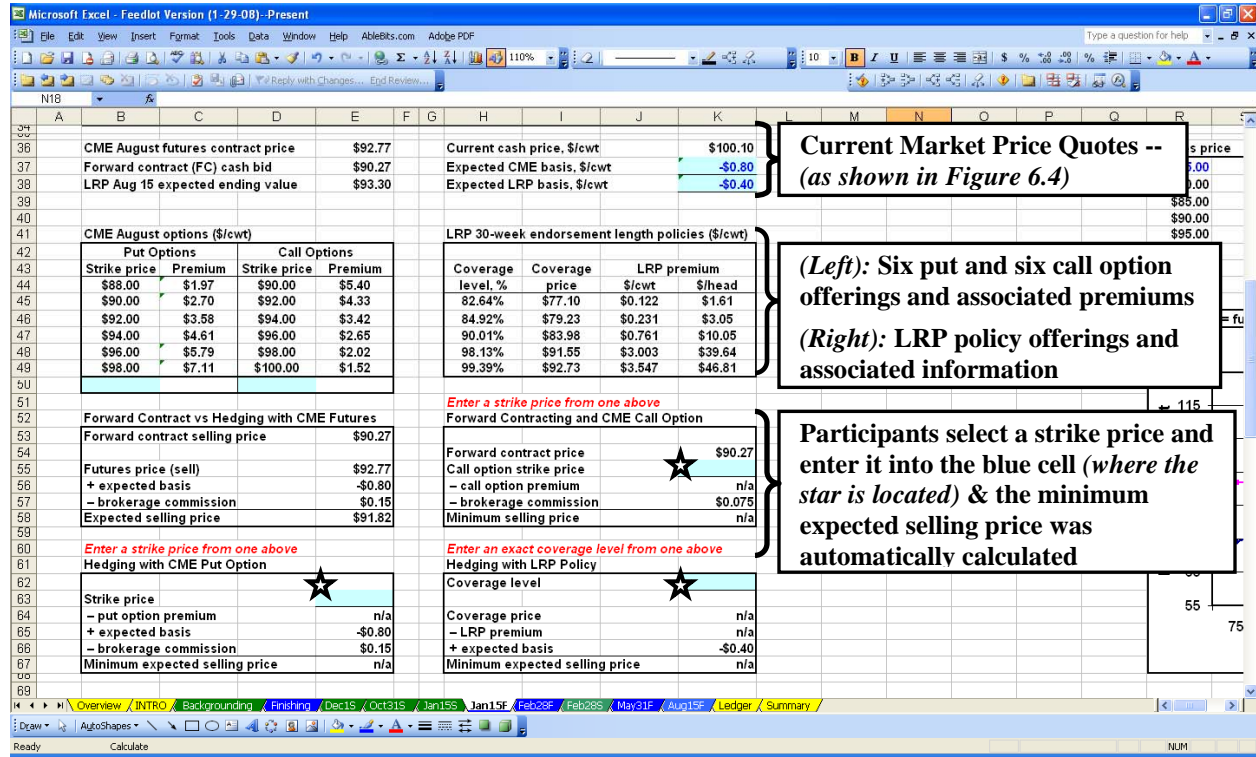
Each decision point worksheet was formatted the same. The participants were provided with a market report that was intended to provide insight into the current market conditions for the simulation year as well as a recent historical price trend graph that contained recent historical daily closing prices for the relevant futures contract. Plus, they were given several other prices: a cash forward contract bid, current cash price, the corresponding futures contract price, the expected CME basis, as well as the LRP expected ending value (EEV) and expected LRP basis, where applicable (Figure 6.4).

**Figure 6.4 Initial Decision Point Screen Shot**



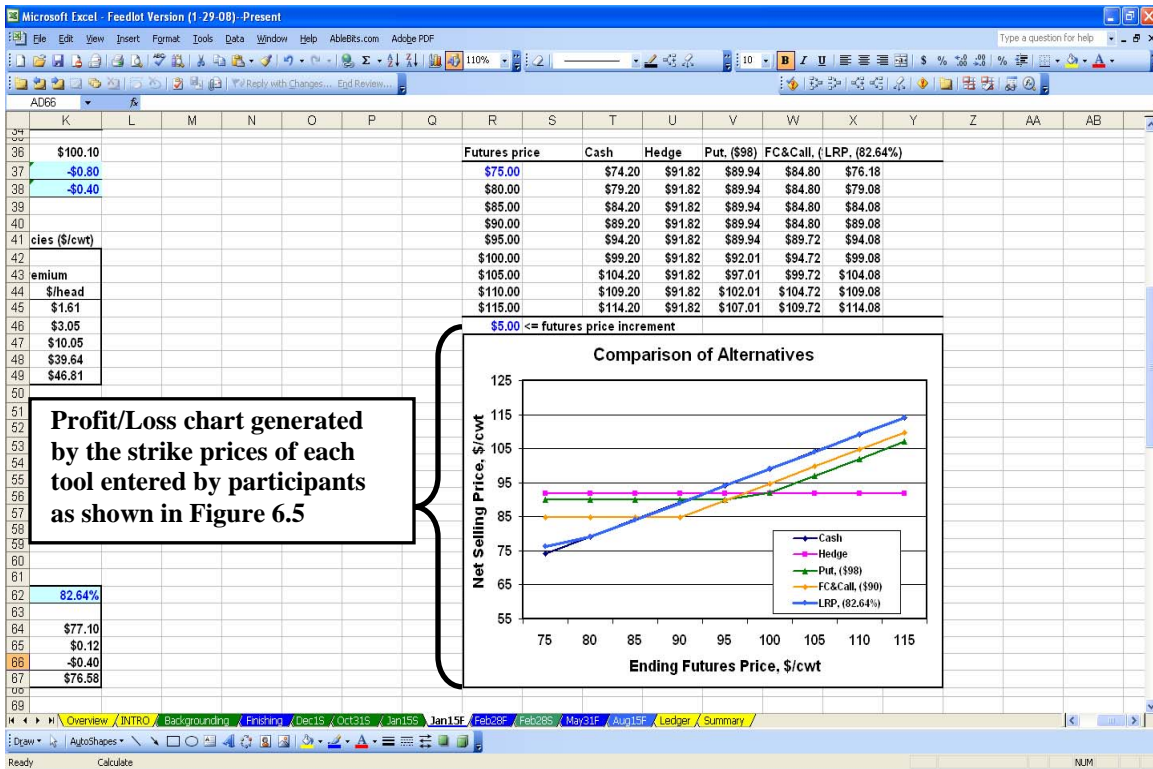
They were also supplied with the corresponding option offerings, including six different strike prices and their corresponding premiums. When offered, participants were given five different LRP and LGM coverage levels with associated information. To assist participants in evaluating the different tools in a timely manner, there were areas of the worksheet where the expected selling price was calculated for the selected hedge. In other areas, the minimum expected selling price for puts and/or LRP were calculated by the participant by entering the desired strike price or coverage level. For the purpose of illustration, the strike price or coverage level was entered into the starred cells (Figure 6.5). The minimum selling price for a synthetic put was calculated when the call strike price and forward contract price were entered.

**Figure 6.5 Decision Point Screen Shot—Showing Decision Point Option Offerings and Calculation Area**



When participants entered a strike price or coverage level into the starred cells, as shown in Figure 6.5, a profit/loss chart was generated which displayed the possible net selling prices across a continuum of possible future prices (Figure 6.6). This allowed participants to directly compare the different price risk management tools simultaneously. Participants could also alter the expected basis and observe the impact this would have on expected selling prices.

**Figure 6.6 Decision Point Screen Shot—Profit/Loss Chart**



On each decision point worksheet, above where the participants entered their final marketing decision for the given point, participants were asked to write the response to a couple of questions (Figure 6.7). They were asked what tools they selected to use for the given decision point and why, as well as the number of head they were pricing. It should be pointed out that they did not have to use any risk management tools if they did not wish to, but they were still encouraged to write down the reasoning for their decision. This forced the participants to review their reasoning behind the selected marketing tools, and allowed facilitators to check for participant understanding.

**Figure 6.7 Decision Point Screen Shot—Explanation of Marketing Decisions Made**

Minimum expected selling price		Minimum expected selling price	
	\$89.94		\$76.58
Marketing decision(s) to make today: 0			
Should I sell some calves TODAY?		What quantity will be sold?	
HOW?			
WHY?			
Do you want to liquidate any open futures or options positions (if Yes, enter data on ledger)?			
Forward contract, number of head			
Hedge with futures contract, contracts			
Hedge with options		Number of contracts	
	Strike price	Bought	Sold
Put option	★		
Put option	★		
TOTAL		0	n/a
		Premiums paid <sup>1</sup>	
		\$/cwt	Total
Put option	★	n/a	n/a
Put option	★	n/a	n/a
TOTAL		\$0	\$0
		Premiums received <sup>1</sup>	
		\$/cwt	Total
Call option	★	n/a	n/a
Call option	★	n/a	n/a
TOTAL		\$0	\$0
LRP contract		Coverage, %	
	★	Coverage, %	Head
Policy	★	n/a	n/a
Policy	★	n/a	n/a
TOTAL		0	
		Pre-period	
			Post-period
Number of head available for forward contracting		0	0
Number of head available to be priced with LRP contracts		0	0
Number of futures contract positions available to take		0	0
Number of options contract positions available to take		0	0

As expected, participants were somewhat overwhelmed at first concerning what price risk management tools to use for their marketing decision. In an attempt to assist participants in thinking through which marketing tools to select, facilitators conducted a role play. One facilitator assumed the role of a producer while the other facilitator assumed the role of a market advisor who was hired to advise the producer as to what tools to use. They began a dialog to discuss the different marketing possibilities. The market advisor walked through a couple of possible tools he would use and his reasoning. The producer then incorporated the market advisor’s advice as he discussed with the audience as to what he ought to do. The producer went back to the budgets to check how different strategies would impact his overall net profit or loss. All the while the participants could watch his actions on the second screen. Finally, the

facilitator entered his final decision and participants were then asked to make their own marketing decisions.

At the first decision point, producers were given the opportunity to cash forward contract, hedge, or use put options. Then, once they learned about calls, LRP, and LGM (in the Feedlot workshop) in the lecture, they had the opportunity to apply them to the following decision points, adding to the list of marketing tools available. This allowed the participants to focus on a couple of strategies initially, building their confidence and adding other tools as time passed.

Participants were highly encouraged to ask questions at any time during the workshop. There was usually one facilitator per four to six participants, so as a result there was generally a facilitator available to help answer questions on an individual basis. The availability of the facilitators encouraged participants to ask for help or ask questions because they would generally receive one-on-one attention.

Midway through the workshop a 'teachable moment' regularly occurred when participants were encouraged to consider retaining ownership of their calves and transfer them to the other enterprise. This was a teachable moment because so many producers, in their own operations, consider this option routinely, but may not do so correctly, at least from an economic standpoint. Many producers do not consider there being more than one enterprise, let alone know how they should value the cattle in the transfer. Many producers consider the value of the cattle to be equal to the expenses associated with raising the cattle up to that point.

Workshop participants were challenged to think of two separate enterprises and then encouraged to value the calves, at the transfer between enterprises, for what they could have sold them for in the cash market. In the case of the workshop, the cash forward contract bid was the best indicator of what they could have received for the cattle had they not chosen to feed them

longer. Consequently, the participants that elected to retain cattle were guided by the facilitators to have the second enterprise purchase the calves from the first enterprise for the price the market would have paid (the cash forward contract price). This provided producers with the method to evaluate the financial feasibility of retaining calves.

Once the workshop reached the final decision point, participants sold the last of their calves in the cash market and closed out any futures, options, or insurance contract positions that were yet open in a ledger tab. At that time, the facilitators would ask participants for their net profit or loss value. Facilitators would generally ask the participants who had the largest profit and loss to describe the marketing strategy they used. This allowed the group to observe the performance of strategies other than their own, and reflect on how their strategy worked in comparison. Upon the conclusion of questions, participants were asked to push a macro button which simulated the results of using the same marketing strategies for each of the last 21 years. This allowed the participants to see the impact of their risk management decisions if routinely made under various market conditions. Plus, they were also able to compare their overall return, in addition to their per head return, had they strictly sold the calves as stockers or fed cattle (Feedlot workshop) for each of the 21 years.

Granted, participants in the real world would not use the exact same strategy for each of the 21 years if given the opportunity, as they would have had information that probably would have altered their actions. However, in practice there are producers who sell their calves at weaning every year regardless of market prices. Producers who market their cattle in the same manner every year may do so for many reasons. It may be for tax consideration, out of habit, they do not know what else to do and are unaware of other alternatives, or do not know how to evaluate alternatives. To assist participants in retaining the information learned during the

workshop, they were provided with a handout that summarized the different price risk management strategies and how to evaluate the different tools (Appendix A.1). It also listed helpful price risk management tools and websites.

## **6.6 Evaluated Effectiveness of the Iowa Cattle Risk Management Workshop**

Prior to the beginning of the workshops, a multiple choice pre-test was completed by each participant. Then, at the conclusion of the workshop each participant completed a multiple choice post-test (Appendix A.2 & A.3). The questions were the exact same on each test. The questions allowed facilitators to evaluate the gain in participants' recognition and understanding as well as explicit application. Their recognition and understanding were tested with basic definition-type questions while their explicit application was tested with questions regarding their ability to apply explicitly stated risk management tools to solve a stated problem. There were only six questions on each of the tests, so not all topics covered in the workshop could be included on the tests. But the questions asked pertained to several overall main concepts. The tests contained only six content questions so they could be completed in a timely manner and to keep participants' annoyance to a minimum.

Table 6.1 summarizes the questions and responses from nine of the ten workshop locations using an attendance weighted average. At one of the Feedlot Workshop the pre-test failed to be administered. There is a difference between the number of participants taking the pre-test and post-test because throughout a total of nine workshops ten people had to leave before the post-test was administered. The tests were administered anonymously, so the pre-test and post-test of an individual were not directly compared.



**Table 6.1 Pre & Post-Test Results of Iowa Cattle Risk Management Workshop**

**Participants**

	<u>Total Participants</u>	<u>Total Percent Correct/Agree</u>	<u>Percent Improvement</u>
<u>Question 1:</u>			
<i>Basis equals...</i>			
Pre-test	153 <sup>1</sup>	17.6	
Post-test	143 <sup>1</sup>	61.5	<b>43.9</b>
<u>Question 2:</u>			
<i>Who can you purchase LRP insurance from?</i>			
Pre-test	153 <sup>1</sup>	43.1	
Post-test	143 <sup>1</sup>	74.8	<b>31.7</b>
<u>Question 3:</u>			
<i>When purchasing LRP Insurance for feeder cattle, what is the maximum insurance coverage price that you can purchase for your feeder cattle on any given day?</i>			
Pre-test	153 <sup>1</sup>	17.6	
Post-test	143 <sup>1</sup>	51.7	<b>34.1</b>
<u>Question 4:</u>			
<i>If you buy a March CME feeder cattle put with a strike price of \$100 at a premium cost of \$2/cwt., you expect a basis for your 750 pound steers to be +\$1/cwt. and your broker charges \$0.10 per cwt. to buy and \$0.10/cwt. to sell a put option, what is your <u>Minimum Expected Selling Price?</u></i>			
Pre-test	153 <sup>1</sup>	43.8	
Post-test	143 <sup>1</sup>	58.0	<b>14.3</b>
<u>Question 5:</u>			
<i>Assume that you hedged the sale of your cattle using October feeder cattle futures. After you have completed the cash market sale of your cattle and you have offset your position in the futures market, how do you calculate your <u>Actual Sale Price?</u></i>			
Pre-test	153 <sup>1</sup>	58.8	
Post-test	143 <sup>1</sup>	76.9	<b>18.1</b>
<u>Question 6:</u>			
<i>The purpose of LGM is to:</i>			
Pre-test	153 <sup>1</sup>	65.4	
Post-test	143 <sup>1</sup>	75.5	<b>10.2</b>
<u>Question 7:</u>			
<i>Would you recommend this workshop to others?</i>			
Post-test	167 <sup>2</sup>	88.0	
<u>Overall summary of Questions 1-6:</u>			
Pre-test	153 <sup>1</sup>	41.4	
Post-test	143 <sup>1</sup>	66.4	<b>25.4</b>

<sup>1</sup> Results include nine of the ten workshops as one location did not complete a pre-test.

<sup>2</sup> The results of Question 7 include all ten workshop locations, as all ten locations completed a post-test.

Each question showed an improvement in the percent of participants who answered the question correctly from the pre- to the post-test. The largest percent improvement was observed in questions considered to be definitional, while less improvement was seen in the explicit application questions. However, it should be noted that on the post-test, the largest percent correct was associated with question five, where participants were asked to calculate the actual sale price, an applied question. The overall post-test scores improved approximately 25 percentage points from the pre-test scores. The majority (88 percent) of workshop participants said they would recommend the workshop to others.

Table 6.2 shows the results of the Cow-Calf workshops, while Table 6.3 illustrates the results of the Feedlot workshops. The overall scores between the two workshops were very similar. The participants of the Feedlot Workshop scored noticeably higher than the Cow-Calf workshop participants did on the first question pertaining to defining basis. The Cow-Calf workshop participants scored higher on the fourth question which asked participants to calculate a minimum expected selling price.

**Table 6.2 Pre & Post-Test Results of the Cow-Calf Iowa Cattle Risk Management Workshop Participants**

	Total Participants	Total Percent Correct/Agree	Percent Improvement
<u>Question 1:</u>			
<i>Basis equals...</i>			
Pre-test	61	19.7	
Post-test	56	48.2	<b>28.5</b>
<u>Question 2:</u>			
<i>Who can you purchase LRP insurance from?</i>			
Pre-test	61	36.1	
Post-test	56	73.2	<b>37.1</b>
<u>Question 3:</u>			
<i>When purchasing LRP Insurance for feeder cattle, what is the maximum insurance coverage price that you can purchase for your feeder cattle on any given day?</i>			
Pre-test	61	13.1	
Post-test	56	44.6	<b>31.5</b>
<u>Question 4:</u>			
<i>If you buy a March CME feeder cattle put with a strike price of \$100 at a premium cost of \$2/cwt., you expect a basis for your 750 pound steers to be +\$1/cwt. and your broker charges \$0.10 per cwt. to buy and \$0.10/cwt. to sell a put option, what is your <u>Minimum Expected Selling Price?</u></i>			
Pre-test	61	23.0	
Post-test	56	44.6	<b>21.7</b>
<u>Question 5:</u>			
<i>Assume that you hedged the sale of your cattle using October feeder cattle futures. After you have completed the cash market sale of your cattle and you have offset your position in the futures market, how do you calculate your <u>Actual Sale Price?</u></i>			
Pre-test	61	47.5	
Post-test	56	66.1	<b>18.5</b>
<u>Question 6:</u>			
<i>The purpose of LGM is to:</i>			
Pre-test	61	50.8	
Post-test	56	62.5	<b>11.7</b>
<u>Question 7:</u>			
<i>Would you recommend this workshop to others?</i>			
Post-test	56	82.1	
<u>Overall summary of Questions 1-6:</u>			
Pre-test	61	31.7	
Post-test	56	56.5	<b>24.9</b>

**Table 6.3 Pre & Post-Test Results of the Feedlot Version of the Iowa Cattle Risk Management Workshop Participants**

	Total <u>Participants</u>	Total Percent <u>Correct/Agree</u>	Percent <u>Improvement</u>
<u>Question 1:</u>			
<i>Basis equals...</i>			
Pre-test	92 <sup>1</sup>	16.3	
Post-test	87 <sup>1</sup>	70.1	<b>53.8</b>
<u>Question 2:</u>			
<i>Who can you purchase LRP insurance from?</i>			
Pre-test	92 <sup>1</sup>	47.8	
Post-test	87 <sup>1</sup>	75.9	<b>28.0</b>
<u>Question 3:</u>			
<i>When purchasing LRP Insurance for feeder cattle, what is the maximum insurance coverage price that you can purchase for your feeder cattle on any given day?</i>			
Pre-test	92 <sup>1</sup>	20.7	
Post-test	87 <sup>1</sup>	56.3	<b>35.7</b>
<u>Question 4:</u>			
<i>If you buy a March CME feeder cattle put with a strike price of \$100 at a premium cost of \$2/cwt., you expect a basis for your 750 pound steers to be +\$1/cwt. and your broker charges \$0.10 per cwt. to buy and \$0.10/cwt. to sell a put option, what is your <u>Minimum Expected Selling Price?</u></i>			
Pre-test	92 <sup>1</sup>	57.6	
Post-test	87 <sup>1</sup>	66.7	<b>9.1</b>
<u>Question 5:</u>			
<i>Assume that you hedged the sale of your cattle using October feeder cattle futures. After you have completed the cash market sale of your cattle and you have offset your position in the futures market, how do you calculate your <u>Actual Sale Price?</u></i>			
Pre-test	92 <sup>1</sup>	66.3	
Post-test	87 <sup>1</sup>	83.9	<b>17.6</b>
<u>Question 6:</u>			
<i>The purpose of LGM is to:</i>			
Pre-test	92 <sup>1</sup>	75.0	
Post-test	87 <sup>1</sup>	83.9	<b>8.9</b>
<u>Question 7:</u>			
<i>Would you recommend this workshop to others?</i>			
Post-test	111 <sup>2</sup>	91.0	
<u>Overall summary of Questions 1-6:</u>			
Pre-test	92 <sup>1</sup>	47.3	
Post-test	87 <sup>1</sup>	72.8	<b>25.5</b>

<sup>1</sup> Results include four of the five Feedlot workshops as one location did not complete a pre-test.

<sup>2</sup> The results of Question 7 include all five Feedlot workshop locations, as all five locations completed a post-test.

## **6.7 Suggested Improvements for the Iowa Cattle Risk Management Workshop**

The length of the workshop was approximately five hours, including a 30-45 minute lunch break. Consequently, any improvement or suggestions cannot add time to the workshop without causing significant logistical changes. Facilitators believed adding length to the workshop would have an adverse effect on attendance, as it was difficult for people to commit one day to this activity. Thus, suggestions and recommendations will focus around integrating teaching methods that emphasize the Dual-Coding Theory and Cognitive Load Theory, with the objective of participants processing and comprehending the material in a more efficient manner.

As structured, the lecture did a very good job of coinciding with the Dual-Coding Theory by using relevant illustrations via PowerPoint slides to coincide with the lecture. Very few times did the facilitators read the slides word for word, which can be counter productive (Mayer and Moreno), but rather used minimal words on the slides to mainly outline only the needed detail. Additionally, graphs and charts, instead of words, were used where possible. Participants of the workshops found the profit/loss graph to be a great asset in helping them to understand how the price risk management tools work. Many of them even looked forward to using the profit/loss graph, located on [AgManger.info](http://AgManger.info), in assisting them in making marketing decisions on their own operations.

There was a large amount of material for workshop participants to absorb, especially for those unfamiliar with price risk management tools. The facilitators were aware of the volume of material they had to present in a relatively short amount of time. As a result they were, at times, forced to proceed through the material at a quicker rate than they would have otherwise preferred. This could have resulted in cognitive overload, where some participants' learning decreased and eventually came close to a standstill, even though information surrounded them.

A way to reduce the cognitive overload of workshop participants would be to break the workshop down into smaller parts. The workshop was already well organized, but more definite segment breaks could be incorporated like having a review slide at the conclusion of a concept. This would allow more time before moving onto the next concept, a method suggested by Mayer and Moreno called segmenting. Segmenting allows participants time to review the concept highlights and organize their thoughts before moving onto new material. The challenging aspect to this suggestion is many of the concepts are integrated into one another. As a result, it is not clear where one concept ends and another one begins. As a result it is critical that presenters emphasize the keys aspects of the workshop. If done properly, the participants will be able to focus their attention on the foundational concepts allowing them to develop schemas, which will enable them to process more advanced concepts which incorporate the foundational information.

To assist in more clearly segmenting the lecture and helping producers develop concept schemas, participants could receive note packets that follow the lecture and highlight the major points of each concept. There could even be a couple blanks in the notes where producers would need to write-in keywords as each concept was covered. This would encourage workshop participants to be engaged in the lecture portion of the workshop. Of course, the facilitator would need to guide participants in filling in the blanks. However, because they would be key concepts, it would naturally fit into the lecture. An example would be as simple as writing in the word ‘cash price’ in a partially given basis equation. Participants received a marketing terminology worksheet at the conclusion of the workshop, while it will greatly assist the participants in remembering what they learned at the workshop, it did not encourage active participation during the workshop (Appendix A.1).

Some participants not familiar with computers are initially intimidated when they hear they will need to operate a computer to participate in the simulation. The idea of the computer, and the anxiety it gives these participants, takes away cognitive space from learning about price risk management and places it on learning how to operate a computer mouse or navigate across the computer screen. Therefore, minimizing the amount of navigation they must do on the computer screen is critical. Facilitators of the workshop went to great efforts to minimize such screen navigation. However, there may be a way to further reduce the amount of excess information and organize the decision point worksheets in such a way that navigation could be further reduced. Information such as the brief market update, historical price trend chart and current market price quotes could be omitted from the participants' computer screens and simply shown on the overhead screens, or passed out to participants at the beginning of each decision point.

To further reduce the amount of text on a decision point worksheet, the area where producers were asked to type in their reasoning for their selected marketing strategy, as shown in Figure 6.7, could be omitted from the computer. It could instead be requested of the individual to write down the information on preformatted sheets of paper. There are a couple of reasons for this suggestion. First, as mentioned earlier, it would reduce the amount of text on each decision point worksheet. The participants who are not comfortable with typing may be more apt to write it down on paper, as opposed to typing. Plus, at the end of the workshop when participants are asked to reflect, or share their overall marketing strategies, it would be easier for them to turn a few pieces of paper and lay them side by side, as opposed to clicking back and fourth on decision tabs.

Without a doubt, for as many people who would prefer writing things down on paper, there are probably just as many who would prefer to type it into the computer. Admittedly, it can be legitimately argued producers ought to become more comfortable with using computers. However, the primary objective of the Iowa Cattle Risk Management Workshop is to assist producers in learning about price risk management tools. If incorporating the use of more paper and pencils achieves that objective by reducing their computer anxiety, then it may be a productive compromise because participants must still use a computer to actually complete the simulation.

A final set of suggestions pertains to the facilitation of the lecture. The facilitation for the lecture portion of the 2008 Iowa Cattle Risk Management Strategies Workshops was conducted in a highly effective manner. However, incorporating a couple of other presentation methods may further increase the impact of the lecture.

As soon as the facilitators are done introducing themselves, it may be beneficial to have the participants take a very brief amount of time to introduce themselves to the person sitting on either side of them. There is a high probability they may already know one another, but it gives them a chance to say hello. The facilitator can explain that not only do they have access to facilitators for help during the workshop, but they also can also confer with their neighbors. Emphasizing this mirrors everyday life; i.e., producers have access to Extension Specialists, market advisors, and their neighbors. The people they are sitting next to are their ‘new neighbors’ for the day, and just like they probably do at home, they can discuss things they will learn about throughout the day with their neighbor, plus the facilitators. Their neighbors are simply another resource.



After a concept or marketing tool has been discussed the facilitator could tell the participants to look over their notes for fifteen seconds and then have the participants turn to the neighbor on their right, for example, and explain to them a specific aspect of the concept just discussed (e.g., overall objective, how the marketing tool works if the futures price decreases below the strike price, what causes a negative basis, etc.). Of course the instructor would need to specify the aspect of the concept the participants are to discuss. This may help participants to clarify a question they may have regarding a marketing tool just discussed, or reinforce their understanding of a concept. This may prove to be helpful for a person who may be reluctant to ask for clarification in front of the entire group. During a decision point, participants could be told to tell the person on their left, for example, what tools they are considering using and why. Promoting participant interaction will encourage work within small groups.

Using small groups in a workshop setting has many advantages. When done correctly group learning in workshops shifts some of the responsibility of teaching from the facilitator to the participant, which is a positive concept (Will). Will states small groups can "...promote learning, retention, and application by presenting new information in context" (pp. 39). Encouraging participants to work with other people allows them to acquire another perspective of the information and reconfirm their understanding of the concepts.

All of these suggestions will take additional time. To compensate for the added time, a decision point may need to be removed. Granted, the simulation is when producers apply what they have learned in lecture. However, if they process and absorb more from the lecture, they may be able to more effectively apply the concepts to the remaining decision points.

## **CHAPTER 7 - Conclusions**

The objective of this thesis was to examine price risk management tools available to cattle producers. The price risk management tools discussed in the thesis included: cash forward pricing, futures hedging, put and call options, as well as relatively new government insurance products Livestock Risk Protection insurance (LRP) and Livestock Gross Margin insurance (LGM). The issues of basis and seasonal pricing were also discussed as they are a key component to understanding and evaluating price risk management tools. The topic of educating producers, and those associated with the cattle industry, about available price risk management tools was also discussed heavily as the Kansas Price Risk Management Workshop was explained and evaluated. The LRP Feeder Cattle Basis model was also introduced and explained. The LRP Feeder Cattle Basis model is intended to assist producers in forecasting LRP basis.

### **7.1 Conclusions**

Risk will forever be present in production agriculture, particularly in the beef industry. The cattle industry is known for its variability of profits. Cattle feeders have seen net returns vary as much as \$500 per head from January 2001 through March 2008 (Lawrence 2001-2006, 2007Y, 2008Y). Similarly, cow-calf operators have endured net returns that have varied almost \$300 per head from 1979 through 2007 (Kansas Farm Management Association). However, because most of these risks can be measured they can be managed, especially for feedlot enterprises. Price risk management tools assist cattle producers not in enhancing profits, but rather to help them manage losses or reduce the risk of undesirable outcomes.

Before producers consider using price risk management tools, it is beneficial if they understand the concept of basis and seasonal pricing. Basis is the difference between the cash price at a specific location and a particular futures contract for a specific commodity. It can be described mathematically as  $CME\ Basis = Cash\ Price - CME\ Futures\ Price$ . In order to use many of the risk management tools available (e.g., futures and options markets), it is critical a producer understand the concept of basis, including how it can impact cash price and how it is calculated.

The cash price can be calculated by rearranging the basis equation:  $Cash\ Price = Basis + Future\ Price$ . Basis is representative of the difference in the local supply and demand situation relative to the aggregate supply and demand reflected in the futures market. Basis can be negative or positive and will vary depending on the geographical location of the market, season, and physical characteristics of the cattle such as sex, weight, breed, and quality. A method of forecasting basis recommended by Kastens, Jones and Schroeder is to determine when the cattle will be sold and then average that week's basis from the past three to four years for the specified location.

Another concept, seasonal prices, can assist producers in making management decisions and forecasting prices. Each year cattle prices fluctuate in a similar pattern. Being aware of this pattern can assist cattle producers in anticipating price changes. Within the cattle industry seasonal changes are motivated by biological, climatic and seasonal demand reasons.

Once basis and seasonal price patterns within the cattle industry are understood, price risk management tools can be analyzed and evaluated. Special attention was given to price risk management tools that protect against a decline in the selling price of outputs. Cash forward contracting is a cash contract established between a buyer and seller. The seller agrees to

purchase and take physical delivery of a certain quantity of cattle at a specific point in time for a specified price. Specifications of the contract are strictly between the buyer and seller. Cash forward contracting locks in the cash price and basis. Consequently, there is no upside or downside price potential.

Producers must be aware of price risk management tools that involve futures contracts, as these contracts have fixed quantities. CME live cattle futures contracts represent 40,000 pounds of finished cattle, while CME feeder cattle futures contracts are based on 50,000 pounds. If a producer does not own, or plan to market an amount equivalent to the contract, they could be assuming a speculative position within the futures market.

Futures hedging, indicative of the name, manages risk using futures contracts. A futures hedge involves taking a position in the futures market as a temporary substitute for an intended future action in the cash market in a quantity that is equal to the cash position. There are two types of hedges: a short hedge and a long hedge. A short hedge protects against unwanted price decreases. A long hedge protects against unwanted price increases. A hedge allows producers to secure the current price. Producers who use a futures hedge as a price risk management tool, have eliminated price risk, but are subject to basis risk and margin calls.

Put options are price risk management tools that can also be used to reduce price variability. The purchaser of a put option earns the right, but not the obligation to sell the underlying futures contract for the specified strike price at any point during the life of the option (Borchart et al.). Put options protect a producer from a decline in prices by establishing a minimum expected selling price. To acquire a put option a producer must pay a premium. The purchaser of a put locks in a floor price while allowing upside price potential, but is still open to basis risk. However, unlike futures hedges, buyers of put options do not have margin calls.

The purchaser of a call option earns the right, but not the obligation, to buy the underlying futures contract at the specified strike price at any point during the life span of the option (Borchart et al.). Basically, call options function inversely of a put option. Call options are used to create a maximum expected purchase price. The ceiling price level is established while allowing downward price potential, but the purchaser of a call is still open to basis risk. There are price risk management strategies that involve using two of the price risk management tools, already discussed, simultaneously.

A livestock insurance policy, called Livestock Risk Protection insurance (LRP) is a single-peril insurance product that insures producers against a decline in cattle market prices below an established coverage level selected by the producer (USDA 1667-09). The coverage level insured is based on a regional or national average cash price, unlike a put or futures hedge. However, the concept of LRP is similar to the concept of a put option. LRP allows a producer to establish a floor price while maintaining upside price potential. There are noticeable differences between a CME put and LRP, including how it is purchased and the basis used. LRP, a product of USDA's Risk Management Agency (RMA), allows a producer to insure from one head to 2,000 head of cattle per crop year.

The three year average can be used to forecast both LRP and CME basis. However, separate forecasts for the LRP and CME basis must be calculated. The LRP basis includes an adjustment factor for beef heifers weighing 600 to 900 pounds and beef steers weighing less than 600 pounds. Plus, the CME Feeder Cattle Index is subtracted from the cash price to calculate LRP basis, and the CME Feeder Cattle Futures Price is subtracted from the cash price to figure CME basis.

To assist producers in forecasting LRP basis, a model was developed based on previous work done for a CME basis forecasting model, BeefBasis.com. The LRP basis model, like the CME basis model, considers basis to be a function of sale date, sale weight, number of head in the lot, sex, fed cattle price, corn price, class, frame, seasonality, and sale location, which Sartwelle et al. concluded to have significant influence on the price paid for cattle. However, unlike the CME basis model, the LRP basis model uses the CME Feeder Cattle Index, applies price adjustment factors to the applicable weights, and accounts for changes in the calculation and specification of the CME Feeder Cattle Index. The LRP Feeder Cattle Basis Model estimated accounts for 71.37 percent of the variation of LRP feeder cattle basis. The current LRP basis model is applicable only to Kansas, but future plans entail developing models for other states and posting the LRP Feeder Cattle Basis tool on the internet for producers to use.

The other livestock insurance policy is Livestock Gross Margin (LGM) insurance. LGM is a product that insures cattle feeders against a decline in feeding margins. LGM allows a producer to simultaneously hedge feeder cattle and corn prices while simultaneously hedging fed cattle sales price as a sort of bundled options. LGM, a product of USDA's RMA, is a relatively new product available to feeders that allows them to insure from one to 10,000 head of feedlot cattle every crop year.

While price risk management tools are available for producers to use, many do not. In fact, past research indicates only a small portion of cattle producers use price risk management strategies. There are many speculated reasons for this. The most suspected answer is that producers are simply not comfortable using price risk management tools because they do not understand the available tools or how to effectively evaluate them. In an attempt to educate cattle producers of the price risk management tools available to them, Kansas State University

Extension developed an Excel computer based simulation. During the winter of 2008 Kansas State University worked in corporation with Iowa State University and USDA's RMA to deliver these workshops across the state of Iowa. There are two versions of the workshop. One version of the workshop is a Cow-Calf case study, while the other is a Feedlot case study.

Participants of the workshop learned about different price risk management strategies including: cash forward contracting, put and call options, futures hedging, as well as LRP and LGM. Initially, workshop participants learned about the tools by listening to a PowerPoint lecture, then applying what they had learned to the simulation where they assumed the role of manager for either a ranch or feedlot. The simulation emulated the marketing decisions cattlemen must make throughout a given year.

The participants were given decision points throughout the simulation's 'calendar year' to forward price their cattle. The Cow-Calf version of the workshop was comprised of a cow-calf and backgrounding enterprise. Participants were in charge of marketing their 250 head of 550 pound weaned calves. The producers could choose to market the calves at weaning, or retain any portion of them and feed them through the backgrounding phase to a weight of 768 pounds. The Feedlot version consisted of a backgrounding and finishing enterprise. The Feedlot version of the workshop was designed so that participants recently 'purchased' 250, 550 pound steers, and were charged with the responsibility of marketing the calves. Participants could market any number of calves as 768 pound feeders at the completion of the backgrounding phase and then market the remaining steers as fed cattle weighing 1,320 pounds at the completion of the finishing phase.

Each workshop participant was charged the same regarding purchase price of the animals, as well as the price and quantity of inputs required. Once the participants had gone

through all the decision points they were able to evaluate their performance and determine the effectiveness of the price risk management tools they had selected. They could also compare their results with the results of other workshop participants and learn what they did differently.

At the conclusion of the workshop marketing year, there was a unique feature participants found interesting. Participants were able to simulate how the marketing strategies they employed would have worked over the past 21 years with regard to profitability. This allowed the participants to see the impact of their risk management decisions over time if routinely made under various market conditions.

Participants probably would not have used the exact same marketing strategy for each of the past 21 years, as new information provided during each year would have altered their actions. However, in practice there are producers who sell their calves at the same time every year regardless of the market conditions. Granted, there are many different reasons for such actions. The reasons may be a result of habit, lack of knowledge, or tax purposes. Producers may not know what the marketing alternatives are or how to evaluate them.

The effectiveness of the Iowa Cattle Risk Management Workshops was determined from pre-and post-tests administered to the participants. The six question, multiple-choice question pre-and post-tests were identical. The post-test scores improved approximately 25 percentage points over pre-test scores. In addition, 88 percent of the 167 participants who completed the post-test said they would recommend the workshop to others.

To producers, the task of selecting and implementing a price risk management strategy can be daunting. The objective of the Iowa Cattle Risk Management Workshop was to alleviate the anxiety and confusion Iowa producers feel when marketing their cattle, in a manner that participants found engaging, stimulating, and beneficial. Goodwin and Schroeder found that



those who participated in educational marketing programs were 17.6 percent more likely to use forward pricing than those who did not attend. This would indicate educational experiences, such as the Iowa Cattle Risk Management Workshops influence producers' management practices. This is further evidence that knowledge has a large impact in motivating producers to use price risk management tools.

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# Appendix A - Cattle Risk Management Workshop Materials

## A.1 Marketing Terminology Handout

### Iowa Cattle Risk Management Workshop

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**Long** – a buyer of a futures contract is often referred to as being “long” the futures contract. Similarly, the buyer of an option is said to be “long” the option.

**Short** – a seller of a futures contract is often referred to as being “short” the futures contract. Similarly, the seller of an option is said to be “short” the option.

**Basis** - is the price of a cash commodity at a particular location in relation to a futures contract. Mathematically, basis is simply the difference between a commodity’s cash and futures price. The Basis formula is: **Basis = Cash Price - Futures Price**. This formula can be rearranged algebraically such that **Cash Price = Basis + Futures Price**. This allows us to decompose a commodity’s cash price into its two component parts, basis and futures prices. This creates a lot of risk management opportunities because we can now choose to manage basis risk and futures price independently. If basis is negative, then the futures price is greater than the cash price. Conversely, if basis is positive, then the futures price is less than the cash price.

**Hedging** – is the use of the futures market as a temporary substitute for an intended transaction in the cash market, which will occur at a later date. A cow-calf operator that plans to sell calves

at weaning in late October can use the sale of a futures contract earlier in the year (for example, mid-spring) as a temporary substitute for the cash market sale that he plans to make in late October. In late October, as soon as the cash market sale is complete, the cow-calf operator notifies his broker to *offset* the sale of the futures contract in the futures market by issuing an order to “buy” the exact same futures contract. The futures exchange and brokerage firm realize that the same person has both sold and purchased the exact same futures contract. These two positions effectively cancel or *offset* each other. This is the origin of the term *offset*.

**Evaluating A Futures Hedge At The Outset** – It’s important at the outset of a hedge to estimate what the hedger expects to receive for his cattle, net of any gain or loss in the futures market, and minus transaction costs. To evaluate a futures hedge at the outset of the hedge, we can fall back on our cash price equation; cash price = basis + futures price. Once the hedger sells a futures contract, the futures price component of this equation is locked in. But the basis is not locked in. As a result we must forecast, at the outset of the hedge, the basis for the date when the cash market transaction will occur. An example is a cow-calf operator interested in hedging the sale of weaned calves that will take place in late October. The hedger needs to forecast the basis for his cattle in late October, the date when he anticipates making the cash sale. The hedger can estimate his **Expected Selling Price** using the following equation:

$$\begin{array}{r}
 \text{Futures Price (at which hedge is initiated)} \\
 + \text{Expected Basis (for the date when the cash sale will take place)} \\
 - \text{Brokerage Commission (per cwt.)} \\
 \hline
 \text{Expected Selling Price}
 \end{array}$$

**Evaluating A Futures Hedge At The Conclusion** – After a hedge is over, it’s important to calculate the **Actual Sale Price**, net of any gains or losses in the futures market and minus brokerage commissions. The hedger can then compare the Actual Sale Price to the Expected Selling Price to compare how successful the hedge was. To do so, we can simply take

$$\begin{array}{r}
 \text{Actual cash price received} \\
 + \text{Net gain or loss on futures transaction} \\
 - \text{Brokerage commission} \\
 \hline
 \text{Actual Sale Price}
 \end{array}$$

**Put Option** – A put option gives the buyer of the put option the right, but not the obligation, to sell a futures contract at a specified price, at any time prior to the option’s expiration. Since the buyer of the put option obtains the right to sell a futures contract, the purchase of a put option can be used in place of selling a futures contract. Because of the put option’s limited risk characteristics, (i.e., the put buyer is not obligated to sell a futures contract) the put option buyer establishes a price floor or a Minimum Expected Sale Price.

**Strike Price** – The strike price is the “specified price” identified in the definition of a put option. The put buyer purchases the right to sell a futures contract at a “strike price”. At any point in time there are multiple strike prices that an option buyer can choose from, and each one is a separate and distinct option contract. For example, a \$100 November feeder cattle put option gives the put option buyer the right, but not the obligation to sell one November feeder cattle futures contract at \$100/cwt., regardless of what the current futures price is. At the same time, the option buyer could choose to purchase a \$102/cwt. November feeder cattle put option, which conveys the right to sell one November feeder cattle futures contract at \$102/cwt.

**Premium** – The amount of money the option buyer pays to obtain an option.

**Evaluating A Put Option Purchase At The Outset** – Put option buyers can estimate their Minimum Expected Sale Price when they purchase a put option similar to a hedger that sells a futures contract. To do so use the following formula:

$$\begin{array}{l} \text{Put Option Strike Price} \\ - \text{Put Option Premium (paid to purchase the put)} \\ + \text{Expected Basis (for the date when the cash sale will take place)} \\ - \text{Maximum Possible Brokerage Commission (per cwt.)} \\ \hline \text{Minimum Expected Sale Price} \end{array}$$

**Evaluating A Put Option At The Conclusion** - After a put option hedge is over, it’s important to calculate the **Actual Sale Price**, net of any gains or losses in the options market and minus brokerage commissions. The hedger can then compare the Actual Sale Price to the Minimum Expected Selling Price to compare how successful the hedge was. To do so, we can simply take



**Actual Cash Price Received**  
**+ Net Gain or Loss on Option Trade**  
**- Brokerage Commission**

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**Actual Sale Price**

**Livestock Risk Protection Insurance for Feeder Cattle** – provides insurance against a possible decline in the Chicago Mercantile Exchange Feeder Cattle Index. The CME Feeder Cattle Index is a 7-day weighted average of cash feeder cattle prices across the U.S., which is used to “cash settle” feeder cattle futures. As a result, purchasing LRP Insurance for Feeder Cattle is similar, but not identical, to purchasing a CME feeder cattle put option. To purchase LRP Insurance, contact your local crop insurance agent.

LRP feeder cattle insurance coverage is available for 13, 17, 21, 26,30, 34, 39, 43, 47, or 52 weeks from the date the insurance is purchased. To purchase LRP insurance for a particular set of cattle, the buyer must choose the coverage price (which is similar to a put option’s strike price) and the insurance contract’s ending date (e.g., the date coverage ends). The price paid for the insurance is known as the LRP Premium, similar to a premium for a CME traded put option.

**Evaluating LRP Purchase at the Outset** – Calculating a Minimum Expected Selling Price using LRP insurance is similar to the approach employed when purchasing a CME put option.

**LRP Coverage Price**  
**- LRP Insurance Premium**  
**+ Expected LRP basis when cash cattle are sold**

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**Minimum Expected Selling Price**

**Evaluating LRP Purchase at the Conclusion** – Calculating an Actual Sale Price using LRP insurance is similar to the approach employed for a CME put option.

**Actual Cash Price Received**  
**+ Net from LRP Insurance**

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**Actual Sale Price**

For more information see *Livestock Risk Protection (LRP) Insurance for Feeder Cattle*, MF-2705, Kansas State University Agricultural Experiment Station and Cooperative Extension Service, December 2005. Available for download at:  
<http://www.agmanager.info/livestock/marketing/LRP>

The Premium Calculator for LRP Insurance is available on the USDA Risk Management Agency web site at: <http://www3.rma.usda.gov/apps/premcalc/>

**Livestock Gross Margin Insurance for Fed Cattle** – provides insurance against the decline in cattle feeding gross margins. The producer will receive a payment if the margin (spread) between the fed cattle sale price and the input prices of feeder cattle and corn drops below the insured level. The indemnity is actually calculated based on the difference between the gross margin guarantee, GMG and the actual gross margin, AGM. LGM is based on future market prices and is similar to taking a bundled option position. LGM ‘bundles’ and simultaneously hedges input and output prices

LGM for cattle is available for sale on the last business day of each month and must be purchased from a licensed crop insurance agent. LGM is an eleven month insurance policy. When a producer purchases LGM they will need to specify if they are feeding calves or yearlings. They will also need to specify their ‘target marketings’, the number of cattle they plan to market for each month. A producer does not need to place LGM on all their cattle; they can insure one to five thousand head per insurance period, 10,000 head per crop year. It should be kept in mind there is no coverage available during the first month of the policy.

The input quantities used to calculate the gross margin are based on Iowa State University feeding budgets. The value of the inputs and outputs are determined using a three-day average of the appropriate futures contracts and is adjusted for state specific basis levels. The expected gross margin value is calculated on the day the policy is purchased. The expected gross margins are calculated for every month there are target marketings specified. The expected gross margins are summed and the deductible is subtracted to calculate the gross margin guarantee. The actual

gross margin is then calculated using the same quantities as the GMG, but using the actual prices after the target marketings month(s) has passed.

At the conclusion of the insurance period the total gross margin guarantee will be compared to the total actual gross margin for all target marketings. If the eleven-month AGM is greater than the eleven-month EGM, there will not be an indemnity paid. However, if the eleven-month EGM (minus the deductible) is greater than the eleven-month AGM, an indemnity will be paid.

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Gross Margin Guarantee and Actual Gross Margin values are available on the USDA Risk Management Agency website at: [http://www3.rma.usda.gov/apps/livestock\\_reports/main.aspx](http://www3.rma.usda.gov/apps/livestock_reports/main.aspx)

The Premium Calculator for LGM Insurance is available on the USDA Risk Management Agency web site at: <http://www3.rma.usda.gov/apps/premcalc/>

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#### **Other Helpful Websites:**

##### **Beef Basis.com**

<http://www.beefbasis.com>

##### **Iowa Beef Center**

<http://www.iowabeefcenter.org/>

##### **Dr. John Lawrence's Homepage**

<http://www.econ.iastate.edu/faculty/lawrence/>

##### **KSU Agmanager**

<http://www.agmanager.info/>

Link to the page with the downloadable Excel spreadsheet containing the comparison price graph, similar to the one used in the workshop:

<http://www.agmanager.info/livestock/marketing/LRP/default.asp>

**RMA Livestock Insurance Page**

<http://www.rma.usda.gov/livestock/>

**RMA Livestock Insurance Agent Locator**

<http://www3.rma.usda.gov/apps/agents/>

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## A.2 Cattle Risk Management Pre - Workshop Review

**Location:** \_\_\_\_\_

1. Basis equals
  - a. cash price minus futures price.
  - b. futures price minus cash price.
  - c. neither a nor b.
  
2. Who can you purchase LRP insurance from?
  - a. commodities brokers.
  - b. crop insurance agents.
  - c. purchase it directly via the RMA web site.
  
3. When purchasing LRP Insurance for Feeder Cattle, what is the maximum insurance coverage price that you can purchase for your feeder cattle on any given day?
  - a. approximately 105% of the Expected End Value
  - b. approximately 100% of the Expected End Value
  - c. approximately 95% of the Expected End Value
  - d. approximately 90% of the Expected End Value
  - e. approximately 85% of the Expected End Value
  
4. If you buy a March CME feeder cattle put with a strike price of \$100 at a premium cost of \$2/cwt., you expect the basis for your 750 pound steers to be +\$1/cwt., and your broker charges \$0.10 per cwt. to buy and \$0.10/cwt. to sell a put option, what is your **Minimum Expected Selling Price**?
  - a. \$98.80/cwt.
  - b. \$97.80/cwt.
  - c. \$99.80/cwt.

5. Assume that you hedged the sale of your cattle using October feeder cattle futures. After you have completed the cash market sale of your cattle and you have offset your position in the futures market, how do you calculate your **Actual Sale Price**?
- a. Cash market sale price plus net gain or loss on futures transaction, minus brokerage commissions.
  - b. Cash market sale price minus brokerage commissions.
  - c. Cash market sale price plus net gain or loss on futures transaction.
  - d. none of the above.
6. The purpose of LGM is to:
- a. Help cattle feeders enhance profits.
  - b. Provide protection against the decline in cattle feeding margins.
  - c. None of the above.

### A.3 Cattle Risk Management Post - Workshop Review

**Location:** \_\_\_\_\_

1. Basis equals
  - a. cash price minus futures price.
  - b. futures price minus cash price.
  - c. neither a nor b.
  
2. Who can you purchase LRP insurance from?
  - a. commodities brokers.
  - b. crop insurance agents.
  - c. purchase it directly via the RMA web site.
  
3. When purchasing LRP Insurance for Feeder Cattle, what is the maximum insurance coverage price that you can purchase for your feeder cattle on any given day?
  - a. approximately 105% of the Expected End Value
  - b. approximately 100% of the Expected End Value
  - c. approximately 95% of the Expected End Value
  - d. approximately 90% of the Expected End Value
  - e. approximately 85% of the Expected End Value
  
4. If you buy a March CME feeder cattle put with a strike price of \$100 at a premium cost of \$2/cwt., you expect the basis for your 750 pound steers to be +\$1/cwt., and your broker charges \$0.10 per cwt. to buy and \$0.10/cwt. to sell a put option, what is your **Minimum Expected Selling Price**?
  - a. \$98.80/cwt.
  - b. \$97.80/cwt.
  - c. \$99.80/cwt.

5. Assume that you hedged the sale of your cattle using October feeder cattle futures. After you have completed the cash market sale of your cattle and you have offset your position in the futures market, how do you calculate your **Actual Sale Price**?

- a. Cash market sale price plus net gain or loss on futures transaction, minus brokerage commissions.
- b. Cash market sale price minus brokerage commissions.
- c. Cash market sale price plus net gain or loss on futures transaction.
- d. none of the above.

6. The purpose of LGM is to:

- a. Help cattle feeders enhance profits.
- b. Provide protection against the decline in cattle feeding margins.
- c. None of the above.

7. I would recommend this workshop to others:

\_\_\_\_\_ Yes      \_\_\_\_\_ No