COW-CALF RISK MANAGEMENT AMONG KANSAS PRODUCERS

by

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Abstract

Considerable risk is present in today's ranching world; especially price and production risk. A producer who can tolerate more risk, and is knowledgeable about how to effectively manage price and production risk, may have opportunity to increase profitability relative to a highly risk averse producer. The purpose of this study is to investigate perceptions and sources of risk, identify how risk management is conducted, assess price and production risks, and view differences between producers' perceptions versus their attitudes towards risk and factors that affect risk. In order to investigate cow-calf producers' perceptions of risk, an instrument was created to survey beef cow-calf producers in the Kansas Farm Management Association (KFMA). Respondents provided information on their production practices, marketing methods, operating decisions and risk related to their cow-calf operations. A risk preference score for individual producers was developed from specific survey questions to determine three objectives: to classify producers' risk preferences related to their operating decisions; determine operating decisions that affect risk preferences; and identify what production and marketing practices in which producers were willing to risk for a chance to increase the net returns to their operations.

A bi-directional causality between risk aversion and operation characteristics was illustrated between how operating decisions are related to risk aversion, and risk aversion is related to operating decisions. Factors that were found to influence risk aversion were socioeconomic factors such as age, off-farm income, debt-to-asset ratio, farm size, and number of cows owned, as well as comparative advantages of producer's: use and analysis of new technology, business planning skills and marketing skills. Models showing how risk aversion

was related to production management focused on producer's financial soundness, production practices and marketing methods, specific to retained ownership. Producers who would participate in value-added programs to increase returns to their operation have a comparative advantage in marketing skills, own more cattle, and are less diversified in terms of their farm enterprise incomes.

Table of Contents

List of Figures

List of Tables

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Dedication

This project is in honor of my Gramps, Marshall Frasier, who passed away from cancer in the middle of this achievement. He was always confident in me, cheered me on to strive for my dreams and instilled in me the love of the beef industry and agriculture.

CHAPTER 1 - Introduction

1.1– Background

New York Times best-selling author, H. Jackson Brown, Jr. said, “If your life is free of failures, you're not taking enough risks.” Brown’s excerpt relates well to cattle operations and it can appropriately be restated as, “If your cow-calf operation is free of failures, you’re not taking enough risks to potentially increase returns.” Considerable risk is present in today’s ranching world; especially marketing, financial (price) and production risk. A producer who can tolerate more risk, and is knowledgeable about how to effectively manage these risks, may have opportunity to increase profitability relative to a highly risk averse producer. For example, retaining ownership of calves increases profit potential, but also increases risk for the cow-calf producer. Both cow-calf input and output prices vary as market conditions change. Recent years have seen particularly elevated price risk for cow-calf producers. How producers perceive and react to risks they face can have substantial impacts on the viability of cow-calf operations, as well as separating the achievers from the failures who are not taking adequate risks.

Thus, a producer who is highly risk averse may avoid taking risks, thus, limiting the operations growth potential. However, taking unjustified large risks can place an entire operation in financial peril. Understanding risk aversion levels of cow-calf producers, what drives their level of risk preference or aversion, and how risk preferences affect producer decision making is critical when designing information systems, education programs, and risk management tools to meet producer needs.

When producers take an unjustified large risk, they may hit it big, or could plummet into the red very quickly. Even though Brown said you are not taking enough risks if your life [cattle

operation] is free of failures, the producer's preference and current financial situation is also likely an important factor affecting risk tolerance. Some producers may prefer higher levels of risk by retaining ownership of their calves through processing. Others may want to retain ownership, or are willing to retain ownership of their calves, however the opportunity for them is not possible because they are not part of a marketing program specific to retained ownership. Therefore, they are viewed as preferring less risk because they do not participate in a retained ownership program. Others may be very risk averse and take the easy road, which hardly ever gives them the chance to earn the possible higher income they could if they were willing to accept more risk.

Price risk is present for cow-calf producers even before the first calf is born. The cost of replacements and breeding stock can be a large price risk. Price risk continues after calves hit the ground depending on if the producer decides to sell calves at weaning and the current feeder price. If the producer decides to retain ownership of calves through processing, they have to worry about carcass rail price risk. Producers can potentially limit profit volatility through utilization of price risk management strategies such as forward contracting, hedging, or Livestock Risk Protection Insurance (LRP).

Production risks are initiated with a line-up of input costs: pasture rent or ownership, forage and grain prices (especially in a volatile economy), animal health, fuel, labor, interest, and maintenance costs. Production risks are not only driven by production costs, but by factors such as severe weather, changes in environmental or other government policies and programs, animal disease prevention, and credit availability. Producers can also have a form of self-insurance to manage their production risks by carrying inventories, diversification, maintaining financial reserves, or off-farm income. The way a producer chooses to manage price and production risks

reveals their tolerance for business risk. Understanding a producer's risk preference in their cow-calf operation and what drives this preference is where this research will be critical to provide information on how to produce profitably in the future.

The purpose of this study is to investigate perceptions and sources of risk, identify how risk management is conducted, assess price and production risks, and view differences between producers' perceptions versus their attitudes towards risk and factors that affect risk. This will provide information to educational institutions and allow for the data set to be used for supplementary research in the future. Notably, this research is conducted and analyzed to allow cow-calf producers to see how their operating decisions compare to their risk preference as an opportunity related to profit margins. In order to investigate cow-calf producers' perceptions of risk, an instrument was created to survey beef cow-calf producers in the Kansas Farm Management Association (KFMA).

1.2 – Objectives

The main objective of this research is to quantify cow-calf producers' risk perceptions and associated determinants. Specifically, the research objectives are:

1. Determine cow-calf producer risk preferences based on a set of risk aversion measurements.
2. Determine how operating decisions producers are making based on their production and marketing practices specific to calf-timing, health management, feeding and grazing, breeding, culling, and selling are related to their risk aversion.
3. Determine how risk aversion affects producer management and marketing practices.
4. Identify what production and marketing practices that might increase risk producers are willing to change for a chance to increase the net returns to their operations.

In order to accomplish these goals, a survey instrument was developed and mailed to KFMA members who reported owning cows in 2008. The purpose of the instrument was to obtain information to better understand risk aversion levels of producers and how risk aversion affects business decisions, and to identify determinants of risk preferences. This information is intended to assist in the development of education programs, and risk management tools to enhance cow-calf producers' risk management decisions and potentially improve profitability in their cattle operations.

1.3 – Organization of Thesis

This thesis is organized into seven chapters. Chapter 2 is a review of previous studies regarding the development of risk preference instruments and risk preferences of cow-calf producers. It also contains reviews of articles that discuss characteristics of risk-taking individuals and analysis of risk management in agriculture. Chapter 3 is devoted to data sources, summary statistics and results from the survey instrument. Definitions of the variables used are also discussed in this chapter. Chapter 4 determines and describes the risk preference score. Additionally, model specifications and results are reported for operating decisions related to risk aversion. In addition, sensitivity analysis is presented with producer financial soundness, production practices, and marketing methods specific to retained ownership. Chapter 5 sets up model specifications and results for risk aversion related to operating decisions and models are compared in three categories: producer financial soundness, production practices and marketing methods specific to retained ownership. Chapter 6 provides models and results to identify what production and marketing methods producers are willing to change or willing to risk to increase their returns. Finally, Chapter 7 reports conclusions collected from this study and discusses suggestions for future research.

CHAPTER 2 - Literature Review

2.1 – Introduction

The purpose of this chapter is to review literature related to constructing risk survey instruments, cow-calf production and price risk, and risk preferences. There is extensive literature on financial risk tolerance that evaluates dimensions of risk scoring. The following section reviews these dimensions as well as findings of research studying risk preferences in the cow-calf industry.

2.2 – Defining Risk in Cow-Calf Operations

Two terms will be used frequently in the following analysis: risk aversion and risk preference. Risk aversion can be described as the tendency to prefer any sure outcome over any gamble (Slovic, 1977). Risk preference is the tendency to prefer a gamble over any sure outcome. This research specifically explores risk preference as an opportunity for producers to increase net returns. As MacCrimmon and Wehrung (1985) establish that even within the most highly developed theory of risk, the determination of a person's risk tendency is not definite. The same goes with this research; it is not aiming to determine the direct attitudinal behaviors of Kansas cattle producers. Rather, it is taking preferences denoted by Kansas cattle producers and using them, leveraged with their whole farm data, to try and show possible systems in which their risk preference is related to their operating decisions, and vice versa.

There are three main attitudinal views a producer can have towards risk (Hardaker, 2004). A risk averse producer is an individual who prefers an investment with a lower, but certain, expected payoff to an investment with a higher, but uncertain, payoff. A risk neutral producer is an individual who cares only about the expected payoff of an investment and not the risk that must be taken to achieve the investment goal. This type of producer will neither

instinctively take risks nor pay to elude them. A risk preferring producer is an individual who actively engages in risky investments with a high, but uncertain, payoff.

2.2.1 – Cow-Calf Price and Production Risk

Cow-calf producers have a myriad of price and production risks, starting when the calf hits the ground until that calf is weaned and ready to sell or be fed. Operation risks can include land and maintenance costs, cost of breeding stock, and veterinarian bills. Cattle prices are subject to seasonal fluctuations. Many producers do not consider their risk options when it comes to marketing and selling their weaned calves, and these cattle producers who market their output in the cash market experience fluctuations in gross incomes due to changing market prices, known as price risks, as well as changes in output quantity caused by environmental factors, known as production risk (Murphy, 1991).

Production risks are considerable as well as important; most producers are more familiar with how to handle production risk, than they are with handling price risk. When it comes to price risk, many producers have less confidence in the outcome of their choices, or have a lack of understanding of strategies available for managing price risks. Murphy (1991) suggests three ways cow-calf producers can manage their price risks: 1) reducing herd size, 2) shifting to a controlled breeding season, and 3) maintaining ownership of calves through stocker and /or feedlot stages.

2.2.2 – Risk-Return Tradeoff

Murphy's study also mentions the tradeoff between risk and return. Some operators may be more willing to sacrifice expected income to keep income variation at a low level (risk averse), whereas others may be willing to accept more variation in income provided expected income is higher (risk preferring). Risk preference is also influenced by a number of

socioeconomic characteristics of the producer, including age, wealth, and other factors (Murphy, 1991; Grable, 1999; Morin, 1983).

2.2.3 – Risk Factors

Areas of research for this study were broken into two categories: production and marketing factors. Within the production factor category, areas of breeding, calving, culling, comparative advantages and managing input costs and volatility were researched and put into question form on the survey. Within the marketing factor category, areas of selling after weaning, backgrounding, retaining ownership through finishing and marketing and pricing methods were also researched and put into question form on the survey.

Production and marketing factors were looked at through previous survey research to develop questions that would provide us with relevant information. Hall (2003) surveyed respondents on perceptions and sources of risk, risk management tools, and risk factors that affect farm/ranch income. Schroeder (2003) surveyed cattle feeders on marketing agreements and alliances, as well as pricing methods. Risk questions are discussed in the next section.

2.3 – Construction of an instrument

In order to prepare an efficient risk survey instrument, different methods and research approaches were studied. Grable and Lytton (1999) understood the need for a widely accepted and commonly used instrument for researchers of all kinds to understand financial risk tolerance. Research to comprehend risk tolerance has been studied for years (Bernstein, 1996), but recognizing and developing trends among agricultural decision makers is a newer area of interest. Grable and Lytton (1999) used MacCrimmon and Wehrung's (1985) research to categorize the risk-tolerance assessment instrument to include five elements: 1) some central

concept of risk, 2) allowance for the derivation of a risk measure, 3) relevance to respondents, 4) ease of administration, and 5) adequate validity and reliability.

Similarly, Babbie (1983) recommended that an instrument be created by 1) selecting items for an instrument, 2) conducting an item analysis, 3) creating index scores, and 4) testing for index and instrument validity and reliability. These elements were considered when classifying questions which assume multidimensional areas of risk. Using several dimensions of risk are important in a survey to find the respondents true attitude toward their form of risk preference. MacCrimmon and Wehrung (1985) determined in their study that they could not label someone as a risk-taker or a risk-averter by only observing his or her behavior in a single situation. Therefore, the dimensions of risk narrowed down from Grable's work for this study were: 1) guaranteed vs. probable gambles, 2) speculative risk, 3) choice between sure loss and sure gain, 4) risk as experience and knowledge, and 5) risk as a level of comfort. The following discussion briefly describes these methods.

The first dimension, guaranteed vs. probable gambles, requires the respondent to make risk calculations. This dimension offers a respondent a guaranteed safe option with a corresponding probable gain. Therefore, a respondent who chooses a gamble over the guaranteed return should be considered more risk tolerant.

The second dimension, speculative risk, assumes that a respondent who has a greater tendency to speculate is more risk tolerant in terms of their finances than others. This dimension combines different aspects of risk preference by allowing the respondent to choose between a safe course of action, or speculate on the degree of return offered by a situation. Usually, a respondent who elects to forego higher rates of return in pursuit of stability or sure gains are considered to be less risk tolerant than others.

The third dimension, choice between sure loss and sure gain, is measured by setting up a question that requires a respondent to choose among alternatives without complete information. Risk-tolerant individuals are more likely to feel a sense of satisfaction when they earn money by taking some sort of action where absolute information is given. Obviously, a sure gain is more attractive to a producer than a sure loss; however, a sure loss, in theory, is a smaller loss. The loss may be smaller than what the producer would gain, thus the producer would rather lose some, than lose it all.

The fourth dimension, risk as experience and knowledge, requires some degree of expertise or knowledge to answer specific questions. This dimension is shown as functional because if experience and knowledge are positively related to risk tolerance, a respondent who answers aggressively to these items should generally be more risk tolerant than others.

Lastly, risk as a level of comfort, assesses the respondents' attitude towards risk preference. This is highly related to expertise and knowledge. Risk tolerant respondents are likely to feel confidence and satisfaction when making a risky choice; less risk tolerant respondents will tend to shy away from taking risks.

Thus, five risk questions were created and included in the survey to encompass these risk dimensions described. Independently, the five questions are not sufficient to accurately assess a producer's risk tolerance, but Grable and Lytton's (1999) study concluded that when these risk dimensions are combined together, they could supply a useful and accurate measure of a person's risk tolerance.

Other questions in the survey, encompassing a producer's production decisions, marketing methods, and financial management, were included to compare to the risk preference questions. Some questions were similarly modeled from previous surveys by Hall et al., (2003);

Murphy, (1991); and Schroeder, et al.,(2003), whereas some questions were created by the author, committee members and other professionals. Questions and summaries are described in Chapter 3.

2.4 – Summary

Previous studies on cattle production surveys show preferences from producers and their opinions on the breeding and marketing of their cattle. Research on these past surveys, as well as research on dimensions of risk and surveys on risk, allow for a good basis to survey cattle producers in Kansas and have the ability utilize the data gathered to present adequate results.

CHAPTER 3 - Data and Survey Summaries

3.1 – Introduction

This chapter describes the data used for this research and presents summary statistics of survey responses. Section 3.2 discusses the sources of the data and how they were collected. Section 3.3 reports survey results on cow-calf reproduction, calving, weaning and culling practices. Section 3.4 reports survey results on marketing and pricing methods. Section 3.5 reports survey results on input costs, volatility and comparative advantages. Section 3.6 reports perceptions of sources of risk from questions specifically asked about risk factors and risk preferences in the producer's operation. Finally, Section 3.7 reports survey results that ask three simple questions to find out the computer and Internet usage of survey respondents.

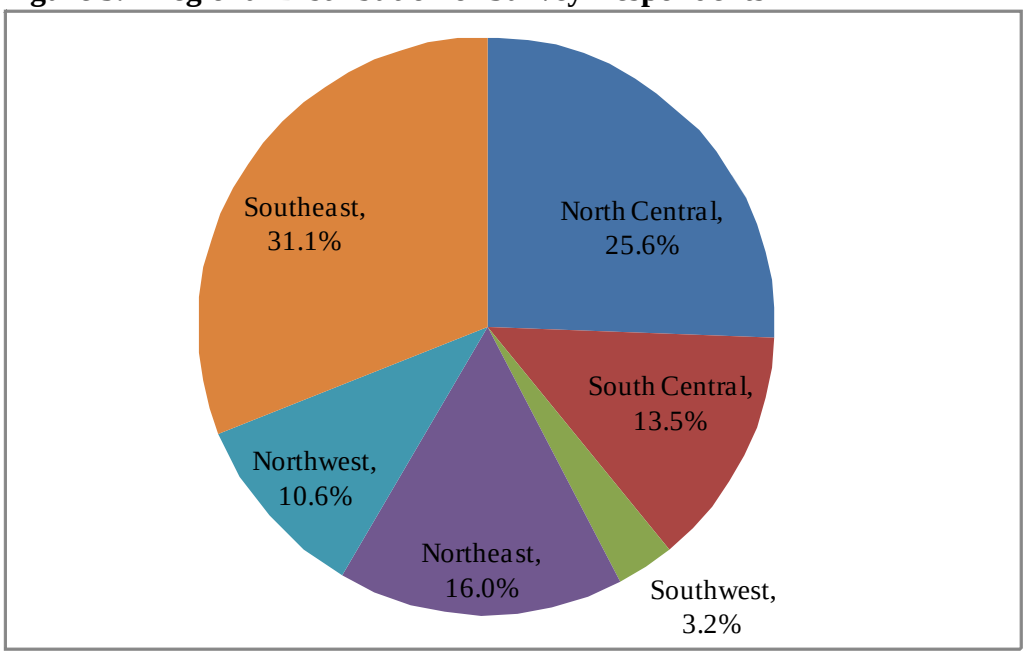
3.2 – Data Sources

The data used for this research was gathered from Kansas Farm Management Association (KFMA) members. The KFMA is one of the largest farm management programs across the country. The association is comprised of 20 association economists who work with farm families and provide information to members on production and financial management. This membership was selected for the survey population because the information from the KFMA data bank can be accessed and merged with survey responses. This provides detailed farm financial information together with producer's preferences from the survey. This combination of detailed farm financial data together with survey responses provides for a rich data set for analysis (see Table 3.1 for a list of variables). A survey was mailed on Wednesday, May 20, 2009 to all KFMA members who reported owning cows in 2008 which comprised 775 producers (see Appendix A for a copy of the survey instrument). Producers identified their management practices associated with risk in the areas of cow-calf reproduction, calving, weaning, culling, marketing and selling,

and items concerning general risk factor choices that affect farm income. Additionally, producers were presented with five questions soliciting information specifically about dimensions of their risk preferences.

Respondents were given the option of completing the survey by hand and returning, or completing via an online version from a web link provided. A reminder postcard was sent on June 4, 2009, and 181 surveys were returned before June 8, a 23.4% initial mailing response rate. Another 140 surveys were received after June 8 (date by which respondents would have received the reminder and sent the survey). This gave a total of 321 surveys received with a response rate of 41.4%. Nine participants returned blank surveys indicating they no longer own cattle. Therefore, the total useable responses was 312 making the effective response rate of those surveyed that own cows 40.7% (assuming all non-respondents still own cows). Eleven participants completed the survey online. Each survey was given a serial code that matched their farm number in order for records from the data bank to be matched to each farm. No personal or farm names were accessed. Respondent associations and counties were determined by the farm number (percentage of response rates from each region reported in Figure 3.1) – the first number represents the association and the second and third numbers represent the counties (see Appendix B for total responses per county and association).

Figure 3.1 Regional Distribution of Survey Respondents



The following five tables descriptively explain the survey question variables, their definitions and summary statistics. Table 3.1 gives the variables involved with cow-calf reproduction, calving and culling of cows.

3.2.1 – Whole Farm Data Source

KFMA economists gather data on individual farms such as net farm income, acreage, age of operator, capital managed, business entities, farm type, value of farm production, balance sheet information and more. Survey responses were matched to these detailed 2008 farm management records from the KFMA data bank. Variables used from the data bank are listed in Table 3.1.

Table 3.1 Whole Farm Variable Definitions and Summary Statistics

Variable	Label	N	Mean	Std Dev
WHOLE	1 if farm has whole farm data; 0 otherwise	312	0.92	0.27
TACRES	Total acres	288	2196.05	1603.74
CACRES	Crop acres	288	1195.26	989.90
HACRES	Harvested acres	288	1178.26	910.42
WACRES	Wheat acres	288	417.25	473.99
FGACRES	Feed grain acres (corn and grain sorghum)	288	292.68	331.34
OACRES	Oilseed acres (soybeans and sunflowers)	288	273.13	345.89
HFACRES	Hay and forage acres (alfalfa, other hay, and silage)	288	187.92	202.39
PASTURE	Total pasture acres	288	976.03	1108.77
OPASTURE	Owned pasture acres	288	323.84	584.53
RPASTURE	Rented pasture acres	288	652.19	869.97
NCOWS	Beef cows (number of head)	288	110.09	89.58
NFEED	Beef feeders (number of head – includes raised and purchased feeders)	288	117.20	201.71
PLC	Labor devoted to crops (%)	288	0.67	0.21
NRAISE	Raised feeders (number of head)	288	69.47	75.49
FBINV	Beef feeders, beginning inventory (number of head)	288	116.68	184.84
FEINV	Beef feeders, ending inventory (number of head)	288	121.07	194.67
BBINV	Beef breeding stock, beginning inventory (number of head)	288	118.83	96.04
BEINV	Beef breeding stock, ending inventory (number of head)	288	117.68	94.63
GROSSR	Gross revenue ($)	288	508497.24	506207.28
VFP	Value of farm production (gross revenue-purchased feed- purchased livestock) ($)	288	411619.69	371434.89
GLIVEI	Gross livestock income ($)	288	89677.72	131122.30
BEEFI	Accrual beef income ($)	288	73769.73	95088.22
CUSTOMB	Custom beef income ($)	288	3755.18	44133.18
CUSTOMG	Custom grazing income ($)	288	88.29	1010.03
PBEEF	Percentage of gross farm income derived from beef	288	0.24	0.24
DAIRYI	Accrual dairy income ($)	288	7327.81	65221.54
SWINEI	Accrual swine income ($)	288	572.34	5213.34
WHEATI	Accrual wheat income ($)	288	89246.09	107297.86
CORNI	Accrual corn income ($)	288	77545.27	148803.35
SORGI	Accrual grain sorghum income ($)	288	30935.17	65522.02
SOYI	Accrual soybean income ($)	288	81974.16	128091.68
HFI	Accrual hay and forage income (alfalfa, other hay, and silage) ($)	288	16018.74	48284.39

NFI	Net farm income ($)	288	112194.90	166051.38
TEXP	Total expenses (cash expenses and depreciation)	288	299424.79	240716.89
TLABOR	Total labor expense (paid and unpaid)	288	62149.67	33469.58
NOPER	Number of operators	288	1.02	0.43
NWORK	Number of workers	288	1.37	0.80
AGE	Operator age (primary operator)	288	55.64	11.38
WAGES	Off-farm wages/income (excludes rent, royalties, stock returns, etc.) (Thousands $)	288	14.79	23.19
INT	Interest expense (does not include opportunity charges)	288	16931.77	20148.66
UNPAID	Unpaid labor ($)	288	51540.79	21693.12
ASSETC	Opportunity charge on net worth ($)	288	69793.86	63062.94
ETERC	Economic total expense ratio below one	288	0.35	0.48
DEBT	Total liabilities ($)	288	275599.22	311783.06
ASSETS	Total assets (Thousands $)	288	1147.69	884.77

3.3 – Cow-Calf Production Practices

Several survey questions were designed to collect information related to cow-calf production practices. Detailed survey questions, variable definitions and summary statistics are reported for each section. Table 3.2 shows the cow-calf production practices questions.

Table 3.2 Cow-Calf Production Practices Survey Questions - Variable Definitions and Summary Statistics

Survey Question	Variable	N	Most Common Response[1]	Mean	Std Dev
Q13	% of herd A.I.'d (1=0%; 2=10-40%; 3=40-70%; 4=70-100%)	302	1	1.27	0.62
Q14	Of cows A.I.'d, % bred (1=0%; 2=10-40%; 3=40-70%; 4=70-100%)	60	3	3.12	0.58
Q1A	Spring Calve (% of respondents)	312		75.85	29.65
Q1B	Fall Calve (% of respondents)	312		23.18	28.79
Q11	Expected net return percent increase needed to convince change of calving season (1=5%; 2=10%; 3=18%; 4=22%; 5=Would not consider carryover)	276	2	3.05	1.11
Q3A	Typical management of steers after weaning – Sell at weaning (5=Always to 1=Never)	287	1	2.82	1.67
Q3B	Typical management of steers after weaning – Background, then sell (5=Always to 1=Never)	301	1	3.1	1.61
Q3C	Typical management of steers after weaning – Retain through finishing (5=Always to 1=Never)	274	1	1.77	1.32
Q3D	Typical management of heifers after weaning – Retain as replacements (5=Always to 1=Never)	299	5	3.39	1.44
Q3E	Typical management of heifers after weaning – Sell at weaning (5=Always to 1=Never)	261	1	2.62	1.54
Q3F	Typical management of heifers after weaning – Background, then sell (5=Always to 1=Never)	274	1	3.12	1.52
Q3G	Typical management of heifers after weaning – Retain through finishing (5=Always to 1=Never)	238	1	1.71	1.25
Q8	Typical decision when cow comes open (1=Cull and sell; 2=Feed out and send to feedlot; 3=Give one more chance to get bred next year; 4=Defer to alternative calving season herd)	307	1	1.75	1.15
Q9A	Reason to keep an open cow – First time open (1=Yes; 0=No)	312		0.24	0.43
Q9B	Reason to keep an open cow – Quality of cow (1=Yes; 0=No)	312		0.3	0.46
Q9C	Reason to keep an open cow – Value of cow (1=Yes; 0=No)	312		0.09	0.29
Q9D	Reason to keep an open cow – Good reproductive record (1=Yes; 0=No)	312		0.27	0.44
Q9E	Reason to keep an open cow – Cull every open cow; no second chances (1=Yes; 0=No)	312		0.34	0.48

[1]Most Common Response is not displayed for continuous variables.

The majority of respondents, 79.8%, do not artificially inseminate (A.I.) their herd, therefore 20.2% do A.I., in which they answered if they A.I. 10-40% of their herd, 40-70% of their herd or 70-100% of their herd. Percentages are reported in Table 3.3. Of the 20.2% that do A.I., the mainstream of respondents, 65.0%, reported typically having a 40-70% success rate of bred cows through A.I. Respondents who reported typically achieving a success rate of 70-100% were smaller at 23.3% and the smallest amount, 11.7%, reported a typical success rate in the range of 10-40%.

Table 3.3 Artificial Insemination

	0% Rate	**10-40% Rate**	**40-70% Rate**	**70-100% Rate**
% of herd A.I.'d	79.8%	14.9%	3.3%	2.0%
Of cows A.I.'d, % typically bred	--	11.7%	65.0%	23.3%

Respondents generally calve in the spring with 75.8% indicating a January through June calving period and 23.2% calving in the fall (July through December). When producers were asked how much more their expected return would need to be to convince them to retain and feed calves over to sell in March if they typically market their spring-born calves at weaning in November, the most common response, 35.1%, was that they would consider retaining calves to sell in March if their expected net return would be 10% higher. Only 14.86% of respondents reported they would not consider carrying them over.

Producers were asked what they did with their calves each year after weaning. Questions were broken into two groupings: steers and heifers. Possible responses were "Always", "Often", "Sometimes", "Seldom" or "Never" in which the respondent could circle the response that best fit their production decisions. Each of the seven production systems encounters a unique set of production costs and produces calves for market at different periods of the year. For steer calves,

27.5% of respondents reported always selling steers after weaning, 28.2% always backgrounded steers then sold them, and only 9.5% always retained steers through finishing. For heifers, 29.1% reported always retaining heifers as replacements, 19.2% always sell heifers after weaning, 24.8% always background heifers then sell them, and only 8.0% always retain heifers through finishing. Figures 3.2 and 3.3 show the percentages of answers by producers. The majority of steer producers background at least some of their steers then sell them. The majority of heifer producers retain at least some heifers as replacements.

Figure 3.2 Producer Preferences of Feeding Steer Calves After Weaning

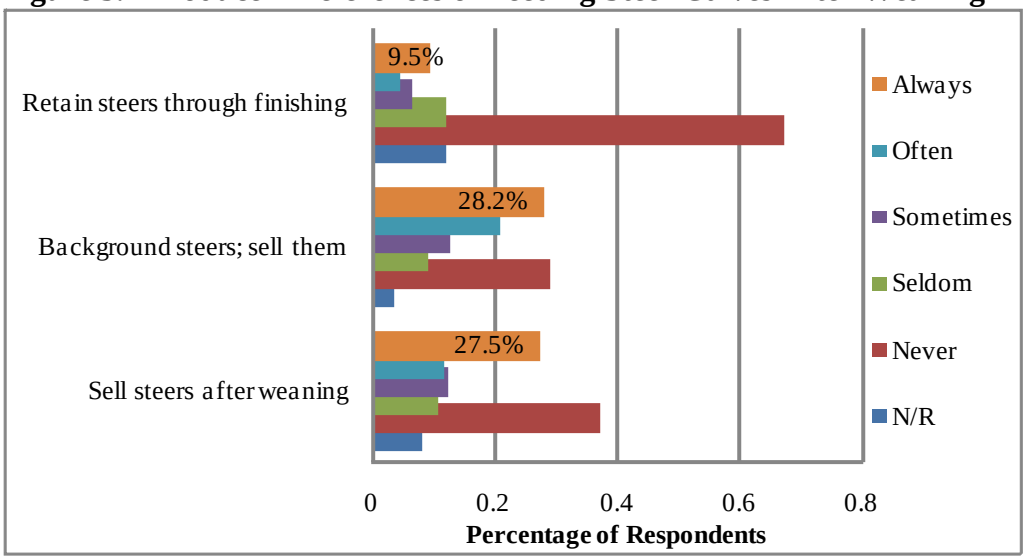
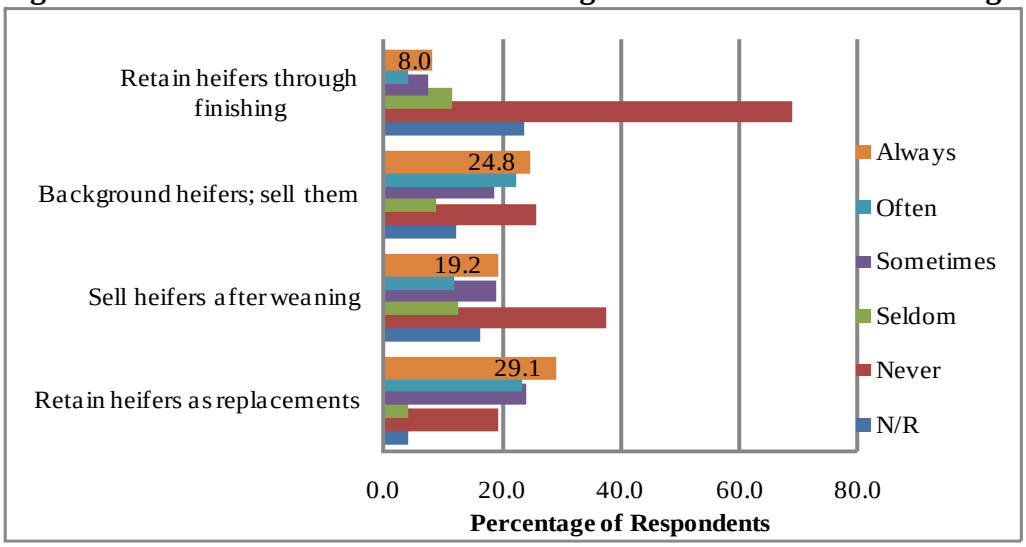
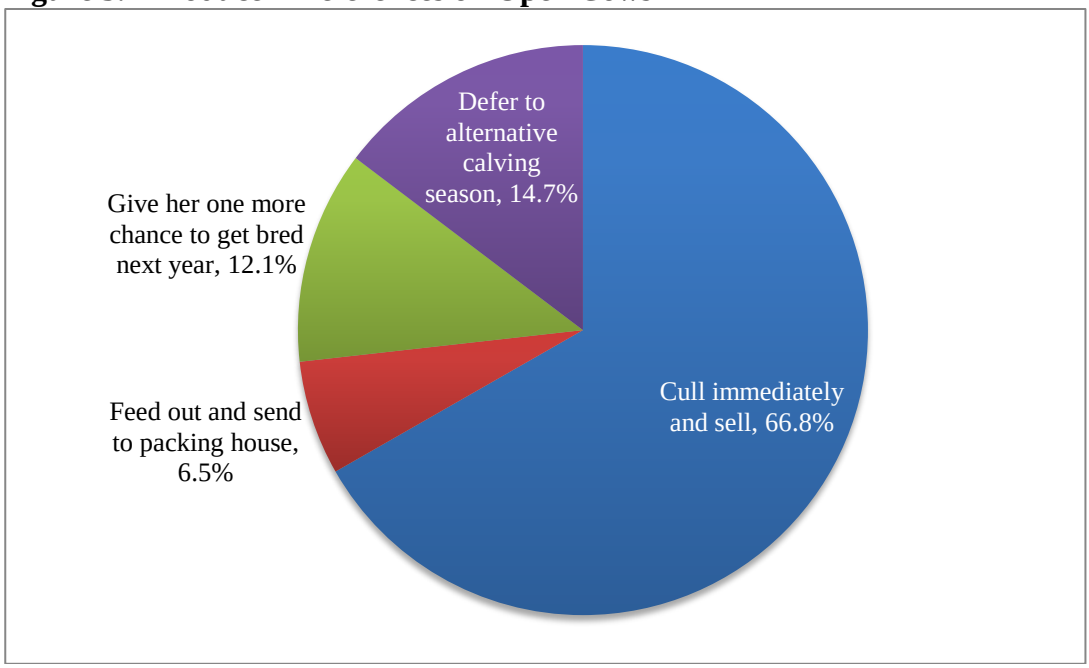


Figure 3.3 Producer Preferences of Feeding Heifer Calves After Weaning



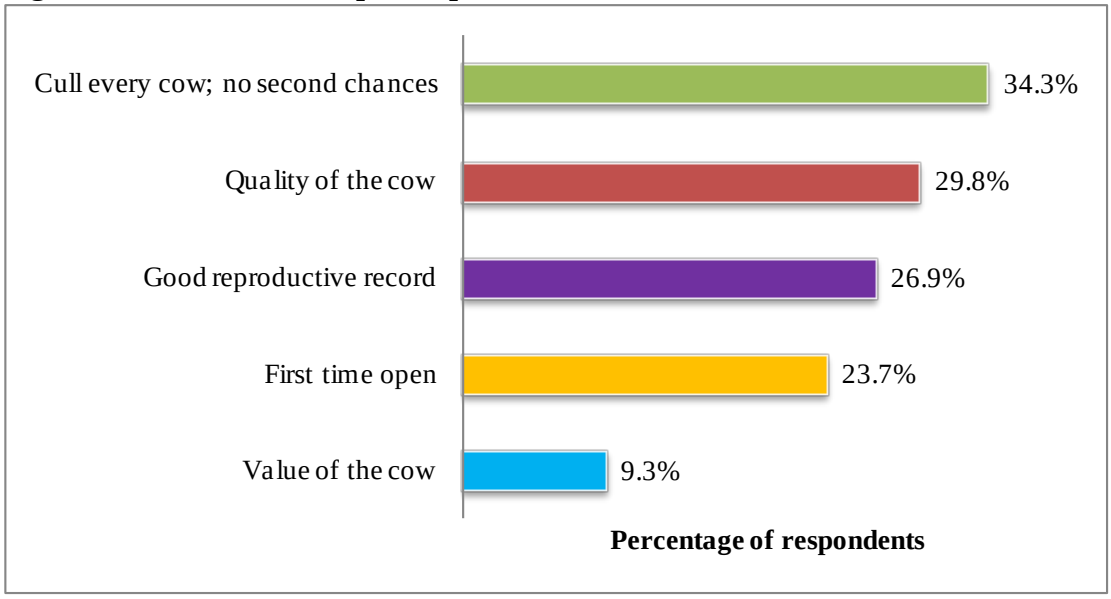
Producers were asked when they had a cow that does not settle/comes up open, what decision they typically make. Figure 3.4 shows percentages of these decisions. The majority of producers, 66.8%, would cull immediately and sell the cow. Almost 15% of respondents would defer to an alternative calving season, and 12.1% would give the cow one more chance to get bred the following year. Only 6.5% of respondents would feed out the open cow and send to get processed.

Figure 3.4 Producer Preferences on Open Cows



Producers have different reasons for keeping an open cow. Survey respondents were given options such as first time open, the quality of the cow (i.e. registered, good genetics), the value of the cow, or a good reproductive record, as well as given the chance to choose more than one answer. The most widely reported response, 34.3% of respondents, give no second chances to an open cow to impregnate no matter the circumstance and cull every open cow. Almost 30% of respondents noted that they would keep an open cow because of her quality, while 27% said they would keep an open cow because of her good reproductive record. When a cow is open for the first time, 23.7% of producers will keep her for another breeding season, and 9.3% of producers will keep a cow depending on her value (i.e. how much money has been put into her: quality, vaccinations or otherwise). Figure 3.5 shows the distribution of percentages.

Figure 3.5 Reasons to Keep an Open Cow



3.4 – Marketing and Pricing Methods

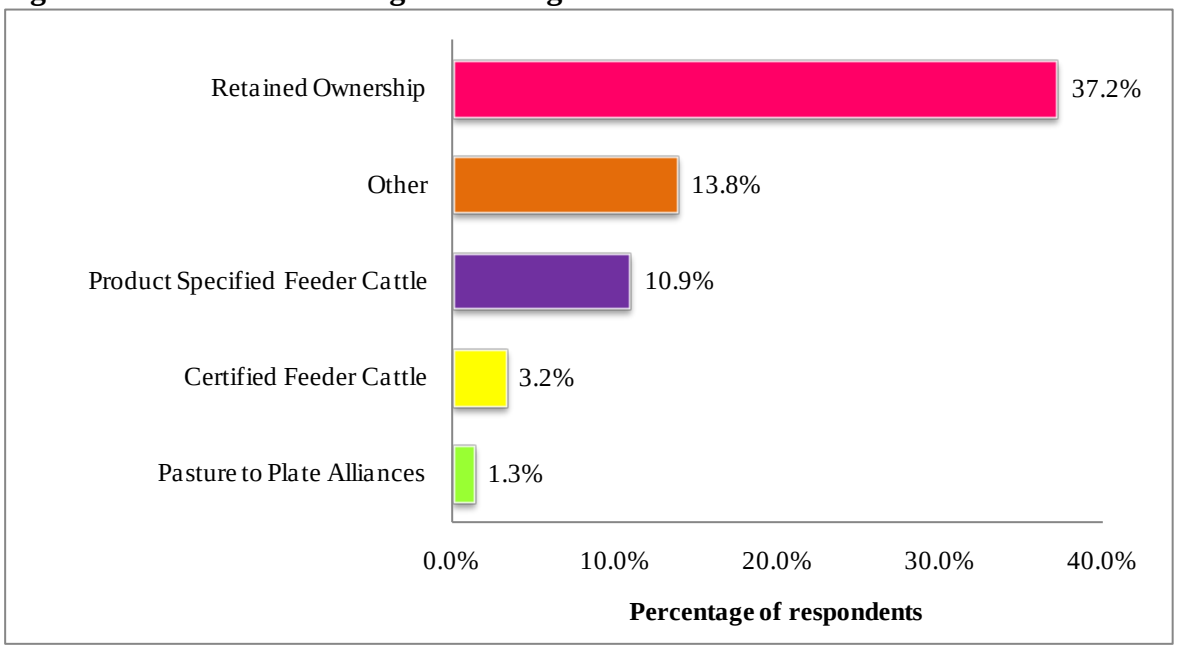
Table 3.4 shows the summary statistics for the marketing and pricing methods questions in the survey.

Table 3.4 Marketing and Pricing Methods Survey Questions - Variable Definitions and Summary Statistics

Survey Question	Variable	N	Mean	Std Dev
Q2A	Participation in production management program – Retain Ownership of Calves (1=Yes;0=No)	312	0.37	0.48
Q2B	Participation in production management program – Certified Feeder Cattle (1=Yes;0=No)	312	0.03	0.18
Q2C	Participation in production management program – Product Specified Feeder Cattle (1=Yes;0=No)	312	0.11	0.31
Q2D	Participation in production management program – Pasture to Plate Alliances (1=Yes;0=No)	312	0.01	0.11
Q2E	Participation in production management program – Other (1=Yes;0=No)	312	0.14	0.35
Q6A	Reason to Retain Ownership – Risk worthwhile (1=Yes; 0=No)	312	0.36	0.48
Q6B	Reason to Retain Ownership – Performance data (1=Yes; 0=No)	312	0.13	0.34
Q6C	Reason to Retain Ownership – Carcass data (1=Yes; 0=No)	312	0.13	0.33
Q6D	Reason to Retain Ownership – Genetic/value-added improvement (1=Yes; 0=No)	312	0.16	0.37
Q6E	Reason to Retain Ownership – Other (1=Yes; 0=No)	312	0.03	0.18
Q7A	Reason to Not Retain Ownership – No add'l profit (1=Yes; 0=No)	312	0.17	0.38
Q7B	Reason to Not Retain Ownership – No carcass data (1=Yes; 0=No)	312	0.05	0.22
Q7C	Reason to Not Retain Ownership – Do not want risk while in feedlot (1=Yes; 0=No)	312	0.47	0.5
Q7D	Reason to Not Retain Ownership – Want revenue before calves finish (1=Yes; 0=No)	312	0.35	0.48
Q7E	Reason to Not Retain Ownership – No relationship with feedlot (1=Yes; 0=No)	312	0.26	0.44
Q7F	Reason to Not Retain Ownership – Other (1=Yes; 0=No)	312	0.09	0.29
Q4A	Direct Marketing (% of marketing method typically used)	311	15.43	32.19
Q4B	Local auction barn normal sale (% of marketing method typically used)	311	70.03	40.16
Q4C	Local auction barn special graded sale (% of marketing method typically used)	311	8.71	23.87
Q4D	Video auction (% of marketing method typically used)	311	3.37	14.61
Q4E	Other (% of marketing method typically used)	311	2.46	13.73
Q5A	Forward contracting/mktg agreement (% of pricing method typically used)	309	4.64	17.77
Q5B	Futures Hedging (% of pricing method typically used)	309	1.47	8.46
Q5C	Futures options (% of pricing method typically used)	309	1.96	9.75
Q5D	Cash only (% of pricing method typically used)	309	90.02	25.08
Q5E	Other (% of pricing method typically used)	309	1.91	12.67

Survey questions on production management programs did not garner very high response rates. This could be predicted after summaries in Section 3.3 show that 28.2% of producers either background steers and then sell them or sell steers after weaning (27.5%). Only 9.5% retain steers through finishing. However, those that responded "yes" to this question on participation in production management programs, retained ownership was the most popular program with 37.2% of respondents (116 producers). A small 10.9% of respondents participate in a product specified feeder cattle programs, 3.21% in certified feeder cattle programs, 1.28% in pasture to plate alliance programs, and 13.8% specified "other". Common other programs listed were: owning registered stock for breeding and selling; backgrounding until around 800 pounds; natural, organic or grass-fed programs; and age and source verified programs. Figure 3.6 shows the allocation of percentages.

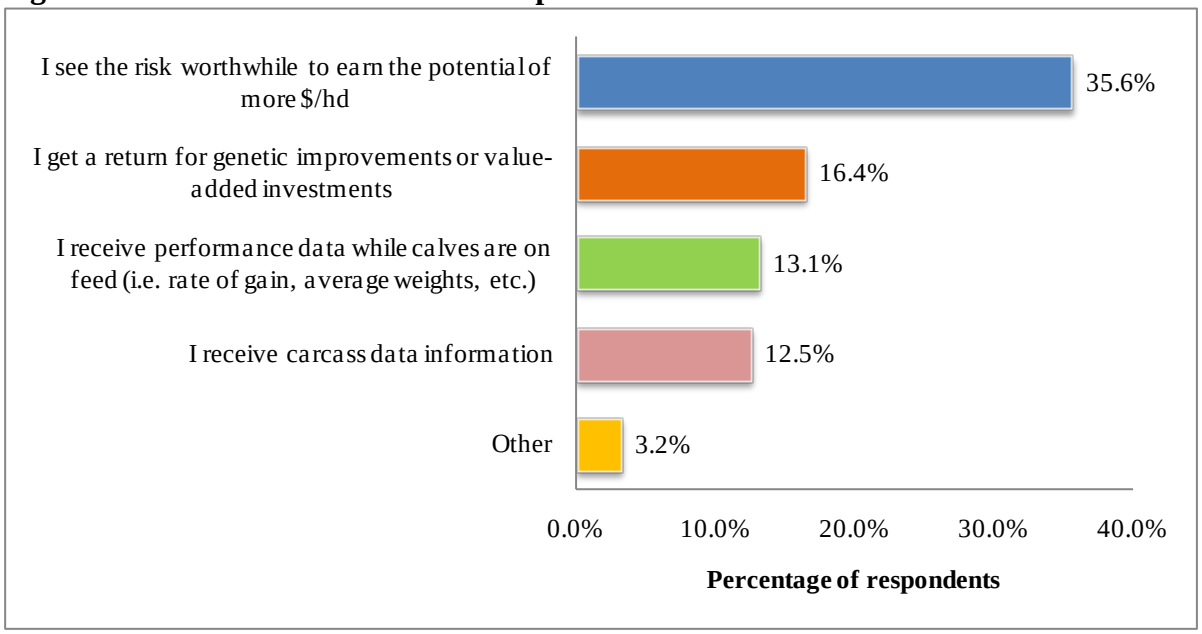
Figure 3.6 Production Management Programs



In order to view respondents preferences for either retaining ownership of their calves or not, they were asked two questions that allowed them to indicate reasons for retaining ownership or reasons for not retaining ownership. Reasons to retain ownership are listed in Figure 3.7. The

reason with the most responses, 35.6%, was that producers see the risk worthwhile to earn the potential of more dollars per head by retaining ownership of their feeders. Producers who earn a return for genetic improvements or value-added investments (16.4%), was the second highest reason to retain. Other common reasons to retain ownership were to use up low quality roughage, market their calves as age and source verified, and others noted that they only retain ownership if they have the feed to do so.

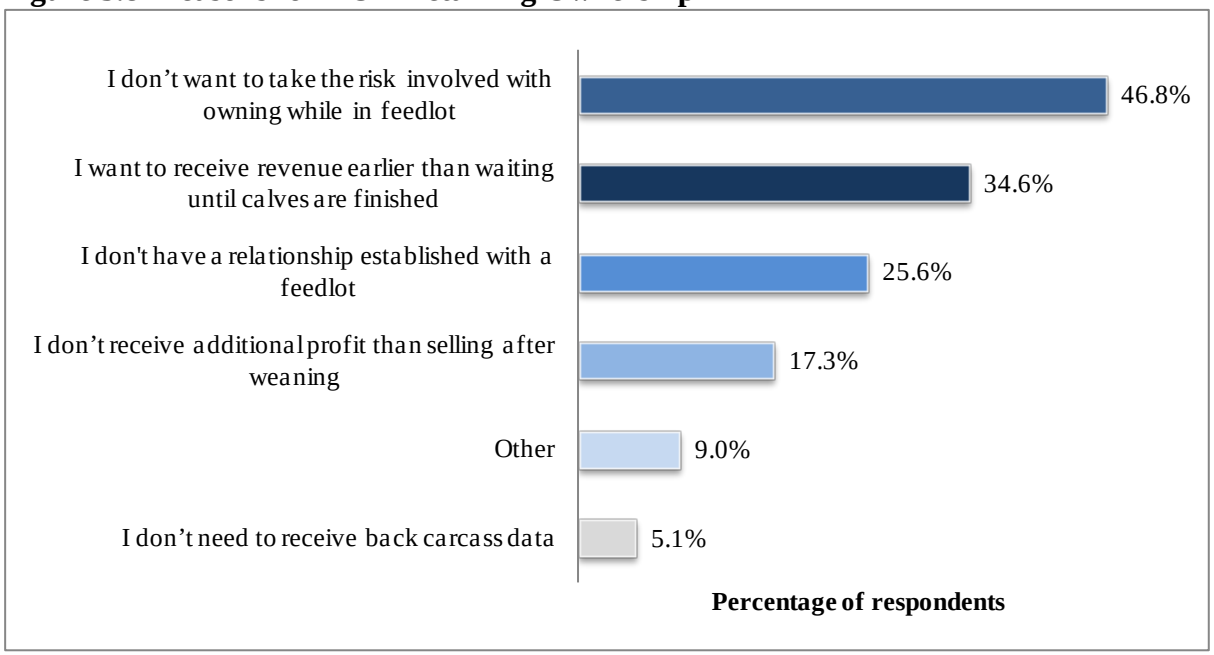
Figure 3.7 Reasons to Retain Ownership



A large proportion of respondents (46.8%) reported they do not retain ownership because they do not want to take the risk involved with ownership feeders in the feedlot (Figure 3.8). Others want to receive revenue earlier than waiting until calves are finished (34.6%). There were several other reasons for not retaining ownership. Generally, some producers note that they would like carcass data, but it is not possible to obtain them through their sale barn, or they want to maximize capital by only owning cattle under their direct management. Others want to spread

out risk rather than retaining 100%, do not have enough calves to fill a pen or the adequate pasture or facilities, and others just do not want the added work.

Figure 3.8 Reasons for NOT Retaining Ownership



In terms of marketing methods of calves sold annually, selling at a local auction barn normal sale was most common (70%), whereas 15.4% used direct marketing, 8.1% use a local auction barn special graded sale, 3.4% use a video auction sale, and 2.5% indicated using other marketing methods. Common other forms of marketing methods were private treaty sales of registered stock, or selling to feedlot or packer directly.

In terms of typical pricing methods of calves sold annually, cash only pricing methods was the most popular (90%), whereas 4.6% used forward contracting or marketing agreements, 2.0% used futures options, 1.9% indicated other pricing methods, and 1.5% used futures hedging.

3.5 – Inputs Costs, Volatility, and Comparative Advantages

Table 3.5 presents the responses to questions pertaining to input costs, volatility, and comparative advantage.

Table 3.5 Input Costs, Volatility and Comparative Advantages Survey Questions - Variable Definitions and Summary Statistics

Survey Question	Variable	N	Most Common Response[1]	Mean	Std Dev
Q10A	Producer's ranking of input costs – Animal health costs (1 being largest cost to 8 being lowest cost)	306		4.81	1.73
Q10B	Producer's ranking of input costs – Cost of breeding stock (1 being largest cost to 8 being lowest cost)	306		3.97	1.9
Q10C	Producer's ranking of input costs – Feed costs (1 being largest cost to 8 being lowest cost)	306		1.91	1.38
Q10D	Producer's ranking of input costs – Fuel (1 being largest cost to 8 being lowest cost)	306		5.68	1.77
Q10E	Producer's ranking of input costs – Interest (1 being largest cost to 8 being lowest cost)	306		5.99	1.94
Q10F	Producer's ranking of input costs – Labor (1 being largest cost to 8 being lowest cost)	306		5.58	1.84
Q10G	Producer's ranking of input costs – Maintenance costs (1 being largest cost to 8 being lowest cost)	306		5.39	1.74
Q10H	Producer's ranking of input costs – Pasture rent/ownership costs (1 being largest cost to 8 being lowest cost)	306		2.67	1.81
Q23A	Manage farm/ranch income volatility – Purchase insurance (1=Yes; 0=No)	312		0.36	0.48
Q23B	Manage farm/ranch income volatility – Off-farm income(1=Yes; 0=No)	312		0.38	0.48
Q23C	Manage farm/ranch income volatility – Saving funds in good years (1=Yes; 0=No)	312		0.53	0.5
Q23D	Manage farm/ranch income volatility – Selling more cull cows in hard times; retaining more other times (1=Yes; 0=No)	312		0.29	0.46
Q23E	Manage farm/ranch income volatility – Utilizing marketing methods to sell calves (1=Yes; 0=No)	312		0.34	0.47
Q25A	Alternative pasture use – Agritourism (1=Yes; 0=No)	312		0.01	0.08
Q25B	Alternative pasture use – Energy development (1=Yes; 0=No)	312		0.09	0.28
Q25C	Alternative pasture use – Hunting (1=Yes; 0=No)	312		0.36	0.48

Q25D	Alternative pasture use – Leased out to another herd (1=Yes; 0=No)	312		0.03	0.16
Q25E	Alternative pasture use – Recreation (1=Yes; 0=No)	312		0.09	0.29
Q25F	Alternative pasture use – Other (1=Yes; 0=No)	312		0.54	0.5
Q25G	No Alternative pasture use (1=Yes; 0=No)	312		0.04	0.18
Q20A	Comparative Advantages – Analysis and use of new technology (1=Yes; 0=No)	312		0.26	0.44
Q20B	Comparative Advantages – Business planning skills (1=Yes; 0=No)	312		0.21	0.41
Q20C	Comparative Advantages – Cattle genetics (1=Yes; 0=No)	312		0.59	0.49
Q20D	Comparative Advantages – High quality land/pasture (1=Yes; 0=No)	312		0.47	0.5
Q20E	Comparative Advantages – Loan and interest rate management (1=Yes; 0=No)	312		0.35	0.48
Q20F	Comparative Advantages – Low cost (1=Yes; 0=No)	312		0.53	0.5
Q20G	Comparative Advantages – Machinery management (1=Yes; 0=No)	312		0.36	0.48
Q20H	Comparative Advantages – Marketing skills (1=Yes; 0=No)	312		0.2	0.4
Q20I	Comparative Advantages – Personnel management (1=Yes; 0=No)	312		0.33	0.47
Q20J	Comparative Advantages – Production skills (1=Yes; 0=No)	312		0.7	0.46
Q12A	Cattle herd size change over next two years (1=expanding; 2=reducing; 3=remaining same)	301	3	2.07	0.93
Q12B	Crop acreage change over next two years (1=expanding; 2=reducing; 3=remaining same)	293	3	2.23	0.9

[1]Most Common Response is not displayed for continuous variables.

In today's volatile economy, inputs costs can play a large role in terms of overall risk in a cow-calf producer's operation. Producers were asked to rank input costs from one to eight – one being the largest cost – with the following options: animal health costs, cost of breeding stock, feed costs (corn, hay, mineral, etc.), fuel, interest, labor, maintenance costs, and pasture rent or ownership costs. Table 3.6 below shows the overall rankings. Producers believed that feed costs were the largest cost to them, followed by pasture rent/ownership costs. Interest cost was the least costly to them.

Table 3.6 Input Costs, Rankings and Means

Rank (1 being largest cost)	Input Costs	Mean
1	Feed Costs	1.9
2	Pasture rent/ownership costs	2.7
3	Cost of breeding stock	4.0
4	Animal health costs	4.8
5	Maintenance Costs	5.4
6	Labor	5.6
7	Fuel	5.7
8	Interest	6.0

Producers were also asked how they manage farm/ranch income volatility. Table 3.7 shows the order of how producers chose the best practices to manage their income volatility. Most prevalent was saving funds in good years (52.9%), followed by receiving off-farm income (37.5%) and purchasing insurance (36.2%).

Table 3.7 Rankings of Farm/Ranch Income Volatility Among Respondents

Rank	Practices to manage farm/ranch income volatility	%
1	Saving funds in good years	52.9%
2	Off-farm income	37.5%
3	Purchase insurance	36.2%
4	Utilizing marketing methods	33.7%
5	Selling more cull cows during hard times and retaining more at other times	29.5%

Related to farm/ranch income is how producers make use of pasture ground for alternative uses other than grazing their personal herd. Choices for them were agritourism, energy development (oil, gas or wind), hunting, leasing out to another herd, recreation, other, or none. Table 3.8 gives the breakdown of percentages per pasture ground for reasons other than grazing. Other alternative uses, which was the majority with 54.5%, included: fishing ponds,

haying, cell phone tower, fescue production of seed, and pecans. The next largest alternative use was hunting (36.2%). The remaining alternatives were much smaller percentages: recreation (9.0%), energy development (8.7%), leasing out to another herd (2.6%), and agritourism (0.6%). Three and a half percent reported using no alternative uses for their pasture ground.

Table 3.8 Alternative Uses for Pasture Ground Other Than Grazing

Alternative pasture use	%
Other	54.5%
Hunting	36.2%
Recreation	9.0%
Energy development (oil, gas, or wind)	8.7%
None	3.5%
Leased out to another herd	2.6%
Agritourism	0.6%

A producer's comparative advantage refers to their ability to produce (cattle or crops) at a lower marginal cost and opportunity cost than other producers of the same ability and competence (Sheffrin, 2003) or the ability to differentiate their product. The ability for a producer to have comparative advantages in the cow-calf industry is important, especially in a volatile economy, to allow for differentiated products and markets, which in-turn allows for the opportunity of a higher profit margin for that producer. A survey question asked what factors were considered to be the producer's top five comparative advantages in their operations.

Production skills took the majority vote of producer's rankings with 70.2%. Production skills can include forage and crop yields, calving rates, weaning weights, etc. A producer with high calving rates, for example, can utilize their comparative advantage in production skills as a good producer to calve out and keep calves healthy to maximize revenue when selling at weaning. Cattle genetics was the second highest ranking (59.3% of respondents consider this as their comparative advantage). This shows that producers are interested in improving their herd and allowing themselves to have a comparative advantage with their ability to bring good

genetics into their herd, either to improve carcass traits or for selling cattle for breeding. Comparative advantage rankings were followed by low costs (52.9%), high quality land/pasture (47.4%), and machinery management (36.2%). Some results were surprising, such as cattle genetics being the second highest comparative advantage (59.3% of respondents) when only 20% of respondents reported using artificial insemination to improve genetics in their herd. It is also interesting that marking skills was the lowest comparative advantage (19.6% of respondents). However, this is not surprising as nearly 86% of respondents are categorized as risk averse and 70% use a local auction barn to market their calves, thus not utilizing marketing techniques. Further investigation would be interesting to know the survey taker's motives behind why they consider themselves to have any specific comparative advantage. All percentages are reported in Table 3.9.

Table 3.9 Producer Perceptions of Comparative Advantages

Comparative Advantage	%
Production skills (forage yields, calving rates, weaning weights, etc.)	70.2%
Cattle genetics	59.3%
Low cost	52.9%
High quality land/pasture	47.4%
Machinery management	36.2%
Loan and interest rate management	34.6%
Personnel management	33.0%
Analysis and use of new technology	26.0%
Business planning skills (transition planning, business structure, alliances, etc.)	20.8%
Marketing skills	19.6%

Looking forward into the next two years, producers were asked how they envisioned their cattle herd and crop acreage changing; they were given the choices of expanding in size, reducing in size, or remaining the same size for each option (Table 3.10). The majority for both cattle herd and crop acreage is to remain the same size. Interestingly, about the same percentage

for each cattle and crops responded to expanding in size (31.7-39.5%), as well as reducing in size (13.95-14.0%). Since a majority of producers in this population (98.9%) have crops and cattle both reported in their operation, it is possible that if a producer is expanding their cattle herd size in the next two years, they are also looking to expand crop acreage. This comparison may also be the same for a reduction in size. Correlations will be analyzed in Chapter 5.

Table 3.10 Cattle Herd and Crop Acreage Changes in Next Two Years

	Cattle Herd	Crop Acreage
Expanding in size	39.5%	31.7%
Reducing in size	14.0%	13.7%
Remaining the same size	46.5%	54.6%

3.6 – Perceptions of Sources of Risk

Perceptions of risk are a key part to this study. Table 3.11 gives the survey questions asked on risk factors and tolerances, as well as the summary statistics.

Table 3.11 Perceptions of Sources of Risk Survey Questions - Variable Definitions and Summary Statistics

Survey Question	Variable	N	Most Common Response[1]	Mean	Std Dev
Q21A	General risk factors to cow operations – Drought (5=Very Concerned to 1=Not Concerned)	306	4	3.84	0.94
Q21B	General risk factors to cow operations – Unexpectedly low cattle prices (5=Very Concerned to 1=Not Concerned)	305	4	3.98	0.91
Q21C	General risk factors to cow operations – High replacement heifer prices (5=Very Concerned to 1=Not Concerned)	305	3	2.81	1.04
Q21D	General risk factors to cow operations – Variation in non-feed input prices (5=Very Concerned to 1=Not Concerned)	306	3	3.25	0.9
Q21E	General risk factors to cow operations – Changes in gov't environmental programs (5=Very Concerned to 1=Not Concerned)	304	4	3.61	1.15
Q21F	General risk factors to cow operations – Storms (5=Very Concerned to 1=Not Concerned)	306	4	3.38	1.04

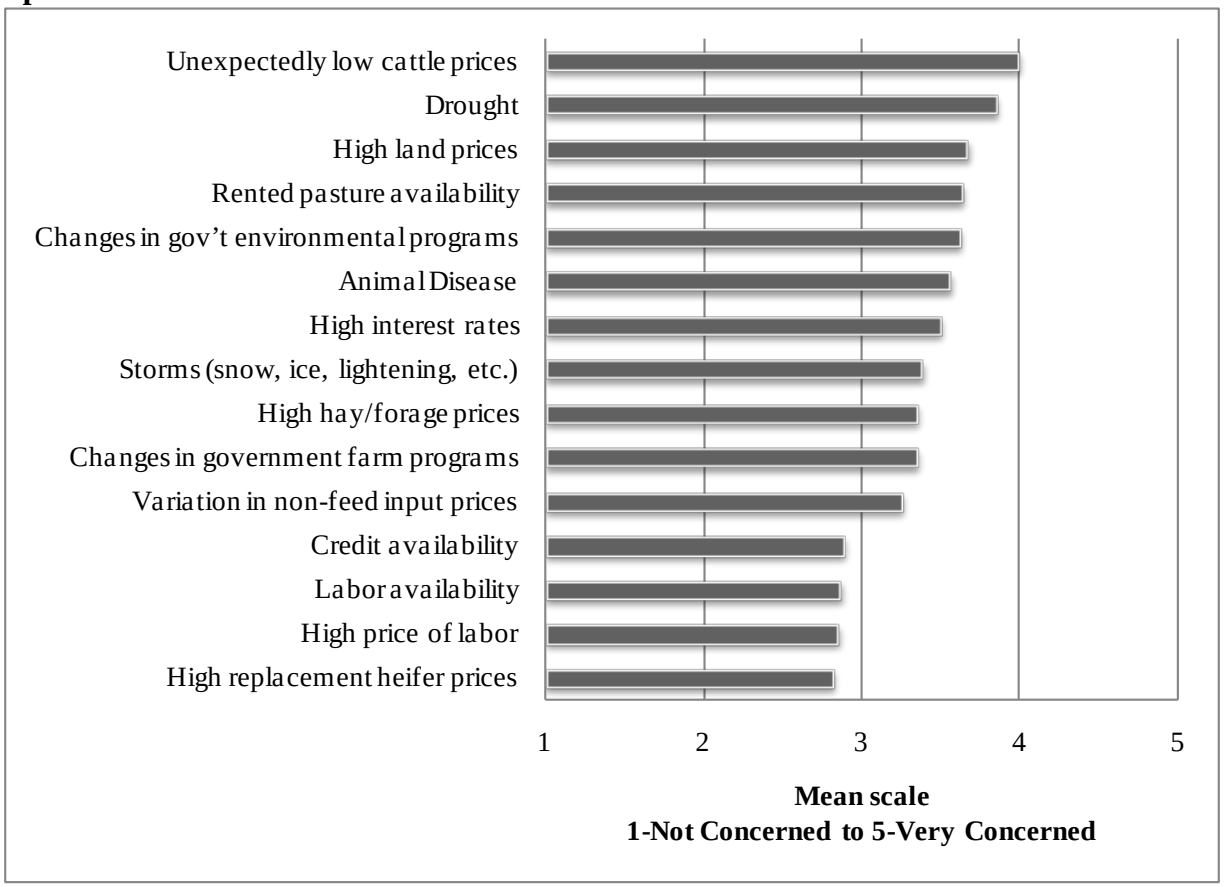
Q21G	General risk factors to cow operations – Changes in gov't farm programs (5=Very Concerned to 1=Not Concerned)	304	4	3.34	1.03
Q21H	General risk factors to cow operations – High hay/forage prices (5=Very Concerned to 1=Not Concerned)	303	3	3.34	0.9
Q21I	General risk factors to cow operations – Animal Disease (5=Very Concerned to 1=Not Concerned)	304	4	3.55	0.96
Q21J	General risk factors to cow operations – High land prices (5=Very Concerned to 1=Not Concerned)	306	4	3.66	1.06
Q21K	General risk factors to cow operations – Rented pasture availability (5=Very Concerned to 1=Not Concerned)	305	4	3.63	1.13
Q21L	General risk factors to cow operations – Labor availability (5=Very Concerned to 1=Not Concerned)	307	3	2.86	0.99
Q21M	General risk factors to cow operations – High price of labor (5=Very Concerned to 1=Not Concerned)	307	3	2.84	0.95
Q21N	General risk factors to cow operations – Credit availability (5=Very Concerned to 1=Not Concerned)	307	3	2.88	1.07
Q21O	General risk factors to cow operations – High interest rates (5=Very Concerned to 1=Not Concerned)	307	4	3.49	1.21
Q22A	Risk factors that affect farm/ranch income – Maintaining animal health (5=Very Important to 1=Not Important)	307	5	4.4	0.84
Q22B	Risk factors that affect farm/ranch income – Being a low-cost producer (5=Very Important to 1=Not Important)	305	4	4.2	0.77
Q22C	Risk factors that affect farm/ranch income – Receiving premiums for calves sold (5=Very Important to 1=Not Important)	305	4	3.99	0.75
Q22D	Risk factors that affect farm/ranch income – Maintaining financial/credit reserves (5=Very Important to 1=Not Important)	302	4	3.85	0.84
Q22E	Risk factors that affect farm/ranch income – Retaining calves for market timing (5=Very Important to 1=Not Important)	300	4	3.44	0.91
Q22F	Risk factors that affect farm/ranch income – Specializing in one phase of cattle production (5=Very Important to 1=Not Important)	304	3	3.16	0.86
Q22G	Risk factors that affect farm/ranch income – Diversifying in numerous ranch/farm enterprises	304	4	3.53	1.02

	(5=Very Important to 1=Not Important)				
Q22H	Risk factors that affect farm/ranch income – Forward contracting futures & options (5=Very Important to 1=Not Important)	304	3	2.68	1.02
Q24A	Cow-calf herd most important part of income (5=Strongly Agree to 1=Strongly Disagree)	307	3	3.31	1.15
Q24B	Economy has focused attention on financial mgmt (5=Strongly Agree to 1=Strongly Disagree)	306	4	3.8	0.74
Q24C	Economy has focused attention on marketing (5=Strongly Agree to 1=Strongly Disagree)	305	4	3.51	0.72
Q24D	Economy has focused attention on intensive herd mgmt (5=Strongly Agree to 1=Strongly Disagree)	304	4	3.53	0.77
Q24E	Individually ID is critical to operation (5=Strongly Agree to 1=Strongly Disagree)	302	4	3.65	0.97
Q24F	Would participate in value-added programs to increase returns (5=Strongly Agree to 1=Strongly Disagree)	306	4	3.77	0.82
Q24G	Disease prevention is important (5=Strongly Agree to 1=Strongly Disagree)	305	4	4.33	0.76
Q24H	Consult with vet for health program (5=Strongly Agree to 1=Strongly Disagree)	305	4	3.92	0.92
Q24I	Inspect herd at least twice weekly (5=Strongly Agree to 1=Strongly Disagree)	306	4	3.79	0.97
Q24J	BCS of cows is important (5=Strongly Agree to 1=Strongly Disagree)	304	4	3.78	0.76
Q15	Neighbor's observation of own risk taking behavior (1=risk avoider; 2=cautious; 3=risk taker after adequate research; 4=real gambler)	296	2	2.86	1.28
Q16	Choice of selling calves at different production stages (1=sell at weaning; 2=retain for two months post weaning; 3=retain through finishing)	295	1	2.04	1.13
Q17	Marketing options most preferred from scenario (1=most risk averse to 4=most risk preferring)	281	3	3.28	2.05
Q18	Investment scenario at 20% success rate (1=nothing; 2=$1,000; 3=$10,000; 4=$50,000; 5=$100,000; 6=more than $100,000)	300	1	1.71	2
Q19	Investment at 60% success rate (1=nothing; 2=$1,000; 3=$10,000; 4=$50,000; 5=$100,000; 6=more than $100,000)	297	3	3.19	2.9

[1]Most Common Response is not displayed for continuous variables.

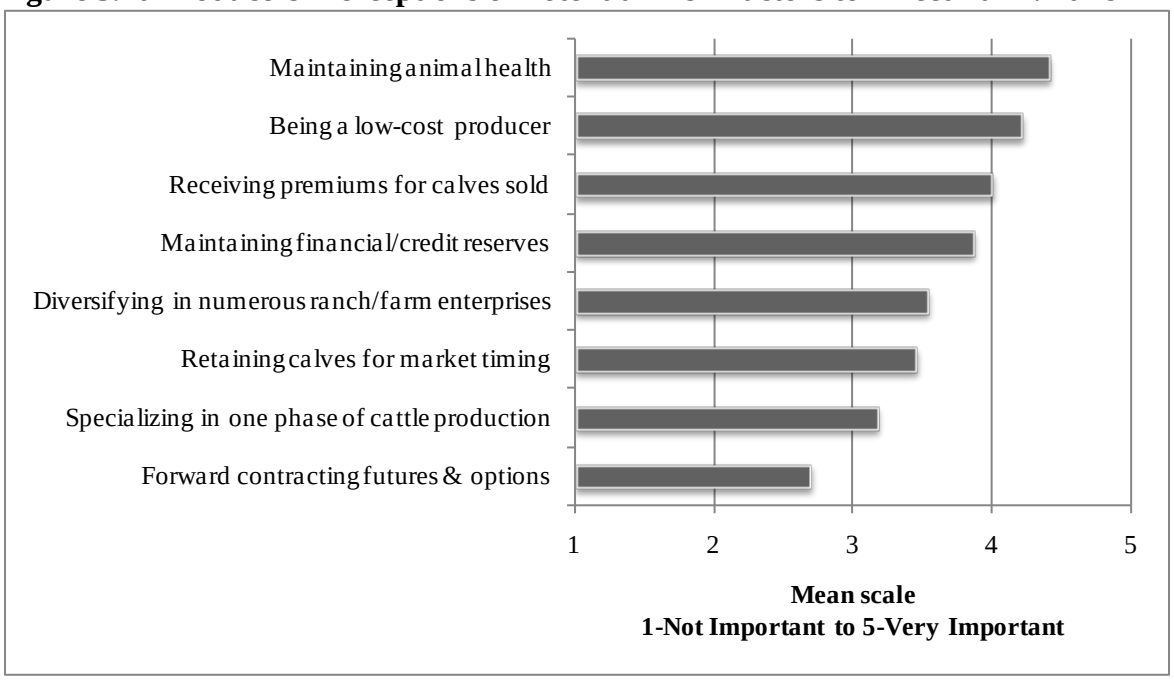
Respondents were asked to rate sources of general risk factors on a concerned level from 5 (Very Concerned) to 1 (Not Concerned). This survey question was fashioned from a survey by Hall (2003), where drought and cattle price variability were the two greatest concerns. For this survey, responses of unexpectedly low cattle prices and drought were the greatest two concerns, with average responses of 4.0 and 3.8 respectively (Figure 3.9). High land prices, rented pasture availability, changes in government environmental programs and animal disease were the next cluster with an average response ranging from 3.5 to 3.6. Availability of credit and labor, high price of labor and high price of replacement heifers were of least concern to producers.

Figure 3.9 Producers' Perception of General Risk Factors by Level of Importance to Cow Operation



Next, producers were asked to rank risk factors in terms of importance that could potentially affect ranch/farm income. This had a similar scale system of 5 (Very Important) to 1 (Not Important), which was also shaped from Hall's (2003) study where maintaining animal health was clearly viewed by respondents as the most important. In this study, maintaining animal health was also the top factor of importance, followed by being a low-cost producer with average responses of 4.4 and 4.2, respectively (Figure 3.10). Receiving premiums for calves sold, maintaining financial/credit reserves and diversifying in numerous ranch/farm enterprises were the second highest grouping with average responses ranging from 3.5 to 3.9. Specializing in one phase of cattle production and forward contracting futures and options were of least importance with average responses of 3.2 and 2.7 respectively. It is not surprising that forward contracting, futures and options was the factor that producer's determined as least important in terms of affecting their farm/ranch income. In a previous question, only 4.6% of respondents reported to use forward contracting or marketing agreements, 2.0% use futures options, 1.9% indicate other pricing methods, and 1.5% use futures hedging; therefore, this factor doesn't affect the sample population's potential risk factors affecting their farm/ranch income as much as maintaining animal health and being a low cost producer.

Figure 3.10 Producers' Perceptions of Potential Risk Factors to Affect Farm/Ranch Income



Next, producers were asked a series of 10 questions in which they could respond with a range of 5 (Strongly Agree) to 1 (Strongly Disagree). The questions were not mutually exclusive, but merely asked about the producer's management preferences. The first question asked if the producer viewed their cow-calf herd as the most important part of their overall farm income in economic terms. The most common response and average response (3 and 3.31 respectively) both coincided that producers were neutral on the statement (30.3%). However, 19.2% of respondents indicated they *strongly* agree that their cow-calf herd is the most important part of their overall farm income and 23.8% agree.

Producers were asked if recent economic instability has focused their attention to spend more time on three categories: careful financial management, marketing, and intensive herd management in their operations. Nearly half, and even over half of respondents in one case, for each of the three categories agree that their attention has been focused with 59.5% of respondents on more careful financial management, 49.8% on marketing, and 47.4% on more intensive herd

management. These results definitely show a strain that has been placed on producers because of the volatile economy and special focus on aspects of their operation is important for continuance of the operation.

Individually identifying cattle is a part of some cow-calf producer's operations, so we asked them if individually identifying cattle is crucial to the operation and marketing of their cattle. Around 32% of respondents were neutral as to the importance of identifying cattle in their operations, while 38.4% agreed that individually identifying their cattle was important.

Following that, producers were asked if they would participate in a value-added program to increase returns to their operation. The most common response was 46.7% of respondents who agreed that they would participate in a program to increase returns and 30.1% of respondents were neutral to the subject.

Disease prevention should be an important factor to any cow-calf producer, and this is reflected by responses of cow-calf producers. Producers agreed (48.2%) that disease prevention was important in their cow-calf herd, and a close second (44.6%) strongly agreed to this topic. A small response from producers of 7.2% responded to neutral, disagree or strongly disagree combined.

Many producers (41.6%) agreed they consult with a veterinarian regularly to develop and implement a whole-herd health program. Some even strongly agree (25.8%) that they consult with a veterinarian and 22.2% are neutral to consulting with a veterinarian about the health of their herd. Some may be neutral or disagree to this as 98.9% of respondents are crop and cattle producers and they choose not to consult with a veterinarian about their cow herd as they only doctor if the need arises.

Along with consulting with a veterinarian, producers who check their herd more often know the health of their herd better and can doctor sooner, as well as finding fencing problems or cattle that may have gotten out. When asked if producers inspect their herd at least twice weekly, 40.2% agree, 25.8% strongly agree, and 22.2% are neutral. A small response of 12% disagreed to checking their herd at least twice weekly.

Lastly in this compilation of producer preference questions, they were asked if body condition scoring of cows is important. Over half of respondents (57.9%) agreed that this is important to their operation. A smaller percentage (13.2%) strongly agreed to this and 23.0% were neutral on the matter. All ten of these questions will be used in later chapters to analyze and relate to risk preferences of producers.

The most important questions in the survey used to access the producer's risk preferences were created from research by Grable and Lytton (1999) and further tested in a follow-up study by the same authors in 2003. These questions were created with causal risk dimensions described in Chapter 2. These five questions were weighted and combined to create the new variable, Risk Preference Score (RPS), which will be described in Chapter 4 on model development.

The first question used the risk dimensions of: 1) risk as a level of experience and knowledge and 2) speculative risk. It asked respondents how their neighbor would describe their own risk taking behavior in terms of their farm/ranch management, given the answers of "a risk avoider", "cautious", "willing to take risks after adequate research" and "a real gambler". The most widely held response was respondents described as cautious at 52.4%. "Willing to take risks after adequate research" described 39.9% of the respondents, "a risk avoider" described 5.7% of respondents, and "a real gambler" described 2% of respondents.

The next risk question contained two dimensions of risk: 1) guaranteed vs. probable gambles and 2) speculative risk. This question set up a scenario revealing to producers that if they could sell their calves at different production stages, what stage would they choose, given the options: a) selling at weaning, b) retaining for two months post weaning with a 30% chance of netting an additional $5/head, 10% chance of losing $10/head, or 60% chance of netting no additional dollars per head; and c) retaining through finishing with a 30% chance of netting an additional $40/head, 15% chance of losing $50/head, or 55% chance of netting no additional dollars per head. Most commonly, respondents selected the most risk averse answer of selling at weaning (40%), followed by retaining for two months post weaning (38%), and retaining through finishing (22%).

The third risk question was developed with three risk dimensions: 1) guaranteed vs. probable gambles, 2) choice between sure loss and sure gain and 3) speculative risk. This scenario question asked producers if given the best and worst case potential outcomes from marketing their weaned calves, which net return/loss prospect would they prefer from four possible choices. These four choices ranged from risk averse (small return and no loss potential) to risk preferring (large return and large loss potential). The largest response (46.3%) was for the second highest risk preferring answer of a $65/calf return best case; $35/calf loss worst case reaction. The other three answers had lower response rates; 26.0% for the most risk averse answer of $20/calf return best case and $0/calf loss worst case; 17.4% for the second risk averse answer of $35/calf return best case; $20/calf loss worst case; 10.3% for the highest risk preferring answer of $100/calf return best case; $75/calf loss worst case.

The last two risk preference questions were similar with different success rates for an investment and used the same two risk dimensions: 1) guaranteed vs. probable gambles and 2)

speculative risk. The first question sets up the background to tell the respondent that their trusted friend was putting together investors to fund a new innovative business venture that could pay back more than 50 times the investment if successful, which is a 20% success rate. However, the investment would be worthless if the venture was a bust. Respondents were given the choice of six options: nothing; $1,000, $10,000, $50,000, $100,000, or more than $100,000. Over half of respondents chose the most risk averse option of investing nothing (59.3%). Nearly a third, 30.7%, of respondents would invest $1,000, 9.3% would invest $10,000, 0.3% would invest $50,000, no one was willing to invest $100,000, but a small 0.3% would invest more than $100,000.

The second similar question changed the success rate from 20% to 60% and then asked how much they were now willing to invest given the same answer choices. The majority increased to be willing to invest $10,000 (39.4%), followed by 32.0% willing to invest $1,000, 21.9% still willing to invest nothing, 4.7% willing to invest $50,000, 1.7% now willing to invest $100,000 and the same 0.3% willing to invest more than $100,000.

These five risk preference questions will be compared to the producers' data compiled in the KFMA data bank in further chapters.

3.7 – Computer and Internet Access

Having access to a computer for a cow-calf producer can help with record keeping, and Internet access can allow a producer to access market information and catch up on news to read about what is going on in the industry. Three simple questions asked producers if they, 1) own a computer, 2) have Internet access, and 3) if they have do Internet access, how often they access it (Table 3.12).

Table 3.12 Computer and Internet Access Survey Questions - Variable Definitions and Summary Statistics

Survey Question	Variable	N	Most Common Response[1]	Mean	Std Dev
Q26	Own a computer (1=Yes; 0=No)	309	1	0.87	0.34
Q27	Have internet access (1=Yes; 0=No)	309	1	0.84	0.36
Q28	How often access internet (1=Daily; 2=Weekly; 3=Monthly; 4=Less often)	267	1	1.72	1.02

[1]Most Common Response is not displayed for continuous variables.

Those who own a computer was 86.7% of respondents and 13.3% did not report to own a computer. Almost the same breakdown of response percentages was for those who have Internet access, in which 84.5% have access and 15.5% do not have access to the Internet. Over half of respondents (57.7%) access the Internet daily, 24.3% access it weekly, 6.0% access it monthly and 12.0% access the Internet less often than monthly.

3.8 – Summary

This chapter was used for reporting summary results from the cow-calf risk preference survey instrument. This data gathered will be combined with 2008 KFMA farm data and used to create and analyze models and report results on the overall purpose of the study.

CHAPTER 4 - Operating Decisions Related to Risk Preferences: Model Specifications

4.1 – Introduction

This chapter will help determine how producers' operating decisions related to calf-timing, health management, feeding and grazing, breeding, culling, and selling are related to risk aversion. In Section 4.2, the Risk Preference Score (RPS) variable is developed and defined from five specific survey question responses, Section 4.3 defines the model specifications for the basic model to support what operating decisions are related to risk preferences, then Section 4.4 describes the estimated equation. In order to determine other operating decisions that affect the RPS, sensitivity analysis was conducted and defined in Section 4.5, with the new estimated equations following in Section 4.6. Results are reported in Section 4.7.

4.2 – Risk Preference Score

In order to assess a cow-calf producer's risk preference, a variable was created to show an individual producer's evident "score" that could be used and compared to other attitudinal and production questions, as well as whole farm data. Five questions in the survey were asked to determine the producer's "Risk Preference Score" (RPS). These five questions were decided on from Grable and Lytton's research on risk preferences in 1999 and follow-up study in 2003, which contained the risk dimensions discussed in Chapter 3, Section 3.7. The Risk Preference Score (RPS) variable was created by summing the weights corresponding to each response for questions 15, 16, 17, 18 and 19, the five questions created according to previous literature to combine certain dimensions of risk. Each response for these five questions was squared to give

more weight to the most risk-preferring answers (Table 4.1). Higher scores represented higher levels of risk preference, whereas lower scores represented lower levels of risk preference.

Table 4.1 Survey Questions and Given Weights for Calculation of Risk Preference Score Variable

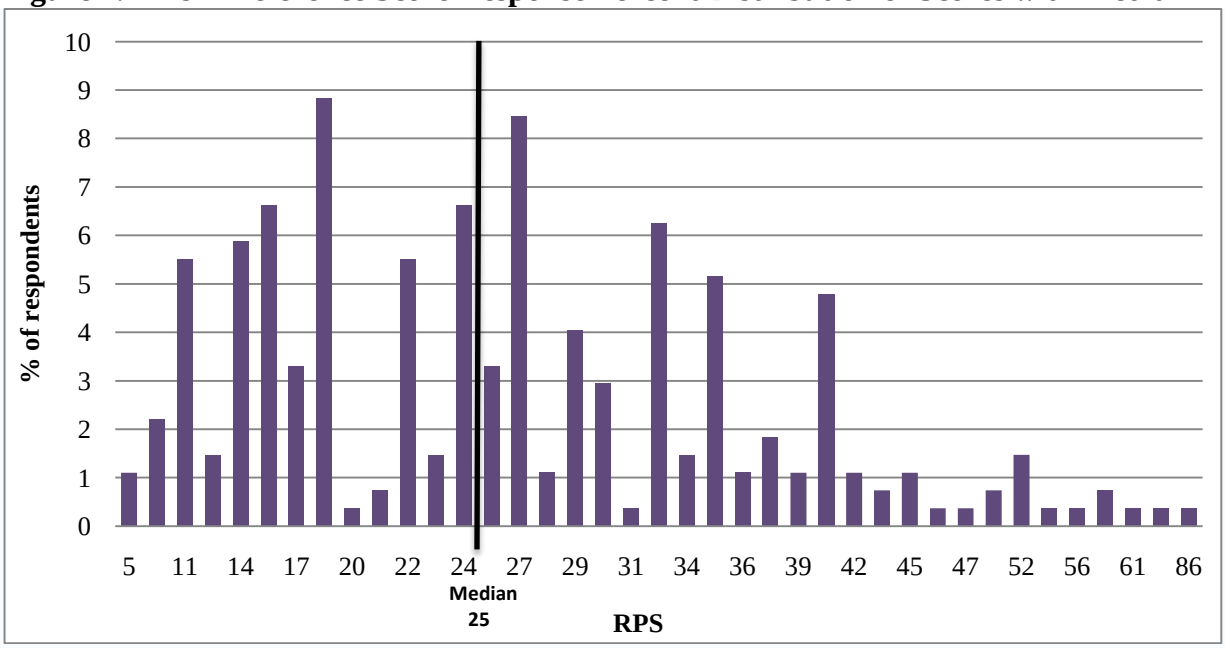
Question #	Answer Choices and Calculated Weights
15	a = 1^2; b = 2^2; c = 3^2; d = 4^2
16	a = 1^2; b = 2^2; c = 3^2;
17	a = 1^2; b = 2^2; c = 3^2; d = 4^2
18	a = 1^2; b = 2^2; c = 3^2; d = $4^{2;}$ e = 5^2; f = 6^2
19	a = 1^2; b = 2^2; c = 3^2; d = $4^{2;}$ e = 5^2; f = 6^2

This method coincided with Grable and Lytton's (1999) index groupings, as well as MacCrimmon and Wehrung (1985). Both of these studies categorized their survey respondents using similar indexes customized to their study; thus, this study uses the same method arbitrarily reorganized to fit the questions and data asked of the KFMA members. The RPS variable is defined by:

(1) $RPSi = \sum_{j=1}^{N} Q\ ij^2$,

where *i* refers to individual producers, Q is the answer given to each question (*j*) by each producer (*i*) and *j* is refers to each question (N=5). As calculated, the smaller RPS, the more risk averse is the respondent. The average RPS was 26.2, with a median of 25, a standard deviation of 11.8, and a range from 5 to 86. Figure 4.1 shows the percent distribution of scores from the respondents, including the median.

Figure 4.1 Risk Preference Score Response Percent Distribution of Scores with Median

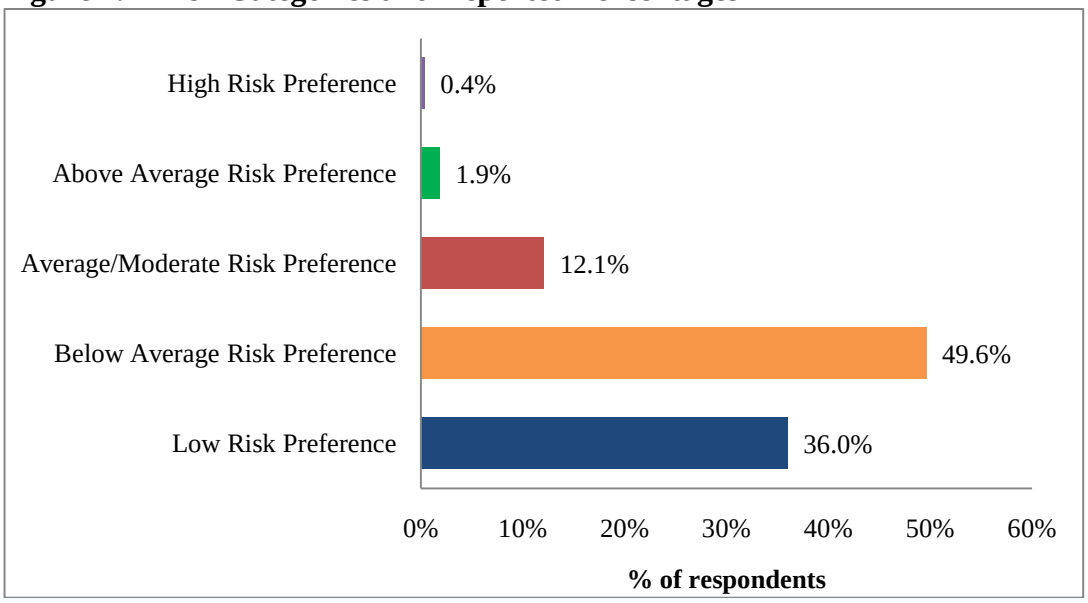


The risk preference scores were categorized to encompass the 20th percentiles, starting with the lowest 20% (low risk preference), second lowest 20% (below average risk preference), middle 20% (average/moderate risk preference), second highest 20% (above average risk preference) and highest 20% (high risk preference). This method also used by Grable and Lytton (1999), as well as MacCrimmon and Wehrung (1985). However, for this study, the method was arbitrarily categorized in order to compare producers simply relative to other respondents. Table 4.2 categorizes the producer's RPS to what type of risk they prefer.

Table 4.2 Risk Preference Score Categories

RPS	Category
5 to 21	Low Risk Preference
22 to 38	Below Average Risk Preference
39 to 55	Average/Moderate Risk Preference
56 to 72	Above Average Risk Preference
73 to 86	High Risk Preference

Figure 4.2 Risk Categories and Reported Percentages



The percentages of responses, as shown in Figure 4.2, reveal that 36% of Kansas producers possess a low risk preference (very risk averse), 49.6% possess a below average risk preference (somewhat risk averse), 12.1% possess an average/moderate risk preference (neutral risk partiality), 2.2% possess an above average risk preference (somewhat risk preferring), and 0.4% possess a high risk preference (very risk preferring). Thus, nearly 86% of Kansas cow-calf producer survey respondents are risk averse using the categorization scheme developed here. As mentioned in the literature, price and production risk are ambiguous and even risk choices among individuals change over time and in the midst of different situations. These are not the only factors affecting a producer's risk preference; therefore, modeling in the following sections of this chapter will support what operating decisions are related to producers' risk preferences, as well as Chapter 5 supporting how risk preferences are related to producers' operating decisions.

4.3 – Model Specification

As risk preferences are the focal point of this study, modeling was focused on the Risk Preferences Score (RPS) variable with the following explanatory variables to determine how these variables are related to risk preference. For producer *i*, the equation explaining risk preferences is specified as:

(2) $RPSi = f(AGE_i, WAGES_i, DAR_i, ASSETS_i, NCOWS_i, H_i, Q20A_i, Q20B_i, Q20H_i, e_i)$

where e_i are random errors and, for producer *i*,

- AGE_i = Primary operator age
- $WAGES_i$ = Off-farm wages (Thousands)
- DAR_i = Debt-to-asset ratio
- $ASSETS_i$ = Total assets (Thousands)
- $NCOWS_i$ = Number of beef cows
- H_i = Herfindahl index of diversification calculated using shares of total farm income
- $Q20A_i$ = Dummy variable to show producer's comparative advantage in analysis and use of new technology
- $Q20B_i$ = Dummy variable to show producer's comparative advantage in business planning skills
- $Q20H_i$ = Dummy variable to show producer's comparative advantage in marketing skills

The empirical definitions and expectations of the variables also are described in detail in the next section.

4.4– Definition of Variables

For this study, data obtained from the KFMA data bank were gathered by association economists from each region (See Appendix B for the region and county breakdown of survey responses). The age variable reports the primary operator's age in 2008. The average age for this test group is 55.6 years with a minimum age of 23 and a maximum age of 84. Grable and Lytton (1999) assume that investors older in age are naturally less risk preferring than younger investors. Therefore, the age variable is expected to have a negative coefficient to show that an

increase in a producer's age will decrease their risk preference score (i.e., older producers are more risk averse). This was also tested by Morin (1983) who studied the effect of age on relative risk aversion. The overall results indicated that the strength of a person's risk aversion increase with the age of that person.

The WAGES variable includes all off-farm income of either the operator or operator's spouse. This does not include rent, royalties, stock returns, or other similar forms of income. Additional sources of income for a cattleman can be used to provide a cushion for fluctuating farm income. The average off-farm income amount in this sample is $14,786.20, with a minimum of no off-farm income recorded to a maximum of $170,156.82. Off-farm income should have a positive coefficient because as the operator's off-farm income increases, their RPS is expected to increase. In general, the more income a producer has to "play" with, meaning more margin for risk, the larger their RPS will be.

The Debt-to-Asset Ratio (DAR) is calculated as,

$$(3) \qquad DAR = \frac{DEBT}{ASSETS},$$

where *i* refers to individual producers, DEBT is total liabilities and ASSETS is total assets. This ratio measures the producer's financial position and reveals to which degree farm debt capital is being combined with farm equity capital. The higher the ratio value, the more total capital has been supplied by creditors and less by the owner (Langemeier, 2004). The higher the ratio, the greater risk will be associated with the operation. Debt ratios of larger than one are of sizeable concern because they indicate that the operation could not meet its debt obligations if it sold off all of its assets (i.e., the operation is considered insolvent).

The ASSETS variable is total assets recorded for 2008 for each producer. An asset represents farm/ranch property or rights to property such as cash, bank deposits, stocks, or other

real estate. The average total assets for the sample of farms was $1,147,691.01 with a minimum of $59,658.00 and a maximum of $5,437,793.13. This variable will most likely be positively related to RPS because a producer with greater wealth is likely able to afford greater risk. Morin (1983) studied risk aversion within different wealth groups using assets, in which their study revealed that the lower the wealth group of the population, the higher the relative risk aversion (and conversely, the higher the wealth group, the lower the risk aversion) which coincides with the expectation of the assets variable. Grable and Lytton (2003) used Modern Portfolio Theory for the basis of their research in which risk tolerant investors should own a higher proportion of high-risk, high expected return assets, *ceteris paribus*, rather than low-risk, low expected return assets.

The NCOWS variable reports the number of cows owned by each producer in 2008. The average number of cows in this population is 110 cows, with a minimum of three cows and a maximum of 650 cows. Similar to assets, the more cows a producer obtains, the higher their RPS is expected to be.

The Herfindahl index of diversification (H) is a measure of the size of firms (income of each enterprise) in relation to the net farm income and an indicator of the amount of diversification among them. Diversification is another way to reduce the cow-calf producer's exposure to market risk by producing crops in conjunction with beef cattle. The Herfindahl diversification measure is calculated by,

$$H_i = \sum_{j=1}^{N} {s_{ij}}^2 , \quad (4)$$

where s_{ij} is the share of individual producer *i*'s income generated from enterprise *j*. In this data set, beef, dairy, swine, wheat, corn, grain sorghum, soybeans, and hay forage incomes are each used as a separate enterprise (i.e., N=8). The purpose for including each enterprise separately

allowed for the Herfindahl index to illustrate the farm's true distinction of enterprise diversification. The share of each enterprise income is squared and summed to equate H. The value of H is between 0 and 1; the larger the H value, the less diversified the operation, the smaller the H value, the more diversified the operation. This variable is expected to be negatively related to RPS as risk averse producers are expected to be more diversified.

Lastly, three comparative advantage variables were included in the initial model to demonstrate their effect on risk preference. These three comparative advantage choices: analysis and use of new technology, business planning skills, and marketing skills, all contain a higher amount of perceived risk. All three comparative advantage variables are expected to positively affect a producer's risk preference; when a producer contains a comparative advantage in each variable, the higher their RPS is expected to be.

A key point to note in the discussion of expected signs on coefficients which is related to RPS is that the direction of causality of the assumed independent and dependent variables is not well established. For example, a highly leveraged producer may be risk averse because of the leverage situation, or conversely a risk taker may be willing to take on more debt and thus be found to be less risk averse. Similarly, a highly risk averse producer may diversify his operation or a diversified operation may cause a producer to be more risk taking since his risks may be offset by diversification. As can be seen, both the direction of causality and expected sign of a pair-wise correlation of RPS with many of the independent variables can be questioned. The purpose of this study is not to determine the direction of causality necessarily, but rather to determine the strength of correlations.

4.5 – Estimated Equation

To predict the effect that an increase in operating decisions, as well as other factors, has on a producer's risk preference, equation (2) was estimated using Ordinary Least Squares (OLS) regression, which is a technique that compares the relationship between the dependent variable, RPS, with the independent variables. The RPS equation estimates how a producer's risk preference is related to a change in many factors, including the variables from the whole farm data set, as well as comparative advantages asked in the survey. Table 4.3 gives the correlation coefficients of the model's explanatory variables, and the estimated equation is reported with standard errors and significance levels reported in Table 4.4.

Table 4.3 Correlation Coefficients of Explanatory Variables used in OLS Regression Model

Variable	*AGE*	*WAGES*	*DAR*	*ASSETS*	*NCOWS*	*H*	*Q20A*	*Q20B*	*Q20H*	*RPS*
AGE	1									
WAGES	-0.110	1								
DAR	-0.360	-0.014	1							
ASSETS	0.059	-0.121	-0.223	1						
NCOWS	-0.065	-0.043	0.062	0.410	1					
H	0.172	0.036	-0.037	-0.135	-0.019	1				
Q20A	-0.042	0.019	0.150	0.087	0.059	0.015	1			
Q20B	-0.035	-0.056	0.079	0.124	0.118	-0.024	0.035	1		
Q20H	0.013	0.001	0.065	-0.018	0.010	0.024	0.068	0.038	1	
RPS	-0.225	-0.091	0.141	0.206	0.208	-0.140	0.077	0.167	-0.020	1

Table 4.4 Risk Preference Score Equation Parameter Estimates and Standard Errors

Number of Observations Used: 253
Adjusted R-Square: 0.12

Variable	Parameter Estimate	Standard Error
Intercept	33.875	4.668
AGE	-0.201***	0.070
WAGES[1]	-0.039	0.030
DAR	3.933	3.122
ASSETS[1]	0.002***	0.001
NCOWS	0.014*	0.009
H	-5.009	3.996
Q20A	0.968**	1.571
Q20B	3.306	1.720
Q20H	-0.797	1.763

[1]*Reported in thousands of dollars ($)*
****, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Although some of the coefficients are not easily interpreted, expected signs and significance levels can be discussed. The adjusted R-Square is 0.12 and half of the variables are statistically significant at the given level (1%, 5%, or 10% level) shown in Table 4.4. The age parameter estimate shows that as an operator gets older, their risk preference tends to decrease. This coincides with research by Grable and Lytton (1999).

An operator's assets and number of cows owned affect their risk preference positively showing that the more assets and cows a producer has in possession, the larger their risk preference. This too coincides with the anticipated expectations, seeing that as a producer operation size increases, all else constant, they are willing to take on greater risk to enhance income potential.

The remaining variable shown to affect a producer's risk preference score was the binary variable of the producer's comparative advantage in analysis and use of new technology (*Q20A*). This can be interpreted as producers who consider themselves to have a comparative advantage in their use of new technology are likely innovators who are willing to take on new ventures and

face greater risk. This assessment appears adequate and can show to be related to the assets variable in that, producers who have the ability to manage and organize use of new technology have the knowledge and opportunity to gain more assets and generally prefer more risk. Other items, such as off-farm income, debt-to-asset ratio, farm diversification, and comparative advantages in business planning and marketing skills were found to not influence the risk preference score among producers as they were not significant at the 10% level.

4.6 – Sensitivity Analysis

To compare and analyze how the risk preference model is working and how operating decision factors are affecting a producer's preference of their risk-taking practices, sensitivity analysis was completed in three models, each concentrating on three specific areas: financial soundness of the operator, production practices of the operator, and marketing methods specific to retained ownership management practices. The three equations (5, 6 and 7) are listed as: (subscript *i* is dropped for notational convenience)

Financial Soundness:

(5) RPS = f(AGE, WAGES, DAR, ASSETS, NCOWS, H, Q20A, Q20B, Q20H, Q20E, Q21N, Q22D, e)

where,

- Q20E = Comparative Advantages – Loan and interest rate management
- Q21N = General risk factors to cow operations – Credit availability
- Q22D = Risk factors that affect farm/ranch income – Maintaining financial/credit reserves

Production Practices:

(6) RPS = f(AGE, WAGES, DAR, ASSETS, NCOWS, H, Q20A, Q20B, Q20H, Q24A, Q24B, Q24C, Q24D, Q24E, Q24F, Q24G, Q24H, Q24I, Q24J, e)

where,

- Q24A = Cow-calf herd most important part of income
- Q24B = Economy has focused attention on financial mgmt
- Q24C = Economy has focused attention on marketing
- Q24D = Economy has focused attention on intensive herd mgmt
- Q24E = Individually ID is critical to operation
- Q24F = Would participate in value-added programs to increase returns
- Q24G = Disease prevention is important in cattle herd
- Q24H = Consult with vet for health program
- Q24I = Inspect herd at least twice weekly
- Q24J = BCS of cows is important

Retained Ownership:

(7) RPS = f(AGE, WAGES, DAR, ASSETS, NCOWS, H, Q20A, Q20B, Q20H, Q2A, Q3C, Q3G, Q4B, Q6A, Q6B, Q6C, Q6D, Q6E, Q22E, Q23E, e)

where,

- Q2A = Participation in production management program – Retain Ownership of Calves
- Q3C = Typical management of steers after weaning – Retain through finishing
- Q3G = Typical management of heifers after weaning – Retain through finishing Q6A = Reason to Retain Ownership – Risk worthwhile
- Q6B = Reason to Retain Ownership – Performance data
- Q6C = Reason to Retain Ownership – Carcass data
- Q6D = Reason to Retain Ownership – Genetic/value-added improvement
- Q6E = Reason to Retain Ownership – Other
- Q22E = Risk factors that affect farm/ranch income – Retaining calves for market timing
- Q23E = Manage farm/ranch income volatility – Utilizing marketing methods to sell calves

The estimated equations of the accompanying variables and their effects on the model are described in detail in the next section.

4.7 – Estimated Equations

To predict the effect that additional factors related to a financial strength of a producer have on their risk preference, equations (5), (6), and (7) were estimated using OLS regression. Table 4.5 gives the parameter estimates and standard error for equation (5) on financial soundness, and conducts sensitivity analysis to see what affects the model.

Table 4.5 Financial Soundness Parameter Estimates and Standard Error

Number of Observations: 249
Adjusted R-Square:0.13

Variable	Parameter Estimate	Standard Error
Intercept	40.751***	5.842
AGE	-0.215***	0.071
WAGES	-0.038	0.029
DAR	5.350*	3.259
ASSETS	0.002**	0.001
NCOWS	0.015*	0.009
H	-4.234	4.038
Q20A	0.904	1.572
Q20B	4.178***	1.747
Q20H	-1.086	1.827
Q20E	1.469	1.463
Q21N	-0.606	0.749
Q22D	-1.488*	0.864

****, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

The only new variable to influence this model on producer financial strength is the importance of maintaining financial/credit reserves (*Q22D*). This significant variable shows as the more important maintaining financial/credit reserves is to a producer, the smaller their risk preference. This can be compared with operator age, where the older a producer gets, the less risk preferring they become. Older investors are essentially less risk tolerant and invest less of their assets in equities and more in fixed income securities (Grable, 1999). The adjusted R-square (ARS) is only improved slightly from the original model at 0.13. The Debt-to-Asset ratio (*DAR*) and comparative advantage in business planning skills (Q20B) variables in the new model

became statistically significant, where they were not statistically significant in the original model. This change showed that as a producer's debt-to-asset ratio and encompassing a comparative advantage in business skills increases, their RPS will increase.

The next model that performs sensitivity analysis uses additional production practices by operators to help determine how they are related to risk aversion. Table 4.6 gives the parameter estimates and standard errors.

Table 4.6 Production Practices Parameter Estimates and Standard Error

Number of Observations: 241
Adjusted R-Square:0.16

Variable	Parameter Estimate	Standard Error
Intercept	42.781***	6.518
AGE	-0.176***	0.075
WAGES	-0.048	0.030
DAR	3.624	3.227
ASSETS	0.001	0.001
NCOWS	0.011	0.010
H	-7.370*	4.335
Q20A	0.634	1.630
Q20B	4.389***	1.810
Q20H	-0.460	1.883
Q24A	-0.447	0.747
Q24B	1.921	1.360
Q24C	-1.413	1.200
Q24D	-1.096	1.147
Q24E	0.001	0.903
Q24F	2.824***	1.065
Q24G	-3.550***	1.403
Q24H	0.767	1.052
Q24I	-0.471	0.869
Q24J	-0.400	1.213

****, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

The two production practice variables included in the new model that affect the producer's RPS are participation in value-added programs (*Q24F*) and disease prevention (*Q24G*) being an important part of their management practice. The more a producer participates

in value-added programs to increase returns in their operation, the larger their RPS. This is a viable result as value-added programs, such as a certified feeder cattle program or a product specified feed cattle program for example, cause the producer to invest more into their cattle to gamble a higher net return. Conversely, the more important disease prevention is to a producer's cow herd, the smaller their RPS. This too is a feasible end result as producers who are more risk averse will not stake any health consequence to their herd, thus risking less to allow disease into their herd. Risk preferring producers, for example may take the chance to purchase less vaccines which prevent disease. This model's adjusted R-square (ARS) has increase additionally to 0.16, from 0.12 in the original model, to show an improved measure of fit of the explanatory variables. The producer total assets (*ASSETS*) and number of cows owned (*NCOWS*) variables in the new model became statistically insignificant, compared to the original model, and the farm diversification (*H*) variable became statistically significant at the 10% level. As the producer's diversification in farm enterprises decreases (becomes less diversified), the lower their RPS will be.

The third model that executes sensitivity analysis looks at marketing practices, yet specifically at the retained ownership form of marketing post-weaned calves. Table 4.7 gives the parameter estimates and standard errors.

Table 4.7 Retained Ownership Parameter Estimates and Standard Error

Number of Observations: 183
Adjusted R-Square:0.21

Variable	Parameter Estimate	Standard Error
Intercept	37.375***	6.952
AGE	-0.171**	0.081
WAGES	-0.054	0.035
DAR	0.705	3.575
ASSETS	0.001	0.001
NCOWS	0.011	0.011
H	-7.093	5.121
Q20A	0.020	1.812
Q20B	1.702	2.042
Q20H	-0.987	2.183
Q2A	0.841	2.099
Q3C	0.957	1.264
Q3G	0.650	1.188
Q4B	-0.031	0.024
Q6A	-1.392	2.144
Q6B	7.375**	3.342
Q6C	-6.010*	3.725
Q6D	6.109**	3.062
Q6E	-8.450**	4.319
Q22E	-0.561	1.024
Q23E	-0.037	2.028

****, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

The process of retained ownership is analyzed more thoroughly because by extending the production process into integrated stocker and/or feedlot stages, cow-calf producers may reduce uncertainty in face of changing price levels for two reasons, according to Murphy (1991): 1) price variability normally decreases as the production stage approaches the slaughter stage, and 2) delayed selling provides an opportunity for price recovery if prices are currently unfavorable. First, a question used from the survey that asked a producer, "If they DO retain ownership, why?", had five possible responses where respondents could check all that applied. Four of the five answer choices tested to affect risk preference. First, producers who receive performance

data while calves are on feed (i.e., rate of gain, average weights, etc.), and those who get a return for genetic improvements or value-added investments, tend to have a larger preference for risk. Conversely, producers who receive carcass data information, or retain ownership for another reason, tend to have a smaller RPS. This model reports the largest ARS of all models analyzed. This model's ARS was 0.21, improved from 0.12 in the original model, showing a more developed model with a better fit of the data. The producer total assets (*ASSETS*), number of cows owned (*NCOWS*), and comparative advantage in business planning skills (*Q20B*) variables in the new model became statistically insignificant, compared to the original model.

4.8 – Results

This chapter tested how operation and operator characteristics, as well as operating decisions, relate to Kansas cow-calf producers' risk preferences. We found that the mainstream of producers (49.6%) are risk averse, and the second greatest population of producers (36.0%) ranked at having a moderate low risk preference. Only 2.6% of producers ranked as high risk preferring. When risk preferences were compared to producers' risk preference scores, operator age, total assets, number of cows owned, and having a comparative advantage in business planning skills all had an effect.

When the model was run to show explanatory variables to affect RPS, age of operator, assets owned, number of cows in herd and a comparative advantage in business planning skills all had an effect on the relationship with a producer's risk preference.

In order to correctly determine what operating decisions affect a producer's risk preference, sensitivity analysis was run on financial strength of the producer, production practices, and marketing methods, specifically on retained ownership, where more variables were revealed to have a statistical relation to RPS. These variables include: maintaining

financial/credit reserves, participating in value-added programs to increase returns in their operation, the importance of disease prevention to a producer's cow herd, and reasons to retain ownership such as receiving performance or carcass data, receiving a return for genetic improvement for value-added investments as well as other reasons to retain, all affected the producer's risk aversion. The next chapter will investigate how risk preferences affect producer management and marketing practices.

CHAPTER 5 - Risk Aversion Affecting Management and Marketing Practices: Model Specifications

5.1 – Introduction

This chapter describes analysis to determine how a producer's risk aversion affects their management and marketing practices. Specifically, the following models are broken into the same three groups as analyzed in the sensitivity analysis section of Chapter 4: 1) financial soundness of the producer, 2) production practices, and 3) marketing methods specific to retained ownership. First, Section 5.2 describes the two model frameworks used for analyzing data: binary and ordered logit models. Section 5.3 develops models for how maintained financial/credit reserves and price risk are affected by risk preference. Section 5.4 analyzes models on production practices, such as herd size changes, maintaining animal health, purchasing insurance and culling decisions including the effect of a producer risk aversion on each. The third factor of marketing methods is looked at in Section 5.5, with specific interest in how producer risk aversion affects retained ownership decisions.

5.2 – Empirical Modeling for Binary and Ordered Logit Models

First, binary logit modeling was used to analyze responses to survey questions where "1" or "0" or "Yes" or "No" was reported in answer to a question. A binary logit model determines factors affecting the probability that a producer would check "1" or "Yes", as well as the probability that a producer would check the opposite, "0" or "No". For example, when a binary dependent variable is used, it is defined as $y_i = 1$ if the producer would circle "Yes" and $y_i = 0$ if the producer circled "No". An empirical representation of the binary logit model is (Greene, 2003):

(1) $\text{Prob}(y_i = 1) = F(x, \beta)$,

where the *x*'s are explanatory variables and β's are parameters to be estimated. The *i* refers to individual producers. Define:

(2) $E(y_i \mid x) = F(x, \beta)$

$F(x, \beta) = \beta' x$

then the regression model can be estimated as:

(3) $y_i = (y_i|x) + (y_i - E(y_i|x))$

$= \beta' x + \varepsilon$

The error, ε, is logistically distributed; therefore, the probability of $y_i = 1$ can be denoted as:

(4) $\text{Prob}(y_i = 1) = \frac{1}{1+\exp(-\beta' x)}$

The marginal effects can be calculated by:

(5) $\frac{\partial E(y_i|x)}{\partial x} = \frac{exp(\beta' x)}{(1+exp(\beta' x))^2} * \beta$

Individual equations are specifically set up in the following sections which will describe each model in more detail.

To analyze a survey question that used 3 or more answer choices, an ordered logit model was utilized, in which the empirical representation (Greene, 2003) is:

(6) $y_i^* = x'_i \beta + \varepsilon_i$,

where *i* refers to producers, y_i^* is an unobservable variable linearly dependent on the explanatory variables, *x*, and ε is random error. The random error is assumed to be logistically distributed, i.e., $F(\varepsilon_i) = \frac{1}{1+\exp(-\varepsilon_i)}$. Survey responses observed, y_i, are based on y_i^*:

(7) $y_i = 1 \text{ if } y_i^* \leq \eta$

(8) $y_i = 2 \text{ if } \eta < y_i^* \leq \eta$

(9) $y_i = 3 \text{ if } \eta < y_i^* \leq \eta$

⋮ ⋮

(10) $y_i = J \text{ if } \eta_{J-1} < y_1^*$,

where the thresholds, η_k , are unknown values that are estimated along with the β coefficients and *J* is the number of categories. As it is assumed that the error is logistically distributed, the following probabilities hold:

$$\text{Prob}(y_i = 1) = \text{Prob}(x'_i\beta + \varepsilon_i \leq \eta$$

$$= \frac{1}{1+\exp(x'_i\beta - \eta_1)}$$

$$\text{Prob}(y_i = 2) = \text{Prob}(x'_i\beta + \varepsilon_i \leq \eta - \text{Prob}(x'_i\beta + \varepsilon_i \leq \eta$$

$$= \frac{1}{1+\exp(x'_i\beta - \eta_2)} - \frac{1}{1+\exp(x'_i\beta - \eta_1)}$$

$$\text{Prob}(y_i = 3) = \text{Prob}(x'_i\beta + \varepsilon_i \leq \eta - \text{Prob}(x'_i\beta + \varepsilon_i \leq \eta$$

$$= \frac{1}{1+\exp(x'_i\beta - \eta_3)} - \frac{1}{1+\exp(x'_i\beta - \eta_2)}$$

$$\vdots$$

$$\text{Prob}(y_i = J) = \text{Prob}(\eta_{J-1} \leq x'_i\beta + \varepsilon_i)$$

$$= 1 - \frac{1}{1+\exp(x'_i\beta - \eta_{J-1})}.$$

The marginal effects associated with the probabilities can be shown as:

$$(12) \quad \frac{\partial Prob(y_i=J}{\partial x_i^J} = -\beta_J \left[\frac{\exp(x_i'\beta - \eta_J)}{(1+\exp(x_i'\beta - \eta_J))^2} - \frac{\exp(x_i'\beta - \eta_{J-1})}{(1+\exp(x_i'\beta - \eta_{J-1}))^2}\right],$$

where $\eta_0 = -\infty$ and $\eta_J = \infty$.

The following sections will elucidate which type of model is being run, expectations, model specifications, and results.

5.3 – Financial Strength Affected by Risk Aversion: Model Specifications

Financial and price risk are an even bigger concern to producers than production risks (Murphy, 1991). Managing these price risks, such as fluctuating cattle prices and alternatives to marketing calves, are analyzed in this section. Additionally, we look at how producers consider the importance of their financial position compared to their personal risk preference. The sub-sections that follow compare risk preferences to producers' maintenance of financial/credit reserves, and if they purchase insurance to manage farm/ranch income volatility, as well as specifically looking at price risk with marketing methods.

5.3.1 – Maintaining Financial/Credit Reserves Empirical Model

Nearly three-quarters of respondents (74.5%) agree or strongly agree that maintaining financial/credit reserves as a risk factor affecting their farm/ranch income is important to them. As maintaining financial/credit reserves importance was modeled in Chapter 4 as an explanatory variable compared to the risk preference variable, the results demonstrated that the more important maintaining financial/credit reserves is to a producer, the smaller their risk preference tends to be.

Survey responses to the question were ranked from 1 to 5, where 1 indicated not important and 5 indicated very important with the three middle rankings being in between the two extremes. The ordered logit model (explained in equations (6) through (12)) for maintaining financial/credit reserves is defined as (subscript *i* is dropped for notational convenience):

(13) $$Q22D = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where maintaining financial/credit reserves (*Q22D)* is the dependent variable and the explanatory variables are defined as:

- RPS = Producer risk preference score
- AGE = Primary operator age

- WAGES = Off-farm wages (Thousands)
- DAR = Debt-to-asset ratio
- ASSETS = Total assets (Thousands)
- NCOWS = Number of beef cows
- H = Herfindahl index of diversification calculated using shares of total farm income
- Q20A = Binary variable to show producer's comparative advantage in analysis and use of new technology
- Q20B = Binary variable to show producer's comparative advantage in business planning skills
- Q20H = Binary variable to show producer's comparative advantage in marketing skills

The age of operator (*age*) and debt-to-asset ratio (*DAR*) are expected to increase the importance of maintaining credit reserves to producers. The older a producer, the more likely they are to view maintaining their savings as important. As a producer's debt-to-asset ratio increases (becomes a highly debt leveraged operation) the more total liabilities a producer possesses, thus, the more important savings are in order to compensate for their debts. The producer's off-farm income (*wages*) and total assets (*assets*) are expected to decrease the importance of maintaining credit reserves to producers. The more assets a producer possesses, as well as the more off-farm income generated, the less likely having credit reserves is important to producers. This can be explained as producers who tend to have more assets and off-farm income already have additional capital and are less worried about reserving extra savings.

Functionally, for this model to show a relationship with the producer's risk tolerance, the risk preference score (*RPS*) variable was included to show if a producer who prefers more or less risk will view savings as important in terms of their farm/ranch income. As risk preference (*RPS*) increases the producer is expected to view maintaining credit reserves as less important. The more risk preferring (or less risk averse) a producer becomes, the less likely they are to view maintaining credit reserves as important, simply because of their risk tolerance. The number of

cows variable (*NCOWS*) and farm diversification (*H*) can be viewed from both sides. The more cows owned by a producer and the more diverse in enterprise income, the more likely they may view maintaining savings as important, or they could view it as less important. The binary variables can be viewed in the same light. Producers who consider themselves to have a comparative advantage in new technology, business planning skills and marketing skills, could view maintaining savings as important to contribute to their comparative advantage. On the other hand, they could view maintaining savings as not important merely because of their comparative advantages.

5.3.2 – Estimated Equation and Results

An ordered logit model was used to estimate the parameters in equation (13) to determine how the different explanatory variables relate to the probability of the producer's response of maintaining financial/credit reserves being of importance to their farm/ranch income, and are reported in Table 5.1. Changes in probabilities associated with a one-unit change in each explanatory variable were calculated and are referred to as marginal probabilities, based on equation (12). Marginal probabilities sum to zero across rows because as the probability of one response choice category increases, all others must decrease collectively by that same amount. Binary variables do not have marginal probabilities as they only take on values of one or zero. Accordingly, the probabilities, based on equation (11), as binary independent variables change from 0 to 1 are also presented in Table 5.1. The probabilities associated with changes in the binary variables were calculated by holding continuous variables at their average values and discrete variables at zero.

Table 5.1 Ordered Logit Estimates for Response to Statement: Rate "Maintaining Financial/Credit Reserves" in Terms of Importance That Affects Farm/Ranch Income. (1 = Not Important to 5 = Very Important)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	5.1957	<.0001	**Probabilities**				
new technology = 1	-0.2462	0.3777	0.0207	0.0458	0.2180	0.5611	0.1544
new technology = 0	Default		0.0162	0.0365	0.1844	0.5735	0.1894
business planning skills = 1	0.2603	0.3958	0.0126	0.0286	0.1521	0.5741	0.2326
business planning skills = 0	Default		0.0162	0.0365	0.1844	0.5735	0.1894
marketing skills = 1	-0.7091	0.0254	0.0325	0.0692	0.2855	0.5097	0.1031
marketing skills = 0	Default		0.0162	0.0365	0.1844	0.5735	0.1894
			Marginal Probabilities (at default = 0)				
RPS	-0.0249	0.0302	0.0004	0.0008	0.0033	-0.0007	-0.0038
Age	-0.0106	0.4087	0.0002	0.0004	0.0014	-0.0003	-0.0016
Wages	-0.0009	0.8655	1.44E-05	3.07E-05	0.0001	-2.48E-05	-0.0001
DAR	0.7590	0.1650	-0.0121	-0.0258	-0.0994	0.0208	0.1165
Assets	0.0001	0.4664	-2.06E-06	-4.39E-06	-1.69E-05	3.53E-06	1.98E-05
Ncows	-0.0012	0.4244	1.99E-05	4.24E-05	0.0002	-3.42E-05	-0.0002
H	-0.1461	0.8323	0.0023	0.0050	0.0191	-0.0040	-0.0224

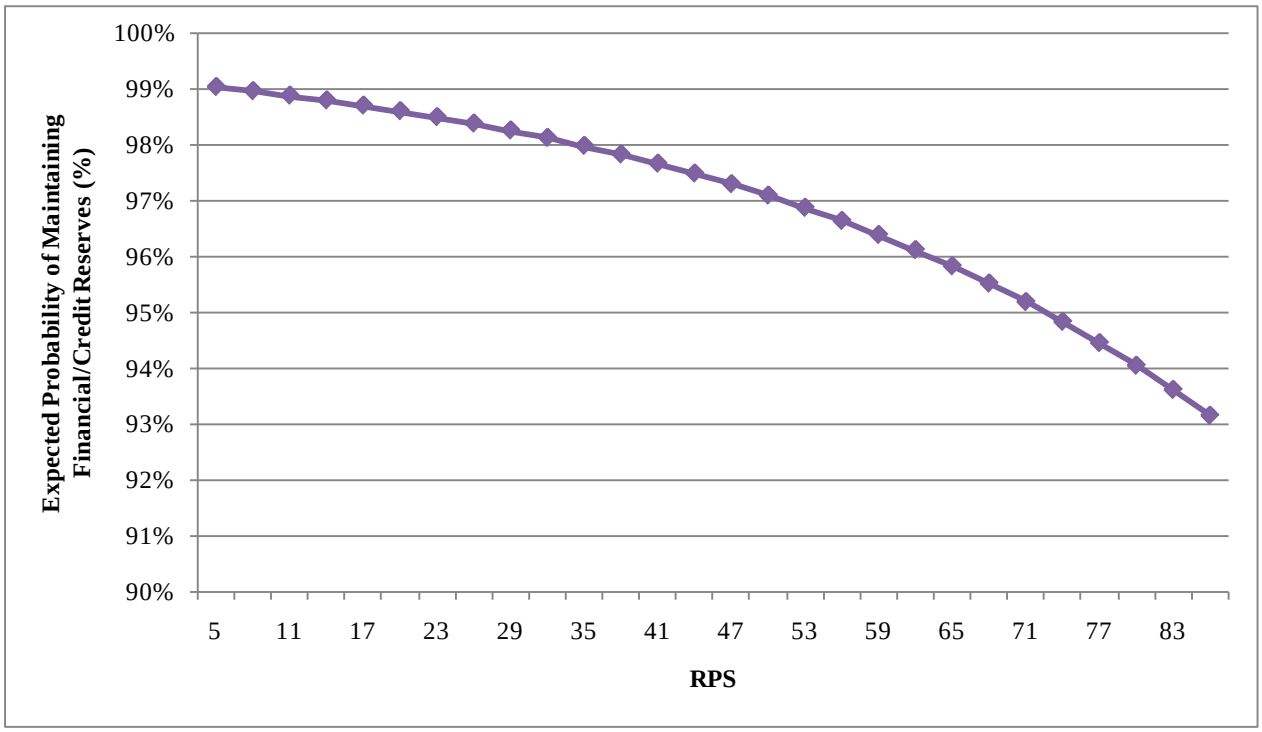
Log-Likelihood Function = -286.84559 Number of Observations Used = 249

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 1.216 (0.0014), Limit 3: 2.9356 (<.0001), Limit 4: 5.558 (<.0001)

Holding other factors constant, the probability that a producer who feels they have a comparative advantage in marketing skills and view maintaining savings as important (response of 4 and higher), was 61.3%. However, those who do not have a comparative advantage in marketing skills have a probability of 76.3% of having a response of 4 and higher. Therefore, producers who believe they have a comparative advantage in marketing skills tend to place greater importance on maintaining credit reserves. Comparative advantages in new technology and business planning skills were not related to desire to maintain credit reserves.

Risk preference was the only continuous variable to affect the producer's view of importance in terms of maintaining financial/credit reserves. The probability of a producer viewing their savings as important (response of 4 and 5), increases as the risk preference of that producer decreases (becomes more risk averse), all else constant. So, as a producer becomes more risk averse, the importance of keeping savings or possessing financial strength increases (Figure 5.1). Furthermore, the probability of a producer's importance of financial reserves being neutral (response of 3) or of little to no importance (response of 1 and 2), increases as their risk tolerance increases. Therefore, there is a tendency for a producer who is willing to take risks to be less concerned with maintaining their financial/credit reserves. Figure 5.1 shows a relationship between risk preference and expected probability of maintaining financial/credit reserves, which is decreasing at a decreasing rate.

Figure 5.1 Expected Probability of Risk Preference Affecting Importance of Maintaining Financial/Credit Reserves in Terms of Farm/Ranch Income



5.3.3 – Purchasing Insurance Empirical Model

Many producers purchase insurance as a form of risk mitigation in their operations. Producers in Kansas can take advantage of Livestock Risk Protection (LRP) and crop insurance of some form to help them manage their farm/ranch income volatility. LRP is a federal insurance program managed by the Risk Management Agency (RMA). It protects livestock producers from price declines, and the feeder cattle option offers cow-calf producers and stocker and backgrounding operators the ability to buy insurance against a decline in the CME Feeder Cattle Index (USDA Risk Management Agency, 2009). Almost all of the cow-calf producers in Kansas who responded to the survey (98.9%) also have crops. In 2008 alone, Kansas farmers had 16,500,103 net acres insured of insurable crops (2008 Kansas Crop Insurance Profile). Looking at this, it can be hypothesized that most producers purchase insurance to manage their farm/ranch income volatility. The specific type of insurance was not mentioned in the survey instrument, but producers could report "yes" or "no" to purchasing insurance to manage their farm/ranch income volatility.

In order to analyze this response, a binary logit model was used to determine factors affecting the probability that a producer would purchase insurance. A binary dependent variable was used and defined as $y_i = 1$ if the producer would purchase insurance and $y_i = 0$ if the producer did not purchase insurance. An empirical representation of the binary logit model is shown in Section 5.2 in equations (1) through (5), and the model for purchasing insurance is defined as:

(14) $$Q23A = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where Q23A is the question variable asking whether or not a producer purchases insurance and the other explanatory variables are the same as defined in Section 5.3.1.

This *RPS* variable was expected to show a negative relationship, meaning that as the producer's RPS increases (becomes more risk preferring), the operator will be less likely to purchase insurance. Risk-averse individuals should always prefer buying insurance as they prefer a sure outcome, whereas a risk preferring person would prefer a gamble (Slovic, 1977). This relationship may also hold true for off-farm income (*WAGES*), the debt-to-asset ratio (*DAR*), and farm income diversification (*H*). The more off-farm income a producer has, the higher the debt-to-asset ratio, and the more diversified in production, the less probable a producer will purchase insurance. According to relevant research, the number of cows owned (*NCOWS*) should be a negative value showing that as the number of cows owned increases, the less probable a producer will purchase insurance. A study by Mahul (2007), showed that cattle producers with herd sizes smaller than the average were the primary purchasers of the insurance programs being provided in the study. Additionally, a producer reveals his risk tendencies by how much insurance he or she purchases (MacCrimmon, 1985).

Operator age (*AGE),* and farm size (*ASSETS*) were expected to show a positive relationship because as the operator's age and the farm size increased, the more probable a producer will purchase insurance. If it is assumed that a producer who prefers less risk will be more probable to purchase insurance; then older producers will be more probable to purchase insurance, along with those who own more cattle and whose farm size is larger. The binary variables can be viewed from both sides. Producers who consider themselves to have a comparative advantage in new technology, business planning skills, and marketing skills, could be more likely to purchase insurance to contribute to their comparative advantage. On the contrary, they could be less likely to purchase insurance simply because of their comparative advantages.

5.3.4 – Estimated Equation and Results

A binary logit model was used to estimate the parameters in equation (14) to determine how the different explanatory (independent) variables relate to the probability of a producer purchasing insurance to manage their farm/ranch income volatility. Model estimation results are reported in Table 5.1. Changes in probabilities related with a one-unit change in each explanatory variable were calculated and are referred to as marginal probabilities, based on equation (6). Marginal probabilities were calculated based on the average survey respondent responses with respect to a one-unit change in each explanatory variable. Binary variables in the model do not have marginal probabilities because they only take on values of one or zero, thus the probabilities as binary variables change from 0 to 1 are presented in Table 5.2 and were calculated using equation (5). The probabilities associated with changes in the binary variables were calculated by holding all other variables at their average values, and analyzing at the default at 0, ceteris paribus, when changing one binary variable from 0 to 1.

Table 5.2 Binary Logit Estimates for the Probability of Managing Farm/Ranch Income by Purchasing Insurance (1 = Yes, Purchase Insurance; 0 = No, Do Not Purchase Insurance)

Variable	Parameter Estimate	P-Value	0	1
Intercept	0.1616	0.8700	Probabilities	
new technology = 1	0.1988	0.5070	0.6360	0.3640
new technology = 0	Default		0.6800	0.3200
business planning skills = 1	0.6484	0.0463	0.5270	0.4730
business planning skills = 0	Default		0.6800	0.3200
marketing skills = 1	0.2110	0.5309	0.6330	0.3670
marketing skills = 0	Default		0.6800	0.3200
			Marginal Probability (at default = 0)	
RPS	0.0077	0.5281	0.0016	
Age	-0.0202	0.1425	-0.0042	
Wages	-8.25E-06	0.1935	-1.72E-06	
DAR	0.3707	0.5342	0.0772	
Assets	2.04E-07	0.2523	4.25E-08	
Ncows	-0.0032	0.0777	-0.0007	
H	0.3357	0.6643	0.0699	
Number of Observations Used = 253				
Percent Concordant = 64.0%				
Percent Discordant = 35.5%				

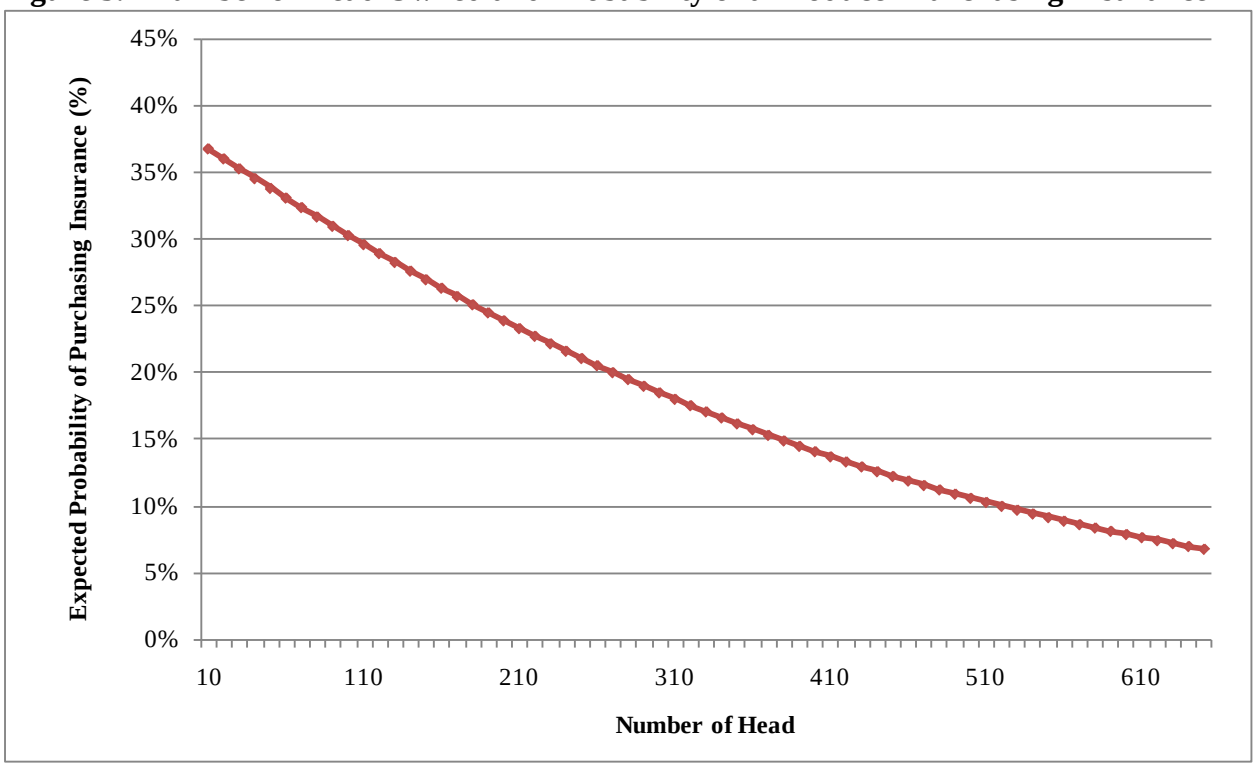
The three binary variables are for those producers who consider themselves to have a comparative advantage in analysis and use of new technology, business planning skills and marketing skills. Producers who consider themselves to have comparative advantage in business planning skills are 47.3% probable to purchase insurance, *ceteris paribus*; whereas the other two comparative advantage variables (new technology and marketing skills) did not have an effect on the model because they were not statistically significant. Those that do not have a comparative advantage in these factors are 32.0% probable of purchasing insurance. Therefore, producers are

more probable to purchase insurance if they possess a comparative advantage in business planning skills.

As the number of cows owned by a producer increases in size (head), the probability of purchasing insurance will decrease. Figure 5.2 shows this relationship: as the number of head of cattle owned increases, the probability of purchasing insurance decreases. A producer who owns 10 head of cattle has a 36.7% probability of purchasing insurance; whereas, a producer who owns 650 head of cattle has a 6.8% probability of purchasing insurance. This result was consistent with expectations, as well as coinciding with Mahul's (2007) research. Risk preference was not found to influence the purchasing of income among producers as it was not significant at the 10% level. Other items, such as age of operator, off-farm income, debt-to-asset ratio, farm size, and farm diversification were also statistically insignificant. Figure 5.2 shows a slightly non-linear relationship between number of cows owned and expected probability of purchasing insurance at a decreasing rate.

The percent concordant and discordant is reported in Table 5.2. These items show the fit of the binary logit model. A pair of observations with different observed responses is assumed to be concordant if the observation with the lower ordered response value (Purchasing Insurance = 0) has a lower predicted mean score than the observation with the higher ordered response value (Purchasing Insurance = 1). The total number of pairs are the distinct pairs with one case having a positive response (Purchasing Insurance = 1) and the other having a negative response (Purchasing Insurance = 0). If the observation with the lower ordered response value has a higher predicted mean score than the observation with the higher ordered response value, then the pair is discordant (UCLA Statistical Consulting Group). This model was 65.0% concordant, and 35.5% discordant.

Figure 5.2 Number of Head Owned and Probability of a Producer Purchasing Insurance



5.3.5 – Economic Instability Focusing Attention to Financial Management Empirical Model

It is important to look at how producers are responding and making decisions during unstable economic situations. At the time this survey was conducted, the feeder cattle (500-600 lbs) price was around $112/cwt when the 5-year average was $134/cwt and all of the reported monthly prices for 2008 were lower than 2009 (USDA & James Mintert, K-State Ag Economics). This situation was the same for 700-800 lb feeder steers, slaughter, and boxed beef prices. The economy as a whole was also unstable as recession set in, the stock market plunged, unemployment rates increased and bailouts occurred for major industries. This specific survey question was asked to see if this instability has caused producers to focus more of their attention to their personal financial management and is described as:

(15) $Q24B = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$

where Q24B is the question variable asking if recent economic instability has focused the producer's attention on more careful financial management, and the other explanatory variables are the same as defined in Section 5.3.1.

A producer's risk preference can be looked at from both sides. If a producer prefers more risk (less risk averse) they could be more probable to focus their attention on more careful financial management because of their risk tolerance. However, producers who are more risk averse may also be more probable to focus their attention on financial management because it is a form of risk aversion management. The debt-to-asset ratio can be viewed similarly. As a producer's debt-to-asset ratio increases (becomes highly debt leveraged), the probability of that producer agreeing that they focus their attention on more careful financial management will decrease. If their past financial management action had been more of an importance to them, their DAR should be a low value. However, if their DAR is a higher value, the probability of the producer focusing their attention on *more* careful financial management could increase because their ratio is a high level and the recent economic instability may change their focus in this direction.

All other variables are expected to positively affect the dependent variable in that as age of operator, off-farm income, assets, number of cows, diversification, new technology, business planning and marketing skills are expected to increase, the probability of that producer indicating that they focus their attention on more careful financial management will increase.

5.3.6 – Estimated Equation and Results

An ordered logit model was again used to estimate the parameters in equation (15) to determine how the different explanatory variables relate to the probability of the producer's

indicated they were focusing more attention on careful financial management, which is reported in Table 5.3.

Table 5.3 Ordered Logit Estimates for Response to Statement: Recent Economic Instability Has Focused My Attention on More Careful Financial Management in My Operation. (1 = Strongly Disagree to 5 = Strongly Agree)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	2.4632	0.0716	**Probabilities**				
new technology = 1	0.2956	0.3177	0.0028	0.0384	0.1910	0.6485	0.1193
new technology = 0	Default		0.0038	0.0508	0.2343	0.6195	0.0916
business planning skills = 1	0.4989	0.1285	0.0023	0.0316	0.1640	0.6597	0.1424
business planning skills = 0	Default		0.0038	0.0508	0.2343	0.6195	0.0916
marketing skills = 1	-0.1970	0.5504	0.0047	0.0611	0.2653	0.5925	0.0764
marketing skills = 0	Default		0.0038	0.0508	0.2343	0.6195	0.0916
			Marginal Probabilities (at default = 0)				
RPS	0.0008	0.9457	-2.99E-06	-3.76E-05	-0.0001	0.0001	0.0001
Age	0.0340	0.0106	-0.0001	-0.0016	-0.0052	0.0042	0.0028
Wages	0.0017	0.7489	-6.45E-06	-0.0001	-0.0003	0.0002	0.0001
DAR	1.3784	0.0182	-0.0052	-0.0660	-0.2120	0.1686	0.1146
Assets	-2.75E-05	0.8704	1.05E-07	1.31E-06	4.23E-06	-3.36E-06	-2.29E-06
Ncows	0.0008	0.6200	-3.12E-06	-3.92E-05	-0.0001	0.0001	0.0001
H	1.6547	0.0247	-0.0063	-0.0792	-0.2545	0.2024	0.1376

Log-Likelihood Function = -256.30671 Number of Observations Used = 251

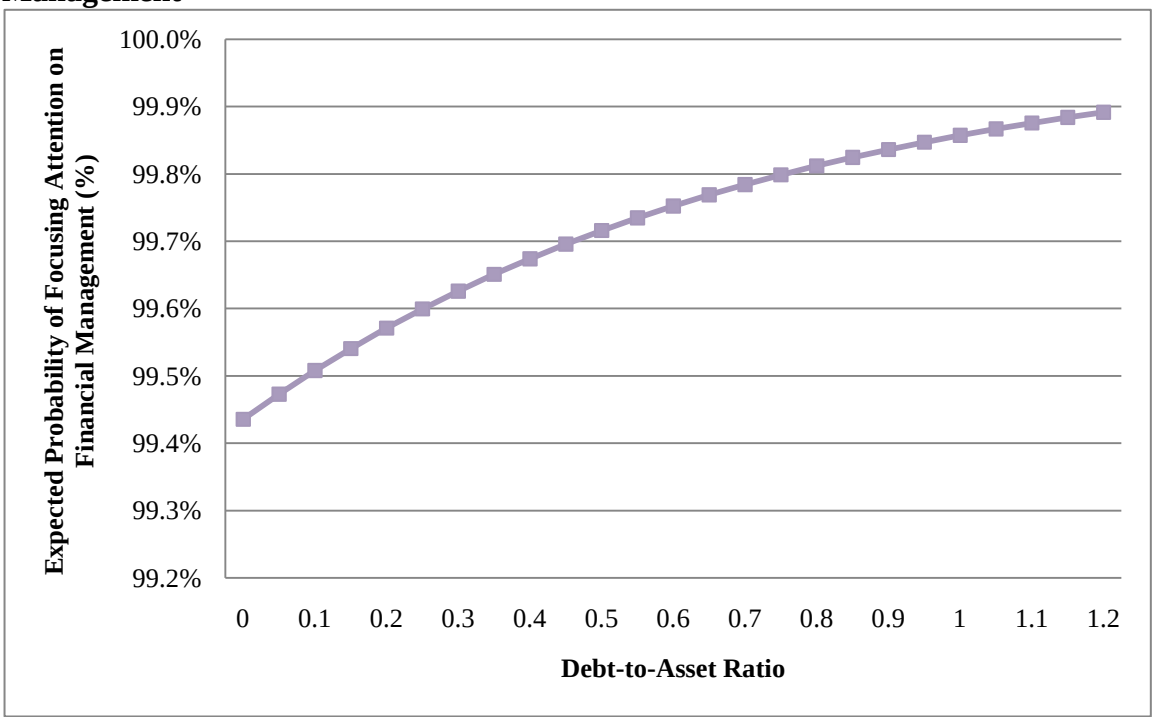
1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 2.7125 (0.0051), Limit 3: 4.6629 (<.0001), Limit 4: 7.8579 (<.0001).

None of the three comparative advantages affected the producer's decision to focus their attention on more careful financial management, but age of the operator, debt-to-asset ratio, and farm diversification did have an effect. As the age of the operator increased, the probability of them agreeing to become more focused on financial management (response of 4 and higher) was a small 0.7%. However, the probability of a producer's attitude of focusing on more careful

financial management being neutral (response of 3) or disagreeing (response of 1 and 2), decreases as the age of the operator increases. Thus, older producers tend to view that recent economic instability has focused their attention on more careful financial management in their operation.

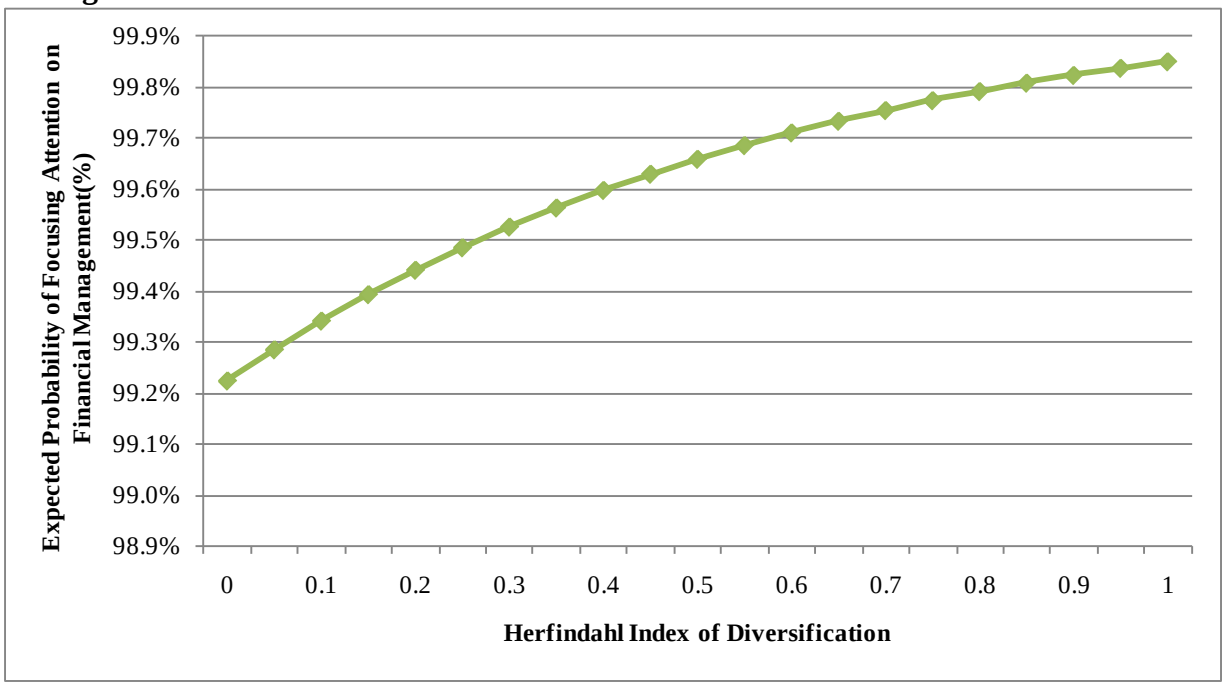
The debt-to-asset ratio was also related in that, the probability that a producer indicated they were more focused on financial management (response of 4 and 5) as their DAR increases, was 28.3%. Figure 5.3 shows that as a producer's debt-to-asset ratio increases, the more probable they are to focus their attention on better financial management. Additionally, as the DAR increases, the less probable a producer's attitude was neutral (response of 3) or disagreeing (response of 1 and 2) in terms of their attitude on financial management. Thus, producers who have a high DAR have a greater risk associated with the operation, and might be expected to be focusing more attention on their financial management practices, whereas producers with a lower DAR do not need to focus as much attention in this area as they are more financially stable.

Figure 5.3 Debt-to-Asset Ratio and Probability of Focusing Attention on Financial Management



Lastly, the farm diversification variable was related to the producer's focus on financial management. The probability of producer directing their attention on financial management as their farm diversification index value increases (producer becomes less diverse in terms of enterprise income), was 34% (Figure 5.4). This figure shows a relationship between the farm diversification index and expected probability of focusing attention on financial management, which is increasing at a decreasing rate. Overall, as farms become less diversified in terms of the operator's enterprise incomes (H gets larger), producers become more likely to view the importance of focusing their attention on financial management; and as farms become more diversified (H gets smaller), producers become less likely to focus their attention on financial management.

Figure 5.4 Farm Diversification and Probability of Focusing Attention on Financial Management



5.3.7 – Pricing Methods Empirical Model

The fourth and final model compared under this section of operator financial strength is how risk aversion affects practices of specific cattle pricing methods. Since the mainstream of respondents (90%) signified they use cash-only pricing methods to sell their calves annually, this dependent variable will be analyzed to determine how a producer's risk preference affects their decision to sell their calves with the cash-only option. Respondents reported their total percentage use of all pricing methods from 0 to 100. They chose between the given options of forward contracting or marketing agreement, futures hedging, futures options, cash only, and other, where the total pricing methods used summed to 100 percent. This model will be defined as:

(15) $Q5D = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$

where explanatory variables are same as defined in Section 5.3.1.

Risk preference is expected to affect the use of cash-only pricing methods in that, as RPS increases, the use of cash-only pricing decreases. Producers who are more risk averse are more likely to use cash only as it is a less uncertain option for selling calves. It is expected that age and the debt-to-asset ratio will affect the use of cash-only pricing in that, as the age of the operator and their debt-to-asset ratio increases, the more likely the producer is to use a cash-only pricing method. The older a producer, the more risk averse they become and will thus be more likely to use cash only. Additionally, if a producer has a high DAR, they most likely will take the less risky option and use cash only as it is a chance to receive cash immediately, without having to risk any more debts.

As off-farm income, assets, number of cows owned and the three comparative advantages: new technology, business planning skills and marketing skills, increase, the less likely the producer will use a cash-only pricing method. Producers who have a higher off-farm income and possess more assets are less likely to use cash only as they will be more willing to venture a more risky pricing method because they have the additional capital to offset if the pricing methods do not perform to their advantage. The more head of cattle owned by a producer, the more likely they are to participate in a marketing or futures agreement instead of cash only because they can use herd-size numbers to their benefit. Lastly, a producer who has a comparative advantage in new technology, business planning skills, and marketing skills all will be less likely to use cash only because of their ability to use their comparative advantages with specific pricing methods to sell calves.

5.3.8 – Estimated Equation and Results

To analyze this model, a censored normal regression model, also known as a Tobit model, was used, as the question was answered in percentage form (0% to 100%). The regression is simply defined as (Greene, 2003):

(16) $$\boldsymbol{y_i^* = \beta x_i + u_i}$$

where *i* refers to producers, y_i^* is an unobservable variable linearly dependent on the explanatory variables, *x*, and ε is random error. When y_i^* is censored from above and below (upper and lower bounds) at the same time:

(17) $$y_i^* = \begin{cases} \boldsymbol{y_i^* \; if \; y_L < y_i^* < y_U} \\ \boldsymbol{y_L \; if \; y_i^* \leq y_L} \\ \boldsymbol{y_L \; if \; y_i^* \geq y_U} \end{cases}$$

Model estimation results are reported in Table 5.3. There were 208 upper bounds and 6 lower bounds.

Table 5.4 Cash-Only Pricing Method Parameter Estimates and Standard Error (UB = 100, LB = 0)

Number of Upper Bounds: 208
Number of Lower Bounds: 6
Number of Observations Used: 252

Variable	Parameter Estimate	Standard Error
Intercept	362.586	68.621
RPS	-2.347***	0.750
AGE	-0.785	0.827
WAGES	-0.185	0.352
DAR	-44.092	35.465
ASSETS	-0.008	0.011
NCOWS	-0.190**	0.089
H	-39.032	46.245
Q20A	-14.426	17.167
Q20B	35.213*	20.899
Q20H	-52.482***	19.134

****, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

The risk preference score, number of cows owned and comparative advantages in business planning skills and marketing skills all affected the use of a cash-only pricing method. Risk preference was significant at the 1% level. As a producer's RPS increases, the predicted percent usage of cash-only pricing methods decreases by 2.3%; thus, producers with higher risk preference use less cash-only pricing. When looking at the number of cows owned and use of marketing skills, as cow herd numbers and the use of marketing skills increase, the predicted percent usage of a cash-only pricing method decreases by 0.19% and 52%, respectively. Having a comparative advantage in marketing skills negatively influences the probability that a producer uses a cash-only pricing method by decreasing the predicted percent usage of a cash-only pricing method by 52.5%. This is logical as producers who tend to use a cash-only pricing method will not utilize their marketing skills. The age of operator, off-farm income, debt-to-asset ratio, farm diversification, and comparative advantage in new technology were not statistically significant, therefore not affecting the usage of a cash-only pricing method.

5.4 – Production Practices Affected by Risk Aversion: Model Specifications

This section aims at analyzing models on production practices, such as herd size changes, and culling decisions and the effect of a producer's risk aversion on them. The way a producer manages their operation can be affected by their attitudinal risk averseness or risk preference. These production practices were chosen because they combine important decisions that producers face every year, and we can hypothesize what in these decisions are affected by risk aversion.

5.4.1 – Herd Size Management Empirical Model

One method of managing price risk is to reduce herd size when output prices are expected to decline and maintain or increase herd size when prices are expected to increase

(Murphy, 1991). A survey question asked just that: "Looking forward over the next two years, how do you envision your cattle herd changing in size?" Respondents were given three options: 1) expanding in size (39.5% of respondents), 2) reducing in size (14% of respondents), 3) remaining the same size (46.5% of respondents). The following model will determine if a producer's risk preference affects their decisions to expand, reduce, or remain the same size, defined by:

(18) $$Q12A = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where Q12A is the question variable asking what decision the producer will make regarding herd size changes, and the other explanatory variables are the same as defined in Section 5.3.1.

Risk preference is expected to affect the producer's herd size, in that, as the more risk a producer prefers, the more probable they are to remain the same size or expand in size. On the contrary, if the producer is more risk averse, the more probable they are to reduce herd size. As age of operator and debt-to-asset ratio increases, it is expected the more probable for the age to decline in years and for the ratio to reduce in size. As off-farm income, assets and comparative advantages in new technology, business planning, and marketing skills increase, the probability of a producer expanding herd size is expected to increase. Obviously, if the number of cows owned and farm diversification increases (becomes less diverse), it is expected that the probability to expand will increase, and vice versa.

5.4.2 – Estimated Equation and Results

An ordered logit model was used to estimate the parameters in equation (18) to determine how the different explanatory variable relates to the probability of the producer's cow herd size changing in the next two years, which is reported in Table 5.5.

Table 5.5 Ordered Logit Estimates for Response to Statement: Over the Next Two Years, How Do You Envision Your Cattle Herd Changing? (1 = Expanding in Size, 2 = Reducing in Size, 3 = Remaining the Same Size)

Variable	Parameter Estimate	P-Value	1	2	3
Intercept	-1.2970	0.1607		**Probabilities**	
new technology = 1	-0.3432	0.2105	0.4075	0.1531	0.4394
new technology = 0	Default		0.3279	0.1472	0.5249
business planning skills = 1	-0.6671	0.0301	0.4874	0.1508	0.3618
business planning skills = 0	Default		0.3279	0.1472	0.5249
marketing skills = 1	-0.1564	0.6217	0.3633	0.1509	0.4858
marketing skills = 0	Default		0.3279	0.1472	0.5249
			Marginal Probability (at default = 0)		
RPS	0.0041	0.7257	-0.0009	-0.0001	0.0010
Age	0.0369	0.0044	-0.0081	-0.0011	0.0092
Wages	-0.0006	0.9126	0.0001	1.60E-05	-0.0001
DAR	-0.2416	0.6674	0.0533	0.0070	-0.0603
Assets	-2.05E-06	0.9903	4.52E-07	5.94E-08	-5.11E-07
Ncows	0.0006	0.7065	-0.0001	-1.77E-05	0.0002
H	-0.3067	0.6605	0.0676	0.0089	-0.0765

Log-Likelihood Function = -242.78081 Number of Observations Used = 252

1Parameter estimates for "limit" with p-values in parentheses: Limit 2: 0.6180 (<.0001).

The business planning skills comparative advantage was the only binary variable to have statistical significance related to future farm size plans. Producers who indicated that they had this comparative advantage had a probability of 48.7% in expanding their cattle herd size, 15.1% in reducing their herd size, and 36.2% in remaining the same size. Operator age was the only statistically significant continuous variable. As the operator age increases, the probability of a producer expanding their herd size in the next two years decreases. Interestingly, as the age of the operator increases, the probability a producer reducing their herd size also decreases. Conversely, as the age of the operator increases, the probability of a producer keeping their herd size the same in the next two years increases. Thus, producers older in age tend to keep their herd

size the same, whereas younger producers tend to either expand or reduce their herd size when looking forward in the next two years.

5.4.3 – Culling Every Open Cow Empirical Model

Producers may have a myriad of reasons for keeping an open cow. The survey gave producers five options as to what reason most described their decision to keep an open cow. These options were a) first time open, b) the quality of the cow, c) the value of the cow, d) had a good reproductive record, or e) I cull every open cow; no second chances. As shown in Chapter 3 in the survey results (Figure 3.4), the most widely held response, 34.3% of respondents, would give no second chances to an open cow to impregnate no matter the circumstance and cull every open cow. Producers have different reasons for keeping an open cow, but many choose to increase their risk of keeping the open cow for a certain reason (because of the value or quality of the cow), only to find out that the cow is not prolific. This model will help show the probability of producers culling every open cow with no second chance, to support their risk preference. In order to determine how individual factors affected the probability of a producer culling every open cow, the following equation was estimated:

(19) $$Q9E = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where Q9E is the question variable asking if the producer culls every open cow with no second chances, and the other explanatory variables are the same as defined in Section 5.3.1.

It is expected that as a producer's risk preference increases, the probability of culling every open cow decreases because keeping an open cow adds additional risk. It is expected that as age of operator, off-farm income, assets, number of cows owned, and the comparative advantages increase, the probability of culling every open cow increases. The older a producer, the more likely they are to cull an open cow because of their risk averseness. The more off-farm

income, assets, and number of cattle a producer possesses, the more likely they are to cull every open cow because losing one cow is not as vital to their operation. Furthermore, as the debt-to-asset ratio increases, the probability of culling every open cow increases; when a producer becomes more debt leveraged, they will sell more open cows in attempt to pay off debts.

5.4.4 – Estimated Equation and Results

Model estimation results are reported in Table 5.6, where a binary logit model was used to estimate the parameters in equation (19) to determine how the different explanatory variables relate to the probability of a producer culling an open cow with no second chance. The probabilities associated with changes in the binary variables were calculated by holding all other variables at their average values, and analyzing at the default at 0, ceteris paribus, when changing one binary variable from 0 to 1.

Table 5.6 Binary Logit Estimates for the Probability of Culling Every Open Cow with No Second Chances (1 = Yes, Cull Every Open Cow; 0 = No, Do Not Always Cull Every Open Cow)

Variable	Parameter Estimate	P-Value	0	1
Intercept	0.3620	0.7287	**Probabilities**	
new technology = 1	0.6495	0.0355	0.6370	0.3630
new technology = 0	Default		0.7706	0.2294
business planning skills = 1	0.6000	0.0746	0.6484	0.3516
business planning skills = 0	Default		0.7706	0.2294
marketing skills = 1	0.3907	0.2635	0.6945	0.3055
marketing skills = 0	Default		0.7706	0.2294
			Marginal Probability (at default = 0)	
RPS	0.0018	0.8911	0.0003	
Age	-0.0360	0.0160	-0.0064	
Wages	0.0119	0.0449	0.0021	
DAR	-0.0247	0.9686	-0.0044	
Assets	0.0000	0.9468	2.30E-06	
Ncows	0.0020	0.2371	0.0004	
H	-0.0602	0.9430	-0.0106	
Number of Observations Used = 253				
Percent Concordant = 68.3%				
Percent Discordant = 31.4%				

Two of the comparative advantage binary variables were significant, new technology and business planning skills. Producers who consider themselves to have a comparative advantage in new technology are 36.3% probable to cull all open cows, and those who consider themselves to have a comparative advantage in business planning skills are 35.2% probable to cull all open cows. Those that do not have a comparative advantage in these factors are 22.9% probable of culling every open cow with no second chance. The age of an operator and the off-farm income generated by the producer affected if producer's culled an open cow every time by being

statistically significant. As the age of the operator increases, the producer's probability of culling all open cows decreases. As more off-farm income is generated, the probability of that producer culling all open cows will increase. Thus, producers tend to cull all open cows if they are younger in age and possess more off-farm income. RPS was not found to influence the culling practices among producers as it was not significant at the 10% level. Other continuous variables, debt-to-asset ratio, total assets, number of cows and farm diversification, did not influence culling practices among cattlemen.

5.5 – Marketing Methods Specific to Retained Ownership Affected by Risk Aversion: Model Specifications

The third, and, last modeling group analyzed is marketing methods specific to retained ownership. By adopting marketing strategies, it shifts some of the price risk off of the individual to other groups (Murphy, 1991). By retaining ownership of calves until feedlot stage or even until slaughter, the producer is taking on more price and production risks as cattle prices in the future may drop (unless a locked-in rate is established with a marketing agreement), and production risks can include sickness or death among calves in the feedlot. However, the return could (or could not) be greater in the end result, which causes a producer to weigh their risk options.

5.5.1 – Marketing Decisions of Calves after Weaning Empirical Model

As this section is looking at marketing methods, specifically retained ownership, the next model will analyze a survey question that particularly asked for the break-down of what producers do with their calves after weaning each year, with retained ownership being a choice. Choices were separated into steers and heifers, and producers had the choice to select 1=Never up to 5=Always. The three steers questions were: 1) sell steers after weaning, 2) background

steers and sell them, and 3) retain steers through finishing. The four heifer questions were: 1) retain heifers as replacements, 2) sell heifers after weaning, 3) background heifers then sell them, and 4) retain heifers through finishing.

This first model will test how a producer's risk preference affects the decision to market their calves using retained ownership management. To establish how individual factors affect the probability of a producer retaining ownership of calves, the following equation was estimated:

(20) $$Q3_j = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where Q3 is the question variable, *j* is for each of the seven answer choices, and the other explanatory variables are the same as defined in Section 5.3.1.

5.5.2 – Estimated Equations and Interpretations

Seven ordered-logit models were analyzed to represent each answer choice for the question. Binary and continuous parameter estimates are reported in Table 5.7 with variable significance notated by each parameter, and a specific table for the significant RPS variable parameter estimates (Table 5.8), to show how risk preference is affecting the exclusive post-weaning marketing decisions.

Table 5.7 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Sell Steers After Weaning. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	1.8671	0.0432			**Probabilities**		
new technology = 1	-0.1008	0.7122	0.3863	0.1395	0.1522	0.1231	0.1989
new technology = 0	Default		0.3627	0.1379	0.1550	0.1290	0.2154
business planning skills = 1	1.0633	0.0010	0.1643	0.0929	0.1395	0.1604	0.4429
business planning skills = 0	Default		0.3627	0.1379	0.1550	0.1290	0.2154
marketing skills = 1	-0.2981	0.3379	0.4340	0.1406	0.1449	0.1112	0.1693
marketing skills = 0	Default		0.3627	0.1379	0.1550	0.1290	0.2154
					Marginal Probabilities (at default = 0)		
RPS	-0.0388	0.0015	0.0090	0.0007	-0.0009	-0.0022	-0.0066
Age	-0.0048	0.7036	0.0011	0.0001	-0.0001	-0.0003	-0.0008
Wages	-0.0073	0.1171	0.0017	0.0001	-0.0002	-0.0004	-0.0012
DAR	0.2214	0.6864	-0.0512	-0.0042	0.0054	0.0126	0.0374
Assets	-0.0004	0.0258	0.0001	7.60E-06	-9.76E-06	-2.29E-05	-0.0001
Ncows	-0.0007	0.6520	0.0002	1.39E-05	-1.79E-05	-4.20E-05	-0.0001
H	1.3221	0.0595	-0.3056	-0.0249	0.0320	0.0751	0.2234

Log-Likelihood Function = -335.8571 Number of Observations Used = 235

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.5661 (<.0001), Limit 3: 1.2075 (<.0001), Limit 4: 1.8562 (<.0001).

Table 5.7 describes the explanatory variables to affect producers who choose to sell steers after weaning. The producer's comparative advantage in business planning skills, RPS, total assets, and farm diversification were all statistically significant variables. As a producer's comparative advantage in business planning skills increases, the probability of them often or always (responses of 4 and 5) is 60.3%. The producer's risk preference score variable showed a relationship in that the less risk averse a producer is, the less probable they were to sometimes, often, or always (responses of 3, 4 and 5 respectively) choose to sell steers after weaning. Conversely, the less risk averse a producer, the more probable they were to seldom or never (responses of 2 and 1 respectively) choose to sell steers after weaning. Therefore, producers who are risk averse tend to sell steers right after weaning instead of feeding them further. Next, a

producer's total assets showed that as their assets owned increased, the less probable they were to always sell steers after weaning; and the more probable they were to seldom, sometimes, often or always sell steers after weaning. Lastly, the producer's diversification of farm enterprises in terms of their overall income illustrated that as a farm becomes less diversified, the more probable the producer is to sometimes often or always sell steers; and the less probable the producer is to seldom or never sell steers after weaning.

Table 5.8 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Background Steers Then Sell Them. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	1.7011	0.0526	**Probabilities**				
new technology = 1	0.2382	0.3621	0.2368	0.0991	0.1340	0.2212	0.3089
new technology = 0	Default		0.2825	0.1084	0.1385	0.2102	0.2605
business planning skills = 1	-0.3248	0.2557	0.3526	0.1177	0.1385	0.1883	0.2029
business planning skills = 0	Default		0.2825	0.1084	0.1385	0.2102	0.2605
marketing skills = 1	0.3663	0.2045	0.2144	0.0935	0.1302	0.2250	0.3369
marketing skills = 0	Default		0.2825	0.1084	0.1385	0.2102	0.2605
			Marginal Probabilities (at default = 0)				
RPS	0.0046	0.6728	-0.0009	-0.0002	-0.0001	0.0003	0.0009
Age	-0.0057	0.6364	0.0012	0.0002	0.0001	-0.0003	-0.0011
Wages	0.0039	0.3782	-0.0008	-0.0001	-4.34E-05	0.0002	0.0008
DAR	-0.0295	0.9543	0.0060	0.0010	0.0003	-0.0017	-0.0057
Assets	-0.0001	0.5283	2.07E-05	3.61E-06	1.13E-06	-5.76E-06	-1.96E-05
Ncows	0.0004	0.7751	-0.0001	-1.47E-05	-4.58E-06	2.34E-05	0.0001
H	-1.2727	0.0659	0.2579	0.0451	0.0141	-0.0719	-0.2452
Log-Likelihood Function = -373.01522			Number of Observations Used = 245				

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.4888 (<.0001), Limit 3: 1.0499 (<.0001) Limit 4: 1.976 (<.0001).

Table 5.8 describes the explanatory variables to affect producers who choose to background steers after weaning then sell them. The only variable in the model that was statistically significant and affected those who background steers after weaning was the farm

diversification variable. As a producer's operation becomes less diversified in terms of enterprise income, the less probable a producer was to often or always background steers then sell them; and the more probable they are sometimes, seldom, or never background steers after weaning then sell them (31.7%).

Table 5.9 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Retain Steers Through Finishing. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	-1.3738	0.1899	**Probabilities**				
new technology = 1	0.5742	0.0648	0.6328	0.1617	0.0746	0.0533	0.0776
new technology = 0	Default		0.7537	0.1191	0.0490	0.0330	0.0452
business planning skills = 1	0.4391	0.194	0.6635	0.1521	0.0681	0.0478	0.0685
business planning skills = 0	Default		0.7537	0.1191	0.0490	0.0330	0.0452
marketing skills = 1	0.6860	0.0447	0.6064	0.1692	0.0802	0.0582	0.086
marketing skills = 0	Default		0.7537	0.1191	0.0490	0.0330	0.0452
			Marginal Probabilities (at default = 0)				
RPS	0.0464	0.0006	-0.0086	0.0035	0.0018	0.0013	0.0020
Age	-0.0231	0.1139	0.0043	-0.0017	-0.0009	-0.0007	-0.0010
Wages	0.0051	0.4321	-0.0010	0.0004	0.0002	0.0001	0.0002
DAR	-0.6179	0.3425	0.1147	-0.0461	-0.0241	-0.0179	-0.0267
Assets	0.0003	0.0528	-0.0001	2.69E-05	1.40E-05	1.04E-05	0.0000
Ncows	0.0012	0.4749	-0.0002	0.0001	4.83E-05	3.59E-05	0.0001
H	-0.2888	0.7409	0.0536	-0.0216	-0.0112	-0.0083	-0.0125

Log-Likelihood Function = -226.58204 Number of Observations Used = 225

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.8078 (<.0001), Limit 3: 1.3487 (<.0001), Limit 4: 1.9311 (<.0001).

Table 5.9 describes the explanatory variables to affect producers who choose to retain steers through finishing. Two comparative advantages, new technology and marketing skills, were statistically significant. When a producer has a comparative advantage in either of these aspects, the probability of them retaining steers through finishing increases. The producer's risk preference and total assets also affected those to retain steers through finishing. As a producer becomes less risk averse, the probability of them retaining ownership of steers decreases when

they never retain steers; however, the probability increases when they participate in any amount of retained ownership of steers through finishing. There is a similar relationship with the producer's total assets. As their total assets increase, the probability of never retaining ownership decreases and the probability increases when they participate in any amount of retained ownership of steers through finishing. All other continuous variables did not affect the retained ownership of steers through finishing.

Table 5.10 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Retain Heifers as Replacements. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	2.4881	0.0044	**Probabilities**				
new technology = 1	0.3216	0.2326	0.1397	0.0406	0.2588	0.2572	0.3037
new technology = 0	Default		0.1830	0.0498	0.2864	0.2406	0.2402
business planning skills = 1	0.7269	0.0134	0.0977	0.0302	0.2150	0.2616	0.3954
business planning skills = 0	Default		0.1830	0.0498	0.2864	0.2406	0.2402
marketing skills = 1	-0.4945	0.1068	0.2687	0.0636	0.3068	0.1993	0.1617
marketing skills = 0	Default		0.1830	0.0498	0.2864	0.2406	0.2402
			Marginal Probabilities (at default = 0)				
RPS	-0.0069	0.4971	0.0010	0.0002	0.0005	-0.0005	-0.0013
Age	-0.0155	0.1962	0.0023	0.0005	0.0011	-0.0010	-0.0028
Wages	0.0008	0.8634	-0.0001	-2.39E-05	-0.0001	0.0001	0.0001
DAR	-0.9219	0.0895	0.1379	0.0268	0.0655	-0.0619	-0.1683
Assets	-2.67E-05	0.8708	3.99E-06	7.75E-07	1.89E-06	-1.79E-06	-4.87E-06
Ncows	0.0024	0.1425	-0.0004	-0.0001	-0.0002	0.0002	0.0004
H	0.1456	0.8231	-0.0218	-0.0042	-0.0103	0.0098	0.0266

Log-Likelihood Function = -353.77347 Number of Observations Used = 242

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.3034 (0.0007), Limit 3: 1.5727 (<.0001), Limit 4: 2.6474 (<.0001).

Table 5.10 describes the explanatory variables to affect producers who choose to retain heifers as replacements to their cowherd. Producer comparative advantages in business planning and marketing skills both affected retaining heifers as replacements. Producers with a comparative advantage in business planning skills are more probable to retain heifers as

replacements; whereas producers with a comparative advantage in marketing skills are less probable. Thus, producers who retain heifers back as replacements in their herd tend to have better business intuition than marketing skills. The producer's debt-to-asset ratio was the only continuous variable to be statistically significant to retaining heifers. It showed that as a producer's DAR increases, the more probable they are to sometimes, seldom, or never retain heifers as replacements and the less probable they are to often or always keep heifers as replacements.

Table 5.11 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Sell Heifers After Weaning. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	1.4546	0.1241			**Probabilities**		
new technology = 1	-0.1055	0.7102	0.3784	0.1509	0.2024	0.1154	0.1529
new technology = 0	Default		0.3539	0.1491	0.2076	0.1224	0.1670
business planning skills = 1	0.4736	0.1260	0.2544	0.1322	0.2180	0.1519	0.2436
business planning skills = 0	Default		0.3539	0.1491	0.2076	0.1224	0.1670
marketing skills = 1	-0.3564	0.2771	0.4390	0.1521	0.1870	0.0988	0.1231
marketing skills = 0	Default		0.3539	0.1491	0.2076	0.1224	0.1670
			Marginal Probabilities (at default = 0)				
RPS	-0.0169	0.1325	0.0039	0.0004	-0.0007	-0.0011	-0.0023
Age	-0.0047	0.7180	0.0011	0.0001	-0.0002	-0.0003	-0.0007
Wages	-0.0040	0.3889	0.0009	0.0001	-0.0002	-0.0003	-0.0006
DAR	0.0974	0.8639	-0.0223	-0.0021	0.0043	0.0065	0.0136
Assets	-0.0003	0.0513	0.0001	7.36E-06	-1.53E-05	-2.30E-05	-4.80E-05
Ncows	0.0010	0.5186	-0.0002	-2.10E-05	4.36E-05	0.0001	0.0001
H	0.3938	0.5905	-0.0901	-0.0084	0.0175	0.0262	0.0548

Log-Likelihood Function = -287.7909 Number of Observations Used = 251

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.6138 (<.0001), Limit 3: 1.4999 (<.0001), Limit 4: 2.2086 (<.0001).

Table 5.11 describes the explanatory variables to affect producers who choose to sell heifers after weaning. None of the binary variables comparing comparative advantages affected

the selling of heifers after weaning. The only continuous variable to affect this was the producer's total assets. A producer who has more assets is more probable to seldom or never sell heifers after weaning, whereas a producer with fewer assets is more probable to sometimes to always sell heifers after weaning. The remaining continuous variables were not statistically significant.

Table 5.12 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Background Heifers, and Then Sell Them. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	2.1538	0.0209	**Probabilities**				
new technology = 1	0.0654	0.8059	0.2176	0.0952	0.2048	0.2427	0.2397
new technology = 0	Default		0.2289	0.0981	0.2069	0.2381	0.2280
business planning skills = 1	-0.3966	0.1888	0.3062	0.1132	0.2106	0.2042	0.1657
business planning skills = 0	Default		0.2289	0.0981	0.2069	0.2381	0.2280
marketing skills = 1	0.4572	0.1283	0.1582	0.0771	0.1851	0.2615	0.3181
marketing skills = 0	Default		0.2289	0.0981	0.2069	0.2381	0.2280
			Marginal Probabilities (at default = 0)				
RPS	0.0057	0.5968	-0.0010	-0.0002	-0.0002	0.0004	0.0010
Age	-0.0028	0.8255	0.0005	0.0001	0.0001	-0.0002	-0.0005
Wages	0.0004	0.9308	-0.0001	-1.76E-05	-1.17E-05	2.95E-05	0.0001
DAR	0.1291	0.8081	-0.0228	-0.0056	-0.0037	0.0094	0.0227
Assets	-0.0001	0.4810	2.10E-05	5.19E-06	3.42E-06	-8.67E-06	-2.09E-05
Ncows	-0.0012	0.4146	0.0002	0.0001	3.45E-05	-0.0001	-0.0002
H	-1.6375	0.0238	0.2890	0.0714	0.0471	-0.1193	-0.2882

Log-Likelihood Function = -341.67248 Number of Observations Used = 222

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.4929 (<.0001), Limit 3: 1.3504 (<.0001), Limit 4: 2.4341 (<.0001).

Table 5.12 describes the explanatory variables to affect producers who choose background their heifers, then sell them. Only one variable demonstrated to be statistically significant within the model, which was the farm diversification variable. This showed that producers whose farm is less diversified are more probable to never, seldom or sometimes background their heifers until they are ready to sell. Producers with a more diversified farm, in

terms of enterprise incomes, are more probable to often or always background their heifers until sale.

Table 5.13 Ordered Logit Estimates for Response to Statement: Each Year After Weaning, I Retain Heifers Through Finishing. (1 = Never to 5 = Always)

Variable	Parameter Estimate	P-Value	1	2	3	4	5
Intercept	-2.0831	0.0767	**Probabilities**				
new technology = 1	0.3978	0.2485	0.7039	0.1285	0.0628	0.0429	0.0620
new technology = 0	Default		0.7796	0.1012	0.0462	0.0305	0.0425
business planning skills = 1	0.7967	0.0279	0.6146	0.1545	0.0822	0.0590	0.0897
business planning skills = 0	Default		0.7796	0.1012	0.0462	0.0305	0.0425
marketing skills = 1	0.4133	0.2753	0.7006	0.1295	0.0635	0.0434	0.0629
marketing skills = 0	Default		0.7796	0.1012	0.0462	0.0305	0.0425
			Marginal Probabilities (at default = 0)				
RPS	0.0477	0.0008	-0.0082	0.0032	0.0018	0.0013	0.0019
Age	-0.0178	0.2737	0.0031	-0.0012	-0.0007	-0.0005	-0.0007
Wages	0.0069	0.3311	-0.0012	0.0005	0.0003	0.0002	0.0003
DAR	-0.2981	0.6767	0.0512	-0.0199	-0.0111	-0.0080	-0.0121
Assets	0.0003	0.0593	-0.0001	2.29E-05	1.28E-05	9.24E-06	1.40E-05
Ncows	0.0004	0.8232	-0.0001	2.73E-05	1.53E-05	1.10E-05	1.67E-05
H	0.2429	0.8164	-0.0417	0.0162	0.0091	0.0065	0.0099

Log-Likelihood Function = -187.78778 Number of Observations Used = 191

1Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.7364 (<.0001), Limit 3: 1.278 (<.0001), Limit 4: 1.8502 (<.0001).

Lastly in this section, Table 5.13 describes the explanatory variables to affect producers who choose to retain ownership of heifers through finishing. The one statistically significant comparative advantage was business planning skills. As producers encompass good business planning skills in their operation, the more probable they are to retain ownership of their heifers through finishing. The producer's risk preference score statistically affects the retained ownership of heifers. The more risk averse a producer becomes, the more likely they are to never retain ownership of heifers. Thus, producers who are more risk preferring are more likely to take the chance at retaining ownership of their heifers through finishing. The last variable to

significantly affect the producers who choose to retain ownership of heifers through finishing was total assets. As we have seen in similar models, the asset variable's sign coincides with the risk preference score. A producer with fewer assets is less probable to retain ownership of heifer calves; whereas a producer with more total assets is more probable to retain ownership of heifer calves in some amount.

5.5.3 – Results

Looking at the producer's risk preference score specifically, the three variables that were affected by RPS were producers who sell steers after weaning, and retain both steers and heifers through finishing. Producers who are risk averse tend to sell their steer calves after weaning, instead of participating in any type of marketing program or continuing the calves on feed until selling to the feed yard. Thus, producers who are more risk preferring tend to retain ownership of their steers and heifers through the finishing stages.

Each post-weaning answer choice that a producer could choose from can be generalized further to show tendencies from the seven models (Tables 5.7 through 5.13). Producers who sell steers after weaning tend to have a comparative advantage in business planning skills, lower total assets, and have a less diversified operation in terms of farm enterprise income. Those who background steers then sell them, tend to have a more diversified operation in terms of farm enterprise income. Also, producers who retain steers through finishing possess a comparative advantage in new technology and marketing skills, are more risk preferring individuals, and own more assets. Looking at heifer calf producers, those who retain heifers as replacements for their cowherd tend to have a comparative advantage in business planning skills, and a lower total debt-to-asset ratio. Producers who sell heifers after weaning tend to have less total assets. Those who background heifers are more diversified in terms of their farm enterprise income. Lastly,

producers who retain heifers through finishing tend to have a comparative advantage in business planning skills, are more risk preferring and are more likely to have more total assets.

5.6 – Summary

This chapter's goal was to determine how management and marketing practices were affected by risk aversion and risk preference. In order to model these practices as asked in the survey, empirical modeling frameworks were described specific to binary and ordered logit models, as well as including a Tobit, or censored normal regression, model. Three sections focused on producer's financial soundness, production practices, and marketing methods, specific to retained ownership.

Risk preference was found to affect producers who maintain financial/credit reserves, those who use cash-only pricing methods, individuals who participate in retained ownership production management programs, and post-weaning selling and marketing practices of selling steers after weaning and retaining ownership of steers and heifers through finishing. A producer who prefers more risk (less risk averse) is more likely to participate in retained ownership and similar production management programs. A producer who is more risk averse tends to view financial savings as more important, more likely to use cash-only pricing methods, and tends to sell steers right after weaning.

The next chapter will determine what new production and marketing practices producers are willing to change or willing to risk to increase their profit margins.

CHAPTER 6 - Producers' Willingness to Increase Net Returns

6.1 – Introduction

Any cow-calf producer may have an attitudinal risk preference whether it is more risk averse or more risk loving that affects their operating decisions, or, their operating decisions may affect what their risk preference may be. Either way, this chapter will look at what production and marketing practices cattlemen are willing to change or willing to risk to potentially increase their net returns. Section 6.2 will focus on how participation in value-added programs can increase returns and Section 6.3 will concentrate producer willingness to change calving seasons to potentially earn a greater net return.

6.2 – Willingness to Participate in Value-Added Programs

A producer's willingness to participate in marketing programs can show their risk preference, as well as likeliness to increase the returns to their operation. An agreement question was asked in the survey which asked for the producer to respond to, "I would participate in a value-added program to increase returns to my operation", with options from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. The most common response was a "agree", with a mean response of 3.77.

6.2.1 – Value-Added Empirical Model

The model for participating in a value-added program to increase returns is defined as (subscript *i* is dropped for notational convenience):

(1) $Q24F = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$

where participation in a value-added program (*Q24F)* is the dependent variable and the explanatory variables are as defined in Chapter 5.

It is expected that the Risk Preference Score will affect the model by increasing in preference as the probability of participation in the value-added program increases. Other variables to affect the model are off-farm income, assets, number of cows owned, diversification index and comparative advantages in new technology, business planning and marketing skills because as they increase in value, the probability of participation in the value-added program increases. As age of operator and the debt-to-asset ratio increases, the probability of participation in the value added program is expected to decrease.

6.2.2 – Estimated Equation and Results

As similar to modeled equations in Chapter 5, an ordered logit model was used to estimate the parameters in equation (1) (as explained in equations (6) through (12) in Chapter 5) to determine how the different explanatory variables relate to the probability of the producer's agreement to participation in value-added programs, and are reported in Table 6.1. Changes in probabilities associated with a one-unit change in each explanatory variable were calculated and are referred to as marginal probabilities, based on equation (12) from Chapter 5. The probabilities associated with changes in the binary variables were calculated by holding continuous variables at their average values and discrete variables at zero.

Table 6.1 Ordered Logit Estimates for Response to Statement: I Would Participate in a Value-Added Program to Increase Returns to My Operation (1 = Strongly Disagree to 5 = Strongly Agree)

Variable	Parameter Estimate[1]	P-Value	1	2	3	4	5
Intercept	2.2294	0.0347	**Probabilities**				
new technology = 1	0.2692	0.3233	0.0099	0.0334	0.2832	0.5047	0.1688
new technology = 0	Default		0.0129	0.0430	0.3323	0.4775	0.1343
business planning skills = 1	-0.0486	0.8749	0.0136	0.0450	0.3413	0.4714	0.1287
business planning skills = 0	Default		0.0129	0.0430	0.3323	0.4775	0.1343
marketing skills = 1	0.6388	0.0463	0.0069	0.0234	0.2206	0.5219	0.2271
marketing skills = 0	Default		0.0129	0.0430	0.3323	0.4775	0.1343
			Marginal Probabilities (at default = 0)				
RPS	0.0187	0.1054	-0.0002	-0.0007	-0.0035	0.0023	0.0022
Age	0.0010	0.9363	0.0000	0.0000	-0.0002	0.0001	0.0001
Wages	0.0004	0.9308	0.0000	0.0000	0.0000	0.0000	0.0000
DAR	0.1183	0.8255	-0.0015	-0.0047	-0.0218	0.0143	0.0137
Assets	0.0001	0.4871	0.0000	0.0000	0.0000	0.0000	0.0000
Ncows	0.0057	0.0010	-0.0001	-0.0002	-0.0010	0.0007	0.0007
H	2.0977	0.0026	-0.0268	-0.0839	-0.3875	0.2543	0.2439

Log-Likelihood Function = -287.7909 Number of Observations Used = 251

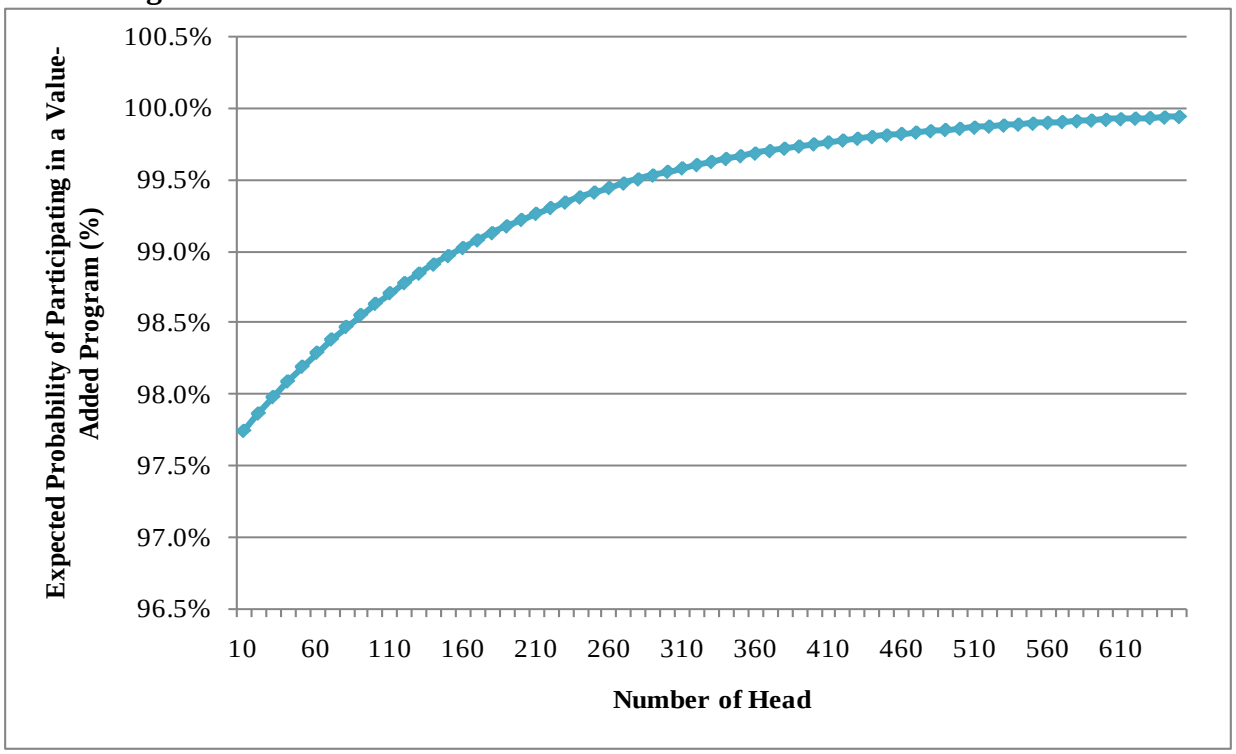
[1]Parameter estimates for "limits" with p-values in parenthesis: Limit 2: 1.5079 (0.0033), Limit 3: 3.879 (<.0001), Limit 4: 6.1978 (<.0001).

Holding other factors constant, the probability that a producer having a comparative advantage in marketing skills, affecting the model to high degree (response of 4 and 5), was 74.9%. However, those who do not have a comparative advantage in marketing skills have a probability of 61.2% of having a response of 4 and higher. Comparative advantages in new technology and business planning skills were not related to willingness to participate in a value-added program.

Risk preference was the shown to not affect the model. The only continuous variable to affect the model was the number of cows owned variable. As the number of cows owned by a

producer increases, the probability of participating in a value-added program increases (Figure 6.1). A producer who owns 10 head of cattle has a total probability of 97.7% of participating in a value-added program, whereas a producer who owns 650 head of cattle has a total probability of 99.9% of participating in a value-added program to increase returns. This figure shows a relationship between number of cows owned and expected probability of participating in a value-added program which is increasing at a decreasing rate. Even though the variable is statistically significant, the impact is not very substantial.

Figure 6.1 Number of Head Owned and Expected Probability of Participation in a Value-Added Program to Increase Returns



6.3 – Production and Marketing Decisions with Willingness to Change

Many producers calve in a certain season, such as spring, fall, or year-round, because that is what they have always done, or else it works better with their farming operation. Others calve in a specific season so they can market their calves when prices are optimal. Producers were

given a survey question that set them up with the scenario where they typically market their spring-born calves at weaning in November. The question then asked how much higher would the expected net return need to be to convince them to feed their calves over the winter to sell in March. This set up the respondent with risks to consider such as, death loss through the winter, higher feed costs, the hassle with feeding calves, which would essentially show their willingness to change production practices to earn a higher return. Five answer choices were: 1 = 5% higher, 2 = 10% higher, 3 = 18% higher, 4 = 22% higher and 5 = would not consider carrying them over. The most common response was a net return of 10% higher, and the average was 3.05.

6.3.1 – Expected Net Return Empirical Model

The model for the expected net return anticipated by carrying over post-weaned calves to increase returns is defined as (subscript *i* is dropped for notational convenience):

(2) $$Q11 = \beta_0 + \beta_1 RPS + \beta_2 AGE + \beta_3 WAGES + \beta_4 DAR + \beta_5 ASSETS + \beta_5 NCOWS + \beta_6 H + \beta_7 Q20A + \beta_8 Q20B + \beta_9 Q20H + e$$

where the willingness to carry over for a certain expected net return variable (*Q11)* is the dependent variable and the explanatory variables are as defined in Chapter 5.

Risk Preference is expected to affect the model in that, an increase in risk preference will increase the producer's willingness to carry over. An increase in off-farm income, assets, number of cows owned, diversification index and comparative advantages in new technology, business planning and marketing skills are expected to affect the model as they increase in value, then the probability of willingness to carry over calves for a certain expected net return increases. As age of operator and the debt-to-asset ratio increases, the probability of willingness to carry over calves for a certain expected net return is expected to decrease.

6.3.2 – Estimated Equation and Results

Again, an ordered logit model was used to estimate the parameters in equation (2) to determine how the different explanatory variables relate to the probability of the producer's willingness to carry over calves for a certain expected net return, and are reported in Table 6.2. Changes in probabilities associated with a one-unit change in each explanatory variable were calculated and are referred to as marginal probabilities, based on equation (12) from Chapter 5. The probabilities associated with changes in the binary variables were calculated by holding continuous variables at their average values and discrete variables at zero.

Table 6.2 Ordered Logit Estimates for Response to Statement: Suppose You Typically Market Spring-Born Calves at Weaning in November. How Much Higher Would the Expected Net Return Need to be to Convince You to Retain and Feed Calves Over to Sell in March?

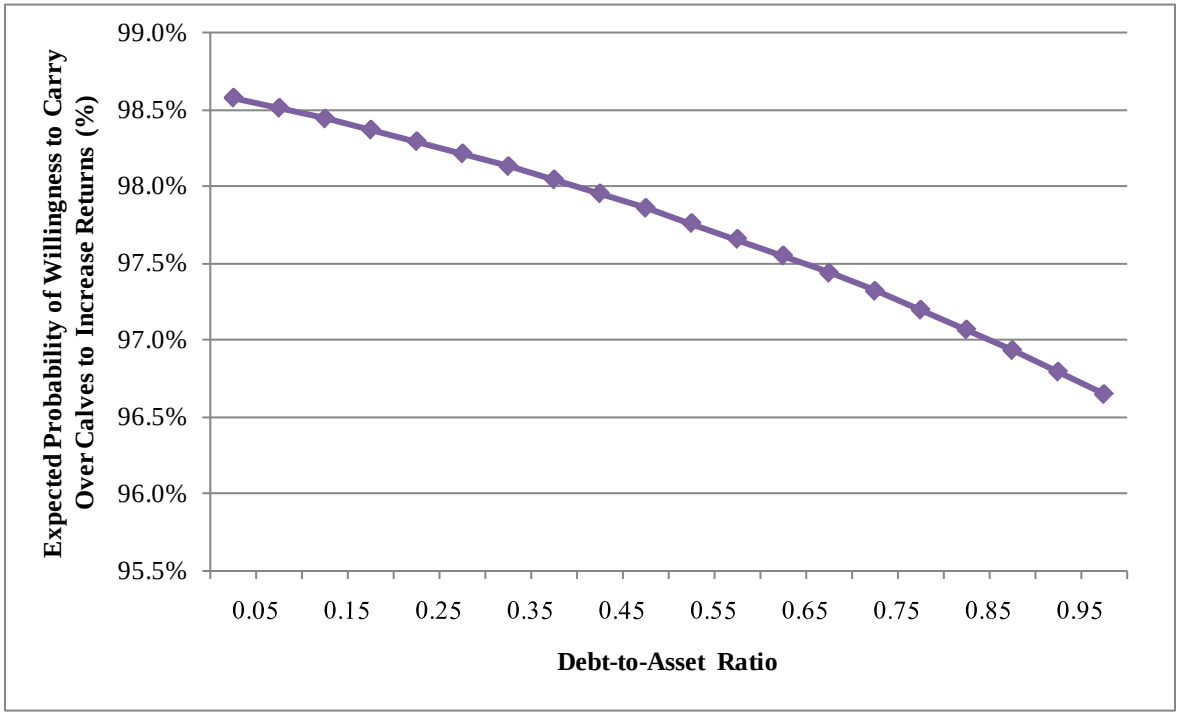
Variable	Parameter Estimate[1]	P-Value	5% Higher	10% Higher	18% Higher	22% Higher	Would not consider carrying them over
Intercept	4.5866	<.0001	**Probabilities**				
new technology = 1	-0.7679	0.0062	0.0372	0.4991	0.3064	0.0891	0.0683
new technology = 0	Default		0.0176	0.3316	0.3639	0.1505	0.1364
business planning skills = 1	0.1893	0.5197	0.0146	0.2929	0.3653	0.1669	0.1603
business planning skills = 0	Default		0.0176	0.3316	0.3639	0.1505	0.1364
marketing skills = 1	0.0109	0.9716	0.0174	0.3293	0.3611	0.1515	0.1377
marketing skills = 0	Default		0.0176	0.3316	0.3639	0.1505	0.1364
			Marginal Probabilities (at default = 0)				
RPS	-0.0139	0.1952	0.0002	0.0029	-0.0003	-0.0012	-0.0016
Age	0.0079	0.5135	-0.0001	-0.0017	0.0002	0.0007	0.0009
Wages	-0.0014	0.7794	0.0000	0.0003	0.0000	-0.0001	-0.0002
DAR	-0.9208	0.0860	0.0159	0.1933	-0.0209	-0.0799	-0.1085
Assets	-0.0001	0.4270	0.0000	0.0000	0.0000	0.0000	0.0000
Ncows	-0.0020	0.1977	0.0000	0.0004	0.0000	-0.0002	-0.0002
H	0.0202	0.9767	-0.0003	-0.0042	0.0005	0.0018	0.0024
Log-Likelihood Function = -311.22690		Number of Observations Used = 237					

[1]Parameter estimates for "limits" with p-values in parenthesis: Limit 2: 3.3994 (<.0001), Limit 3: 4.9323 (<.0001), Limit 4: 5.8675 (<.0001).

Having a comparative advantage in new technology is related to the model, holding other factors constant, in that, as the comparative advantage increases, the probability that a producer is willing to carry over calves for a certain expected net return was largest for a 10% higher net return at 49.9%. The probability of an 18% higher net return was 30.6%; the probability of a 22% higher net return was 8.9%; the probability of a 5% higher net return was 3.7%; and, the probability of not carrying them over was 6.8%, for possessing a comparative advantage in new technology. Comparative advantages in business planning and marketing skills were not related to willingness.

Risk preference was not related to the model. The debt-to-asset ratio was the only continuous variable to affect the model. The probability of a producer's willingness to carry over calves for a certain expected net return decreases as the debt-to-asset ratio of that producer increases. So, as a producer's debt-to-asset ratio because larger (closer to 1), the probability of the producer being willing to carry over calves for a certain expected net return decreases (Figure 6.2). This figure shows a relationship between debts to assets and expected probability of willingness to carry over calves for a certain expected net return which is slightly non-linear at a decreasing rate.

Figure 6.2 Debt-to-Asset Ratio and Expected Probability of Willingness to Carry Over Calves to Increase Returns



6.4 – Summary

The goal of this chapter is to show what production and marketing practices producers are willing to change to increase returns to their operations. First, we found that producers who would participate in value-added programs to increase returns to their operation have a comparative advantage in marketing skills, own more head of cattle, and are less diversified in term of their farm incomes (beef income is a larger percentage of their income than crops or other livestock). Second, we found that producers on average are willing to risk carrying over their calves to market in spring for an expected 10% higher net return. Producers who are willing to carry over their calves for a certain expected net return have a comparative advantage in new technology and have low debt-to-asset ratios (less debt than assets).

CHAPTER 7 - Conclusions & Implications

7.1 – Introduction

This chapter includes a brief synopsis of the research and results presented and discussed in the previous six chapters. This study evaluated means of managing production risk related to operating decisions, as well as looking at the producer's operating decisions and how they are related to their risk preference. Risk preference, which we defined as looking at risk as an opportunity for increased net returns, was the sole type of risk considered in the analysis. The main objective of this research was to quantify cow-calf producers' risk perceptions and associated determinants. Specific research objectives were:

1. Determine cow-calf producer risk preferences based on a set of risk aversion measurements.
2. Determine how operating decisions producers are making based on their production and marketing practices specific to calf-timing, health management, feeding and grazing, breeding, culling, and selling are related to their risk aversion.
3. Determine how risk aversion affects producer management and marketing practices.
4. Identify what new production and marketing practices producers are willing to change or willing to risk to increase their profit margins.

As we began this research with the quote, "If your cow-calf operation is free of failures, you're not taking enough risks to potentially increase returns", operators who are not fully utilizing their production and marketing potential for calves, can take advantage of ways, such as retaining ownership, to increase their returns. The following sections will conclude these

potentials and bring to a close what preferences producers are operating at, describe each objective and report significant results.

7.2 – Cow-Calf Producer Risk Preference

The producer's risk preference was quantified as a "score" (*RPS*) variable by combining five questions, created based on previous literature to merge certain dimensions of risk. The purpose of this score was for its use to compare to other attitudinal and production questions, as well as whole farm data. The risk questions were formatted to ask producers for their preference of risk-taking practices and viewing risk as an opportunity. The RPS was arbitrarily categorized in order to compare producers in basic terms relative to other respondents, a method researched and described fully in Chapter 4.

We found that when split into 20 percent size-categories relative to the range of RPS, 36% of Kansas producers possess a low risk preference (very risk averse), 49.6% possess a below average risk preference (somewhat risk averse), 12.1% possess an average/moderate risk preference (neutral risk partiality), 2.2% possess an above average risk preference (somewhat risk preferring), and 0.4% possess a high risk preference (very risk preferring). According to the categorization scheme developed, nearly 86% of Kansas cow-calf producer survey respondents are risk averse and only 2.6% are risk tolerant.

7.3 – Operating Decisions Related to Risk Aversion

It is difficult to identify whether producer operating decisions are driven by their personal risk preference, or if their risk preference is based on their operating decisions, and this study did not test which of these prevail. Quite likely there is bi-directional causality between risk

aversion and operation characteristics. In fact, this study illustrated how operating decisions are related to risk aversion, and risk aversion is related to operating decisions.

Factors that were found to influence risk aversion were socioeconomic factors such as age, off-farm income, debt-to-asset ratio, farm size, and number of cows owned, as well as comparative advantages of producers: use and analysis of new technology, business planning skills, and marketing skills. Age was related to risk preference in that, as an operator gets older, their risk preference decreases. This coincides with research by Grable and Lytton (1999). An operator's assets and number of cows owned affect their risk preference positively with the more assets and cows producers own, the larger is their risk preferences. Producers who consider themselves to have a comparative advantage in use and analysis of new technology have a higher preference for risk.

In order to determine operating factors that affect a producer's risk preference, sensitivity analysis was run on financial strength of the producer, production practices, and marketing methods specific to retained ownership, where independent variables were revealed to have an effect on RPS. Producers maintaining financial/credit reserves tend to have a smaller preference for risk, producers who participate in value-added programs to increase returns in their operation have higher tolerance for risk, and producers who are highly concerned with disease prevention tend to be more risk averse. In terms of reasons to retain ownership, producers who retain ownership to receive performance data have more preference for risk, whereas producers who retain ownership to receive carcass data have less preference for risk. Producers who retain ownership to receive a return for genetic improvement for value-added investments have a larger preference for risk.

7.4 – Risk Aversion Related to Operating Decisions

Several binary and ordered logit models were used to determine how risk aversion was related to cow-calf producer operating decisions. Three sections focused on producer's financial reserves, production practices, and marketing methods specific to retained ownership. Analysis of producer financial credit reserves revealed that the probability of a producer maintaining credit reserves is likely to increase as risk aversion increases. Additionally, the higher the producer's risk preference, the less likely they are to use cash-only pricing methods. Neither of the two models used to look at production practices were related to risk preference. Results of analysis of marketing methods specific to retained ownership were that risk preference was higher for individuals that participated in retained ownership production management programs. When looking at post-weaning selling and marketing practices, risk preference was higher for producers who retain ownership of steers and heifers through finishing, than those who sell steers after weaning.

7.5 – Production and Marketing

After looking at producers' preferences of risk related to operating decisions and operating decisions related to risk preference, more research was conducted to identify what production and marketing practices producers were willing to change or willing to risk to increase their returns. Two more logit models were analyzed on producer participation in value-added programs to increase returns, and producer willingness to carry over their fall-weaned calves to market in spring for a certain expected net return.

Producers who would participate in value-added programs to increase returns to their operation have a comparative advantage in marketing skills, own more cattle, and are less diversified in terms of their farm incomes (beef income is a larger percentage of their income

than crops or other livestock). This model was not related to risk preference. Producers, on average, are willing to risk carrying over their calves to market in spring for an expected 10% higher net return. Additionally, producers who are willing to carry over their calves for a certain expected net return have a comparative advantage in new technology and have low debt-to-asset ratios. This model was also not related to risk preference.

The study demonstrated a potential bi-directional causality of how operating decisions are related to risk aversion, and how risk aversion is related to operating decisions. When looking at operating decisions that were related to risk preferences, we found that older producers and those who have less assets and smaller cow herd are more risk averse, compared to younger producers and those with more assets who are more risk tolerant. Additionally, those with a comparative advantage in use and analysis of new technology have a higher preference for risk. Conversely, looking at the risk preferences that were related to operating decisions, risk preference was found to affect producers who maintain financial/credit reserves, those who use cash-only pricing methods, individuals who participate in retained ownership production management programs, and post-weaning selling and marketing practices of selling steers after weaning and retaining ownership of steers and heifers through finishing.

A major finding in this research is that risk aversion does determine a producers' willingness to retain ownership. We found that in terms of reasons to retain ownership, producers who retain ownership to receive performance data or to receive a return for genetic improvement for value-added investments have a larger preference for risk. When looking at post-weaning selling and marketing practices, risk preference was higher for producers who retain ownership of steers and heifers through finishing, than those who take the less risky option of selling steers directly after weaning. Thus, producers who choose to start retaining ownership of their calves

through finishing are considered as more risk preferring, and producers who already retain ownership of their calves have a higher preference for risk.

Essentially, a goal of this project was to research and analyze how cow-calf producers view their operating decisions compared to their risk preference as an *opportunity* associated to profit margins. We found that producers who use new forms of technology, use pricing methods besides cash only (like futures) and retain ownership of steers and heifers through finishing, all have a higher preference for risk. These three forms of management give the producer the potential to market their cattle better and add value to their product. Not always will these three allow a producer to gain larger profit margins, but the opportunity associated with these higher risk practices can be an opportunity which is relevant to earnings, in which Kansas cattlemen can view as a possible practice to include in their operation.

7.6 –Limitations and Future Research

Limitations of this study included a limited data set of only Kansas producers in the KFMA, where opening up this survey to all producers in the state, or even nationally, could provide for a larger, more complete set of data. The response rate was higher than expected (40%), but an even higher response rate could essentially enhance the study. Of course, these generalizations only take a conditional view of the respondents to the survey, and not all KFMA members, or even all Kansas cattlemen. Furthermore, measuring risk aversion is not an exact science and the questions used in this study serve as only a proxy for measuring this complex concept. Additionally, limitations could show multicollinearity issues with including RPS as both an endogenous and exogenous variable, but this issue did not affect overall results on risk preference.

Future research could focus on utilizing more of the whole farm data set from KFMA members, along with survey questions to research additional reasons for specific risk preferences. Furthermore, time series data could be used to show the change in producer's risk preference over a certain time period. It would be interesting to research why so many producers are so risk averse. Is it because their fathers, or persons involved in their training, were very risk averse, or have they had an experience where they risked a lot and the outcome was traumatic, or are they just risk averse because they do not know how to effectively market their cattle to earn more? These questions may be answered within the survey questions already asked, or a follow-up study in a few years could determine changes in producer risk preferences, production, and marketing practices and routines willing to change or risk to potentially increase their net returns. More specific questions could be asked about why their risk preference/averseness is the way it is, and if any education, either from college or extension workshops, contributed to their preference. These additions to the research could allow for extension educators to provide more materials specific to producers' wants and needs in terms of risk preferences.

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Appendix A - Cow-Calf Risk Management Survey

KANSAS FARM MANAGEMENT ASSOCIATION

Your Farm - Your Information - Your Decision

For more information:

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The purpose of this survey is to obtain information that will assist in the development of programs and timely information to enhance your risk management decisions and improve profitability in your cattle operation. Your individual responses are anonymous and will be treated with complete confidentiality. Results will be reported only in summary form. Thank you for your time and assistance. Estimated time of completion: 15 minutes.

For questions, please contact Kelsey Frasier, Graduate Research Assistant, Kansas State University, (785)410-3024 or email at kfrasier@agecon.ksu.edu.

Please return completed survey by June 10 in enclosed postage paid envelope or complete web version at https://surveys.ksu.edu/TS?offeringId=129946 .

1. **Approximately what percentage of your cows do you calve out in spring and fall?** *(Total should equal 100%).*

   _____% Spring (Jan to June) _____% Fall (July to Dec)

2. **What type of production management programs do you participate in?** *Circle all that apply.*
   a. Retained Ownership
   b. Certified Feeder Cattle (Red Angus Feeder Calf Certification Program, Linmark, etc.)
   c. Product Specified Feeder Cattle (i.e. AngusSource®, Hereford Verified, etc.)
   d. Pasture to Plate Alliances
   e. Other:_____

3. **Each year after weaning, what do you do with your calves?** *Please circle response for each question.*

Steers:	**Always**	**Often**	**Sometimes**	**Seldom**	**Never**
Sell steers after weaning	5	4	3	2	1
Background steers; sell them	5	4	3	2	1
Retain steers through finishing	5	4	3	2	1

Heifers:					
Retain heifers as replacements	5	4	3	2	1
Sell heifers after weaning	5	4	3	2	1
Background heifers; sell them	5	4	3	2	1
Retain heifers through finishing	5	4	3	2	1

4. **Of calves you sell annually, what percentage of each marketing method do you typically use?**

   _____% Direct Marketing
   _____% Local Auction Barn – normal sale
   _____% Local Auction Barn – special graded sale
   _____% Video Auction (i.e. Superior Livestock Auction, web listings, etc.)
   _____ % Other: _____
   100% = Total

5. **What is your typical pricing method you use for your calves you sell annually?**
   _____% Forward Contracting or Marketing Agreement
   _____% Futures Hedging
   _____% Futures Options
   _____% Cash only
   _____% Other: _____
   100% = Total

6. **If you DO retain ownership, why do you?** *Please check all that apply.*
   _____I see the risk worthwhile to earn the potential of more $/hd
   _____I receive performance data while calves are on feed (i.e. rate of gain, average weights, etc.)
   _____I receive carcass data information
   _____I get a return for genetic improvements or value-added investments
   _____Other:_____

7. **If you DON'T retain ownership, why don't you?** *Please check all that apply.*
   _____I don't receive additional profit than selling after weaning
   _____I don't need to receive back carcass data
   _____I don't want to take the risk involved with owning while in feedlot
   _____I want to receive revenue earlier than waiting until calves are finished
   _____I don't have a relationship established with a feedlot
   _____Other:_____

8. **If a cow does not settle/comes up open, which decision do you typically make?**
   a. Cull immediately and sell
   b. Feed out and send to packing house
   c. Give her one more chance to get bred next year
   d. Defer to alternative calving season herd (i.e., if she was supposed to calve spring, breed to have her calve in fall or vice versa)

9. **A reason I would keep an open cow would be:**
   a. First time open
   b. The quality of the cow (i.e. registered, good genetics)
   c. The value of the cow (i.e. how much money has been put into her: quality, vaccinations or otherwise)
   d. Had a good reproductive record (i.e. raised healthy calves in the past)
   e. I cull every open cow; no second chances

10. Please rank the input costs below relative to their effect on your operation:
(1 being largest cost to 8 being lowest cost)

_____Animal health costs
_____Cost of breeding stock
_____Feed costs (corn, hay, mineral, etc.)
_____Fuel
_____Interest
_____Labor
_____Maintenance costs
_____Pasture rent or ownership costs

11. Suppose you typically market your spring-born calves at weaning in November. How much higher would the expected net return need to be to convince you to retain and feed your calves over to sell in March?

a. 5% higher
b. 10% higher
c. 18% higher
d. 22% higher
e. Would not consider carrying them over

12. Looking forward over the next two years, how do you envision your <u>cattle herd</u> and <u>crop acreage</u> changing? *Please "X" one for each category.*

	Cattle Herd	**Crop Acreage**
Expanding in size		
Reducing in size		
Remaining the same size		

13. What percent of your herd do you artificially inseminate (A.I.)? *Please circle one.*

<u>0%</u> <u>10-40%</u> <u>40-70%</u> <u>70-100%</u>

14. Of cows you A.I., what percentage typically end up bred from the A.I.? *Please circle one.*

<u>0%</u> <u>10-40%</u> <u>40-70%</u> <u>70-100%</u>

15. In your farm/ranch management, how would your neighbors describe your risk taking behavior?

a. A risk avoider
b. Cautious
c. Willing to take risks after adequate research
d. A real gambler

16. You can sell your calves at different production stages. If given the following options, which would you choose?

a. Sell at weaning
b. Retain for two months post weaning with a:
   30% chance of netting an additional $5/hd, 10% chance of losing $10/hd, or 60% chance of netting no additional $/hd
c. Retain through finishing with a:
   30% chance of netting an additional $40/hd, 15% chance of losing $50/hd, or 55% chance of netting no additional $/hd

17. Given the best and worst case potential outcomes from marketing your weaned calves, which net return/loss prospect would you most prefer from the four listed below?

a. $20/calf return best case; $0/calf loss worst case
b. $35/calf return best case; $20/calf loss worst case
c. $65/calf return best case; $35/calf loss worst case
d. $100/calf return best case; $75/calf loss worst case

18. Your trusted friend is putting together investors to fund a new innovative business venture. The venture could pay back more than 50 times the investment if successful. If the venture is a bust, the entire investment is worthless. Your friend estimates the chance of success is 20%. How much would you invest?

a. Nothing
b. $1,000
c. $10,000
d. $50,000
e. $100,000
f. More than $100,000

19. If your trusted friend and banker each conclude that success of the venture in the above question is 60% instead of 20%, how much would you invest?

a. Nothing
b. $1,000
c. $10,000
d. $50,000
e. $100,000
f. More than $100,000

20. Which factors below do you consider your comparative advantages? *Please "X" up to five options.*

_____Analysis and use of new technology
_____Business planning skills (transition planning, business structure, alliances, etc.)
_____Cattle genetics
_____High quality land/pasture
_____Loan and interest rate management
_____Low cost

_____Machinery management
_____Marketing skills
_____Personnel management
_____Production skills (forage yields, calving rates, weaning weights, etc.)

21. Please rate these general risk factors by their level of importance to your cow operation. *Please circle the best response.*

	Very Concerned	**Concerned**	**Neutral**	**Low Concern**	**Not Concerned**
Drought	5	4	3	2	1
Unexpectedly low cattle prices	5	4	3	2	1
High replacement heifer prices	5	4	3	2	1
Variation in non-feed input prices	5	4	3	2	1
Changes in gov't environmental programs	5	4	3	2	1
Storms (snow, ice, lightening, etc.)	5	4	3	2	1
Changes in government farm programs	5	4	3	2	1
High hay/forage prices	5	4	3	2	1
Animal Disease	5	4	3	2	1
High land prices	5	4	3	2	1
Rented pasture availability	5	4	3	2	1
Labor availability	5	4	3	2	1
High price of labor	5	4	3	2	1
Credit availability	5	4	3	2	1
High interest rates	5	4	3	2	1

22. Rank these risk factors in terms of importance that each affects your ranch/farm income. *Please circle the best response.*

	Very Important	**Important**	**Neutral**	**Low Importance**	**Not Important**
Maintaining animal health	5	4	3	2	1
Being a low-cost producer	5	4	3	2	1
Receiving premiums for calves sold	5	4	3	2	1
Maintaining financial/credit reserves	5	4	3	2	1
Retaining calves for market timing	5	4	3	2	1
Specializing in one phase of cattle production	5	4	3	2	1
Diversifying in numerous ranch/farm enterprises	5	4	3	2	1
Forward contracting futures & options	5	4	3	2	1

23. How do you manage farm/ranch income volatility? *Please "X" all that apply.*

_____Purchase insurance
_____Off-farm income
_____Saving funds in good years
_____Selling more cull cows during hard times and retaining more at other times
_____Utilizing marketing methods to sell calves

24. Please circle the best response for each statement.

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Economically, I view my cow-calf herd as the most important part of overall farm income	SA	A	N	D	SD
Recent economic instability has focused my attention on more careful financial management in my operation	SA	A	N	D	SD
Recent economic instability has focused my attention on more time spent on marketing in my operation	SA	A	N	D	SD
Recent economic instability has focused my attention on more intensive herd management in my operation	SA	A	N	D	SD
Individually identifying cattle is crucial to my operation and marketing of my cattle	SA	A	N	D	SD
I would participate in a value-added program to increase returns to my operation	SA	A	N	D	SD
Disease prevention is important in my cattle herd	SA	A	N	D	SD
I consult with my veterinarian regularly to develop and implement a whole-herd health program	SA	A	N	D	SD
I inspect my herd at least twice weekly	SA	A	N	D	SD
Body condition scoring of cows is important	SA	A	N	D	SD

25. Do you use your pasture ground for reasons other than grazing your personal herd?
Please circle all that apply.

a. Agritourism
b. Energy development (oil, gas or wind)
c. Hunting
d. Leased out to another herd
e. Recreation
f. Other, please list:_____
g. None

26. Do you own a computer? _____ Yes _____ No

27. Do you have Internet access? _____ Yes _____ No

28. How often do you access the Internet?

a. Daily
b. Weekly
c. Monthly
d. Less often

Thank you for your time! Your assistance is greatly appreciated.
For questions, please contact Kelsey Frasier, Graduate Research Assistant, Kansas State University,
(785) 410-3024 or email at kfrasier@agecon.ksu.edu.

Please return completed survey in enclosed postage paid envelope or complete web version at https://surveys.ksu.edu/TS?offeringId=129946 .

Appendix B - Association & County Data

KFMA Association and County Numbers*

Total survey reponses per county and association

1: North Central Association	
14 Saline	6
18 Dickinson	13
20 Marshall	2
23 Marion	9
30 Riley	1
36 Cloud	2
37 Washington	2
40 Republic	3
41 Clay	8
43 Jewell	4
47 Geary	8
50 Smith	3
55 Mitchell	3
56 Osborne	5
60 Russell	2
64 Ellsworth	3
65 Ottawa	4
66 Lincoln	2
Total	**80**

2: South Central Association	
02 Sedgwick	1
06 Reno	11
12 Sumner	1
26 McPherson	4
28 Harvey	3
33 Barton	3
48 Rice	8
51 Harper	2
53 Pratt	4
57 Kingman	4
59 Stafford	1
Total	**42**

Total useable surveys	**312**
Response rate	**40.7%**

3: Southwest Association	
00 Hamilton	0
01 Haskell	0
02 Wichita	3
03 Grant	0
04 Stanton	0
05 Greeley	0
35 Ford	1
67 Barber	0
69 Pawnee	0
71 Finney	0
79 Edwards	0
84 Seward	0
85 Kiowa	0
86 Meade	0
89 Gray	1
90 Commanche	1
91 Clark	0
92 Stevens	0
93 Hodgeman	3
94 Morton	0
96 Scott	0
97 Lane	1
98 Kearny	0
Total	**10**

4: Northeast Association	
01 Wyandotte	0
03 Shawnee	4
07 Leavenworth	3
13 Lyon	4
15 Atchison	2
16 Douglas	3
19 Johnson	1
25 Brown	5
34 Nemaha	4
39 Pottawatomie	2
42 Jackson	8
45 Doniphan	3
46 Jefferson	5
54 Morris	2
62 Wabaunsee	4
81 Chase	0
Total	**50**

5: Northwest Association	
38 Ellis	0
58 Phillips	2
61 Norton	1
70 Rooks	5
73 Rush	1
74 Decatur	1
75 Ness	0
76 Graham	5
77 Rawlins	4
78 Thomas	2
80 Sherman	2
82 Cheyenne	2
83 Trego	1
87 Sheridan	2
88 Gove	0
95 Logan	5
99 Wallace	0
Total	**33**

6: Southeast Association	
04 Crawford	10
05 Montgomery	2
08 Cowley	5
09 Butler	4
10 Cherokee	7
11 Labette	5
17 Bourbon	6
21 Franklin	7
22 Neosho	4
24 Allen	3
27 Wilson	6
29 Osage	4
31 Miami	5
32 Greenwood	5
44 Coffey	1
49 Linn	2
52 Anderson	3
63 Chautauqua	3
68 Elk	3
72 Woodson	12
Total	**97**

*Please note that the first number represents the association and the second and third numbers represent the counties.