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Nebraska Cow-Calf Operations: Use of Pricing Tools and Market Diversification Strategies to Manage Market Risk

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This thesis is the work of Logan Kalkowski with assistance and direction from the University of Nebraska-Lincoln and advisors Jay Parsons and Elliott Dennis. This thesis is divided into three chapters. The first chapter of this thesis investigates years of research and data collection from multiple agencies to find connections to reasoning for producers to choose marketing and diversification tools used in their operation.

The second chapter examines cow-calf marketing and risk management practices in Nebraska. Marketing and risk management behavior are examined by using the University of Nebraska-Lincoln Cow-calf survey data collected in 2016. The survey captures characteristics of operations and their use of marketing and risk management practices. While it is important to understand what operations are doing currently, it is also important to understand what options are available to these producers in the marketplace. This chapter explains the marketing and risk management options available to cattle producers.

The third chapter of this thesis examines the relationship between producer characteristics and use of market strategies. This is examined because of the importance of market timing and location when making decisions to retain or sell livestock. This chapter uses a multinomial logit model to examine four modes of action discussed in chapter two. The four modes of action are grouped by how individuals responded to specific marketing questions and are examined to see if there are similarities in the operations connected to each mode.

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Chapter 1: A Review of the Literature on Marketing Practices for North American Cow-Calf Operations

Introduction

Agricultural production of food and resources is vital to human survival. Nebraska is home to 6.8 million head of cattle and calves, making it the second-largest state in the United States in terms of inventory (Nebraska Department of Agriculture). Cow-calf production is important to the state and, therefore, it is important to explore ways the industry can continue to improve. This chapter will look at research done by individuals across the United States cattle industry focusing on cow-calf operations, their marketing practices, and the impact operator decisions can have on the operations.

Literature Review

Factors Impacting Producers' Use of Risk Management Tools

Previous research focused on marketing practices for cow-calf operations has been dedicated to demographics, pricing strategies, and diversification strategies. Demographics can include a wide range of characteristics, such as the size of the operation, the location of the operation, the age of the individuals on the operation, and the education received by the producers. The individual characteristics that make up each operation can help researchers understand strategies and diversification techniques used within various demographic groups.

A study by Hall et al. (2003) published in the *Review of Agricultural Economics*, surveyed farms in the states of Nebraska and Texas. Their survey was mailed in April of 2000, and a second reminder letter was sent two weeks later, and then a third was sent

two weeks after to the individuals who had not returned their surveys. In the end, Hall et al. received 1,313 completed questionnaires from which they created their findings, signifying a response rate of 32.8 percent. Individuals who completed the survey were grouped into separate categories based on the number of animals in the herd. They were grouped in the herd sizes of 50-499, 500-999, and 1000+ to match groups used by the National Agricultural Statistical Service (NASS). The main objective of the study was to learn about risk preferences and tolerance for risk issues including drought, cold weather, and disease (Hall et al. 2003).

In the paper, Hall et al. (2003) explain why they used the specific questions they did to learn about the operations. Many of the questions were asked on a Likert Scale (a ranking from 1 being low to 5 being high) to analyze characteristics for decision-making on the operations. The goal of this survey was to focus on education, specifically for educators and legislators to create better programs to inform producers about their marketing options. Respondents described drought and cattle price variability as the largest two concerns regarding their operation. The researchers reported that 25 percent of respondents showed strong interest in wanting additional information about forward contracts and futures and options (Hall et al. 2003). The 25 percent of respondents who showed interest were made up of producers who were traditionally risk-averse and younger. This is important because it shows producers have an interest in growing their education about the pricing strategies that are available in the marketplace.

With the demographics seeking more education, it was found that on average, a 55-year-old producer is 13.8 percent less likely to express strong interest in attending risk management education than a 35-year-old producer. This shows age is related to a desire

for marketing education, specifically older producers are less likely to desire it. The mean age for respondents to this survey was 57.31. This average age is consistent with what the National Agricultural Statistics Service states, confirming that the study uses an accurate representation of producers in the area (NASS 2020).

Along with age being a factor for educational desires, so were risk preferences. Individuals who self-identified as risk-averse were 9 percent more likely to show interest in attending further education on financial management. This shows that risk aversion is associated with a desire for more marketing education. The results of this study revealed that 51 percent of respondents stated they did not use futures and options because they did not have enough knowledge about the tools. Thus, this lack of knowledge reveals a need for more marketing education. The study revealed the impact age and risk preferences can play on the use of marketing tools and the desire for education among livestock producers.

Schroeder et al. (1998) looked at educational workshops and compared the perspective of the extension educator to that of a producer. Schroeder et al. (1998) conducted two specific surveys to look at the impact of extension educational programs on the use of marketing, forward contracting, and hedging for agricultural producers. The first survey was distributed nationwide to extension educators who had focused on areas dealing with marketing economics. The second survey was distributed to producers and industry representatives at two different conferences at Kansas State University.

The survey that was sent out to extension educators was looking specifically at market actions and the impact they carried with an operation. They looked at the use of futures markets, price forecasting, market risk management, and market timing to

compare with answers collected by producers in a similar survey (Schroeder et al. 1998). The extension members represented many different industries including specialty crops, feeder cattle, corn, soybeans, hogs, and more. The educators held appointments of more than 70 percent extension marketing, almost 8 percent in research, and just over 5 percent in education. Responses with a direct relationship to livestock were used from the surveys provided by extension educators. This resulted in 34 useable surveys.

In 1996, a related survey was distributed at two different conferences hosted at Kansas State University to gain similar information to what had been collected from extension educators, but now from producers (Schroeder et al. 1998). Collecting responses from both groups separately allowed the researchers to create connections without having the respondents experience the exact same prior conference. The producer survey resulted in 91 usable surveys of producers between the two events. The conferences where the surveys were collected required an admittance fee of $150/person. This is notable as some producers may not have been willing or able to spend the money for a conference and thus responses were never recorded, and the sample population cannot be counted as random. Because the responders paid to attend the conferences, the survey population is understood to be a group of individuals who are well educated and looking to learn and implement ideas found in the conference regarding market strategies (Schroeder et al. 1998).

The conferences each attracted a different type of crowd. The individuals who attended the Agricultural Land Value conference resulted in the higher use of forward contracting, futures, contracts, and hedges than the other conference that focused on cattle profit. This can be explained by the familiarity of futures and hedging accounts

used in the marketing of crop systems. This means that a larger number of attendees at the Agricultural Land Value conference were farmers or row-crop individuals as opposed to ranchers and livestock operation managers. This is significant because when comparing the assumption of market economists and the use of marketing tools for livestock, the individuals who have more experience marketing through contracts and hedges will be more willing to use them moving forward (Schroeder et al. 1998).

As the research showed, the two conferences that were held for producers resulted in some similarities to the survey sent to the extension economists. Schroeder et al. (1998) agreed that producers receive lower prices by forward contracting and feel that hedging will not reduce their risk. However, a difference between the producers and economists was that the economists viewed risk reduction as a less important marketing strategy than the producers did. This is significant because like Hall et al. (2003), it shows a disconnect between educators and producers, which has become common amongst the education of marketing strategies.

When considering marketing strategies and marketing education, it is essential to understand a producer's perspective. An easy way to do that is to look at what makes operations different. A key difference would be the size of the operation. In an article written by researchers in Mississippi, Little, Forrest, and Lacy (2000) looked at characteristics and decisions being made based on the size of the operation. The size of the operation can determine what tools and diversification measures are used along with the timing of decisions being made. Because size can play a role on decision making, the tools and diversification measures used can differ between operations because of access

to such items in their given market and the ability of the operation (Little, Forrest, and Lacy 2000).

Looking specifically at the timing of decisions on an operation, producers can select a calving date. The calving period is important because it helps determine the uniformity of cattle being raised and when the cattle become available to the market (APHIS 2009). A shorter calving season leads to a more uniform calf crop at a given point in time, giving a seller the ability to provide a specific type of cattle on a specific date. This can be beneficial to smaller operations if they can manage the herd because it opens their operation up to alternatives for marketing.

Little, Forrest, and Lacy (2000) examined marketing strategies and decision-making skills by surveying individuals in Mississippi who reported receiving an income from sold livestock in 1999. They determined that larger herd sizes (larger operations) tend to be more willing than smaller operations to use marketing practices beyond selling in a conventional auction market. The study also examined factors that influence or cause a producer to look at selling and marketing livestock, such as reaching the desired weight, cash market reaching a specific level, feed availability, and anticipation of price changes. Of those surveyed, 57 percent of calves were born in the spring. Of the operations, 75 percent of the larger operations and up to 90 percent of operations of size 50-99 head reported that heifers raised were the replacements in the operation. The operations that did not report that they vaccinate their animals tended to be the small operations (Little, Forrest, and Lacy 2000, 13). Producers with larger herds tended to use outside services when it came to seeking the best outcome and health for their herd.

Little, Forrest, and Lacy (2000) determined that 75 percent of producers in Mississippi sell their cattle regularly at conventional livestock auction markets. The survey also showed that producers consider herd size to be a factor in marketing. Of those surveyed, 75 percent stated they believed that larger groups of cattle often brought more money per head. As the size of the operation increased, the less likely they were to use local auction markets, showing that operation size plays a role in marketing decisions.

Mississippi was part of eight states that were being converted from pasture ground into tree production, which caused a decrease in land availability for grazing and livestock operations. This was likely a cause for the decrease in the number of operations over time. Not only was the number of operations being reduced, but so was the number of auction markets in the area. This caused even fewer marketing options for producers, especially for the smaller operations. As the operation size increased, so did the use of sale to private markets. With fewer auction sites came fewer buyers for smaller herds. The sale directly to stocker or backgrounding operations was not used by approximately 75 percent of all respondents regardless of herd size, but as herd size increased, the usage of direct selling increased significantly.

Little, Forrest, and Lacy (2000) believe operations were using economies of scale. The process of economies of scale states that the larger inventory operations can provide larger numbers of uniform cattle to a backgrounder and can do so much easier than can a smaller operation. Larger producers have an advantage when it comes to direct selling, so they are more likely to do it. Thus, they are less likely to mix their livestock being sold with another individual's livestock, allowing higher pay for a uniform group. A more uniform group can occur because they will have similar characteristics and performance

rates while having less chance of sickness and death loss by bringing different groups of cattle together. The same thinking can be said when looking to sell cattle to a feedlot or backgrounder. A feedlot is looking to fill a 150-200 head pen of cattle and can do so with the least amount of headache by purchasing from a single operation that has the quantity to fill a pen.

Moving away from large operations, responses to the survey indicated that only 4 percent of producers have sold cattle through a video auction, which constitutes low usage of video auctions (Little, Forrest, and Lacy 2000). It must be noted that this survey was conducted in 1999, so some of these practices, such as a video auction, were an up-and-coming marketing option. Today with more readily available Internet access, this marketing method can be more commonly used.

Along with video marketing, forward cash contracts could be used by producers. Less than 5 percent of all those surveyed indicated they used a forward contract. But within the operations that were 500+ in size, approximately 29 percent were willing to extensively use a forward contract (Little, Forrest, and Lacy 2000). Similar to the use of selling to a backgrounding operation or a feedlot, a forward contract is less likely to be used by smaller operations. Larger operations can produce a fully loaded truck, which equates to 50,000 pounds, to fill a contract. The weight of 50,000 pounds is often used as the measurement tool for delivery within a contract.

Another topic of interest examined in the 1999 Mississippi survey was the education of producers. According to the survey respondents, approximately 70 percent stated they had not attended a beef cattle course or seminar (Little, Forrest, and Lacy 2000, 42). However, respondents also stated that the larger the operation was, the greater

the chance their participation was in attending such events. This shows that smaller operations are not using educational opportunities when making their business decisions. In summary, the article determined that this study was the first of its kind in the area and brought more information to researchers regarding the needs of the producers. Looking at producers' willingness to adopt production practices and marketing tools is a new idea and shows that there is some room for improvement to better understand the options available.

The articles previously discussed all incorporate survey response data to determine that there is a desire among producers for education on successful marketing strategies. The researchers found that producers are not using futures and options unless they have prior marketing knowledge that typically comes from marketing grain. This is more often seen in farmers who also own livestock than it is in those who strictly self-identify as ranchers. Additionally, researchers determined that 75 percent of producers are selling at local auctions while larger operations are more likely to use alternative marketing practices. Amid a desire for more education for producers, there is a lack of participation amongst small operations in existing educational opportunities.

Factors Impacting Producers' Use of Market Diversification

Another factor that has an impact on producers' marketing decisions is diversification. Diversification can be seen in many ways; a livestock producer can diversify by owning other livestock, a row-crop operation, or owning another business alongside the primary livestock operation. This can be a strategy used by producers to mitigate risk. When looking at diversification used in livestock marketing, one way diversification is implemented is marketing different sets of livestock. For example, as

the calf crop approaches the age for weaning, which is the process of separating the calf from the mother cow, the producers must decide whether to sell weaned calves or do some form of retained ownership (Turner et al. (2012). Retained ownership is a broad way of describing ownership after weaning. This period can last a month, or it can last years. Selling some of the calves at weaning and retaining ownership of some of the calves after weaning is a market diversification strategy.

In a 2019 study by Colorado State University, cow-calf producers were examined to learn more about their management strategies and the challenges they faced in the market. It examined the risk associated with sale timing and how retained ownership can play a role in specific operations (Martin et al. 2019). The survey was completed electronically in 2017 and was sent to individuals who had a subscription to the online BEEF magazine (Martin et al. 2019). From the group of subscribers, 1,414 completed responses were recorded and analyzed, giving it a 3.43 percent response rate. The survey looked at demographic information, management decisions, marketing, and animal selection criteria. Regarding marketing, the survey included questions looking at the age animals were marketed, what avenues were used to market, the process of specific sales of livestock, openness to source and age verification of animals, and openness to quality assessments.

The Martin et al. (2019) survey data was broken down into size categories by herd size. These categories were then compared against each other to determine the participation within different diversification options. The different options included animals as replacements, sold at weaning, backgrounded, and finished. Martin et al. (2019) found that no matter the size of the operation, 15-20 percent of the herd was held

for replacements. Regarding those sold at the time of weaning, operations of size 0-50 and 501-1000 both sold close to 30 percent of their calf crop and operations larger than 1000 sold only 15 percent of the calf crop. The next diversification choice was backgrounding. All the operations backgrounded anywhere from 30 to 40 percent of the calf crop. Lastly, it was found that the operations of 0-50 animals and larger than 1000 animals were most likely to retain ownership through the finishing stage. The assumption of Martin et al. (2019) was that the smaller operations react in this way because they may be directly selling finished beef products to consumers. Larger operations retain ownership through the finishing process because they have the financial ability and bargaining power to participate in the finished cattle market. Backgrounded calf sales are shown to be the largest form of sale amongst operations 51-500 with close to 40 percent of the producers in this category selling in this way (Martin et al. 2019). This could be caused by the ability to transport and sell cattle as well as other factors.

The article goes on to discuss a constraint facing smaller operations regarding selling abilities. It examines the issues of transportation and video marketing for private buyers. Transportation is completed using semi-truck and trailers that are allowed a certain weight, which typically equates to 72 yearling calves (Martin et al. 2019). Individuals seeking to purchase calves are looking for large numbers to fill semi-trailers, making transportation a limiting factor for small producers. This could contribute to the reason approximately 81 percent of individuals in this survey used local auction barns when selling the calf crop. The local auction barn can sell any number of cattle from any individual buyer, allowing sellers to ship cattle in any quantity desired. Little, Forrest,

and Lacy (2000) also found that large numbers of people are using the local auction barn with 75 percent of their responses using an auction barn.

Of the four marketing options producers could choose for their calf crop (sell animals as replacements, sell at weaning, backgrounded post-weaning, and then sell, and sell after finishing), "backgrounded post-weaning, and then selling" was the highest response with 50.3 percent of responses (Martin et al. 2019). It is difficult to determine the length of time animals were backgrounded based on the questions asked in the survey. The second highest response rate was "sold at weaning" with a response of 35.7 percent followed by "replacements" and "retained through finishing" both having a 24.6 percent response (Martin et al. 2019). Individuals could answer to more than one of these choices, but this gives an overall view of marketing practices.

Martin et al. (2019) also examined key parts involved in the marketing of livestock and it was determined that risk-averse individuals are three times more likely to sell calves at the time of weaning, and those who are considered most risk-tolerant have less than 20 percent chance of selling their calves at weaning. Along with this finding, it also became clear that producers who were already using good management practices are likely to be using multiple good management strategies.

While Martin et al. (2019) were looking at the size of operations and its impact on sale opportunities, it is important to note another study that was done years prior recognizing some other barriers that may be associated with selling calves after a period of backgrounding. In an article written by Popp, Faminow, and Parsch (1999), the topic of farm diversification was addressed through value-added practices. A logit model was used to examine the relationship of operational characteristics to actual decisions made

on the operation. The model was created using survey data from a 1996 mailed survey to cow-calf producers. The producers all had operations between the size 50 and 1000 animals in Arkansas. Of the producers, 71 percent had herd sizes of 50-149 cows. They found that 60 percent of respondents were between the age of 41 and 60 years old and that only 3.9 percent of respondents completed a college education (Popp, Faminow, and Parsch 1999). This survey received a 42.3 percent response rate and represents 40 percent of beef producers and close to 80 percent of the cattle in Arkansas (Popp, Faminow, and Parsch 1999). The responding producers were grouped into two major categories based on their responses. The groups were labeled as "traditional cow-calf producers" and "value-added producers." Researchers define a "value-added product" as the ability to background or finish out cattle past the date of weaning. The groups were asked about age, education, location, calving season, and decision choices based on current operation design. These questions were used to see what producers considered hurdles when looking at continuing value-added products in their operation.

Popp, Faminow, and Parsch (1999) looked at two specific parts of a backgrounding operation to distinguish traits that prevented more producers from backgrounding. The first was the high cost of financing a feeding operation. When this was examined, producers who were practicing value-added production methods (retention) did not consider financing the feeding operation as a significant reason for their decisions. The second barrier to entry was access to facilities for feeding and growing the calf crop. This is a barrier because of the high cost of equipment, facilities, and feed sources necessary to background and feed cattle.

Popp, Faminow, and Parsch (1999) determined that livestock producers are motivated by profits and therefore the idea of diversifying by retaining ownership made sense to many producers, even if it was not something they were currently doing. This study determined that the cost of backgrounding facilities plays a major role in this decision. The survey results and model showed that producers were willing to invest in backgrounding operations if they see the decision as profitable and that it does not increase price risk while still being a physical possibility on their operation.

By grouping the responses in this survey, the researchers were able to distinguish how producers reacted to the given market options. Most responses saw value in retaining ownership or backgrounding, but the risk preferences of some individuals prevented them from seeking the facilities and/or the financing often required to perform such actions. This is consistent with the findings of Martin et al. (2019), who determined that risk-averse individuals have a high probability of selling calves at weaning. If an operation understands its risk preferences, it can also be helpful to look at how diversification can play into the tools used by producers to manage their risk.

Gilliam (1984) found that 64 percent of calves in the U.S. were being marketed at the time of weaning. Later research conducted by Martin et al. (2019) and Popp, Faminow, and Parsch (1999) also found that most cattle are sold at the time of weaning. Gilliam also found that while 36 percent were retaining calves past weaning, almost no producers were retaining through the finishing stage (Gilliam 1984). Thirty-five years later, the Martin et al. 2019 study found that approximately 25 percent of respondents were retaining ownership through the finishing stage.

From Gilliam's findings, Schroeder and Featherstone (1988) looked at risk management in the form of retention activities. They saw that some individuals used hedging for 100 percent of their risk management strategy. This was viewed as a way producers could reduce price risk. The decision for retention was interdependent on the marketing alternatives available. This would make sense, as other researchers have similarly noted that the decision of how to market livestock is impacted by the choice to diversify (retain in this case) in their herd. So, Schroeder and Featherstone created a model that would look at the impacts of retaining and its relationship to the use of hedging and futures. The study tried to determine what happens to the use of hedging and futures contracts when producers retain ownership of larger numbers of the calf crop.

Their model was a discrete stochastic programming (DSP) model to look and find retention and marketing decisions for cow-calf producers. The model was set up to create different environments and test what options would provide the best returns to the operator. The assumptions used included three different pricing strategies: cash, futures, and options markets. The environment used was set up through a computer model creating 10 states of nature. The states of nature define what is occurring in a marketplace. The prices for the livestock were considered stochastic, meaning they had a random probability of occurring, while operating expenses were held constant. From these assumptions, it was found that in times of high profits, it made sense to sell steer calves and retain heifer calves as replacements to grow the size of the herd. This would enable the producer to receive the greatest prices for steer calves (Schroeder and Featherstone 1988). It was also determined that when profits are low, it makes sense to retain ownership until the finishing stages to capture the largest share of the cost and

benefit of the crop before finishing. They stated that although retaining ownership may make sense, it is not always adopted because of producer risk preferences and facilities. A similar conclusion was found by Popp, Faminow, and Parsch (1999), stating that producers saw value in retaining ownership but that facilities were a barrier to entry. In the conclusion of this article, it was stated that when ownership of calves is retained, profits are often greater, as is the risk associated with retaining the animals. Schroeder and Featherstone (1988) determined that when calf retention increases, so do the use of hedges and futures contracts.

Schroeder and Featherstone's model is consistent, concluding that risk-averse individuals are less likely to retain ownership of a calf crop. Popp, Faminow, and Parsch (1999) used this research to say a cow-calf operation's overall risk can be reduced if backgrounding takes place and that there is a risk versus reward associated with all marketing and diversification decisions.

Price Determination vs. Price Discovery

The next topic of interest is looking into the relationship between supply and demand and why the two work together to examine price determination. An article written by Ward and Schroeder (2009), faculty from Oklahoma State University and Kansas State University, examined what is impacting the pricing issues seen in the livestock industry. The article takes a broad look at what is involved in cattle prices. In a simple form, Ward and Schroeder break down price determination into a supply and demand function. Supply and demand lead to price determination and that provides the foundation for any subsequent price discovery when it comes to livestock marketing because all price discovery bargaining is based on a reference price that was determined

by supply and demand. The article looks at what causes beef prices to vary. Ward and Schroeder (2009) determined that price variability is caused by the variance in input prices such as grain and feeder cattle. They also say that both technology and expected prices of the output result in a change in the supply. This makes sense for the marketplace as producers make decisions based on forecasting and outlook. The livestock industry is not a market that can transition based on demand as quickly as other industries, thus causing variability in prices. Ward and Schroeder note that price variability can come from competing products, consumer tastes and preferences, and the available income of consumers. The understanding of preferences and producer decision-making helps in the understanding of price determination (Ward and Schroeder 2009).

The article further explains the idea that when supply is increased (more cattle available or ready for market), the price is likely to decrease if demand stays constant. Much like if consumer preferences for poultry, a competing product, rises, the demand for beef is likely to fall which would also cause a decrease in the price of beef products. The final idea addressed in this article deals with price discovery. This means that buyers are willing to bid, and sellers are willing to offer different prices on any given day (Ward and Schroeder 2009). The article concludes that prices for livestock products are a result of price determination and not price discovery. It is important to understand the idea of supply and demand for these markets because the reason options are looked at is to add value or reduce risk and that can influence the decisions made by the end consumer. Since the producers cannot control what consumers utilize as a food source, it is important for the producer to be aware of their options and how they can protect

themselves in the event of the consumer's income changing or their preferences changing.

Risk Management Tools Available

There are several risk management tools available for producers to use to manage market price risk. An article written by Feuz, Feuz, and Feuz (2013) discussed many different options available for livestock producers when it comes to marketing. The article goes through the many sources of market risk and the different strategies available that can be used to help manage this risk. The article goes over the reasons these sources of risk are evident in the marketplace and keys in on the volatility of the market itself. This article shares what the market has done in the Utah area and how it has changed over time. It looked at the years 2007 through 2011 and tracked the market price monthly. The research by Feuz, Feuz, and Feuz (2013) shows that the prices were consistent when moving month to month, but that between years, there was some variability. The year 2011 appeared to have the highest prices, but this was also partially due to it having the largest amount of volatility.

After discussing volatility and risk associated with the market, this study examined and explained the available tools that can be used in marketing livestock. It discusses auction barns and the effects of the location of a barn being a determinant of what cattle are taken to an auction. A key discussion point about auction barns in this article is the use of regional auctions or much larger auction barns. These provide a larger number of animals to be available, a larger number of buyers to be present, and an increase in competition for cow sales. Little, Forrest, and Lacy (2000) explained that 75

percent of producers market at local auction barns. This can contribute to a large number of animals available for sale, which can impact the way cattle are bought and sold.

Additionally, Feuz, Feuz, and Feuz (2013) and Little, Forrest, and Lacy (2000) both discussed the use of video auctions and the benefits of this system. Video auctions help with the issues of shrinkage and transportation to the auction. Further, video auctions help allow the buyer and seller to arrange delivery dates and times. Feuz, Feuz, and Feuz (2013) go into the use of niche markets and being able to create a differentiated product and utilize marketing channels to best benefit a specific operation. By differentiating a product, it implements the idea of diversifying the animals sold. Feuz, Feuz, and Feuz (2013) further explained other avenues to manage an operation's risk including the use of Livestock Risk Protection Insurance (LRP).

Diving deeper into LRP, an article written by Fields and Gillespie (2008) discusses the results of a study introducing Livestock Price Insurance (LPI). LPI was a pilot program started in the United States in 2000 with the goal of reducing price risk to livestock producers. It was created in part with the Agricultural Risk Protection Act of 2000 and is referred to now as Livestock Risk Protection Insurance or LRP insurance (Fields and Gillespie 2008). In this study, they conducted 52 in-person interviews with Louisiana producers examining different economic scenarios and their use of a Livestock Price Insurance. This study ran a tobit model and a univariate probit model to estimate and evaluate the association between producer characteristics and LPI purchase decisions. Of the responses, 90 percent used auction barns to some level while 54 percent used private buyers and 33 percent used video auctions. This high percentage of auction barn usage is consistent with the findings of Little, Forrest, and Lacy (2000). Of the 52

responses, more than half said they checked futures prices, and 89 percent said that LPI would be beneficial in their operation (Fields and Gillespie 2008).

This article also looked at marketing resources used by these producers and determined that producers who currently use video marketing or forward contracting would likely use LPI because these risk strategies can be viewed as complements when looking for price protection (Fields and Gillespie 2008). The risk strategies discussed are all used by producers who likely have had experience with futures markets. These producers are typically the operations of a size to handle more opportunities and have a greater level of confidence with the tools. Producers who choose not to use these price risk tools likely do not have the expertise to utilize the tools or as Fields and Gillespie (2008) said, they may have a "hobby farm mentality." The study used a two-limit tobit economic scenario to statistically determine that individuals with more experience in other tools, and higher age (more experience) were more willing to use a program like Livestock Price Insurance.

Much like Livestock Price Insurance, the use of grid and dressed weight pricing can be overwhelming to producers because of the lack of knowledge or comfortability with the process. An article written by Schroeder and Graff (2000) for the *Review of Agricultural Economics,* discusses the importance of looking at different ways to market livestock. This article aims to deepen an understanding in the use of grid and dressed weight pricing when marketing livestock. Schroeder and Graff (2000) look at the relationship of revenues on operations with respect to the tools being used in the marketing process. It compares a traditional use of live weight marketing to the use of dressed weight and grid pricing.

Schroeder and Graff (2000) review similar studies looking at the relationship of grid pricing to traditional methods and the need to look at other marketing methods saying, “Beef demand has declined substantially over the past several decades” (Schroeder and Graff 2000, 89). They are saying this with the knowledge that the demand for beef products has decreased due to increase in substitutes available, changes in lifestyles, food safety concerns, and product convenience. All of these are reasons producers should be planning and looking into alternative ways to market their livestock inventories.

This specific study looked at 11,703 head from a feeding operation in the Midwest and tracked marketing through use of a packer (Schroeder and Graff 2000). Factors used to find information in comparison were pulled from packer sheets describing carcass quality, weight, and revenue. From the information collected and the different marketing options, the data was put together in a regression model to determine the importance of the different factors in the animal performance. Researchers determined that selling cattle using a grid results in nearly twice the variability in price across carcasses relative to selling all cattle either live or dressed weight (Schroeder and Graff 2000, 93). They later translated this into a value comparison to determine the impact of grid pricing. The grid pricing provided a $3.87/cwt greater price than live pricing and a $2.31/cwt greater price than a dressed price. This test provided a great observation into the power of grid pricing and motivation for operations to look further into new alternatives (Schroeder and Graff 2000, 96).

Schroeder and Graff (2000) allow for a better understanding of the variation in price across the year as well as the difference in larger number of herds. When looking at

the marketing of an operation, size of inventory (herd size) plays a key role in the availability of options, which is why having the ability to contract grid and take cattle to the stage of finishing is difficult for the operations of middle size.

No matter the size of the operation, marketing can be one of the most challenging things to do, but with the right education and the right teacher, it can help make the process more attainable. Therefore, it is important for researchers and educators to be aware of where producers stand on understanding these issues.

Conclusion

This chapter reviewed literature studying the impact of many different marketing tools: the use of livestock risk protection insurance to prepare for fluctuations in market price, the use of cash markets, local sale barns, and the use of forward contracting in the industry. A lot of the data collected in research of cow-calf operations is done through survey data. Surveys provide a great avenue of collecting information. From the research above, it was found that there is a gap in the education shared between the producers and extension educators. This was shown through Hall et al. (2003) saying that young producers have a desire for more education and Little, Forrest, and Lacy (2000) explaining how there are many educational tools that are not being used by the producer.

Along with a disconnect in education, Little, Forrest, and Lacy (2000) and Martin et al. (2019) determined that economies of scale play a key role in marketing strategies of an operation. Larger operations have access to markets that smaller producers may not. For the smaller producers to gain access, they may have to partner with neighbors to be able to compete. This can be a setback for smaller operations and can make their products less desirable to buyers. Previous research has shown that most cattle are being marketed

at the time of weaning and through local auction barns (Martin et al. 2019; Popp, Faminow, and Parsch 1999; Gilliam 1984). This is consistent with findings in the upcoming chapters showing a low participation in price protection activities and low use of diversification. Popp, Faminow, and Parsch (1999) stated that producers are motivated by profit and are willing to make changes if it is followed by increased profit and lower risk.

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Chapter 2: Nebraska Cow-Calf Marketing and Risk Management

Introduction

Marketing is the process that brings together buyers and sellers to exchange something of value at a mutually agreed-upon price. For cattle, the price can vary depending upon season, location, and cattle characteristics. Price may also depend on each participant's supply and demand situation and projections at the time of sale. Because supply and demand change over time, marketing decisions can mitigate some market risks for producers while simultaneously exposing them to others. A large amount of attention and planning is given by producers to decisions related to production (i.e., when to wean, what heifers to keep back for breeding, what feed to use, etc.). Comparatively, little planning or attention is typically given to effective ways to market cattle.

Marketing decisions take effort and planning to effectively mitigate price risk and improve the likelihood of profitable outcomes. Producers often feel there is little they can do to impact the price received for cattle. As individual operations, producers have no impact on the overall cattle market situation. However, producers can implement marketing strategies that significantly influence the prices received from given market situations. This is where the benefits of good marketing practices come to fruition.

A marketing plan provides clear objectives, a good set of alternatives, and a plan of action on how to use the available alternatives to mitigate market risk and uncertainty. These plans range from simple to complex, depending on a producer's situation and desired level of detail. Simple marketing plans can be quite effective, especially since producers are not likely to do well implementing advanced marketing strategies whose

sophistication is greater than their comfort level and understanding (Peel and Anderson 1992). Since the cattle industry follows seasonal price patterns, but market conditions can vary greatly between years, marketing plans should be flexible and easy to update as market conditions change (Brooks, Parsons, and Jansen 2017).

Marketing plans are particularly important to cow-calf producers who make breeding herd decisions years in advance of selling animals. For example, between 2012 and 2014 cattle prices spiked higher. However, from 2015 to 2017 cattle prices dropped back to the level seen in the time period before 2012. For cow-calf producers, breeding herd investments and production time lags make adjustments to changing market conditions difficult. Thus, a set of marketing strategies and/or tactics that are implemented in the course of day-to-day business to address this type of price uncertainty can be formalized into a marketing plan to stabilize pricing outcomes and provide operational risk management protection in times of extreme uncertainty. The purpose of this chapter is to address how frequently marketing strategies are used by Nebraska cow-calf producers and how these strategies impact risk and ultimately ranch profitability.

Methods

Survey Design

In 2016, the University of Nebraska-Lincoln (UNL) Department of Agricultural Economics and Nebraska Extension conducted the *2016 Nebraska Cow-Calf Producer Survey* asking about production and management practices cow-calf producers engaged in during 2014-2015. One goal of the survey was to understand marketing strategies employed by cow-calf producers that could help guide future extension programming and outreach. The survey was developed to parallel the principles and ideas created by

previously completed cow-calf surveys in 1991 and 2001. The 2016 survey asked Nebraska cow-calf producers about their operation, record keeping, marketing strategies, breeding, replacement, and haying and grazing decisions.

The survey was distributed to 5,123 Nebraska cow-calf producers using a mailing list consisting of county-level data gathered by University of Nebraska-Lincoln Extension faculty and staff. The sample population met the criteria of being at least 19 years of age and operating a Nebraska farming or ranching operation that includes a cow-calf livestock enterprise. The survey instrument was mailed to the sample population with an informed consent letter, self-addressed postage-paid envelope, and a cover letter explaining the purpose of the survey, directions for completing and returning the survey instrument, and assurance that all surveys responses were voluntary and completely confidential. Three weeks after the primary mailing, a secondary mailing of the survey instrument, informed consent letter, self-addressed postage-paid envelope, and cover letter were mailed to sample participants who had yet to return the survey instrument. Sample participants who did not return the survey instrument from either one of the first two mailings received a follow-up postcard via U.S. mail three weeks after the second mailing of the survey instrument. The postcard asked the participant to complete and return the survey instrument and provided additional instructions to request a replacement survey instrument if prior mailings were not received, damaged, or lost before being returned. Of the surveys sent out, just over a 1000 were completed giving this survey approximately a 20 percent response rate. For this analysis missing information in survey responses was removed. The number of fully completed responses was 881 or 17.19% of the surveys sent.

Survey Participants

Fifty-one percent of the operations responding indicated that income generated from the cow-calf operation supported one household full- or part-time (Table 2.1). Forty-two percent of operations supported two households and seven percent of operations supported three or more households. More than 62 percent of operators identified themselves as ranchers and 38 percent identified themselves as farmers with livestock. Operations tended to have a primary manager living onsite (91 percent) who was older than 45 years old (82 percent). The average age of managers was 57.6 years old. This age is similar to the 57.8 years of age reported as the Nebraska average age of primary producers in the 2017 census (NASS 2020). Finally, nearly 73 percent of respondents reported having an education beyond high school while 49 percent reported having a college degree. By comparison, the U.S. Census data of 2010 reported 31 percent of Nebraskans had a bachelor's degree or higher (United States Census Bureau 2020). This indicates a relatively higher level of education among Nebraska cow-calf producers responding to this survey. The survey was modeled after previous University surveys conducted in 1991 and 2001 with a wide range of questions designed to help extension educators understand more about current production practices on Nebraska cow-calf operations. Thus, marketing decisions and risk management were not the focus of the survey. Only later did the idea to investigate these topics more extensively as a focus of this thesis become relevant which somewhat limits the data available for this analysis.

Marketing Methods

From the information collected in the 2016 survey and some additional understanding of livestock operations in Nebraska, responses could then be analyzed to understand the decisions being made by producers. Cow-calf operations were classified by their use of price management tools and market diversification. Price management tools include forward contracts, futures and options contracts, and Livestock Risk Protection (LRP) insurance. Information regarding the use of these tools was specifically asked for in the survey (see Appendix C). Questions about this topic were examined and respondents were identified as engaging in price management if they indicated the use of one or more price management tools. The operations doing some combination of selling calves at weaning, selling backgrounded calves, and retaining ownership of calves during feeding were classified as having market diversification.

Given these classifications, four producer categories were created: 1) no price management and no market diversification, 2) market diversification with no price management, 3) price management with no market diversification, and 4) both price management and market diversification. Table 2.2 summarizes the relative prevalence of each marketing strategy. Most operations (58 percent) use neither price management tools nor market diversification to manage market risk. These operations simply sell weaned calves on the cash market, typically at a local sale barn. Twenty-two percent of all operations used at least one price risk management tool.

Price Risk Management Tools

Price risk management tools are best understood through the relationship between the (local) cash and the national market, more commonly known as the futures market. Basis is the local cash price minus the national futures price (i.e., Basis = Cash –

Futures). Thus, a cattle producer can think of their local cash price as being a combination of the futures market price and the basis (Cash = Futures + Basis). In most areas of the United States, basis is typically a negative number (Futures > Cash). However, in Nebraska, basis can often be a positive number (Cash > Futures). It is important to clarify the relationship between cash and futures prices when discussing the basis as people often report it as a positive number regardless of the actual relationship between cash and futures prices (Cash > Futures or Futures > Cash).

Cow-calf producers typically receive the best knowledge about the cash price at the local sale barn during a competitive auction. This allows producers to have a better understanding of local cattle supply, demand, and ultimately price. Sale barn auctions are typically set up in a central location that gathers buyers and sellers to determine the value of cattle based on quality, frame, lot uniformity, and origin. Selling price can vary given current market conditions and reflects the local demand buyers have for a set of cattle characteristics on a given day at a specific location. The producer of the cattle incurs all the price risk when selling at the local sale barn. If prices are relatively high on a particular sale day, more money is made, but if prices are relatively low, less money is made. These outcomes vary by day and can be a result of market timing, weather, and participation by buyers and sellers.

One tool to mitigate this full exposure to price risk that can be found in a sale barn or cash market is to use forward (cash) contracts such as video auctions. Cattle sale price is still subject to what buyers are willing to pay at a given point in time. While a video auction allows prices to be determined based on a given point in time, it does not often result in immediate delivery of the animal. This means that when a cash contract is

executed, the seller agrees to deliver a type of cattle (feeder cattle, fed cattle, etc.) on a given date with a given price "slide". The price slide is an adjustment of the effective contract sale price to ensure cattle are priced at the fair market value given their size and classification upon delivery. Cash contract agreements lock in a sale price subject to an agreed-upon slide adjustment scheme thus eliminating any price risk in cash, futures, and ultimately basis.

Another tool that can be used when looking at cattle is if a producer decides to retain ownership in a feedlot, they can use cash forward contracts to mitigate fed cattle price risk. There are several choices for pricing in a cash-forward contract. It is most common for the agreed-upon price to simply be applied to the live weight of the animal. Some fed cattle contracts may involve pricing on a grid or carcass basis. Grid pricing is a method where prices are based on specific characteristics of the animal. This option allows the value of the livestock to be individually determined for quality instead of the overall value assigned to a total group. A contracted carcass price is similar to a contracted live price, but the agreed-upon price is applied to a carcass weight after the time of slaughter. A contracted carcass price assigns the risk of dressing percentage to the seller whereas a contracted live price assigns that risk to the buyer. In all forward contract cases, a buyer and a seller create a contract agreeing that delivery takes place for a specific quantity of live cattle on a predetermined date and at a predetermined price. Thus, all these are classified as cash contracts because they lock in a cash price, eliminating any risk associated with a change in national prices or the local basis.

Feeder and fed cattle futures contracts can be bought and sold on the Chicago Mercantile Exchange (CME). Producers can use these contracts to protect themselves

from the impact of fluctuations in the national market price. Producers sell futures contracts (i.e., “going short”) to buyers who are willing and able to take delivery of cattle (i.e., “going long”) at a defined date in the future. This provides a price “hedge” which protects the producer against the risk of a falling national price. The CME provides a platform for producers to “offset” a futures contract position with an equal and opposite transaction before the delivery date. If prices move lower, the offsetting transaction provides a profit to the producer that will help compensate for lower cash market prices. If prices move higher, the offsetting transaction produces a net loss that in turn is compensated for by higher cash market prices. Regardless of the directional movement of the national CME price, producers will have “locked-in” that component of their local cash price. This risk management technique exposes producers to basis risk. If basis is stronger (i.e., gets more positive relative to the expected basis at the time of the hedge) then the actual price received increases. However, if the basis is weaker (i.e., gets more negative relative to the expected basis at the time of hedge), then the actual price received will be less than expected based on the “locked-in” price.

Rather than entering a futures contract to sell cattle, producers may also enter an options contract. A buyer of a put option contract obtains the right, but not the obligation, to sell a particular futures contract at a specified price at any time between when the option is purchased and when the option expires. Put options protect against falling prices by providing the buyer the option to sell a futures contract at a given price, commonly referred to as the “strike price”. The cost (i.e., premium) to purchase an option varies by how much time is left before the option expires (time value) and how much the strike price differs from the current futures price (intrinsic value). As a rule, options that can be

exercised farther into the future or carry a higher intrinsic value are more expensive. In essence, a put option creates a minimum price received for cattle sold where the minimum price is the strike price minus the premium paid. If national prices are below the strike price, it allows the producer to exercise (buy and then offset a futures contract) or sell the put option at a profit to help compensate for lower cash market prices. If national prices rise, then the price protection is not needed and the put option owner is not obligated to do anything and can allow the option to expire. Since exercised options allow a position in the underlying futures markets, producers are still exposed to basis risk, but it does give them opportunities to capture favorable futures price movements.

Some producers have chosen not to use futures or options because of the perceived complexity involved with conducting transactions on the CME. These complexities include the requirement to have a relationship with a CME clearing member (i.e., through a brokerage firm), the need to establish and maintain a margin account to cover trading positions, and the standardized contracts for feeder cattle (50,000 pounds of 700 to 899-pound feeder steers) and fed cattle (40,000 pounds of 70 percent choice, 30 percent select grade live steers or live heifers at a slaughter weight between 1,050 and 1,500 pounds). In response, the USDA developed the Livestock Risk Protection (LRP) insurance contract as a flexible but simplified price risk management tool for producers to use. Through licensed livestock insurance agents, producers can purchase a government subsidized LRP insurance policy that protects a percentage of the expected national price index for a specific number of head of livestock for a specific end date. If at the end of the coverage period, the national price index falls below the price coverage level, an indemnity payment is made to the producer to cover the price difference.

Producers are not required to sell the insured cattle as a condition of participation in the program, so the cattle can be retained and potentially insured again beyond the end of the coverage period. LRP protects against a drop in national price once again leaving the producer subject to basis risk.

Market Diversification

Diversification is another separate and distinct form of managing risk within a marketing plan. Market diversification is defined by whether an operation engages in more than one value-adding enterprise. Market diversification was measured in the survey by the response to a question about what was done with weaned calves (see Appendix C, question 8). A cow-calf producer who retains part of his/her weaned calves is spreading out sales from that year's calf crop and considered to be diversifying the livestock they raise. This in-turn diversifies risk across different points in time of a changing market. The fact that the retained calves will be sold into a different market than the weaned calves provides risk management benefits from market diversification. Retaining animals also involves retaining both price and production risk in those animals. However, diversifying sales into multiple markets provides a counteracting reduction in price risk if those markets are not perfectly correlated with one another. On the survey, cow-calf producers were asked to report the percentage of their weaned calves that were sold at weaning, backgrounded, and/or put into a feedlot with retained ownership at the time of weaning. Selecting more than one of these enterprises was an indication of market diversification. The assumption was made that producers were choosing to diversify for the dual purpose of capturing additional profits and reducing exposure to

market risk. Diversification, as a marketing strategy, allows producers to rely on multiple sources of income and be responsive to market movements.

Results

While analyzing the 2016 survey, we came across responses that did not have questions answered. We determined that for this study, we would remove the surveys from individuals who did not answer the questions we were interested in because our analysis would utilize the surveys without imputing any data.

We assessed how producers use pricing tools and/or market diversification to mitigate price risk. Table 2.3 displays the percentage of Nebraska cow-calf operations that engaged in price risk management and/or market diversification by age, education, and type of operation based on responses by the primary manager of the operation. Columns 2 to 4 indicate whether calves were all sold at weaning, backgrounded, or retained ownership in the feedlot, respectively. The total column under *No Market Diversification* is the sum of these operations which were classified as having no market diversification because all animals marketed fit into one classification. The columns under *Market Diversification* indicate the multiple markets an operation is engaged in. The total column under *Market Diversification* indicates the percentage of diversified operations represented in each row. Under each subcategory of age, education, and type of operation are the two price management strategies of "No Pricing" and "Any Pricing". "Any Pricing" indicates that producers used one or more of the price risk management tools: forward contracts, futures, options, or LRP.

For operations with no diversification, age was an indicator associated with the use of pricing tools. For producers with no market diversification, the percentage of producers reporting the use of pricing tools was twice as high for producers younger than 45 years old (34 percent) than it was for producers older than 60 years old (17 percent). One explanation for this difference may be that managers under the age of 45 are less willing or less financially able to remain fully exposed to local cattle price risk. In the absence of market diversification, the importance of using pricing tools to manage risk appeared to be magnified.

Surprisingly, level of education was not an important factor associated with the use of pricing tools. Whether or not a producer had completed at least a minimum amount of college education had little impact on their reported use of pricing tools regardless of whether their cattle operation was market diversified or not. This could be an indication that producers receive education on cattle price risk management tools from extension programming and other informal educational opportunities rather than from formal college coursework. Another interesting correlation to note, is that more than 70 percent of producers who indicated using price risk management tools, regardless of the level of education, were involved in selling backgrounded calves either exclusively or as part of a diversified cattle operation, showing that many cow-calf operations are engaging in some type of backgrounding program following weaning.

Level of education and type of operation were not strong indicators associated with the use of pricing tools for managers who also were using diversified marketing. For example, five to six percent of producers in every age category were managing diversified operations and using pricing tools. Likewise, type of operation and level of

education did not seem to be an important determinant for use of pricing tools if their cattle operation was diversified. This could be because producers with market diversification feel they are managing price risk best with diversification rather than using pricing tools. However, there is a tendency for managers with market diversification who sold calves at weaning and backgrounded cattle to be more likely to use pricing tools compared to other diversified operations. This result indicates diversified producers who took some of their animals to the fed cattle market were more willing to shoulder the risk without the use of pricing tools. This could indicate a perceived increase in market diversification benefit resulting from marketing animals in the fed cattle market as well as the feeder cattle market classification.

Comparing market diversified and non-market diversified operations, cow-calf operations that were not market diversified (i.e., focused on sales into a single market) were more likely to use tools to manage price risk. For example, 73.03 (48.03 + 25.00) percent of producers younger than 45 years old had no market diversification. Of these, 34.23 (25.00/ 73.03) percent used pricing tools. This was more than 1.5 times higher than the 19.53 (5.27/ (21.71 + 5.27)) percent of producers younger than 45 years with market diversification who used pricing tools. Likewise, regardless of educational status, non-diversified operations tended to use pricing tools more often than market diversified operations. However, those managers who identified themselves as ranchers tended to use pricing tools in the same frequency regardless of their market diversification status. Ranchers with no market diversification and ranchers with market diversification were both about 20 percent likely to use pricing tools. This means that market diversification is more of a primary tool for managing price risk exposure for producers who identify

themselves as ranchers. Meanwhile, producers who identified themselves as farmers with livestock were less likely to be diversified but more likely to use pricing tools to manage risk.

Conclusion

The *2016 Nebraska Cow-Calf Producer Survey* indicates that approximately 25 percent of the operations use diversification and 22 percent use pricing tools to manage price risk. The age of the primary manager was a key indicator associated with using pricing tools for non-market diversified operations whereas it had little impact on the tendency for market diversified operations to use pricing tools. Overall, non-market diversified operations tended to use pricing tools more than market diversified operations. The one exception to this tendency was cow-calf operations managed by people who classified themselves as ranchers. Approximately 20.37 (14.55 + 5.82) percent of ranchers use pricing tools regardless of diversification status.

The information displayed in this chapter has been aimed to help educate cow-calf producers on some of the available options for managing market risk and show what Nebraska producers have recently been doing to manage price risk. Livestock markets are constantly changing because of the variety of factors that affect supply and demand relationships. As markets change, marketing plans can be used as a tool to help producers manage price risk and protect cow-calf operations from financial difficulty. Our survey results indicate that almost 58 percent of Nebraska cow-calf producers are not managing this risk with either pricing tools or diversification strategies. While every year produces new challenges, recent examples like the Holcomb beef processing plant fire and the

COVID-19 pandemic illustrate how quickly markets can shift and expose livestock operations to significant financial risk.

Our results indicate only a small number of Nebraska cow-calf producers are actively engaged in managing market risk, exposing the industry to potentially significant financial stress on an annual basis. This information reviewed in this chapter has shown that there seems to be a need for additional help to more pro-actively manage risk on operations, thus producers should use this as motivation to engage with educators to learn more about how to best utilize price risk management tools in their operation without fear of being viewed as underperforming operations when it comes to managing price risk.

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Appendix A

Table 2.1. Demographics of primary managers represented in the 2016 Nebraska Cow-Calf Producer Survey Results (*n* = 881)

Demographic	Operations (%)	Operations (n)
Households supported		
1	50.86	441
2-3	41.58	366
4-5	5.84	51
> 5	1.72	15
Characterize Operation		
Rancher	62.43	550
Farmer with livestock	37.57	331
Manager on site		
Yes	90.58	798
No	9.42	83
Age of Primary Manager		
< 30	2.56	22
30-44	15.02	132
45-60	40.09	353
> 60	42.39	374
Level of Education		
Less than High School **High School Graduate / GED**	27.24	240
Some College, College Graduate, or Postgraduate	72.52	638

Source: 2016 Nebraska Cow-Calf Producer Survey

Table 2.2. Marketing strategy classifications and percentage responses from producers completing the 2016 Nebraska Cow-Calf Producer Survey (*n* = 881)

	None	Market Diversification	Price Management Tools	Diversification + Price Management
Diversification[1]	No	Yes	No	Yes
Pricing Tools[2]	No	No	Yes	Yes
Percent of Responses (%)	57.78	19.97	16.80	5.45
Number of Responses (n)	509	176	148	48

[1] Operations doing some combination of selling calves at weaning, selling backgrounded calves, and retaining ownership of calves during feeding.
[2] Operations used one or more of the price risk management tools: forward contracts, futures, options, or LRP.
Source: 2016 Nebraska Cow-Calf Producer Survey

Table 2.3: Marketing strategies by demographics represented in percentage responses to the 2016 Nebraska Cow-Calf Producer Survey (*n*=881).

	No Market Diversification				Market Diversification			
	Sold[1]	Backgrounded[2]	Retained[3]	Total	Sold + Background	Sold + Retained	Backgrounded + Retained	Total
Age of Primary Manager								
Under 45 (n=154)								
No Pricing	15.79	25	7.24	48.03	15.79	1.97	3.95	21.71
Any Pricing	4.61	14.47	5.92	25	4.61	0	0.66	5.27
45 to 60 (n= 353)								
No Pricing	17.87	34.01	2.88	54.76	16.43	2.59	4.03	23.05
Any Pricing	2.02	11.53	3.46	17.01	3.17	0.58	1.44	5.19
Over 60 (n= 374)								
No Pricing	24.87	35.34	4.19	64.4	12.57	1.57	2.36	16.5
Any Pricing	2.09	8.38	2.88	13.35	4.45	0	1.31	5.76
Education of Primary Manager								
Less than college (n= 240)								
No Pricing	24.2	31.05	5.02	60.27	12.79	1.37	3.65	17.81
Any Pricing	2.28	11.42	4.11	17.81	3.2	0	0.91	4.11
Minimum college (n= 638)								
No Pricing	19.34	33.69	3.93	56.96	15.26	2.27	3.17	20.7
Any Pricing	2.57	10.42	3.47	16.46	4.23	0.3	1.36	5.89
Type of Operation								
Rancher (n= 550)								
No Pricing	21.27	33.09	2.55	56.91	18.91	1.45	2.36	22.72
Any Pricing	2.73	9.27	2.55	14.55	4.55	0.18	1.09	5.82
Farmer with Livestock (n= 331)								
No Pricing	19.34	32.93	6.95	59.22	7.55	3.02	4.83	15.4
Any Pricing	2.11	12.99	5.44	20.54	3.02	0.3	1.51	4.83

Notes: [1] Calves are sold at weaning; [2] Calves are backgrounded; [3] Calves are placed in feedlots with retained ownership

Source: 2016 Nebraska Cow-Calf Producer Survey

Chapter 3: Factors influencing Nebraska cow-calf operations use of pricing strategies and market diversification to manage risk

Introduction

The beef industry has a large impact on the Nebraska economy. Nebraska ranks second in the country for the number of cattle and calves. As of January 1, 2020, there were an estimated 6.8 million head of cattle in the state while Nebraska also produced 8.3 billion pounds of red meat in 2019 (Nebraska Department of Agriculture 2020). Livestock plays a vital role in the economy with $11.9 billion in cash receipts from all livestock and products sold in Nebraska in 2018 (Nebraska Department of Agriculture 2020).

The livestock industry and cattle operations face many challenges on a day-to-day basis. These challenges include input and output price fluctuations, weather variability, and raising, breeding, and feeding cattle. A large amount of attention and planning is given to decisions related to production – when will cattle be weaned and at what weight, what heifers will breed back, what feed sources to use, etc. However, comparatively little planning or attention is given to determine effective ways to market cattle. These decisions and efforts take planning and management to lower risk and improve outcomes.

Cattle are marketed in a wide range of ways and places. The value of cattle depends on how much people are willing to pay at the time of sale, comparable recent sales, and current supply and demand trends. The animal value varies by season, location, and cattle characteristics. How a producer chooses to market cattle can mitigate certain types of risk while exposing them to other forms of risk.

This chapter identifies the relationship between characteristics of Nebraska cow-calf operations and their choices of forward pricing techniques and operation diversification as ways to manage market risk using survey data collected in 2016. Previous research has focused on the relationship between the size of operations and the marketing tools being used (Martin et al. 2019 and Schroeder and Featherstone 1988). But research has not been conducted analyzing the relationship between the level of education and the level of experience of the primary operator and their corresponding use of marketing tools. This chapter provides insight for future research into marketing decision-making by cow-calf producers as well as implications for future outreach education decisions.

Background

Livestock Price Risk Management Tools

Price risk management is a management strategy used by livestock producers to manage uncertainty in the market resulting in price fluctuations. An analysis of Nebraska and Texas cattle producers showed risk-averse individuals are more likely to attend educational workshops and that less than half of producers are utilizing futures and options marketing tools (Hall et al. 2003). The analysis also found that producers identified price risk and drought as the two highest risk factors to affect ranch income (Hall et al. 2003). However, when asked to choose the best risk management strategies among nine options, the least two chosen options were forward contracting and futures and options contracts (Hall et al. 2003).

In the United States, ad hoc disaster programs are used to help mitigate the impact of catastrophic events affecting agriculture. Participating in ad hoc disaster programs was

the primary government supported risk management tool available for livestock producers until the early 2000's (USDA RMA). Through the USDA Risk Management Agency (RMA), crop insurance ideas for the livestock industry were discussed and funding became available to look at options in the swine industry and then in the cattle industry. By 2002, a pilot program focusing on feeder cattle was approved. This program was known as Livestock Price Insurance (LPI). Fields and Gillespie did a study in 2002 later published in the *Journal of Agricultural and Applied Economics* looking at the LPI pilot program (Fields and Gillespie 2008). In this study, they did 52 in-person interviews with Louisiana producers examining different economic scenarios to examine their use of a Livestock Price Insurance. They ran a tobit model and a univariate probit model to estimate and evaluate the relationship between producer characteristics and livestock sale decisions. Ninety percent of respondents used auction barns to some level while 54 percent used private buyers and 33 percent used video auctions. More than half of the people interviewed said they checked futures prices, and 89 percent said that LPI would be beneficial in their operation (Fields and Gillespie 2008). They also determined that producers who currently use video marketing or forward contracting would likely use LPI because these risk strategies can be viewed as complements when looking for price protection (Fields and Gillespie 2008). The study used two-limit tobit economic scenarios to statistically determine that individuals with more experience using other price risk management tools, and higher age (more experience) were more willing to use a program like Livestock Price Insurance. These producers are typically the operations that have the size to handle more opportunities and a greater level of confidence with the tools. Producers who choose not to use these price risk tools likely do not have the expertise to

utilize the tools or as Fields and Gillespie (2008) said, they may have a “hobby farm mentality”.

Price risk management has many different forms. One way to handle price risk is using a hedging contract. A hedging contract is typically used to provide more stable returns to the producer than what the producer can obtain exclusively using a local cash market (Pruitt and Riley 2011). Pruitt and Riley studied the use of several different price risk strategies in the southeastern U.S. cattle market and determined that producers using a hedging contract as a price risk strategy often saw greater returns when a hedging contract was created in advance before time of weaning the calf crop. The lack of use of specific price risk tools resulted from a lack of understanding of the products as well as the cost associated with being involved. Pruitt and Riley (2011) determined that hedging can be impacted by the changes in basis but will typically result in stable returns when compared to sales at a local cash market.

Diversification Strategies

Diversification is another strategy used by some cow-calf producers to mitigate price risk in their operation. Diversification for the purpose of managing price risk can be implemented in several different ways. A common way is to use a combination of different pricing tools to price cattle for a specific delivery time. For example, entering a cash forward contract to deliver part of the calf crop to the buyer at some point after weaning while selling the rest of the calf crop on the cash market is a way to diversify. Another way diversification can be used is to vary the time of sale. Often this leads to different products being sold, but it does not have to. For example, a producer may choose to market some calves at weaning and some calves after 30 days of

backgrounding post weaning, while also retaining some calves to feed through finishing. Another producer may choose to maintain both a spring calving herd and a fall calving herd, leading to sales of weaned calves at two distinctly different times during the calendar year.

A 2011 article by Pope et al. discussed the risk preferences of Kansas cow-calf producers and the relationship it had with decisions to retain ownership of calves for longer periods in the growing cycle. Their survey sample showed that 40 percent of producers often or always sell at time of weaning while 44 percent retain through backgrounding and 13 percent often or always retain through finishing. Using a multinomial ordered probit model looking at three different marketing time periods (calf sales at weaning, backgrounded then sold, and retain and finish), they discovered that the most risk averse producers are three times more likely than the most risk tolerant producers to sell calves at weaning (Pope et al. 2011). They also concluded that individuals who considered their operation to have a comparative production advantage (71 percent of respondents) were positively associated with retaining ownership through some level of backgrounding. Those that said they had a production advantage were 15 percent less likely to always sell at time of weaning and 14 percent more likely to never sell at time of weaning (Pope et al. 2011). Finally, they concluded that letting producers know about profit potential and options with retained ownership were not likely to change the producer's behavior without additional risk management considerations (Pope et al. 2011). These conclusions have important implications for diversification since they show that producers are more likely to diversify if they have a higher tolerance for risk,

and if they believe they have a production advantage that differentiates their operation over other cow-calf operations.

Schroeder and Featherstone (1988) created a discrete stochastic programming (DSP) model to look at optimal retention and marketing practices for cow-calf producers. As later confirmed by Pope et al. (2011), they also determined that more risk averse producers see calf retention as less of a priority. In addition, they also found that hedges and options contracts were used more often to optimize profit when calves were retained.

Popp, Faminow, and Parsch (1999) used a survey to look at Arkansas cow-calf operations use of value-added marketing. Value-added marketing was viewed as the willingness to retain ownership of a calf crop to feed and or finish the animal. They used a logit model to view the demographics of farm size, human capital, risk tolerance, costs associated with backgrounding and management of calving period. These demographics were used to view the decisions to create a value-added product. The survey looked at characteristics like size of operation, education, age, location, and experience when looking at the response group. Approximately 71 percent of the response group had herd sizes of 50-149 cows. They found that 60 percent of respondents were between the age of 41 and 60 years old. Interestingly, only 3.9 percent of the respondents had a college education (Popp, Faminow, and Parsch 1999). Other questions specifically focused on access to financing for value-added feeding activities and the feeding facilities available in the operation. They determined that producers who were not currently backgrounding cattle selected cost of financing a feeding operation to be a greater barrier to entry than individuals who currently were backgrounding. The individuals who were already backgrounding selected availability of facilities as the larger barrier to adopting

background and diversification operations. The study concluded that the size of the operation did not play a significant role in the choice to background. Producers were willing to background if they felt it was profitable and the risk was not increased to the operation.

Survey

In 2016, the University of Nebraska-Lincoln (UNL) Department of Agricultural Economics and Nebraska Extension conducted the *2016 Nebraska Cow-Calf Producer Survey* asking about production and management practices cow-calf producers engaged in during 2014-2015. This survey looked at marketing strategies employed by cow-calf producers that could help guide future extension programming and outreach. The survey was developed to parallel the principles and ideas created by previously completed cow-calf surveys in 1991 and 2001. The 2016 survey asked Nebraska cow-calf producers about their operation, record keeping, marketing strategies, breeding, replacement, and haying and grazing decisions (see Appendix C).

The survey was distributed to 5,123 Nebraska cow-calf producers using a mailing list consisting of county-level data gathered by University of Nebraska-Lincoln Extension faculty and staff. The sample population met the criteria of being at least 19 years of age and operating a Nebraska farming or ranching operation that includes a cow-calf livestock enterprise. The survey instrument was mailed to the sample population with an informed consent letter, a self-addressed postage-paid envelope, and a cover letter explaining the purpose of the survey, directions for completing and returning the survey instrument, and assurance that all survey responses were voluntary and completely confidential. Three weeks after the primary mailing, a secondary mailing of the survey

instrument, informed consent letter, self-addressed postage-paid envelope, and cover letter were mailed to sample participants who had yet to return the survey instrument. Sample participants who did not return the survey instrument from either one of the first two mailings received a follow-up postcard via U.S. mail three weeks after the second mailing of the survey instrument. The postcard asked the participant to complete and return the survey instrument and provided additional instructions to request a replacement survey instrument if prior mailings were not received, damaged, or lost before being returned. Of the surveys sent out, just over a 1000 were completed giving this survey approximately a 20 percent response rate.

Data

Figure 3.1 illustrates the percentage of responses from each of the eight crop reporting districts in Nebraska to the 2016 Nebraska Cow-Calf Producer survey. As expected, a large percent of the survey responses came from the northern crop reporting districts along with the Central district where a large amount of the cattle in the state are located. The location of an operation can play a role in use of marketing tools because of local support of specific tools, the feasibility to retain ownership, and operator attitudes toward alternatives.

We examined the size of the operation to determine the relationship with marketing strategies. Little, Forrest, and Lacy (2000) confirmed that size is a factor in the use of marketing tools. The 2016 Nebraska Survey data was grouped into two size demographic categories. The two categories were created based off the Nebraska average cow herd size of 94 head. Because our responses were grouped in different categories than specifically 94 head, our breakdown created a group that was less than 100 head and

those that had more than 100 head. Sixty-six percent of the survey responses were from the cow-calf operations with herd sizes of 100+ head of cows. (Table 3.1).

The 2017 United States Census of Agriculture for Nebraska found an average age for agricultural producers of 57.8 years old (NASS). Our survey found an average age of 57.6 years old making this very consistent with the state average. For this analysis, age was kept numerical and allowed responses to be recorded based off their reported operator age. The USDA considers beginning farmers and ranchers to be individuals who have operated a farm or ranch for 10 years or less (USDA FSA 2020). The 2016 Nebraska cow-calf producer survey indicated at least 7 percent of the surveyed sample could be classified as beginning farmers or ranchers based on the number of respondents indicating less than 10 years of experience. The 2016 survey was distributed to individuals who were known to have cattle, thus this number included operators that self-identify as ranchers or farmers with livestock. Meanwhile, the 2017 NASS data indicated roughly 22 percent of all producers in Nebraska are beginning farmers or ranchers. This includes producers who do not have livestock and therefore, our sample population of Nebraska cow-calf producers had a higher level of experience than is represented by all producers across the state according to NASS data.

Fifty-one percent of the operators responding to the 2016 Nebraska Cow-Calf Producer survey indicated the income generated from the operation was used to support one household full- or part-time. The average number of households supported by the operations represented in the survey sample was 1.9 (Table 3.1). Sixty-six percent of the respondents identified as ranchers while 38 percent identified as farmers with livestock.

Finally, 49 percent reported having a college degree while 13 percent indicated they had a professional or employee hired for financial record keeping.

Survey responses were collected at a time immediately following several years of large disruptions or market changes that could play a part in the decision-making of the operations. In 2012-2013, Nebraska producers experienced devastating drought which led to lower cattle numbers, higher feed costs and high market prices. The year 2014 held the highest cattle prices on record which were followed by a record drop in cattle prices.

Much information collected in the 2016 Nebraska Cow-Calf Producer Survey could be associated with the use of diversification and marketing tools. This included information regarding feed availability and future intentions to liquidate the herd. For example, a survey respondent with future intentions of liquidating their herd may be desiring to get out of the livestock business, so their marketing plans may be different than an individual who has the goal of growing or maintaining the size of the herd. Through the 62 questions reviewed in this survey, 13 of them proved to be highly associated with the use of marketing tools and diversification strategies. These 13 questions included topics of the size of the herd, the age of the producer, the experience of the producer, the education level of the producer, the number of houses supported by the operation, who maintained financial records for the operation, and what feed sources were available in the dormant (non-growing) season.

To determine use of marketing strategies, responses were grouped into four categories. These categories are not weighted, meaning there is no single category that is more important than the others. These four categories are seen in Table 3.2. The first category (1) is that the respondent does not use pricing tools and does not use market

diversification strategies. The second (2) group is individuals who do not use pricing tools but do use market diversification strategies. The third (3) group uses pricing tools but does not use market diversification strategies. The fourth (4) group uses both pricing tools as well as market diversification strategies. From here, a multinomial logistic regression was then used to see how producer demographic information was associated with which marketing group they participated in.

Missing Data

The survey data and additional data used in this analysis were analyzed using R. All data collection, especially with survey data, has the issue of missing data. Missing data presents a challenge for research. Previous work using this dataset did not use imputed values or average values to fill in the missing pieces of information, this was done to find a simple explanation of the results completed for the study. However, this study utilizes tools to help manage missing information. A program within the coding software, known as MICE (multivariate imputation by chained equations) was used to replace the missing values or NA responses within the dataset. The MICE program creates multiple regressions for each missing point of data to fill in what was not filled in by the respondent (Van Buuren et al. 2020). For this study, we created 500 imputations to ensure that we were gaining a wide spectrum of responses for each piece of missing data. We then used the mean value of these imputed responses to replace the missing data found in the study. Before imputing the missing data, the data was reviewed to determine how large of an issue the missing information could be. The original data set was missing 3.7 percent of the responses on operation identification, 2.6 percent of the responses for the number of cows run, 3.6 percent for the number of households supported, 4.1 percent

missing for the age of the operator, 5.5 percent missing for the years' experience by the operator, 3.4 percent missing for education group and the last data point that had missing information was who managed the finances with a 5.7 percent of the responses missing. From these missing data points, it was determined that using the MICE program would be the best use of all data points. Several of the missing answers were from reoccurring survey responses. MICE would allow the data to be preserved and use similar responses to fill in the missing information.

Summary statistics were compared between the original data set and the new imputed data set with the missing data replaced by the results of the MICE program regressions. The results of the two approaches were compared and the largest differences between the imputed responses and original were small enough they did not have an impact on the results. From the results, it was determined that the imputed data set using the MICE program was the most effective way to capitalize on the total amount of responses and surveys that were conducted.

Empirical Model

The examination of operations through the use of pricing strategies as well as diversification were two ways our data would allow us to find relationships in decision making. Using a multinomial logistic regression and the R program, the probabilities of individuals selecting specific operational choices could be examined. The multinomial logistic model is used to examine the probability of a livestock operation *n* to be categorized into one of the four categories in Table 3.2.

$$(1)\ P_{ni} = Prob(Y_{ni} = j) = \exp(X'_n\beta_i) \Big/ [\textstyle\sum_{j=1}^{4} \exp(X'_n\beta_i)]$$

- j = 1,2,3,4 (categories created using combinations of pricing and diversification use)
- exp = exponentiated coefficient (the amount a relative risk is multiplied when variable is increased by a single unit)
- X' = specific regressors
- n = livestock operation (individual)
- β_i = the point estimate multiplied by value of each variable to predict the dependent variable
- *J=1* highest number of responses → base category

The four categories, where $j = 1,2,3,4$, are a decision that the operator decided to make when operating the business. In this case, option one, j=1, the operator decided to use no pricing tools and no market diversification. This is the same as option one from Table 3.2 and is used as our base because it was the most common response, having 502 of the total responses to the survey. The **X**'s in the formula are the specific regressors. The regressors are items deemed important to understanding which of the four categories a producer could be a part of. The ten regressors identified in the first column of Table 3.3 were selected by examining the work of other researchers and the availability of information from the survey responses.

Results

The model used in this research allows four different categories of operations to be examined. The multinomial logistic regression used a base category to examine other regressors that could help researchers find factors that impact the producer's decision to engage in using pricing tools and market diversification strategies.

Table 3.3 shows the results of the multinomial logit model using each of the four categories to display responses. The logit model coefficients with a positive value indicate a more frequent use of a specific combination while those that were negative resulted in a less frequent use of marketing strategies. Many of the responses to this

survey were counted in the base category. The effect of this is that the output values cannot be directly interpreted. This means that a measure of caution must be used when interpreting the values calculated in the logistic regression. This being said, the results suggest we should further analyze and examine the values surrounding operation identification, number of households supported, herd size as well as college education which all showed a significant P value.

From table 3.3, it should be noted that use of pricing tools instead of using neither pricing tools nor market diversification (base case) was associated with individuals who identified as ranchers, operations with a cow herd size larger than 100 head and operations supporting more households rather than less. This would make sense because as an operation increases in size, it becomes more open to the opportunity of private sale and use of non-cash contracts. With more households, there is also a higher likelihood for someone to focus on marketing.

As well as interpreting the operation size, something unique to this survey were the questions looking at the education level of the primary manager. When comparing operators that had completed a college degree or higher, the results would suggest that individuals who had completed college were more likely to use both pricing tools and diversification strategies in combination with one another than they were to use neither.

When examining other variables used in this study, winter forage shown in the table as DG/ Corn Residue, was hypothesized as being important when looking at the diversification of an operation. This was hypothesized because if the operation has the availability of significant feed sources and the financial capacity to use them, they may have a higher chance of backgrounding or retaining ownership of yearling animals

instead of selling at the time of weaning. A survey question (Appendix C, question 53) was directed specifically at winter (dormant) feed sources and we examined the use of distillers grains (DG) and/or corn residue for stocker and feeder animals. Our logit parameter model was unable to confirm a significant relationship between winter feed sources (DG/ Corn Residue) and having feeder/ stocker animals in the operation.

Relative Risk Ratios

Table 3.4 displays calculated relative risk ratios. A significant risk ratio that is greater than 1 would suggest an increased risk of a specific outcome in the group, while a risk ratio of less than 1 would suggest a decreased risk of an outcome in the group. If the risk ratio is equal to 1 that would show that the risk of the outcome does not create any difference to the group. These values can only be interpreted if they show a significant p value. For example, in the variable category of Operation Identification an individual who self identifies as a rancher is 2.04 times more likely to be in category 4 than in category 1. We would likely see this because an individual who has a primary role of raising livestock will be finding ways to manage risk.

Again, using group 1 of Table 3.4 as our base category, no pricing and no diversification, producers who had a herd size larger than 100 head, were 2 times as likely to be in category 3. This is consistent with Little, Forrest, and Lacy (2000) who stated that as herd size increased, the use of private sale increased as well as larger operations had more marketing options available. We could also see this because producers with larger herd sizes, may be looking at alternative ways to price their inventory and it can open a producer up to more marketing strategies such as contracts that require certain number of head or weight. Another variable that showed a significant

relationship was having a college degree. A college degree resulted in being 1.9 times more likely to be in category four, using both pricing tools and market diversification, than they were to be in category one, using neither. This could be explained with the idea that education expands producers' perspectives making them more open to alternatives in marketing and diversification. How an operator identifies himself or herself also is related to marketing strategies used. If an operator identifies as a rancher, they are 1.54 times more likely to be in category two and 2 times more likely to be in category four, than they are to be in category one. This shows that individuals who identify as ranchers, are more likely to use diversification tools or diversification tools and pricing together. They however seem to not be more likely to be in category 3, which we can interpret to say producers who identify as a rancher do not show a tendency to use pricing tools by themselves without diversification.

Table 3.5 examines what happens when a different base category is selected. Originally the first group was selected as the base because it contained the largest number of responses, but now we examine what happens when we look at the individuals who use just pricing tools or just diversification tools and see how they compare to the individuals who use both methods. Originally the study examined the likelihood of choosing a pricing tool or diversification strategy or both ideas together. Now they are looking at the individuals who use one or the other tool and how they would move to a category using both strategies. The results of this analysis are reported in Table 3.5. An interesting thing to note from these risk ratios is that when looking at the operation identification, there was no significant movement from category 2 to category 4. But, when comparing from category 3 to category 4, individuals were 3.6 times more likely to

be in category 4. This could be explained as producers who identify as ranchers are not using pricing alone but will use it in coordination with diversification.

Marginal Effects

A marginal effect shows us the outcome change that is found from the dependent variable to the specific independent variables that are changing. In our data, an example of how it works would be to look at the operation identification variable. When the operation identification variable is examined in Table 3.6, it shows a positive value for category 2 and 4 while showing a negative value in category 3. This translates to say that a rancher is 6.9 percent more likely to be in category 2, 7.2 percent more likely to be in category 4 and 12.4 percent less likely to be in category 3. This verifies earlier statements that an individual that identifies as a rancher is more likely to use market diversification than they are to use pricing tools by themselves or no marketing strategies.

Another variable to examine in the marginal effects would be the number of households supported. This variable can be examined to say that as the number of households increases, the operation is 4.2 percent more likely to be in category 3 and 2.2 percent more likely to be in category 4. This may be seen because with additional households involved, more human resources are available for someone to focus on using marketing tools. An operation with herd size greater than 100 head, it should be noted, is 9.4 percent more likely to use pricing tools without diversification (category 3) not necessarily more likely to use pricing tools with diversification.

The final significant variable that can be examined in Table 3.6 would be education. An individual that has completed a college degree or greater is, 5.745 percent

more likely to use both pricing and diversification together in category 4, verifying the previous results in Table 3.4 and Table 3.5.

Conclusion

In summary, this multinomial logit model showed a significant relationship between the use of marketing strategies and the number of households supported, the size of the cow herd, the age of operator, the education level of the operator, and whether the operator identified as a rancher or farmer with livestock. If an individual identified as a rancher, they were more likely to use diversification or a combination of pricing and diversification. They did not appear to use pricing on its own. Along with the identification of the operator, the more households an operation reported, the more they were willing to use pricing or a combination of pricing and diversification. Alongside these findings, an operation also seemed to use more pricing tools as the herd size increased while age had a slight impact on the use of diversification. The final variable that seemed to be associated with marketing decisions was education. As an individual had a college degree or higher, they were more likely to use pricing tools and diversification together.

These findings help identify producer characteristics associated with Nebraska cow-calf marketing strategies in 2016. While this information is subject to the completeness of the data and the interpretation of the questions by survey respondent, the findings do help researchers better understand practices of livestock producers in Nebraska. This study increased researchers understanding of the impact of producer education level. This showed a positive relationship with the use of pricing tools and market diversification strategies in combination.

Nebraska producers who completed this survey had recently gone through a drought followed by high market prices and were in the middle of a large decrease in market pricing. This as well as many other variables can determine use and adoption of pricing and diversification strategies. With 47 percent of this data's responses not using any pricing tools or diversification strategies, the findings agree with those found by Little, Forrest, and Lacy (2000), Schroeder and Featherstone (1988) as well as Hall et al. (2003). These results help support future research and can be used to help aid educators in better understanding how to move forward.

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Appendix B

Tables

Table 3.1: Variable Definitions

Variable Name		Variable Definition	Mean	SD	Min	Max
Operation Identification	=	1 if individual self-identified as a rancher	0.66	0.47	0	1
100+	=	1 if individual stated that their operation has more than 100 cows	0.66	0.47	0	1
households	=	number of households supported by the operation	1.9	1.36	1	15
age	=	the age of the primary operator	57.57	12.54	15	90
experience < 10	=	1 if the individual has more than 10 years of experience	0.93	0.25	0	1
college +	=	1 if the primary manager has at least a college degree	0.49	0.5	0	1
Financial manager	=	1 if a professional or employee is completing financial record keeping and not a family member	0.13	0.33	0	1
Winter forage	=	1 if individual responding to survey marked that they do use distillers grain and corn residue	0.24	0.43	0	1
Winter forage stocker	=	1 if individual responding to survey marked that they do use distillers grain and corn residue for stocker cattle	0.16	0.37	0	1
Winter forage feeder	=	1 if individual responding to survey marked that they do use distillers grain and corn residue for feeder cattle	0.16	0.36	0	1

Source: 2016 Nebraska Cow-Calf Producer Survey -demographics and characteristics of Nebraska operations (University of Nebraska Extension program).

Table 3.2: Percentage of survey participants in each risk management category

Risk Management Strategy	Description	Percentage (%)	Individuals (N)
1	No pricing tools, no market diversification	47.31%	502
2	No Pricing tools, yes market diversification	19.98%	212
3	Yes pricing tools, no market diversification	21.21%	225
4	Yes pricing tools, yes market diversification	11.50%	122
Total		**100**	**1061**

Source: 2016 Nebraska Cow-Calf Producer Survey, author's calculations

Table 3.3: Multinomial Logit Parameter estimates for risk management tool combinations.

Variable	(1) no pricing, no diversification		(2) no pricing, diversification		(3) pricing, no diversification		(4) pricing, diversification	
Intercept	-0.924	(0.4986)	-0.9039	(0.4701)	-3.7496**	(0.7122)		
Operation identification	0.3894*	(0.1903)	0.5287**	(0.1782)	0.7293**	(0.2631)		
# of households supported	0.0196	(0.0873)	0.2989***	(0.0695)	0.3032***	(0.0779)		
Herd size ≥100	0.2995	(0.1918)	0.7002***	(0.1993)	0.4168	(0.2595)		
Age	-0.0167*	(0.0076)	-0.0137	(0.0076)	0.0092	(0.0096)		
Experience	0.6532	(0.3847)	0.1047	(0.3531)	0.7157	(0.5319)		
College +	0.0106	(0.1717)	0.1881	(0.1707)	0.6476**	(0.218)		
Financial Manager	-0.3337	(0.2767)	0.1839	(0.2399)	-0.1017	(0.3129)		
DG/ Corn Residue all	-0.174	(0.5367)	-0.0859	(0.5032)	-0.2717	(0.6912)		
DG/ Corn Residue Stocker	0.6276	(0.4569)	0.3316	(0.4052)	0.3472	(0.5756)		
DG/ Corn Residue Feeder	-0.5346	(0.4096)	-0.2027	(0.4075)	-0.3291	(0.5444)		

Notes: * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$ Standard Error is calculated alongside the logit parameter values in (). Category 1 is used as the base.

Table 3.4: Relative risk ratios from multinomial logit model estimates

Variable	(1) no pricing, no diversification	(2) no pricing, diversification	(3) pricing, no diversification	(4) pricing, diversification
Intercept		0.3969	0.405	0.0235**
Operation identification		1.4563*	0.5688**	2.042**
# of households supported		1.0175	1.351***	1.3521***
herd size ≥100		1.3609	2.0354***	1.5303
Age		0.9837*	0.9865	1.0008
Experience		1.8492	1.0748	1.9527
College +		1.0077	1.1791	1.913**
Financial Manager		0.7172	1.2042	0.9062
DG/ Corn Residue all		0.8428	0.911	0.7509
DG/ Corn Residue Stocker		1.8699	1.3968	1.4128
DG/ Corn Residue Feeder		0.5844	0.8206	0.7298

Notes: Combination (1) is the reference category, * P ≤ 0.05, ** P ≤ 0.01, *** P ≤ 0.001. Category 1 is used as the base.

Table 3.5: Impact of relative risk ratios on combination choices

Variable	Relative Risk of Choosing 4 to 1	Relative Risk of Choosing 4 to 2	Relative Risk of Choosing 4 to 3
Operation identification	2.042**	1.4022	3.59***
# of households supported	1.3521***	1.3288**	1.0008
herd size ≥100	1.5303	1.1244	0.7518
Age 57+	1.0008	1.0174	1.0145
Experience	1.9527	1.056	1.8168
College +	1.913**	1.8983**	1.6224*
Financial Manager	0.9062	1.2634	0.7525
DG/ Corn Residue all	0.7509	0.8909	0.8242
DG/ Corn Residue Stocker	1.4128	0.7555	1.0114
DG/ Corn Residue Feeder	0.7298	1.2487	0.8893

Notes: Combination (1) is the reference category, * P < 0.05, ** P < 0.01, *** P < 0.001

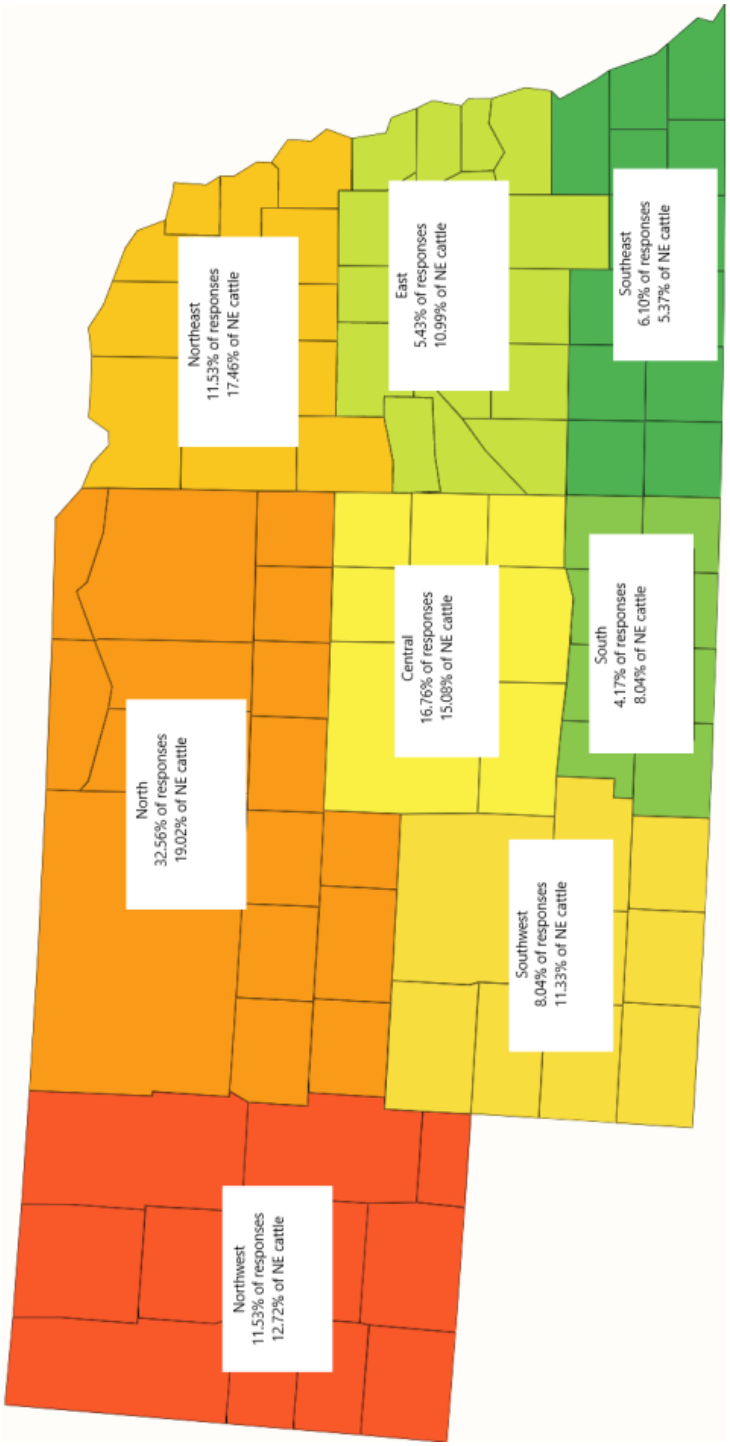
Table 3.6: Marginal Effects

Variable	(1) no pricing, no diversification	(2) no pricing, diversification	(3) pricing, no diversification	(4) pricing, diversification
Operation identification	-0.0168	0.0689*	-0.1238**	0.0717**
# of households supported	-0.04738	-0.0162	0.042**	0.0215**
herd size ≥100	-0.1234	0.0109	0.0944***	0.0181
Age	0.0029	-0.0021*	-0.0016	0.0007
Experience	-0.1018	0.0818	-0.0284	0.0485
College +	-0.0506	-0.01094	0.0126	0.0575***
Financial Manager	0.0189	-0.0592	0.0465	-0.0063
DG/ Corn Residue all	0.0408	-0.0176	-0.0018	-0.0214
DG/ Corn Residue Stocker	0.0887	-0.0716	-0.0031	-0.0139
DG/ Corn Residue Feeder	-0.0168	0.0689	-0.1238	0.0716

Notes: These marginal effects are a distribution of the marginal effects of all responses at the mean value, * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$

Figures

Figure 1: Map of Crop Reporting District in Nebraska and response amount



The values in this table are pulled from the 2016 Nebraska Cow-Calf Producer survey using the 1061 responses in each crop reporting district

Appendix C

University of Nebraska Lincoln

EXTENSION
INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
Agricultural Economics

2016 Nebraska Cow-Calf Producer Survey

Please skip questions that do not apply to your operation or you think are intrusive.

Part I. Operation Characteristics

1. In which county or counties is your operation located? (If multiple counties, circle the "home" county)

   _____

2. What percentage of the total land base used in livestock production is
   Owned by the operation? ____% Rented from family members? ____%
   Rented from non-family entities? ____%

3. How would you characterize your operation? (Check as many as apply)
   ____Rancher ____Farmer with livestock

4. How would you characterize your livestock? (Check as many as apply)
   ___Cow-Calf ___Stocker grazing

   ___Calf backgrounding ___Feeding/Finishing

5. How many cows do you normally run? (Check one)
   ____less than 50 ____50-99 ____100-199

   ____200-499 ____500 or more

6. What percentage of the cows are (Should total 100%)
   Owned? ____% Leased? ____%
   Taken in on shares? ____% Taken in for cash? ____%

7. How many calves do you sell per year? (Check one)
   ____less than 50 ____50-99 ____100-199

   ____200-499 ____500 or more

8. What percentage of your weaned calves are (Should total 100%)
   Sold at the time of weaning? ____% Backgrounded? ____ %
   Put into the feedlot with retained ownership at the time of weaning? ____%

9. How large is a typical, mature cow in your operation? ____pounds
10. What is your average weaning weight for? steers _____ heifers _____
11. What type of bulls do you use? (Check as many as apply)
    ____Crossbred ____Purebred (not registered) ____Registered
    ____ AI
12. What are the future plans for this operation? (Check all that apply)

Future Plans	1 Year	5 Years	10 Years
Increase cow numbers			
Maintain cow numbers			
Decrease cow numbers			
Liquidate herd			
Transfer operation to a new generation			

Part II. Producer Characteristics

13. How many households are totally or part-time supported by this operation? ____
14. Does the primary manager live on-site? ___Yes ___No
15. How old is the primary manager? ____years
16. How many years of production experience does the primary manager have? ____years
17. What is the highest level of school the primary manager has completed?
    ____Less than High School Graduate ____High School Graduate ____GED
    ____Some College ____College Graduate ____Post Graduate

Part III. Records

18. Who is responsible for maintaining financial records? (Check as many as apply)
    ____Manager ____Spouse ____Other family member
    ____Employee ____Professional
19. What kind of financial accounting do you use? (Check one)
    ____ Accrual accounting ____ Cash accounting
20. How are financial records used? (Check as many as apply)
    ____Income tax calculation ____Cash flow analysis
    ____Enterprise analysis ____Obtain financing
21. What production records are kept? (Check as many as apply)
    ____Feed purchases ____Feed usage by livestock group
    ____Grazing history ____Feed production (Crop production records)

____Breeding and calving history ____Birth weights
____Calf weaning weights ____Calf yearling weights
____Body condition score (BCS) ____Herd medical treatments
____Individual animal medical ____Other (Describe_____)

22. How are <u>production</u> records used? (Check as many as apply)
____Cow culling decisions ____Bull culling decisions
____Replacement selection ____Marketing advertisements
____Financial analysis ____Standardized Production Analysis (SPA)

Part IV. Marketing

23. What was your primary method of selling owned livestock in 2014-2015?
____Auction barn ____Video auction ____Contracted live
____Contracted carcass ____Contracted grid ____Negotiated private treaty
24. What pricing tools were used in 2014-2015? (Check all that apply)
____None ____Cash contracts
____Hedges ____Option contracts
____Livestock Risk Protection (LRP) Insurance
25. What are your sources of cattle income? (Check all that apply)
____Weaned calves ____Wintered calves ____Backgrounded calves ____Grazed stockers ____Finished ____Bred heifers
____Open breeding heifers ____Cull replacements ____Cull cows
____Bred cows ____Cull bulls ____Breeding bulls

Part V. Breeding

26. What percent of your heifers are bred using AI? ____% Embryo transfer? ____%
27. What percent of your mature cows are bred using AI? ____% Embryo transfer? ____%
28. What traits do you consider when selecting semen for heifers? (Rank with “1” being highest)
____Birth weight ____Maternal traits ____Growth ____Survivability
____Carcass traits ____Feedlot performance ____Other (Describe_____)
29. What traits do you consider when selecting semen for cows? (Rank with “1” being

highest)
____Birth weight ____Maternal traits ____Growth
____Survivability
____Carcass traits ____Feedlot performance ____Other
(Describe_____)

30. What, if any, estrous synchronization tools do you use? (Check all that apply)
____Prostaglandin ____CIDR ____MGA ____Other
_____

31. How many cows are serviced per bull? _____

32. What do you consider when selecting bulls? (Check all that apply)
____Birth weight ____Weaning weight ____Yearling weight
____Growth records ____Conformation ____Breeder reputation
____Pedigree ____Performance of dam ____Performance of sire
____Disposition ____Frame size ____Scrotal circumference
____EPD ____Pelvic measurement

33. How do you obtain herd sires? (Should total 100%)
Purchase ____% Raise ____% Lease ____%

34. Why are bulls culled? (Should total 100%)
Years in Service ___% Illness ___% Injuries ___%
Unsound ____% Other ____%
(Describe_____)

35. How long do you typically keep a bull? ____years

36. When do you fertility test your bulls?
___Never ____Before they are put in service
____Annually

37. What are the start and end dates of your breeding seasons?

Breeding Season	**Heifers**		**Cows**	
	Start Date	**End Date**	**Start Date**	**End Date**
Primary herd				
Secondary herd				

38. Do you pregnancy check your mature cows? ____Yes ____No

39. Do you pregnancy check your replacements? ____Yes ____No

40. What percent of your calves are born in the first
20 days? ____% 40 days? ____% 60 days? ____%

41. What is your breeding efficiency?

Factor	**Bred Heifers**	**Mature Cows**
What is your normal weaning rate? (% calf crop)		
What percentage of animals need any kind of help at parturition?		

Part VI. Replacements

42. In a normal year, what percent of your cows need to be replaced? ____%

43. In a normal year, why are your cows culled? (Should total 100%))
    No calf ____% Open ____% Unsound____%
    Low body condition____% Age___%

44. How were your replacements acquired in 2014-2015? (Should total 100%)
    Retained heifers ____% Purchased open heifers ____%

    Purchased bred heifers____% Purchased bred cows ____%

45. What percent of retained heifers are normally culled? ____% ___Do not retain heifers

46. What considerations do you use to select replacement females? (Check all that apply)
    ____Visual appraisal ____Disposition ____Early breeding
    ____Size ____Frame ____Pelvic area

    ____Heifer performance ____Sire performance ____Dam performance ____Pedigree ____Breeder reputation

47. What adjustments were made because of the 2012 drought? (Check all that apply)
    ____Weaned early ____Sold stockers early

    ____Allowed cow body condition to decline ____Reduced cow numbers
    ____Utilized growing crops normally sold ____Purchased forage
    ____Reduced cattle taken in from others

48. If cow numbers were reduced in 2012, how do current numbers compare?
    ____less than ____about the same ____greater than

49. If cow numbers were reduced because of the 2012 drought and have increased since, how was the number of cows increased? (Check all that apply)
    ____Cows were purchased ____Bred heifers were purchased
    ____Additional heifers were retained

Part VII. Feeding

50. Do you test your hay or forages for the following? (Check all that apply)
    ____Energy ____Protein ____Minerals

51. Do you use the results of hay or forage nutrient tests to balance your ration?
    ___Yes ____No

52. What are your feed sources during the summer, growing season? (Mark the feeds used)

Feed Stuff	Cows	Replace-ments	Bulls	Stockers	Feeders
Pastures and Other Grazing					
Upland grass grazing					
Meadow grazing					
Irrigated pasture grazing					
Annual crop grazing					
Hay					
Grass hay					
Alfalfa hay					
Other hay					
Grains, Supplements, and Byproducts					
Grain					
Protein cubes					
Protein tubs					
Protein blocks					
Liquid protein					
Mineral supplement					
Distillers grains					

53. What are your feed sources during the winter, dormant season? (Mark the feeds used)

Feed Stuff	Cows	Replace-ments	Bulls	Stockers	Feeders
Pastures and Other Grazing					
Upland grass grazing					
Meadow grazing					
Windrow grazing					
Irrigated pasture grazing					
Annual crop grazing					
Corn residue grazing					
Hay					
Grass hay					
Alfalfa hay					
Other hay					
Grains, Supplements, and Byproducts					
Grain					
Protein cubes					
Protein tubs					
Protein blocks					
Liquid protein					
Mineral supplement					
Distillers grains					

Part VIII. Haying and Grazing

54. What kind of system is used for your hay? (Check all that apply)
    ____Small square bales ____Large round bales ____Large square bales
    ____Stacked loose hay ____Grazed from windrows

55. How do you feed hay? (Check all that apply)
    ____On the ground ____In bunks ____In bale feeders
    ____With bale processor ____Hay feeder wagon (bale and loose)

56. Who does your haying? (Check all that apply)
    ____Done by operator ____Custom operator

57. How many times during a growing season do you move your cattle between pastures? ____

58. How large is a typical pasture on your operation? _____ acres

59. How many times per year is a typical pasture grazed? _____

60. What are the normal start and end dates of your haying and grazing seasons?

Operation	Start Date	End Date
Summer grazing uplands		
Winter grazing uplands		
Summer grazing meadows		
Winter grazing meadows		
Haying uplands		
Haying meadows		
Other grazing (Describe)		
Other haying (Describe)		

61. What percentage of the meadows in the above table are sub-irrigated? ____%

62. Of animals that are custom fed in confinement, what percent is done in the following arrangements? (Should total 100%)
    Feed cost plus yardage ____% Animal gain ____%
    Other ____% (Describe_____)

Thank You for Your Participation.