Journal of Agricultural and Applied Economics, 43,4(November 2011):497–513

Cow-Calf Producer Risk Preference Impacts on Retained Ownership Strategies

Kelsey Frasier Pope, Ted C. Schroeder, Michael R. Langemeier, and Kevin L. Herbel

Considerable efforts have been made to provide cow-calf producers with information to help them make informed decisions about adding value to calves. Despite demonstrated market incentives to retain calves, many producers still sell right after weaning. We postulate this observed behavior is related to producer risk aversion. Our study concludes risk aversion is an important factor affecting calf retention as the most risk-averse producers have more than a 60% probability of selling calves at weaning and the most risk tolerant have less than a 20% probability of selling at weaning.

Key Words: cow-calf producers, ordered probit, retained ownership, risk aversion

JEL Classifications: Q13, C25, D18

Cow-calf producers have long been challenged with low and volatile returns. Krause (1992) noted U.S. cow-calf net returns were negative 10 of 18 years from 1972–1989. Dhuyvetter and Langemeier (2010) illustrated, using Kansas Farm Management Association Annual (KFMA) Enterprise Analysis Records, that return over total costs for cow-calf producers in Kansas averaged −$94 per cow with a standard deviation of $85 per cow during 1979–2008, with 26 of these 30 years having negative returns. Common recommendations to cow-calf producers to improve returns have included devoting more attention to record keeping and managing production costs (Ramsey et al., 2005); improving cull cow values (Little et al., 2002); increasing calf sale prices through advanced marketing and value-added programs (Blank, Forero, and Nader, 2009; Bulut, Lawrence, and Martin, 2006); and retaining ownership of calves though later stages of production (Fausti et al., 2003; Franken et al., 2010; Lawrence, 2005; White et al., 2007b).

Potential returns to retained ownership of calves and to producer adoption of advanced marketing and value-added programs have received considerable attention by applied research and outreach efforts (Gillespie, Basarir, and Schupp, 2004; Lacy et al., 2003). Tools for evaluating retained ownership or for assessing value-added feeder calf programs are common (e.g., Schulz and Dhuyvetter, 2009; Missouri

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The authors gratefully acknowledge Kansas Farm Management Association Economists for cooperating with us in the survey process and providing necessary data to complete this study. We are also indebted to the producers who graciously provided their time and shared candid information through participating in our survey. We appreciate the time and constructive comments offered by four anonymous journal reviewers who helped us improve the overall quality of the paper.

Beef Resource Guide, 2011). Despite numerous studies over time illustrating increased returns associated with retained ownership strategies (Davis, McGrann, and Mintert, 1999; Greiner, 2010; Lawrence, 2005; Watt, Little, and Petry, 1987) and value-added programs (Bulut, Lawrence, and Martin, 2006; Schulz and Dhuyvetter, 2009), many cow-calf producers have not adopted these practices. We hypothesize that one reason producers are reluctant to adopt is because they are risk averse and retained ownership increases risk (Fausti et al., 2003; Schroeder and Featherstone, 1990; Van Tassell et al., 1997). In particular, the added financial risks associated with retaining calves or with incurring additional costs to add value to calves may discourage cow-calf producers from pursuing this production strategy. The objective of this study is to determine how producer risk preferences affect cow-calf producer steer calf retention programs. In addition, we also determine how producer and farm business characteristics affect calf retention strategies used by cow-calf producers.

Our study uses survey data from Kansas cow-calf producers that we merge with KFMA farm financial records to quantify determinants of calf retention. Results reveal that producer risk preferences are an important determinant of calf retention strategies employed by producers. In particular, risk-averse producers tend to sell calves at weaning. In contrast, producers who are more willing to incur risk are more likely to retain calves through finishing. In addition, farm operation diversification, liquidity concerns, share of farm income generated from the cattle enterprise, calving season, adoption of production technology, and the producer's comparative advantages in business planning and production also impact calf retention activities.

Results of our study are important for a number of reasons. Findings help us better understand factors that impact producer calf retention activities. As such, extension education programs are directly impacted by knowing factors that influence a cow-calf producer's willingness to adopt value-added production and marketing strategies. For example, if retained ownership offers positive expected returns, but producer risk aversion is discouraging involvement in this endeavor, extension programs directed at managing the added risk would be valuable. Results from our study also identify farm and producer characteristics that constrain family farm operations from adding value to calves through retained ownership programs. Addressing these constraints will help increase the efficacy of efforts to provide greater economic sustainability to these kinds of targeted operations. More generally, methods used in this study and accompanying findings are valuable to researchers interested in determining how risk preferences influence producer behavior.

Past Literature

Several studies have illustrated that retaining ownership of calves beyond weaning offers cow-calf producers opportunity to increase returns. For example, Watt, Little, and Petry (1987) estimated that retaining ownership of calves through custom feeding was profitable in 20 of 26 years generating an average of $30.85 per cow. Lawrence (2005) and Simms, Mintert, and Maddux (1991) found similar results. However, retaining ownership of calves presents additional price and production risk to the producer. Schroeder and Featherstone (1990) illustrated, using a dynamic programming model, how optimal calf retention decisions at various production and market decision nodes (weaning, backgrounding, and finishing) are affected by producer risk aversion. Van Tassell et al. (1997) extended this work by showing that optimal calf production and marketing decisions under uncertainty are influenced by production as well as price risk.[1] The foundation of work that has shown enhanced return potential, together with the modeling of optimal decisions given risk considerations, motivates our study to determine the extent to which producer risk aversion affects retention decisions and how other operation attributes also influence those decisions.

Several studies have examined factors affecting cow-calf producer production and marketing decisions. Young and Shumway (1991)

[1] Belasco et al. (2009) quantified animal performance, price, and revenue risks for feeding cattle.

employed a binary logit model to quantify determinants of whether cow-calf producers indicate they maximize profit. Higher income producers, those with larger pasture acreage, those who indicated owning cattle allowed them to be employed off the farm, and those who were using the cattle operation to increase their net worth were more likely to profit maximize. Social reasons for owning cattle had mixed effects on whether the producer maximized profit.

Popp, Faminow, and Parsch (1999) conducted a survey of Arkansas cow-calf producers to determine factors impacting decisions to feed weaned calves to heavier weights. They modeled producers' decisions to sell calves at weaning or retain them using a binary logit framework with several farm and farmer characteristics as explanatory variables. Producers with more land, those who perceived increased profit from retaining calves, and those that had adequate facilities to feed calves to heavier weights were more likely to retain ownership. Producers who perceived that price risk was not a significant problem were more likely to retain ownership than those that reported greater concerns about price risk. Producers with greater control over calving timing and those with more reported calving seasons were more likely to retain ownership.

Gillespie, Basarir, and Schupp (2004) completed a survey of Louisiana cow-calf producers to determine factors affecting choices of marketing methods. In addition to other marketing practices, they modeled the decision of producers to retain ownership through custom feeding. Age and contact with a county agent in the past year were the only variables, among several examined, to have statistically significant impacts on retained ownership. The indirect measure of risk they used was a diversification measure of the number of enterprises in the operation. Diversification was not statistically related to retention activity.

Franken et al. (2010) completed an analysis of cow-calf producer motivations for retained ownership using a survey of Missouri producers. They used a structural equation model to determine how cattle quality (including registered, purebred, percent black), producer age, operation size, and operator interest in feedlot or carcass data of calves were associated with retained ownership preferences. Producers with higher quality cattle, particularly those interested in obtaining feedlot and carcass information on their calves, were more interested in retaining ownership.

Our study extends the work of Popp, Faminow, and Parsch (1999); Gillespie, Basarir, and Schupp (2004); and Franken et al. (2010) in several ways. First, we examine three distinct levels of retention as opposed to just sell at weaning or retain: 1) selling at weaning, 2) retaining through backgrounding then selling, and 3) retaining through finishing. The three levels provide opportunity to determine how producer choices among the three alternatives are associated with characteristics of the producer and operation. Franken et al. (2010) considered more than just dichotomous retain or not retain decisions, but their study did not assess the broader operator and operation characteristics of retention that we explore. As described later, we use a broader measure of producer risk preference beyond the price expectation measure or diversification measure used by Popp, Faminow, and Parsch (1999) and by Gillespie, Basarir, and Schupp (2004). We also incorporate specific financial measures of the operation that have not been explored in analyzing retention decisions (White et al., 2007a).

Modeling Calf Retention Decisions

Cow-calf producers can sell steer calves they produce at three broadly defined stages of production: 1) at weaning, 2) after growing for a period of time (referred to as backgrounding), and/or 3) after feeding cattle until finished and ready for harvest. These decisions are not independent and producers can utilize combinations of any of the three for producing and marketing their calves. Our objective was to determine important producer and farm operation characteristics that affect the intensity of producer use of these three alternative calf production and marketing programs. One way to measure the dependent variables in this study would be to measure and model the percentage of calves a producer typically markets using each

method. However, asking producers specific percentages marketed using each method is challenging because the time frame must be defined and measurement error would undoubtedly be substantial.

Instead of asking specific percentages, we asked producers to provide an ordinal ranking to the question "Each year after weaning, what do you do with your steer calves?" The options were: 1) sell steers at weaning, 2) background steers, then sell them, or 3) retain steers through finishing. We did not define these activities in any more detail and we let the respondent interpret specific protocols for each of these alternatives. For each option the producers were provided five ordinal choices to select from: 1) *never*, 2) *seldom*, 3) *sometimes*, 4) *often*, or 5) *always*. In this light, we have a set of multinomial ordered choice dependent variables. Given the ordinal discrete nature of the dependent variables, we utilize an ordered probit model to quantify determinants. The ordered probit model is well documented in the literature so we provide a condensed summary (Greene, 1997):

$$(1) \qquad y^* = \beta x + \varepsilon,$$

where y* is an unobserved latent dependent variable that depends linearly on the x variables. β are parameters to be estimated and ε is a random error. What we observe in our survey are ordered responses of 1 = *never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, or 5 = *always* for each of the three calf retention options. Thus, for each option we observe:

$$(2) \qquad \begin{aligned} y &= 1 \quad if \quad y^* \le \mathbf{1} \\ y &= 2 \quad if \quad 1 < y^* \le \mathbf{n_1} \\ y &= 3 \quad if \quad \mathbf{n_1} < y^* \le \mathbf{n_2} \\ y &= 4 \quad if \quad \mathbf{n_2} < y^* \le \mathbf{n_3} \\ y &= 5 \quad if \quad \mathbf{n_3} \le y^* \end{aligned}$$

The $\mathbf{n}_i$ s are unknown parameters to be estimated with β. Calculations for the probabilities associated with each response and the associated marginal effects for the ordered probit model are presented in Greene (1997). Because producer responses to each of the three retention options are not independent of responses to the other two, we allow for correlation among the errors of the three models. Estimating each equation separately would result in consistent, but inefficient estimates, if the errors are correlated. Accounting for the cross equation correlation results in efficient estimates.

The explanatory variables included in the model were formulated based on past literature and on previously untested factors we hypothesized might be related to cow-calf producer calf retention decisions. The explanatory factors included broadly categorized *Producer Characteristics, Farm Attributes,* and *Management Traits.* All variables are defined in Table 1.

Producer Characteristics included farm operator risk aversion preference (*RiskAver*), operator age (*Age*), and off-farm wages (*OffFarm*). One contribution of our study is to incorporate a broader measure of operator risk aversion into our model than previous studies of calf retention strategies.[2] White et al. (2007a) highlighted the potential importance of risk considerations associated with retained ownership including price, animal performance, and health risks. A challenge with developing a measure of risk aversion is that such measures are by nature *ad hoc* because, at best, all we can do is develop a proxy for producer risk aversion. MacCrimmon and Wehrung (1985) suggested that risk tolerance measures ask respondents questions covering a variety of risky situations, not be redundant, be interesting, and take a limited amount of time to complete. Pennings and Garcia (2001) completed a comprehensive assessment of ways to construct risk aversion measures with an application to hog producers. We take a less comprehensive approach, but we follow recommendations that risk aversion be measured

[2] For example, diversification was used as a proxy for risk by Gillespie, Basarir, and Schupp (2004) – we have separate measures for diversification and risk aversion. Popp, Faminow, and Parsch (1999) used a statement about whether producers perceived price risk as a major concern or not as a measure of risk perception.

Table 1. Variable Definitions and Summary Statistics (N = 215)

Variable	Description	Average	Std. Dev.
Dependent Variables			
Weaning	sells steer calves at weaning (1 = *never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, 5 = *always*)	2.82	1.67
Background	sells steer calves after backgrounding (1 = *never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, 5 = *always*)	3.03	1.64
Finish	sells steer calves after finishing (1 = *never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, 5 = *always*)	1.76	1.3
Explanatory Variables			
Producer Characteristics			
RiskAver	risk aversion score (5 = most averse to 44 = most tolerant)	13.05	4.61
Age	producer age in years	54.10	10.52
OffFarm	household annual off farm wages in 2008 ($1,000)	14.99	22.86
Farm Attributes			
Leverage	debt to asset ratio at end of 2008	0.30	0.25
Liquidity	importance of maintaining credit reserves (5 = very important to 1 = not important)	3.82	0.85
Cows	number of beef cows in inventory at end of 2008	110	90
CattleShare	share of gross farm income from beef cattle in 2008	0.28	0.26
Herfindahl	sum of squared gross farm income shares from farm enterprises in 2008	0.42	0.18
Management Traits			
SpringCalf	typical percentage of calves born in spring (%)	75	30
Alliance	binary variable = 1 if farm participates in a certified calf, product specified, or other alliance, = 0 otherwise	0.10	0.30
AI	binary variable = 1 if producer uses artificial insemination on cows, = 0 otherwise	0.19	0.39
TechCA	binary variable = 1 if producer considers technology adoption as a comparative advantage, = 0 otherwise	0.28	0.45
BusCA	binary variable = 1 if producer reports business planning as a comparative advantage, = 0 otherwise	0.19	0.39
MktgCA	binary variable = 1 if producer reports marketing skills as a comparative advantage, = 0 otherwise	0.18	0.38
ProdCA	binary variable = 1 if producer reports production skills as a comparative advantage, = 0 otherwise	0.71	0.46

by using more than a single construct.[3] We were particularly sensitive to asking producers risk tolerance questions providing situations that they could potentially relate to (Grable and Lytton, 1999) and understand (Fausti and Gillespie, 2006).[4] Fausti and Gillespie (2006) illustrate that risk aversion is situation dependent and different risk aversion rankings can result from different constructs.

[3] Pennings and Garcia (2001) used factor analysis to combine the several risk constructs they use into a single risk aversion index. As discussed later, we elected not to use factor analysis of the responses to our risk questions, but instead checked for robustness of our results by using variations of the risk measures we construct.

[4] In previous survey work we have conducted with cow-calf producers, we have used generic lottery questions and broad questions about investments producers may not participate in to measure risk as if often done (e.g., Risk Preference Calculator – Internet site: http://www.risknavigatorsrm.com/toolbox/RiskPreferenceCalculator/default.aspx). Cow-calf producers were reluctant to answer these types of questions and typically left them blank.

Perceptive to these recommendations, we constructed five risk questions and used a combined weighted set of responses to these questions to construct the risk aversion score we use in our analysis. The five specific questions are listed in the Appendix. The questions were designed with the goals of the producer being able to relate to them, being able to understand them, finding them easy to answer, and being interested in them. We designed the questions to try to encompass dimensions recommended by Grable and Lytton (1999 and 2003) that include guaranteed versus probable gambles, speculative risk, choice between sure loss and sure gain, risk as experience and knowledge, and risk as a level of comfort. As discussed later, we estimated the models including several different sets of the risk aversion score questions to assess sensitivity of results to the constructed risk aversion score. We expect more risk-averse producers, those with smaller risk aversion scores, to more often sell calves at weaning and seldom retain calves through finishing (White et al., 2007a).

Operator age (*Age*) was included in the models to determine how age affects retention decisions. Age could be a proxy for experience and more experienced producers might be more willing to retain calves. Alternatively, older producers may be less willing to engage in additional management needed to retain calves and thus be less likely to retain. As such, the expected impact of age is uncertain. Off-farm income (*OffFarm*) was included to determine how having a more stable source of income for the household might impact producer willingness to retain. Off-farm income could be a source of cash flow enabling producers more flexibility to consider retaining ownership.

Farm Attributes were financial leverage (*Leverage*), liquidity concerns (*Liquidity*), number of cows (*Cows*), share of gross farm income from the cattle enterprise (*CattleShare*), and farm operation diversification (*Herfindahl*). The debt-to-asset ratio was expected to constrain producer willingness to retain ownership as more leveraged producers may not want to take on added risk associated with retaining ownership. Liquidity concerns are expected to reduce retained ownership as producers who are concerned with liquidity would be more likely to want cash sooner by selling calves at weaning. The number of cows in the operation was included to assess whether operation size affects retention. The expected sign of herd size was uncertain, though Lacy et al. (2003) provide evidence that smaller operations may be less likely to retain ownership. The share cattle production represents in gross farm income was used to measure how important the cow herd was to overall farm income. It could be a tautology that those who retain ownership, all else equal, would have a larger share of income from cattle operations. Lack of facilities is also cited as a reason some producers do not adopt certain animal health, production, calf retention, or management systems (Hodur et al., 2007; United States Department of Agriculture, Animal and Plant Health Inspection Service, 2011). However, ample opportunities are present for the producers in Kansas to place calves in nearby custom backgrounding and feedlot operations. Therefore, we did not include a variable for facility constraints in our survey.

The Herfindahl index was constructed by summing the squared shares of gross farm income generated by beef cattle, dairy, swine, wheat, corn, sorghum, soybeans, and hay. For farms in our sample, these comprise the vast majority of enterprises. Popp, Faminow, and Parsch (1999) and Gillespie, Basarir, and Schupp (2004) did not find diversification statistically significant calf retention determinants. However, more diversified farms could have more forage available for backgrounding and thus be more likely to retain ownership.[5]

[5] As pointed out by a reviewer, the Herfindahl could be related to the risk aversion measure, presuming risk-averse producers diversify production. However, the correlation between the Herfindahl and the risk aversion measure was only −0.105 (p-value = 0.13). As such, the small correlation, though of the expected sign, suggests diversification of the enterprises on the farms in our sample is related to factors other than risk aversion. Likely factors affecting diversification on the farms in this sample include type of land, climate, and alternative uses for the land the farmers operate.

Management Traits included season of calving (*SpringCalf*), whether the producer was an alliance member (*Alliance*), and whether the producer used artificial insemination on any of the cow herd (*AI*). Also included were questions about whether the producer considered one of their comparative advantages to be technology adoption (*TechCA*), business planning (*BusCA*), marketing (*MktgCA*), and/or production skills (*ProdCA*). Past work suggested seasonality is present in calf retention profitability (Watt, Little, and Petry, 1987). Furthermore, there may be innate differences with operations that calve in the spring versus the fall. Whether a producer is a member of an alliance or whether they use AI on their cow herd are indications of progressive management and as such might be expected to be associated with increased retention at least through backgrounding. Furthermore, use of AI could be motivated by efforts to improve animal quality. Producers using AI to enhance animal quality may find it advantageous to capture part of that added value through calf retention.

Producers who indicate they have a comparative advantage for marketing calves could either be more or less likely to retain. They may be less likely if the advantage they have is toward marketing calves to capture value they have added through their production management programs. Alternatively, their marketing advantage may be for downstream value-added programs such as grid pricing of finished cattle in which case the producer may be more likely to retain calves. The comparative advantages provide opportunities for the producers to categorize what they perceive they are particularly good at relative to others. Generally, those who are good at technology and planning may be more prone to retain cattle longer than those who are good at production.

Data

The data used for this study are compiled from two sources: 1) a producer survey we administered and 2) a farm financial records service. The Kansas Farm Management Association was the source for identifying cow-calf producers to survey. The KFMA is a farm management program comprised of 21 economists who work with approximately 110 farmer operations each to provide production, management, and financial planning services. The KFMA member producers were used to survey because the KFMA database has information on farm financial records (e.g., debt, assets, farm income by enterprises, cow herd size, and off farm income) which are prone to reporting error in surveys and contain information producers often times do not want to provide in a survey. We were able to anonymously match each survey respondent to the KFMA data for that respondent's farm operation.

In May 2009 all KFMA members who reported owning cows in 2008 were mailed a survey. A total of 775 producers were sent surveys. A reminder postcard was sent in June 2009. A total of 321 surveys were completed for a response rate of 41.4%. Incomplete survey responses for specific variables needed to estimate the ordered probit models as a system resulted in a total of 215 useable respondents for this study. The survey identified producer management practices, calf selling methods used, and producer characteristics. Five questions (see Appendix) were specifically used to construct a risk tolerance score (*RiskAver*) for each producer.

Summary statistics of the variables used in the calf retention models are provided in Table 1. The average age of the respondents is 54 which is comparable to Census data for 2007 where the average age of U.S. producers was 57. The average herd size was 110 cows with 21% having fewer than 50 head; 36% having 50–99 head; and 43% having 100 head or more. The survey respondents tend to have larger cow-calf operations than NASS data for the United States as a whole where the average herd size was 43 head and 77% of operations had less than 49 head; 12% had 50–99 head; and 11% had 100 head or more in 2007 (United States Department of Agriculture, National Agricultural Statistics Service, 2009).

Distributions of respondent calf retention strategies are illustrated in Figure 1. Most producers (80%) indicate they *seldom* or *never*

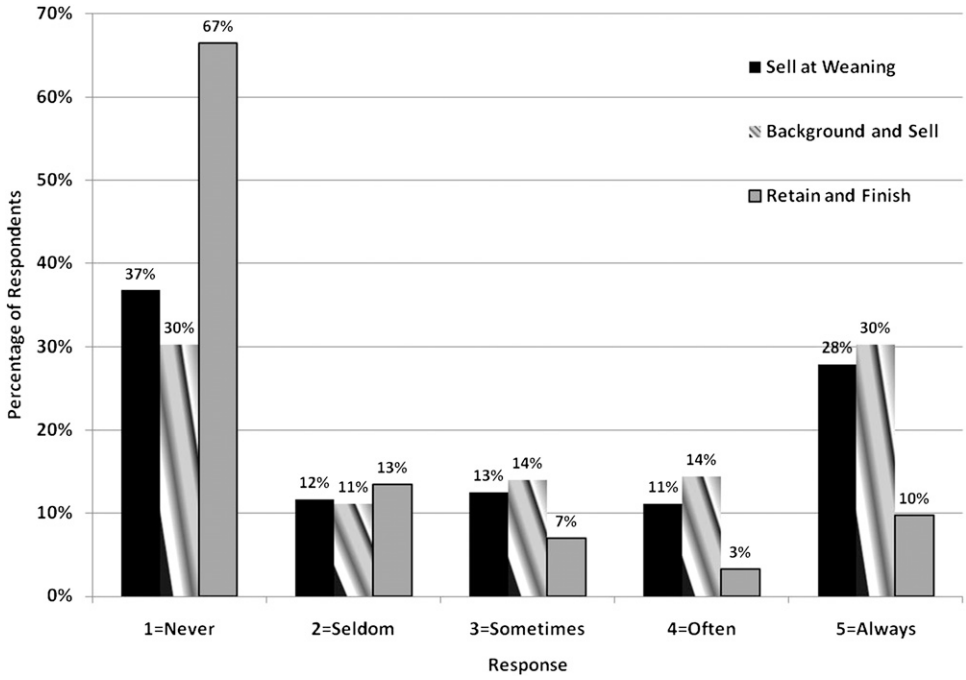

Figure 1. Distribution of Respondents to Steer Calf Retention Strategies

retain steer calves through finishing. In contrast, 39% typically (*often* or *always*) sell at weaning and 44% typically background and sell. Approximately 35% of respondents indicate they most often sell calves at weaning, 42% most often sell after backgrounding, 9% most frequently retain through finishing, and 14% do not have a primary or most common retention scheme. Hodur et al. (2007) found 74% of Northern Plains producers market at least some calves at weaning, 44% retained some calves through a backgrounding phase, and 9% retained some calves through finishing. Steer calf retention decisions vary and are not necessarily retain or not retain binary decisions for the operation. We do not know from our survey data whether a mixed portfolio of selling at weaning, backgrounding, and retaining through finishing is present most years on many operations or whether the producers tend to do the same thing with all calves each year, but vary the decision across years. The distribution of our measured risk aversion scores is illustrated in Figure 2. The minimum combined score on the five risk questions (see Appendix) is a 5. That is, a risk aversion score of 5 indicates the respondent selected the most risk-averse response to each question. Three respondents had a risk aversion score of 5. The maximum possible score is 44. The highest score of respondents was one person with a 31. The average risk-aversion score was 13.1 with a standard deviation of 4.6 (Table 1). Most respondents have a score between 8 and 19 with a distribution of scores skewed to the right (Figure 2). Precise interpretation of these scores as to where on the scale someone is categorized as "risk averse" compared with someone who is "risk tolerant" is not possible. However, relative to other respondents, someone with a larger score is more risk tolerant.

Results

The ordered probit model estimation results are presented in Table 2. McFadden's R-squared for the system of equations was 0.18. Statistically significant error correlation was present between the weaning and backgrounding and the backgrounding and finishing models indicating estimating the model as a system increased efficiency. Marginal effects for statistically

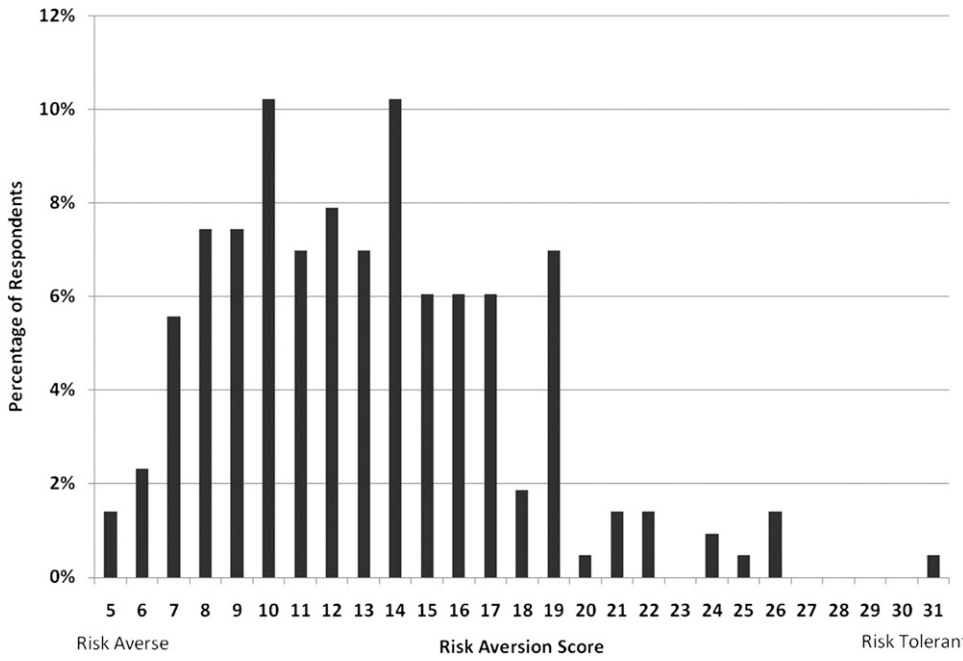

Figure 2. Distribution of Respondent Risk Aversion Scores

significant (0.10 level) continuous variables and changes in probabilities for binary variables at the means of all continuous variables and at values of 1 for all binary variables are reported in Table 3.

Producer Characteristics

The risk-aversion measure was statistically significant for both the *Weaning* and *Finish* models (Table 2). The probability that producers sell calves at weaning decreased with greater risk tolerance (i.e., lower risk aversion). Likewise, more risk tolerant producers were more likely to retain ownership through finishing. The predicted probabilities of selling at weaning, retaining through backgrounding, and retaining through finishing as risk aversion score changes are illustrated in Figure 3. The most risk-averse producers have about a 60% probability that they *often* or *always* sell calves at weaning. The most risk-tolerant producers have only a 15% probability that they will sell calves at weaning. Risk tolerance does not have much effect on producer decisions to background calves and then sell them. However, risk preferences have substantial impact on the probability producers *often* or *always* retain ownership through finishing. The most risk-averse producers have about a 10% chance of retaining ownership through finishing. In contrast, the most risk tolerant has more than a 70% chance of retaining ownership through finishing.[6]

Producer age and the level of off-farm wages were not statistically significant determinants of retention strategy. Popp, Faminow, and Parsch (1999) found age of producer to not

[6] Our risk aversion measure is based upon asking a set of questions measuring a complete set of risk tolerance attributes as discussed earlier. However, it is also by nature, *ad hoc*. Thus, to test sensitivity of our results to the questions selected and analyzed in our model, we estimated the model using three additional versions of the risk aversion measure. In particular, we considered just the answer to the first question in the Appendix as the risk aversion score, we considered just the fourth question and just the answer to the fifth question as risk aversion scores and we re-estimated the model. Though results were not identical across these iterations, general conclusions were similar in each case.

Table 2. Ordered Probit System Estimation Results Explaining Calf Retention Decisions

Variable	Sell at Weaning	Background and Sell	Retain and Finish
Producer Characteristics			
RiskAver	**−0.0609**	−0.0097	**0.0734**
	(0.0014)	(0.5866)	(0.0002)
Age	−0.0016	−0.0055	−0.0080
	(0.8526)	(0.5019)	(0.3852)
OffFarm	−0.0027	0.0019	0.0008
	(0.4295)	(0.5671)	(0.8441)
Farm Attributes			
Leverage	**0.5919**	−0.0170	−0.4219
	(0.0835)	(0.9598)	(0.2622)
Liquidity	**−0.2738**	0.1222	**−0.2491**
	(0.0039)	(0.1907)	(0.0195)
Cows	−0.0004	−0.0009	0.0001
	(0.6988)	(0.3376)	(0.8927)
CattleShare	−0.3031	0.3465	**1.1227**
	(0.4469)	(0.3739)	(0.0152)
Herfindahl	**1.2096**	**−1.1912**	**−1.3182**
	(0.0271)	(0.0246)	(0.0473)
Management Traits			
SpringCalf	**−0.0086**	**0.0080**	0.0007
	(0.0019)	(0.0035)	(0.8240)
Alliance	−0.1330	0.3470	−0.1929
	(0.6250)	(0.2004)	(0.5191)
AI	−0.1730	**0.3472**	0.1344
	(0.4011)	(0.0923)	(0.5479)
TechCA	−0.1161	0.1149	0.2592
	(0.5167)	(0.5117)	(0.1727)
BusCA	**0.7347**	**−0.3911**	**0.4340**
	(0.0005)	(0.0538)	(0.0433)
MktgCA	−0.1157	−0.0383	0.3146
	(0.5765)	(0.8532)	(0.1688)
ProdCA	**−0.4153**	**0.4519**	−0.0953
	(0.0236)	(0.0118)	(0.6379)
Intercept	**0.3014**	0.0590	0.1539
	(0.0001)	(0.9381)	(0.8484)
Limit 1[a]	**0.6615**	**0.3108**	**0.5186**
	(0.0001)	(0.0001)	(0.0001)
Limit 2[a]	**1.0446**	**0.7015**	**0.9089**
	(0.0001)	(0.0001)	(0.0001)
Limit 3[a]	**0.0590**	**1.1432**	**1.1388**
	(0.9381)	(0.0001)	(0.0001)

Notes: Numbers in () are *p*-values. Coefficients in bold font are statistically different from zero at 0.10 level. Observations = 215; Log Likelihood = −732.29; McFadden's R-Squared for System = 0.18. Rho (weaning, background) = −0.75 (0.04); Rho (weaning, finish) = −0.04 (0.10); Rho (background, finish) = −0.37 (0.09).

[a] *Limit 1, 2,* and *3* are the estimates of n_i (I = 1, 2, and 3 respectively) from Equation (2).

statistically influence calf retention (they did not have an off-farm wage variable in their model). Gillespie, Basarir, and Schupp (2004) found older producers more likely to retain ownership, but off-farm wages were not statistically significant.

Table 3. Marginal Effects for Continuous (c) and Change in Probability for Binary (b) Variables for Statistically Significant Variables (0.10 level)

Variable	Never	Seldom	Sometimes	Often	Always
Producer Characteristics			Sell at Weaning		
RiskAver (c)	0.0225	0.0017	−0.0008	−0.0038	−0.0197
Farm Attributes					
Leverage (c)	−0.2186	−0.0166	0.0074	0.0368	0.1910
Liquidity (c)	0.1011	0.0077	−0.0034	−0.0170	−0.0884
Herfindahl (c)	−0.4466	−0.0339	0.0150	0.0752	0.3903
Management Traits					
SpringCalf (c)	0.0032	0.0002	−0.0001	−0.0005	−0.0028
BusCA (b)	−0.2866	0.0101	0.0401	0.0618	0.1745
ProdCA (b)	0.1377	0.0197	0.0068	−0.0149	−0.1493
Farm Attributes			Background and Sell		
Herfindahl (c)	0.2770	0.0875	0.0843	0.0237	−0.4726
Management Traits					
SpringCalf (c)	−0.0019	−0.0006	−0.0006	−0.0002	0.0032
AI (b)	−0.0952	−0.0232	−0.0176	0.0034	0.1327
BusCA (b)	0.0731	0.0287	0.0330	0.0196	−0.1544
ProdCA (b)	−0.1292	−0.0287	−0.0197	0.0082	0.1694
Producer Characteristics			Retain and Finish		
RiskAver (c)	−0.0272	−0.0018	0.0035	0.0035	0.0220
Farm Attributes					
Liquidity (c)	0.0923	0.0062	−0.0119	−0.0118	−0.0748
CattleShare (c)	−0.4160	−0.0279	0.0535	0.0534	0.3370
Herfindahl (c)	0.4884	0.0328	−0.0628	−0.0627	−0.3957
Management Traits					
BusCA (b)	−0.1694	0.0078	0.0306	0.0231	0.1080

Farm Attributes

Several farm attributes were evaluated to determine their impact on calf retention. We expected leverage to be a potential determinant of retention as producers may need revenue from the calf crop to service debt obligations. In addition, if producers are concerned about liquidity, they may sell calves to get the cash sooner than if they retain. Our results indicate debt load relative to asset base does affect retention decisions (Table 2). *Leverage* is positive and statistically significant for *selling at weaning*. A 10 percentage point increase in leverage (e.g., going from 0.20–0.30) increases the probability a producer will *often* or *always* sell calves at weaning by 2.3% (0.0368 + 0.191 in Table 3 times 0.10). Perhaps producers with greater debt loads prefer not to take added risks of retaining calves and instead prefer to use the certain income by selling at weaning to use for debt servicing. Previous studies have not explicitly tested leverage as a determinant of calf retention.

Liquidity had the expected impact on producers retaining calves through finishing but an unexpected impact on selling calves at weaning. Producers indicating they have greater concerns about liquidity were less likely to retain calves through finishing. An incremental increase in liquidity concern (e.g., going from a response that liquidity concern was 3 = neutral to 4 = important) increased the probability producers *seldom* or *never* retain through finishing by 10% (Table 3). Unexpectedly, concern for liquidity also increased likelihood of producers retaining calves beyond weaning (Table 2). We presume this finding is spurious.

Cow herd size was not statistically different from zero for any retention activity. This result is consistent with results of Gillespie, Basarir,

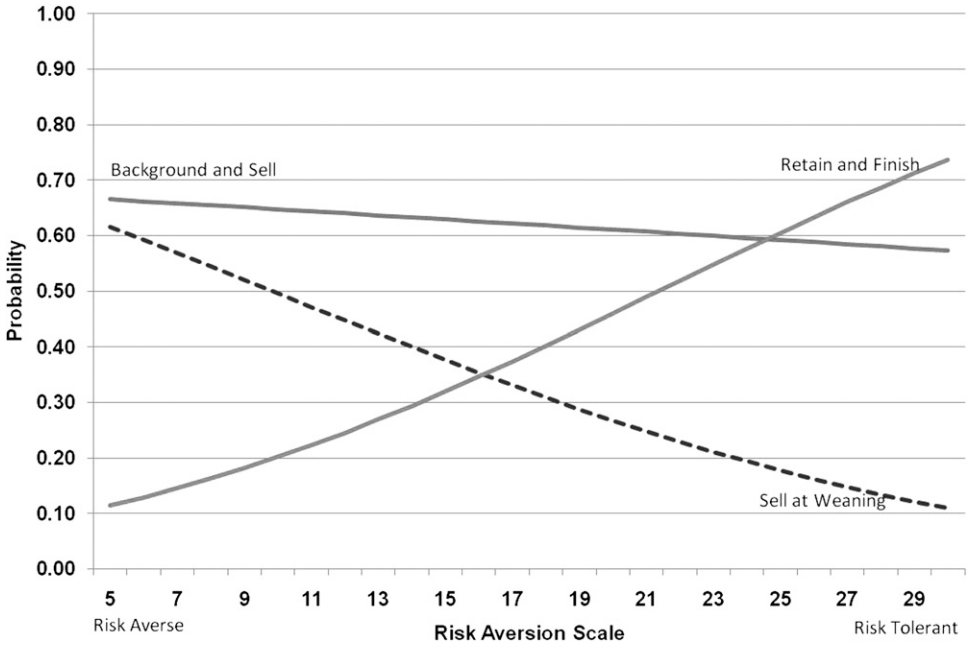

Figure 3. Probability of Cow-Calf Producer *Often* or *Always* Employing Steer Calf Retention Strategies as Risk Aversion Varies

and Schupp (2004) and Popp, Faminow, and Parsch (1999). The share of gross farm income is significantly related to producers retaining ownership through finishing (Table 2). As noted earlier, this might be a tautology as producers who retain ownership will have greater gross farm income from cattle operations, all else equal, than those who do not retain. An increase in the share of income generated by the cattle operation of 10 percentage points (e.g., *CattleShare* increasing from 0.28–0.38) increases the probability a producer would *always* retain ownership by 3.4% (i.e., Table 3 probability of *always* = 0.34 times 0.10 marginal increase in *CattleShare*).

The farm's level of enterprise diversification (*Herfindahl*) had a statistically significant impact on producer retained ownership strategy for each retention decision (Table 2). An increase in the *Herfindahl* of 0.10 increases the probability a producer would *always* sell at weaning by 3.9% and reduces the chance they would *never* sell at weaning by 4.5% (Table 3). In contrast, increasing the *Herfindahl* by 0.10 would be associated with increasing the chances a producer *never* retains ownership of calves through finishing by 4.9% and reduces the probability of *always* retaining through finishing by 4.0%.

Figure 4 illustrates how the added predicted probabilities of a producer *often* or *always* retaining ownership changes as farm enterprise diversification increases. Bottom line, more specialized farms tend to sell calves at weaning and diversified farms background calves and then sell them. For diversified farms, the cow-calf herd is a less important component of overall farm income and, as such, the impact of production and price risk from retaining calves is less. Also, on diversified farms, there is increased opportunity for feed availability along with a smaller percentage of time being devoted to adding value to calves. More specialized farms, with fewer enterprises, are more likely to devote a greater percentage of time to calf backgrounding and/or finishing and to realize a greater level of production and price risk from retaining ownership. Popp, Faminow, and Parsch (1999) and Gillespie, Basarir, and Schupp (2004) both found no impact of number of other enterprises on calf retention. However, neither previous study examined retention

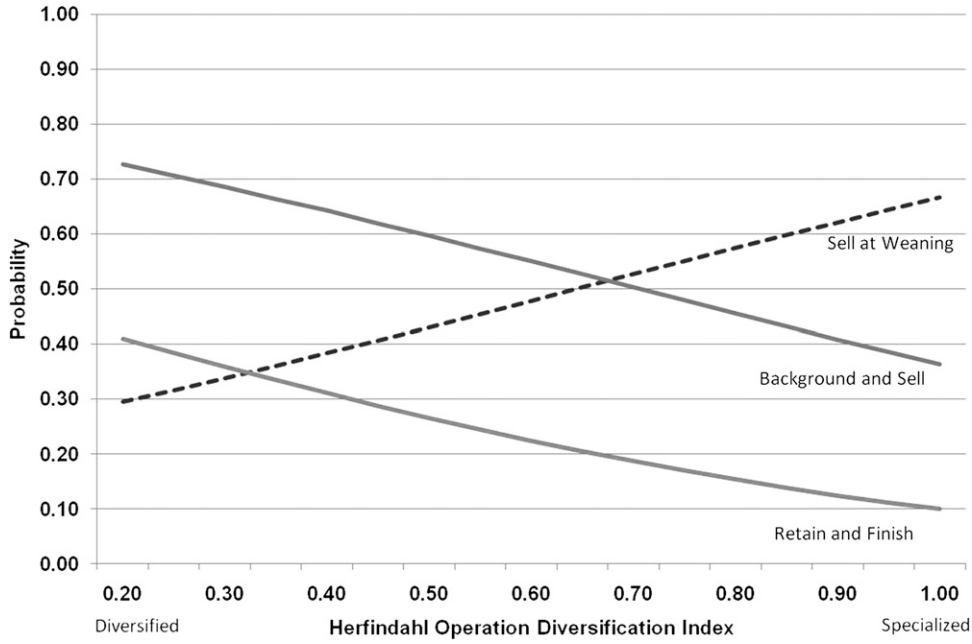

Figure 4. Probability of Cow-Calf Producer *Often* or *Always* Employing Steer Calf Retention Strategies as Operation Enterprise Diversification Varies

through finishing compared with selling at weaning where enterprise specialization impact differences become most pronounced.

Management Traits

Calving season (*SpringCalf*) was statistically significantly related to both selling at weaning and backgrounding, but was not significant in the decision to finish calves (Table 2). Producers who spring calve a larger percentage of their calves, are less likely to sell at weaning and instead retain through backgrounding before they sell. A 10 percentage point increase in spring calving (e.g., from 70% to 80%) increases the chance a producer *never* sells at weaning by 3.2% and reduces the chance they *always* sell at weaning by 2.8% (Table 3). Increasing spring calving by 10 percentage points increases the chance a producer *always* backgrounds calves by 3.2% and reduces the chances they *never* background by 1.9%. Popp, Faminow, and Parsch (1999) found that the more control a producer had over calving seasons, and the more number of seasons in which calving took place, both increased the probability that a producer retained ownership. They argued that production control and market timing flexibility were both important for retaining ownership beyond weaning. Our results are likely reflecting the expected seasonal advantages to retaining ownership for spring-born calves weaned in the fall when calf prices often are at seasonal lows for the year.

Producers being part of an alliance is not associated with retention strategy. Producers who use artificial insemination (*AI*) are more likely to background calves. However, *AI* use does not affect retaining through finishing. Producers who consider themselves to have comparative advantages in technology adoption or in marketing skills do not show systematic differences in calf retention strategies, all else equal. However, producers who consider themselves as having comparative advantages in business planning (*BusCA*) and in production skills (*ProdCA*) do exhibit different calf retention strategies (Table 2). Those who tend to consider themselves good business planners tend to sell calves at weaning or retain ownership of calves through finishing—they tend not to sell calves at the backgrounding

stage. Compared with producers not noting business planning as a comparative advantage, those that indicated it was a comparative advantage had a 17% greater probability of *always* selling at weaning and 29% lower probability of *never* selling at weaning (Table 3). Business planners had an 11% greater probability of *always* retaining calves and a 17% lower probability of *never* retaining calves through finishing (Table 3).

Most producer respondents considered themselves to have a comparative advantage in production skills (71%, Table 1). Production skill comparative advantage was positively associated with retaining ownership through backgrounding, negatively associated with likelihood of selling at weaning, and not related to retaining through finishing (Table 2). Those with a production comparative advantage had a 14% greater probability of *never* selling at weaning and a 15% lower probability of *always* selling at weaning (Table 3). Respondents indicating a production advantage were 17% more likely to *always* retain through backgrounding.

Conclusions

For years agricultural economists have identified and disseminated information about potential profit opportunities associated with cow-calf producers retaining ownership of calves and adding value through backgrounding and finishing. Despite apparent profit enhancements present, many producers have not adopted calf retention and value added strategies. Results from our survey of a sample of Kansas producers reveal that nearly 40% indicate they *often* or *always* sell calves at weaning. However, 44% indicate they *often* or *always* retain through backgrounding, and 13% through finishing. If profit opportunities are prevalent from retaining ownership, what precludes producers from engaging in more frequent retention strategies? Our study was designed to determine specific factors affecting calf retention decisions by cow-calf producers.

Risk aversion is one of the important factors affecting cow-calf producer calf ownership retention decisions. Our survey reveals cow-calf producers have a wide range of risk tolerance—they are not uniformly risk averse. Risk-averse producers have more than a 60% probability they will *often* or *always* sell their calves at weaning. Risk tolerant producers are much more willing to consider retained ownership through finishing. This indicates that informing producers about profit potential and variation associated with retained ownership will likely not change their behavior without consideration for how they might manage added risk associated with retention beyond weaning. More attention to how producers might manage risks associated with retained ownership might be as important as illustrating return potential.

Several factors related to calf retention strategies are innately related to the structure of the operation and to management attributes of the producer. Specialized farms sell calves at weaning. Such operations do not retain calves either through backgrounding or finishing. Perhaps specialized farms do not have as many alternative cheap forage sources, such as crop residue, for backgrounding calves relative to more diversified operations. Calving season is also an important determinant of calf retention. Operations with more spring-born calves are more likely to retain through backgrounding (but not finishing). This may reflect the availability of cheap crop-residue forage in the fall when spring-born calves are weaned and the seasonal gains expected in calf prices into the late winter and early spring.

Several questions remain unanswered in this study. For example, if risk aversion is a key driver of producers selling calves at weaning, what are the sources that risk producers are most concerned with (e.g., production, animal health, expected costs, expected prices) and how might they best be addressed (White et al., 2007a)? What is the risk premium a risk-averse cow-calf producer would need to encourage retaining calves beyond weaning, if that is an identified goal? Do producer decisions to retain calves change each year in accordance with market expectations and how does risk aversion enter into that decision?

[Received December 2010; Accepted June 2011.]

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Appendix

Below are the risk questions and scoring methods used to construct risk aversion scores (score assigned to each answer in constructing overall scores are indicated in parentheses).

1. In your farm/ranch management, how would your neighbors describe your risk taking behavior?
   (1) a. A risk avoider
   (2) b. Cautious
   (4) c. Willing to take risks after adequate research
   (8) d. A real gambler
2. You can sell your calves at different production stages. If given the following options, which would you choose?
   (1) a. Sell at weaning
   (2) b. Retain for two months post weaning with a: 30% chance of netting an additional $5/head, 10% chance of losing $10/head, or 60% chance of netting no additional $/head
   (4) c. Retain through finishing with a: 30% chance of netting an additional $40/head, 15% chance of losing $50/head, or 55% chance of netting no additional $/head
3. Given the best and worst case potential outcomes from marketing your weaned calves, which net return/loss prospect would you most prefer from the four listed below?
   (1) a. $20/calf return best case; $0/calf loss worst case
   (2) b. $35/calf return best case; $20/calf loss worst case
   (4) c. $65/calf return best case; $35/calf loss worst case
   (8) d. $100/calf return best case; $75/calf loss worst case
4. Your trusted friend is putting together investors to fund a new innovative business venture. The venture could pay back more

than 50 times the investment if successful. If the venture is a bust, the entire investment is worthless. Your friend estimates the chance of success is 20%. How much would you invest?
(1) a. Nothing
(4) b. $1,000
(6) c. $10,000
(8) d. $50,000
(10) e. $100,000
(16) f. More than $100,000

5. If your trusted friend and banker each conclude that success of the venture in the above question is 60% instead of 20%, how much would you invest?
(1) a. Nothing
(2) b. $1,000
(3) c. $10,000
(4) d. $50,000
(6) e. $100,000
(8) f. More than $100,000