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## **Cow-Calf Producer Interest in Retained Ownership**

**Jason Franken, Joe Parcell, David Patterson,  
Michael Smith, and Scott Poock**

The beef industry's share of domestic meat demand continues to decline, as increasing vertical coordination in pork and poultry contribute to these industries' ability to offer convenient, consistent, and less expensive products. For such vertical coordination to be effective, incentives must be properly aligned so that those responsible for making the most important investments for system profitability are appropriately compensated. This study demonstrates that cow-calf producers who invest in quality registered cattle and those who are interested in incorporating feedlot and carcass data into herd management decisions are also more interested in retained ownership.

**Key Words:** beef cattle, property rights theory, retained ownership

The beef industry's share of domestic meat demand is declining, as pork and poultry offer increasingly convenient, consistent, and less expensive products (Gillespie, Basarir, and Schupp, 2004). At one time, pork and poultry markets were much like the beef industry, with cash market transactions dominating between successive stages in the supply chain (Rhodes, 1995). Each of these industries faces similar challenges in transforming commodities into retail products that meet specific consumer demands. Specifically, uncertainty regarding producer effort and/or the quality of the animal prior to slaughter and price risk impede product consistency and preservation of low retail prices (Martinez, 2002). Various forms of increasingly tighter vertical coordination have been adopted in response to these issues, with the pork and poultry industries leading the way in coordinating product consistency.

Vertical linkages in agricultural supply chains are coming under increasing scrutiny as efforts to enhance coordination become more common (Vukina et al., 2007). Applications of property rights theory (Grossman and Hart, 1986; Hart and Moore, 1990) suggest that various forms of vertical coordination adopted in pork

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Jason Franken is post-doctoral fellow and Joe Parcell is associate professor, both in the Department of Agricultural Economics, University of Missouri. David Patterson is professor and state beef extension specialist, Michael Smith is professor and Interim Director in the Division of Animal Sciences, and Scott Poock is extension specialist in Extension Veterinary Medicine, all at the University of Missouri. This project was supported by University of Missouri Extension and the National Research Initiative of the Cooperative State Research, Education and Extension Service, USDA, Grant No. 2007-55618-18238.

and poultry industries are responses intended to incentivize optimal investment or effort and to economize on monitoring and other transaction costs. Under tournament contracts, poultry producers are paid based on productive efficiencies (e.g., feed gain and minimal death loss) relative to peers, while integrators bear the common production risk, much of which depends on their decisions regarding chick genetics and ration formulations (Knoeber, 1989; Knoeber and Thurman, 1995; Vukina and Leegomonchai, 2006). Similarly, the use of alliances, contracts, and vertical ownership of the supply chain in the hog industry has been shown to depend upon the characteristics of investments at different stages and their importance for system profitability (Cozzarin and Westgren, 2000; Reimer, 2006).

Here, we argue that retained ownership by cow-calf producers also represents an augmentation of a traditional supply chain and, like other organizational forms in poultry and pork markets, this marketing alternative may induce optimal producer investments in animal quality. Much of the prior research on retained ownership is normative, identifying when producers should consider retained ownership based on variations in differences between current and expected future profits and their aversion to risk (e.g., Schroeder and Featherstone, 1990; McKissick and Ikerd, 1996; Van Tassell et al., 1997). Other research finds price differentials (i.e., live weight versus dressed weight and grade; auction versus grid pricing) consistent with risk premiums for cattle of unknown quality, which may suggest opportunities for producers of above average quality cattle to benefit from retained ownership (e.g., Fausti and Feuz, 1995; White et al., 2007). While Gillespie, Basarir, and Schupp (2004) report that retained ownership is statistically more likely for younger producers and producers regularly in contact with extension agents, little is known about what producer attributes contribute to use of retained ownership.

Using 2008 survey data on 188 Missouri cattle producers, we examined linkages among producer characteristics, interest in feedlot and carcass data and in retained ownership, and actual retained ownership in a structural equation model (SEM) framework (Bollen, 1989). The SEM allows us to trace the path of effects from producer characteristics to interest in retained ownership, and subsequently to retained ownership practices. Results indicate that younger producers and producers who have registered cattle (an indicator of quality), as well as those who are interested in performance-based management using feedlot and carcass data, are more interested in retained ownership.

The remainder of this article is organized as follows. First, we provide a review of the literature on retained ownership. The data and research design are then discussed, followed by a description of the SEM approach employed. Next, the empirical results are presented. The final section offers our concluding remarks.

### **Previous Literature**

Schroeder and Featherstone (1990) used expected utility-maximizing discrete stochastic programming to model optimal calf retention and marketing decisions

for cow-calf producers, using steer, heifer, and corn prices as stochastic variables. The authors conjectured, “The decision of whether to retain calves will be related to the current cash price the producer could receive by selling his calves, the producer’s expectations regarding future prices, production and opportunity costs, pricing alternatives available, and his aversion to risk” (p. 1029). Results confirmed that retention decisions depend on current profit, expected future profit distributions, pricing alternatives available (cash, hedging, and options), and producers’ risk aversion. Using a similar approach, Van Tassell et al. (1997) found that retained ownership decreased with profit realization at the decision point, producers’ risk aversion, and growing season precipitation, and increased with growth potential based on sires’ expected progeny differences (EPDs) for yearling weight.

As noted by Marsh (1999, p. 336), “retaining ownership through finishing ... has become an increasingly important value-added option for producers marketing quality cattle.” Using data on 218 pens of five steers from a South Dakota Retained Ownership Demonstration Project that were marketed on dressed weight and grade, Fausti and Feuz (1995) detected premiums of \$9.22/head and \$6.74/head over cattle sold on live and dressed weight bases, respectively, indicative of risk aversion among cattle buyers facing quality uncertainty for nongraded cattle. Similarly, White et al. (2007) detected risk premiums between \$31/head and \$75/head charged by buyers at traditional auction markets over cattle purchased through grid pricing. They concluded, “Producers of cattle with known feedlot performance, carcass potential, or both might be better off retaining ownership of their calves or marketing them in a way that communicates the information ... directly to the buyer” (p. 87).

Gillespie, Basarir, and Schupp (2004) examined Louisiana cattle producers’ marketing methods, including conventional auctions, private treaties, video auctions, retained ownership, and strategic alliances. In general, producers using methods other than traditional auctions were younger and had larger and more diverse farming operations, heavier weaning weights, greater contact with county extension agents, and less dependence on off-farm income sources. For retained ownership specifically, only the effects of age and contact with extension agent variables were statistically significant.

### **Research Design**

In May 2008, a survey was sent to 1,200 Missouri cow-calf producers regarding management and marketing practices. The mailing list comprised producers who participate in the Show-Me-Select (SMS) replacement heifer program and a second mailing list purchased from Survey Sampling International. Of the 1,200 surveys distributed, 200 were returned with address unknown, and 266 were returned with responses. Four of the responding producers indicated they had retired and several other surveys were only partially completed. For the questions used in this analysis, 188 usable observations were available.

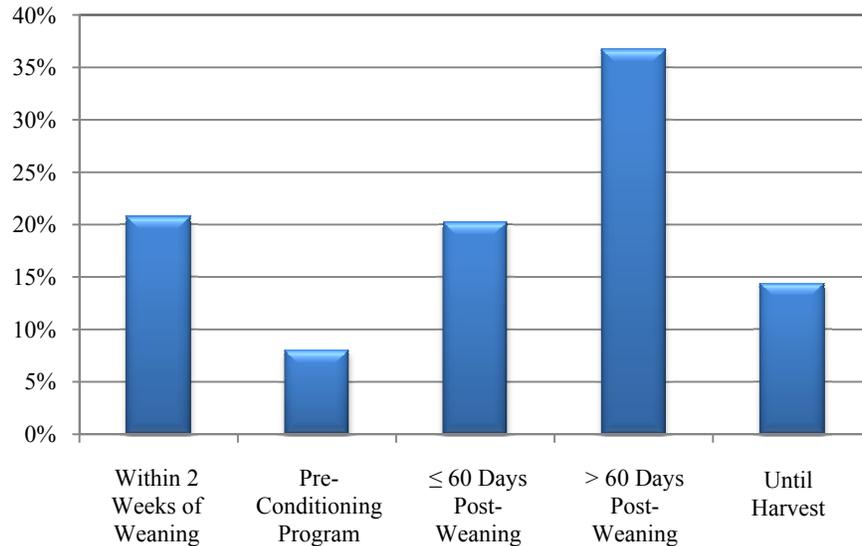
**Table 1. Summary Statistics for Missouri Cow-Calf Producers (N = 188)**

Variable	Maximum	Minimum	Mean	Standard Deviation
<b>Continuous Variables</b>				
<i>Age (years)</i>	91.00	21.00	56.94	13.68
<i>Cows (head)</i>	1,250.00	4.00	169.01	171.10
<i>Bulls (head)</i>	300.00	0.00	8.29	22.86
<i>Recent Bull Purchases (head)</i>	40.00	0.00	4.80	5.61
<i>% Black Calves</i>	100.00	0.00	64.00	29.00
<i>Length of Retained Ownership<sup>a</sup></i>	5.00	1.00	3.16	1.35
<b>Binary Variables (= 1 if yes)<sup>b</sup></b>				
<i>Interest in Retained Ownership</i>	1.00	0.00	0.36	0.48
<i>Commingles Cattle</i>	1.00	0.00	0.19	0.39
<i>Registered Cattle</i>	1.00	0.00	0.20	0.40
<i>Purebred Cattle</i>	1.00	0.00	0.46	0.50
<i>Interest in Feedlot Data</i>	1.00	0.00	0.64	0.48
<i>Interest in Carcass Data</i>	1.00	0.00	0.69	0.46

<sup>a</sup> *Length of Retained Ownership* = 1 if producer sells within two weeks of weaning, = 2 if producer sells after a preconditioning program, = 3 if producer sells after backgrounding up to 60 days post-weaning, = 4 if producer sells after backgrounding more than 60 days post-weaning, and = 5 if producer sells when calves are harvested. This question includes both cattle fed-out on-farm and retained ownership through a feedlot.

<sup>b</sup> The binary variable *Interest in Retained Ownership* pertains only to retained ownership through a feedlot. Mean statistics for binary variables effectively indicate the percentage of respondents answering "yes."

As observed from the summary statistics reported in table 1, the sample is representative of Missouri producers in terms of age, but herds are larger on average. The average age of the survey respondents (56.9) is within one year of the average age for Missouri beef cattle producers (57.3) reported by the U.S. Department of Agriculture's 2007 *Census of Agriculture*. The average herd size of 169 cows is much larger than the average range for Missouri of 30 to 35 head (Missouri Agricultural Statistics Service *Farm Facts*). Some producers have no bulls, suggesting they either rely on artificial insemination or borrow or rent other producers' bulls. The herds seem to be heavily influenced by the Black Angus breed, as 64% of calves are black on average. The average producer retains ownership while backgrounding up to 60 days post-weaning, as indicated by the mean statistic of 3.16 (see the footnote to table 1 for the coding of this variable). As shown in figure 1, however, the largest portion of respondents retain ownership more than 60 days post-weaning (37%), while substantial portions sell shortly after weaning (21%) and others retain ownership until harvest of the calves (14%). This survey question pertains to maintaining ownership of calves and does not distinguish between calves fed-out on-farm and other forms of retained ownership where calves are fed-out in a feedlot.



**Figure 1. Frequency of responses regarding *Length of Retained Ownership***

About 36% of the sample producers were interested in retaining ownership through a feedlot, as indicated by the mean statistic reported for this binary variable in table 1. A smaller portion of the sample had actually commingled their calves with other producers' calves prior to selling (19%). Similarly, only 20% of the survey respondents had registered cattle. Over twice that many had purebred cattle, and over half of the sample was interested in using carcass and feedlot data in cow herd management decisions.

Correlations are presented in table 2. Consistent with Gillespie, Basarir, and Schupp's (2004) finding, *Age* is negatively correlated with *Interest in Retained Ownership* and actual *Length of Retained Ownership*. Similarly, *Age* is negatively correlated with *Interest in Feedlot Data* and *Interest in Carcass Data*. The three measures of *Scale* (*Cows*, *Bulls*, and *Recent Bull Purchases*) are strongly correlated, but their correlation with other variables is often small in magnitude. *Length of Retained Ownership* is positively correlated with *Commingles Cattle*, *Interest in Retained Ownership*, *Interest in Feedlot Data*, and *Interest in Carcass Data*. While *Registered Cattle* and *Purebred Cattle* are correlated, their correlations with these other variables are generally opposite in sign. The only notable correlation for *% Black Calves* is the negative relationship with *Purebred Cattle*.

### Empirical Methods

Following Pennings and Leuthold (2000), a covariance structure model or structural equation model (SEM) is expressed as:

**Table 2. Correlations (N = 188)**

Variable	Age	Cows	Bulls	Recent Bull Purchases	Registered Cattle	Purebred Cattle
Age	1.00					
Cows	0.03	1.00				
Bulls	0.10*	0.65***	1.00			
Recent Bull Purchases	0.07	-0.80***	0.40***	1.00		
Registered Cattle	0.00	-0.01	0.14**	-0.14**	1.00	
Purebred Cattle	0.02	-0.10*	0.04	-0.18***	0.46***	1.00
Length of Ret. Ownership	-0.07	-0.05	0.04	-0.03	0.07	-0.13**
Interest in Ret. Ownership	-0.15**	0.05	0.09	0.01	0.13**	-0.05
Interest in Feedlot Data	-0.17***	0.06	0.06	0.00	0.20***	-0.07
Interest in Carcass Data	-0.22***	0.12**	0.08	0.07	0.16**	-0.08
Commingle Cattle	-0.06	-0.02	0.15**	0.01	0.10*	0.01
% Black Calves	0.01	0.03	0.06	-0.05	-0.03	-0.12**

Note: Single, double, and triple asterisks (\*, \*\*, \*\*\*) denote statistical significance at the 10%, 5%, and 1% levels, respectively.

( extended . . . → )

$$\begin{aligned}
 (1) \quad & \mathbf{x} = \Lambda^x \boldsymbol{\xi} + \boldsymbol{\delta}, \\
 (2) \quad & \mathbf{y} = \Lambda^y \boldsymbol{\eta} + \boldsymbol{\varepsilon}, \\
 (3) \quad & \boldsymbol{\eta} = \mathbf{B} \boldsymbol{\eta} + \boldsymbol{\Gamma} \boldsymbol{\xi} + \boldsymbol{\zeta}.
 \end{aligned}$$

Equations (1) and (2) are factor-analytic measurement models that tie observable indicants to unobservable latent constructs. The  $q \times 1$  vector  $\mathbf{x}$  contains measures of the exogenous constructs in the  $n \times 1$  vector  $\boldsymbol{\xi}$ , while the  $p \times 1$  vector  $\mathbf{y}$  contains measures of the endogenous constructs in the  $m \times 1$  vector  $\boldsymbol{\eta}$ . The coefficient matrices  $\Lambda^x$  and  $\Lambda^y$  relate  $\mathbf{x}$  to  $\boldsymbol{\xi}$  and  $\mathbf{y}$  to  $\boldsymbol{\eta}$ , respectively, with measurement errors represented by the vectors  $\boldsymbol{\delta}$  and  $\boldsymbol{\varepsilon}$ . Equation (3) is the path model that expresses the relationships among the constructs. The coefficient matrix  $\mathbf{B}$  denotes the effects of endogenous constructs on one another, while the coefficient matrix  $\boldsymbol{\Gamma}$  denotes the effects of exogenous constructs on endogenous constructs. The vector of disturbances  $\boldsymbol{\zeta}$  represents errors in equations. Best practices for implementing SEMs, as summarized by McDonald and Ho (2002), are followed here. Empirical results are reported in the following section.

The literature reviewed herein indicates that retained ownership is an increasingly important value-added option for producers marketing quality cattle (Marsh, 1999; White et al., 2007). Hence, we hypothesize that higher quality cattle enhance (interest in) retained ownership. Producers may manage their herds based not only on genetics or pedigree, but also on performance. Thus, we hypothesize that interest in using feedlot and carcass data for herd management is associated with (interest in) retained ownership. To ascertain such effects, other factors likely need to be controlled for, such as scale, producer age, and cattle breed.

**Table 2. Extended**

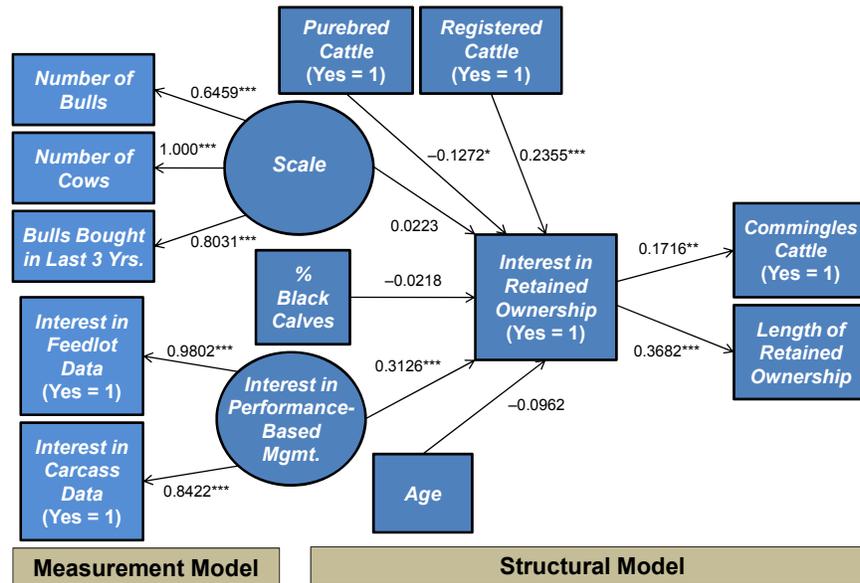
Variable	<i>Length of Retained Ownership</i>	<i>Interest in Retained Ownership</i>	<i>Interest in Feedlot Data</i>	<i>Interest in Carcass Data</i>	<i>Commingles Cattle</i>	<i>% Black Calves</i>
<i>Age</i>						
<i>Cows</i>						
<i>Bulls</i>						
<i>Recent Bull Purchases</i>						
<i>Registered Cattle</i>						
<i>Purebred Cattle</i>						
<i>Length of Ret. Ownership</i>	1.00					
<i>Interest in Ret. Ownership</i>	0.36***	1.00				
<i>Interest in Feedlot Data</i>	0.26***	0.35***	1.00			
<i>Interest in Carcass Data</i>	0.33***	0.31***	0.83***	1.00		
<i>Commingles Cattle</i>	0.09*	0.17***	0.11*	0.12**	1.00	
<i>% Black Calves</i>	-0.06	0.01	0.10*	0.08	-0.07	1.00

Gillespie, Basarir, and Schupp (2004) did not find scale to be a significant predictor of retained ownership. Their summary statistics suggested that proportional use of retained ownership was largest among the smallest (1 to 19 head) and largest (over 100 head) scale segments of their sample. While the authors found age to be a significantly negative predictor of retained ownership, they noted the effect was indeterminate a priori. Older, more experienced cattle producers may be expected to recognize the advantages of alternative marketing arrangements or, as in the case of technology adoption, may be slower to adopt newer marketing procedures.

### Empirical Results

Abbreviated SEM results are presented in figure 2. (Full results, including error variances, are available from the authors upon request.) The model is designed to trace the path of effects of various producer characteristics on interest in retained ownership, and subsequently on actual retained ownership and commingling of calves.<sup>1</sup> While the model fit is somewhat less than ideal (root mean squared error = 0.1970), this is notably the first attempt to model retained ownership as a function of producers' cattle quality and interests in performance-based management. Marginal effects cannot be inferred from SEM results, but the standardized coefficients presented here provide insight into the relative magnitude or importance of effects.

<sup>1</sup> Factor analysis (Hair et al., 1995) was used to validate the measures of *Scale* and *Interest in Performance-Based Management* employed in the measurement model. The observable variables underlying these latent or unobservable variables are highly correlated (table 2). Another latent variable, comprised of *Registered Cattle*, *Purebred Cattle*, and *% Black Calves*, was investigated as a measure of perceived cattle quality, but the analysis indicated these observable variables should be considered separately.



Notes: Single, double, and triple asterisks (\*, \*\*, \*\*\*) denote statistical significance at the 10%, 5%, and 1% levels, respectively. Reported statistics are standardized coefficients, indicative of the magnitude of each variable's relative impact.  $N = 188$ ,  $\chi^2_{[56]} = 462.25$ , and root mean squared error (RMSE) = 0.1970.

**Figure 2. Results of structural equation model**

Consistent with Gillespie, Basarir, and Schupp (2004), the sign of the coefficient on *Age* is negative, but the same level of statistical significance is not found here ( $p$ -value = 0.1472). Also as in the previous study, *Scale* has a small, positive, but statistically insignificant impact. A subtle nuance is that here these variables influence *Interest in Retained Ownership*, whereas they directly influence actual retained ownership in Gillespie, Basarir, and Schupp. In our study, *% Black Calves* also has a statistically insignificant effect.

Interestingly, *Registered Cattle*, a proxy for quality cattle, significantly increases *Interest in Retained Ownership*, while *Purebred Cattle* has a significantly negative impact. While purebred cattle may also be high quality, animals destined for slaughter are of interest here, and purebred producers more likely provide seed stock to other producers or, as Gillespie, Basarir, and Schupp (2004) suggest, sell directly to persons involved in 4-H programs. Alternatively, producers of purebred cattle may not emphasize quality as much in their management, particularly if the producers don't own registered animals. The results also suggest that producers who are interested in using feedlot and carcass data for herd management decisions are likely more interested in retained ownership. Intuitively, *Interest in Retained Ownership* through a feedlot significantly increases the actual *Length of*

*Retained Ownership* and the associated commingling of cattle in feedlots (i.e., *Commingles Cattle*). These effects are of notable magnitude and are statistically significant at the 1% and 5% levels, respectively.

## Conclusions

This study utilizes cow-calf producer survey data and structural equation modeling to limit measurement error and trace the path effects of various producer characteristics on interest in and actual use of retained ownership. While the analysis is consistent in some respects with an earlier study on retained ownership (Gillespie, Basarir, and Schupp, 2004), further insights are gained regarding the impacts of cattle quality and interest in performance-based management. Cattle quality, as measured by ownership of registered cattle, significantly increases interest in retained ownership, which itself is significantly associated with actual retained ownership and commingling of calves. Similarly, interest in performance-based management, as measured by interest in feedlot and carcass data, is significantly associated with interest in retained ownership.

These results are consistent with an incentives-based argument that ownership supports producer investments in cattle quality and management effort. In the vastly more vertically integrated pork and poultry industries, similar arguments are employed to explain the observed vertical organization of supply chains. For instance, Cozzarin and Westgren (2000) conclude that within alliances in the hog industry, claims to residual rents should be shifted from finishing units to farrowing units, the stage which most impacts system profits. Future research on vertical supply arrangements in the beef industry may apply similar theoretical approaches as currently used in hog and poultry market research, such as transaction cost economics (Williamson, 1975) and property rights theory (Grossman and Hart, 1986; Hart and Moore, 1990).

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