

Cow-Calf Producer Interest in Retained Ownership

Authors

Jason Franken, University of Missouri, frankenj@missouri.edu

Joe Parcell, University of Missouri, parcellj@missouri.edu

David Patterson, University of Missouri, pattersond@missouri.edu

Michael Smith, University of Missouri, smithmf@missouri.edu

Scott Pook, University of Missouri, pooks@missouri.edu

*Selected Paper prepared for presentation at the Southern Agricultural Economics Association
Annual Meeting, Orlando, FL, February 6-9, 2010*

Copyright 2010 by Franken, Parcell, Patterson, Smith, and Pook. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract

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

JEL Code: Q13

Cow-Calf Producer Interest in 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 keeping retail prices low (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 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

* 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 2007-55618-18238.

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 that, 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 Tassel, McNeley, MacNeil, Short, and Grings 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, Anderson, McKinley, and Parish 2007). While Gillespie, Basarir, and Schupp (2004) find 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 between 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 that have registered cattle (an indicator of quality), as well as those that

are interested in performance based management using feedlot and carcass data are more interested in retained ownership.

The article is organized as follows. The next section reviews the literature on retained ownership. Then, the data and research design are discussed, followed by a description of the SEM approach employed. Subsequently, results are presented, followed by concluding remarks.

Previous Literature

Schroeder and Featherstone (1990) applied an expected utility-maximizing discrete stochastic programming model to calf retention and marketing decisions for cow-calf producers, using steer, heifer, and corn prices as stochastic variables. Results showed that retention decisions depend on current profit, expected future profit distributions, pricing alternatives available (cash, hedging, and options), and the producers' aversion to price risk. "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).

Using a similar discrete stochastic programming model as Schroeder and Featherstone (1990), Van Tassel, *et al.* (1997) modeled optimal retained ownership decisions. 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 non-graded cattle. Similarly, White, et al. (2007) detected risk premiums between \$31/head to \$75/head charged by buyers at traditional auction markets over cattle purchased through grid pricing and 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 where 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 out to 1200 Missouri cow-calf producers regarding management and marketing practices. The mailing list comprised producers that participate in the Show-Me-Select (SMS) replacement heifer program and a second mailing list purchased from Survey Sampling International. Of the 1200 surveys distributed, 200 were returned with address unknown, and 266 were returned with responses. Four of the responding producers indicated that they had retired. Several of the surveys were only partially completed, and for the questions used in this analysis, 188 usable observations were available.

Summary statistics indicate that the sample is representative of Missouri producers in terms of age but are larger herds on average (Table 1). The average age of the survey respondents is within a year of the average age for Missouri beef cattle producers (57.3) reported by the United States 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 indicating that 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 percent 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 of 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 percent), while substantial portions sell shortly after weaning (21percent) and others retain ownership until harvest of the calves (14 percent). This 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.

About 36 percent of the sample was 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 co-mingled their calves with other producers' calves prior to selling (19 percent). Similarly, only 20 percent of the population 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 and length of actual retained

ownership. Similarly, age is negatively correlated with interest in feedlot and 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 co-mingling calves and interest in retained ownership and interest in feedlot and 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:

$$\mathbf{x} = \Lambda^x \boldsymbol{\xi} + \boldsymbol{\delta} \quad (1)$$

$$\mathbf{y} = \Lambda^y \boldsymbol{\eta} + \boldsymbol{\varepsilon} \quad (2)$$

$$\boldsymbol{\eta} = \mathbf{B}\boldsymbol{\eta} + \mathbf{\Gamma}\boldsymbol{\xi} + \boldsymbol{\zeta} . \quad (3)$$

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 Λ^x and Λ^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 each other, while the coefficient matrix $\mathbf{\Gamma}$ 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 for 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 enhances (interest in) retained ownership. Producers may manage their herds not only based on genetics or pedigree, but also based on performance. Hence, 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. Gillespie, Basarir, and Schupp (2004) did not find scale to be a significant predictor of retained ownership. 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 that 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 co-mingling of calves.¹ 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.

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 (2004). Here, the percentage of calves that had a solid black coat 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

¹ Factor analysis (Hair, Anderson, Tanham, and Black 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 percent black calves was investigated as a measure of perceived cattle quality, but the analysis indicated that these observable variables should be considered separately.

feedlot significantly increases the length of actual retained ownership and the associated co-mingling of cattle in feedlots. These effects are of notable magnitude and are statistically significant at the one and five percent 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 co-mingling 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) find 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 the hog and poultry market research, such as transaction cost economics (Williamson) and property rights theory (Grossman and Hart 1986; Hart and Moore 1990).

References

- Bollen, K.A. 1989. *Structural Equations with Latent Variables*, Wiley: New York.
- Cozzarin, B.P., and R.E. Westgren. 2000. "Rent Sharing in Multi-Site Hog Production." *American Journal of Agricultural Economics* 82,1(February):25-37.
- Fausti, S.W. and D.M. Feuz. 1995. "Production Uncertainty and Factor Price Disparity in the Slaughter Cattle Market: Theory and Evidence." *American Journal of Agricultural Economics* 77,3(August):533-540.
- Gillespie, J., A. Basarir, and A. Schupp. 2004. "Beef Producer Choice in Cattle Marketing." *Journal of Agribusiness* 22,2(Fall):149-161.
- Grossman, S.J. and O.D. Hart. 1986. "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy* 94,4:691-719.
- Hair, J.F., R.E. Anderson, R.L. Tanham, and W.C. Black. 1995. *Multivariate Data Analysis*. Englewood Cliffs, New Jersey: Prentice Hall, Inc.
- Hart, O.D. and J. Moore. 1990. "Property Rights and the Nature of the Firm." *The Journal of Political Economy* 98,6(December):1119-1158.
- Knoeber, C.R. 1989. "A Real Game of Chicken: Contracts, Tournaments, and the Production of Broilers." *Journal of Law, Economics, & Organization* 5,2(Autumn):271-292.
- Knoeber, C.R. and W. N. Thurman. 1995. "'Don't Count Your Chickens...': Risk and Risk Shifting in the Broiler Industry." *American Journal of Agricultural Economics* 77,3(August):486-496.
- Marsh, J.D. 1999. "The Effects of Breeding Stock Productivity on the U.S. Beef Cattle Cycle." *American Journal of Agricultural Economics* 81,2(May):335-346.
- Martinez, Steven W. 2002. Vertical Coordination of Marketing Systems: Lessons From the Poultry, Egg, and Pork Industries: USDA-ERS. Available at <http://www.ers.usda.gov/publications/aer807/>. [Retrieved January 7, 2010].
- McDonald, R.P., and M.H.R. Ho. 2002. "Principles and Practice in Reporting Structural Equation Analyses." *Psychological Methods* 7,1:64-82.
- McKissick, J.C., and J. Ikerd. 1996. "Retained Ownership in Cattle Cycles." In *Managing for Today's Cattle Market and Beyond*. Livestock Marketing Information Center. Available at <http://www.lmic.info/memberspublic/pubframes.html>. [Retrieved December 8, 2009].
- Missouri Agricultural Statistics Service. *Farm Facts*. Available at http://www.nass.usda.gov/Statistics_by_State/Missouri/index. [Retrieved May 8, 2009].

- Pennings, J.M.E., and R.M. Leuthold. 2000. "The Role of Farmers' Behavioral Attitudes and Heterogeneity in Futures Contracts Usage." *American Journal of Agricultural Economics* 82,4: 908-919.
- Reimer, J.J. 2006. "Vertical Integration in the Pork Industry." *American Journal of Agricultural Economics* 88,1(February):234-248.
- Rhodes, V.J. 1995. "The Industrialization of Hog Production." *Review of Agricultural Economics* 17,2(May):107-118.
- Schroeder, T.C. and A.M. Featherstone. 1990. "Dynamic Marketing and Retention Decisions for Cow-Calf Producers." *American Journal of Agricultural Economics* 72,4(November):1028-1040.
- United States Department of Agriculture, 2007. Census of Agriculture 1(51). Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Missouri/st29_1_062_062.pdf. [Retrieved November 21 2009].
- Van Tassel, L.W., S.M. McNeley, M.D. MacNeil, R.E. Short, E.E. Grings. 1997. "Retained Ownership of Beef Cattle When Considering Production and Price Risk." Presented at Western Agricultural Economics Association 1997 Annual Meeting July 13-16, 1997 in Reno/Sparks, Nevada. Available at <http://ageconsearch.umn.edu/bitstream/35876/1/waeasp13.pdf>. [Retrieved May 21 2009].
- Vukina, T. and P. Leegomonchai. 2006. "Oligopsony Power, Asset Specificity, and Hold-Up: Evidence from the Broiler Industry." *American Journal of Agricultural Economics* 88,3(August):589-605.
- Vukina, T., M.K. Muth, N. Piggott, C. Shin, M. Wohlgenant, X. Zheng, S. Cates, M. Coglaiti, S. Karns, J. Lawrence, J. Taylor, C. Viator. 2007. "GIPSA Livestock and Meat Marketing Study, Volume 4: Hog and Pork Industries," Final Report: RTI International, January 2007. Available at http://archive.gipsa.usda.gov/psp/issues/livemarketstudy/LMMS_Vol_4.pdf. [Retrieved March 4, 2009].
- White, B.J., J.D. Anderson, W.B. McKinley, and J. Parish. 2007. "Factor Price Disparity and Retained Ownership of Feeder Cattle: An Application of Feedlot and Carcass Performance Data to Farm-Level Decision Making." *Journal of Agricultural and Applied Economics* 39,1(April):87-101.

Table 1. Summary Statistics

	Maximum	Minimum	Mean	Standard Deviation
<u>Continuous Variables</u>				
Age (years)	91.00	21.00	56.94	13.68
Cows (head)	1250.00	4.00	169.01	171.10
Bulls (head)	300.00	0.00	8.29	22.86
Recent Bull Purchases (head)	40.00	0.00	4.80	5.61
% Black Calves	100.00	0.00	64.00	29.00
Length of Retained Ownership	5.00	1.00	3.16	1.35
<u>Binary Variables (=1 if yes)</u>				
Interest in Retained Ownership	1.00	0.00	0.36	0.48
Co-Mingle Cattle	1.00	0.00	0.19	0.39
Registered Cattle	1.00	0.00	0.20	0.40
Purebred Cattle	1.00	0.00	0.46	0.50
Interest in Feedlot Data	1.00	0.00	0.64	0.48
Interest in Carcass Data	1.00	0.00	0.69	0.46

Note: n = 188. Length of Retained Ownership equals 1 if producer sells within 2 weeks of weaning, 2 if producer sells after a pre-conditioning 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. 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.

Table 2. Correlations.

	Age	Cows	Bulls	Recent Bull Purchases	Registered Cattle	Purebred Cattle	Length of R.O.	Interest in R.O.	Interest in Feedlot Data	Interest in Carcass Data	Co-Mingle Cattle	% Black Calves
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 R.O.	-0.07	-0.05	0.04	-0.03	0.07	-0.13**	1.00					
Interest in R.O.	-0.15**	0.05	0.09	0.01	0.13**	-0.05	0.36***	1.00				
Interest in Feedlot Data	-0.17***	0.06	0.06	0.00	0.20***	-0.07	0.26***	0.35***	1.00			
Interest in Carcass Data	-0.22***	0.12**	0.08	0.07	0.16**	-0.08	0.33***	0.31***	0.83***	1.00		
Co-Mingle Cattle	-0.06	-0.02	0.15**	0.01	0.10*	0.01	0.09*	0.17***	0.11*	0.12**	1.00	
% Black Calves	0.01	0.03	0.06	-0.05	-0.03	-0.12**	-0.06	0.01	0.10*	0.08	-0.07	1.00

Note: n = 188. R.O. denotes retained ownership.

Figure 1. Frequency of Responses Regarding Length of Retained Ownership

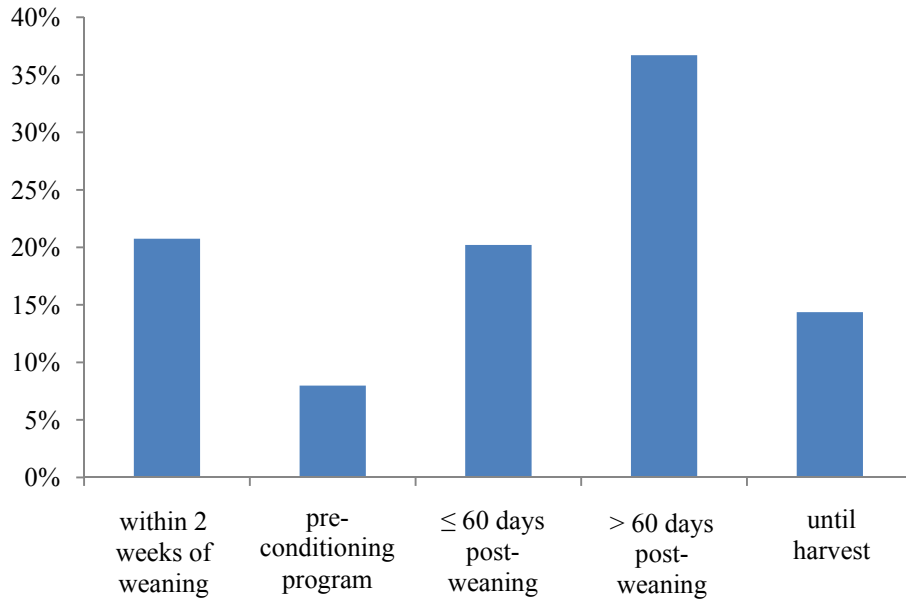
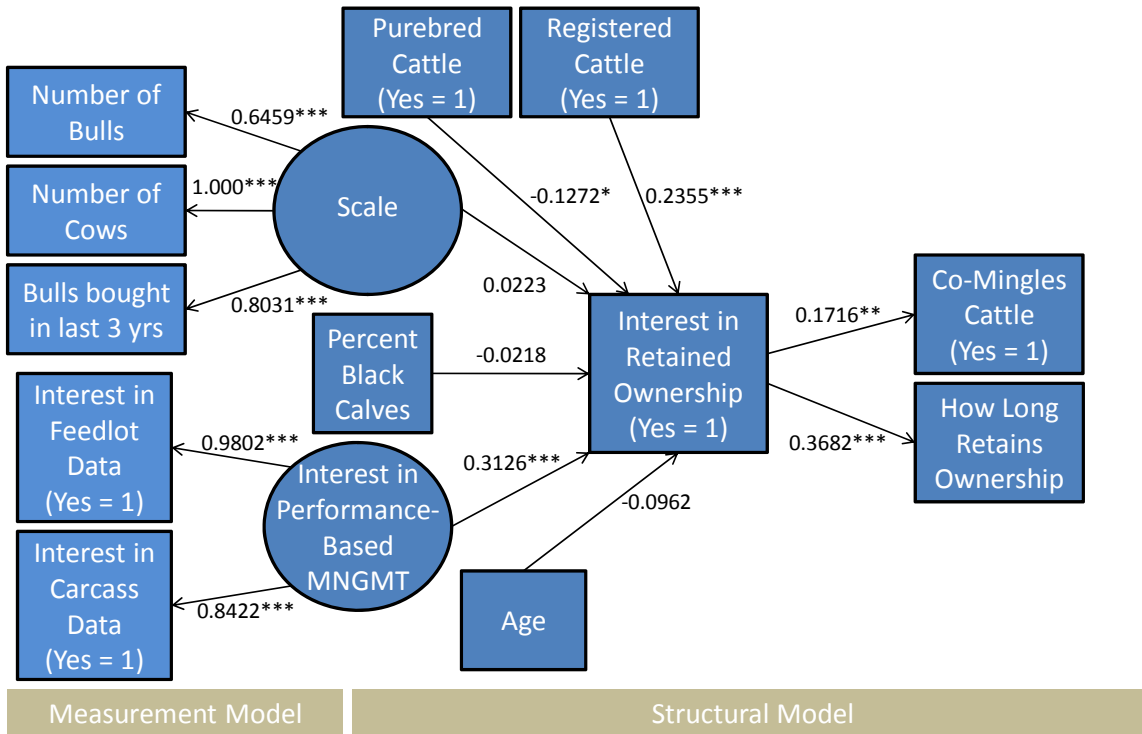


Figure 2. Results of Structural Equation Model.



Note: $n = 188$. $\chi^2(56) = 462.25$ and Root Mean Squared Error = 0.1970. ***, **, * denote statistical significance at one, five, and ten percent levels, respectively. Reported statistics are standardized coefficients, indicative of the magnitude of each variable's relative impact.