Price Signals as Indicators of Profitability at Various Stages of Production in Oklahoma Beef

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Abstract

Cow-calf producers face an annual decision on when to sell their calves. They can sell them at any point between weaning and slaughter, with the objective of finding the profit maximizing selling point. This paper investigates the use of price signals to determine profit maximizing selling points/retention strategies. Three retention strategies, one for fall calving and two for spring calving, are considered. Producers can sell their calves at weaning, after preconditioning, after grass pasture, after wheat pasture, or after the feedlot depending on the retention strategy. These price signals indicate the optimal selling point based on an observable price ratio at weaning. This paper also considers factors such as the level of preconditioning premiums and the length of the preconditioning period required to impact the profit maximizing selling point.

Introduction

Cow-calf producers decide annually whether to sell calves at weaning or retain ownership through additional stages of production. The stages of production considered here are preconditioning, wheat pasture, grass pasture, and feedlot. Preconditioning is a 45-day period in which calves are weaned, vaccinated, and prepared for the next stage of production. When calves go on wheat pasture, they graze wheat over the winter from about November until March. If they are put on grass, fall born calves are grazed on grass pasture for a three month period in the summer. After each stage of production, producers decide whether to sell the calves or keep them through the next stage. If calves are retained, producers are faced with another decision: what is the next stage? Since the profitability of each decision varies between years, no single choice is optimal every year. What decision rules should producers use?

Many researchers have explored the profitability of retaining ownership in a beef cattle operation. They have explored the decision from a variety of directions, looking at biological characteristics, prices, timing, risk, and management strategies. Williams and Farris (1971) used a linear programming approach to examine factors such as differences in feed costs, net revenues, and cost of gain to rank feeding systems within and between regions in Texas. Anderson and Trapp (2000) used an econometric model to find the elasticity of corn with respect to the cost of gain. They find that corn price does not play as big of a role in finding a breakeven price as theory may suggest. Bullock and Logan (1970) used statistical decision theory to determine whether an animal should be retained in the feedlot an additional 30 days based on the expected change in fed prices. They found the change in expected net revenue while holding the expected cost of gain constant. Each of these papers considered the profitability of only the feedlot stage of production.

Others such as Reisenauer et al. (2001), Lambert (1989), VanTassell et al. (1997), and Schroeder and Featherstone (1990) analyzed profitability at stages up to and including the feedlot stage. Reisenauer et al. (2001) used biological production simulation models to compare three retention strategies for spring, summer, and fall born calves, taking into account differences in feed prices, requirements, type, and availability for each management strategy. Lambert (1989) developed a discrete stochastic programming model to develop a retained ownership strategy, assuming decisions are made at several points in the production process. In Lambert's model, each decision relies on current and expected market conditions and forage availability. VanTassell et al. (1997) and Schroeder et al. (1990) used discrete stochastic programming models to compare retention strategies under different levels of risk aversion.

While many authors have examined various aspects of retained ownership, none have looked solely at price signals while holding everything else constant. Some, such as Reisenauer et al. (2001), Lambert (1989), VanTassell et al. (1997), and Schroeder et al. (1990) allowed physical production to vary in their analysis. Others such as Bullock and Logan (1970) allowed fed cattle prices to vary but held feed prices constant, while Anderson and Trapp looked solely at corn prices while holding fed cattle prices constant. Since producers can often give an accurate estimate of many of the calves' physical characteristics such as growth and size, this paper focuses on an aspect that is out of producers' control: prices. Unlike Bullock and Logan and Anderson and Trapp, feed prices, feeder calf prices, and fed cattle prices are allowed to change each year to capture the full effect of price movements.

Many authors have estimated premiums for preconditioned calves (Avent et al. 2004), (King and Seeger 2004), (Roeber and Umberger 2002), while others have examined the impact that preconditioning has on feedlot profitability (Gardner et al. 1996; Gardner et al. 1999; Cravey 1996). Some such as Dhuyvetter (2006) have estimated the profitability of preconditioning. Here we assess the profitability of preconditioning with different premium values and alternative retention strategies.

Past research has explored retained ownership and its profitability from all directions. Some have looked at new strategies that will reduce risk or increase profits. Garoian et al. (1990) recommends that Texas producers reduce herd size and instead supplement revenues by retaining calves for a longer period of time during good years but sell the calves during drought years to reduce costs and risks from a larger herd size. Lawrence et al (2003) recommends smaller cattle to produce more efficient and profitable calves. Others have researched topics related to the profitability of certain stages of production. Peterson et al (1989) finds that the costs in preconditioning outweigh the benefits. Others such as Reisenauer et al (2001) and Lambert (1989) have found that owning cattle through the finishing stage will improve a producer's profitability.

The primary objective of this paper is to estimate the profitability of retaining calves through several stages of production and to estimate price signals for producers to use in their decision making process. The profitability is found at each stage of three popular retention strategies in Oklahoma over 30 years. The first is a spring stocker system in which spring born calves are weaned in the fall, put through a preconditioning period, grazed on wheat over the winter, and placed on feed in the spring. The second is a spring calf-fed system where spring born calves are preconditioned after weaning and then immediately placed on feed. In the final system, fall born calves are weaned and preconditioned in the spring, put on grass over the summer, and then placed on feed in the fall.

Theory

This paper will first examine the profitability at each stage of production over the last thirty years and then use the results to solve for price signals to indicate whether a year is likely to be profitable in each stage of production. While some research looks at new strategies or scenarios, the scenarios in this paper are those that are commonly used in Oklahoma. To eliminate price variation except for basis risk, it is assumed that producers will hedge at weaning. Physical production characteristics are assumed to remain constant over all years. Holding physical production constant and eliminating price variation within each year restricts the variation in profits to be a function of price variation between years. As a result, a producer's discrete choice maximization problem (1) is

$$(1) \quad \max_{D_{st}} E(\pi_t) = \sum_{s=1}^{n} D_{st}(P_{st}Y_s - \sum_{j=1}^{k} C_{jst}X_{js})$$

subject to

$$D_{st} \in \{0,1\}$$

$$D_{st} \leq D_{(s-1)t}$$

$$Y_{ist} = Y(X_{jst})$$

where π_t is the profit in year *t*, P_{st} is the price of output in stage *s* and year *t*, Y_s is the expected quantity of output *s*, C_{jst} is the cost of input *j* for stage *s* in year *t*, D_{st} is a binary dummy variable that is one if production takes place in stage *s* of year *t* and zero if not, and X_{js} is the amount of input *j* for stage *s*. The quantity of inputs and outputs is assumed to remain constant over all years and there is only one output for each stage. If calves are sold in stage *s*, then production in subsequent stages will not take place. It is hypothesized that a price signal exists at weaning that will indicate the optimal selling point in that year.

Methods

Thirty years of historical price data are used to create partial budgets for each stage of three popular retained ownership strategies. The strategy for fall-born calves, which will be called "fall calving", consists of two possible preconditioning periods: a 45-day preconditioning period if calves are sold at the end of preconditioning or a 21-day preconditioning period if calves are retained past preconditioning. Preconditioning is followed by 90 days on grass pasture before being finished for 135 days in a feedlot. These calves have a starting weight of about 620 pounds at weaning in April and will have a finished weight of around 1300 pounds in December. There are two strategies for spring-born calves. In the first, which will be called "spring calf-fed", the calves are weaned in early October at a weight of 450 pounds, go through a 45-day preconditioning period, and are sent straight to the feedlot where they are fed to a finishing weight of approximately 1150 pounds over a 171-day period. Calves are weaned at the same weight and go through a 45-day preconditioning period if sold after preconditioning or 21-days if retained after preconditioning in the second spring-born strategy, "spring stocker." Instead of going to the feedlot after preconditioning in the spring stocker strategy, the calves are grown on wheat pasture until March before going to the feedlot for 130 days and are fed to 1320 pounds.

During the preconditioning period calves receive a ration consisting of corn, soybean meal, grass hay, alfalfa hay, Synergy (a high energy feed additive), and a supplement. While in the feedlot, the steers receive a ration of corn, soybean meal, sorghum silage, alfalfa, and a supplement. Many of today's feedlot rations contain distiller's grains, but they were not readily available 30 years ago and therefore no distiller's grain prices are available during much of the time period. As a result, higher concentrations of corn and sorghum silage have been substituted for distiller's grain for all years to maintain a consistent ration over all years.

Thirty years of price data are collected for the strategy with fall-born calves and twenty nine years were collected for the two strategies for spring-born calves. The price data are used in a partial budget from DeVuyst et al. (2009) to calculate profits each year. An example budget for the spring stocker strategy can be found in Table 1. This budget is assuming a 45-day preconditioning period in which last year's preconditioning premiums are received. Budgets for the fall calving and spring calf-fed strategies are very similar to the spring stocker strategy. Table 2 describes the calculations used to determine the feedlot feed costs in the spring stocker strategy. As with the partial budget, similar methodology is used to find the feedlot and preconditioning feed costs for the other strategies.

Two price ratios, $Ratio_{qst}$, for each stage of production are used. The first, *q=cattle*, is the expected cattle price at the end of each stage divided by the expected cattle price at the beginning of each stage and the second, *q=feed*, is the expected cattle price at the end of each stage divided by the price of the largest feed source in that stage. Each of these prices is easily observed by a producer at weaning in the form of futures prices with basis as the only remaining risk. The price ratios will be used to aid in the decision making process. The objective is to find a price signal, λ_{qs}, that will maximize the number of correct decisions, $Correct_{st}$, in stage *s*. The optimization problem is defined as

$$(2) \quad \max_{\lambda_{qs}} \sum_{t=1}^{T} Correct_{st}$$

subject to

$$R_{qst} = \begin{cases} 0 \text{ if } Ratio_{qst} < \lambda_{qs} \\ 1 \text{ if } Ratio_{qst} > \lambda_{qs} \end{cases}$$

$$Correct_{st} = \begin{cases} 0 \text{ if } R_{qst} \neq D_{st} \\ 1 \text{ if } R_{qst} = D_{st} \end{cases}$$

where R_{qst} is a binary dummy variable for the decision made according to price signal *q* in stage *s* at time *t*. As the ratio of the expected cattle price at the end of each stage divided by the price of the largest feed source in that stage increases, it is expected that profits will increase. Similarly, as the ratio of the expected cattle price at the end of each stage divided by the expected cattle price at the beginning of each stage increases, it is expected that profits will increase.

Data

Each of the retention strategies and rations associated with them were developed with the help of Lalman (2010) and Krehbiel (2010). They also assisted in estimating the physical characteristics of the animals such as growth, starting weights, and ending weights through each stage of production.

Feeder cattle prices, feeder cattle futures, fed cattle prices, fed cattle futures from 1980-2009, and corn prices used in this study were taken from the Livestock Marketing Information Center's website (2010). Corn and soybean meal futures and fed cattle futures from 1978-1980 were obtained from the Great Pacific Trading Company's website (2010). Alfalfa prices, grazing rates, wheat prices, wheat seed prices, and nitrogen prices were taken from the United States Department of Agriculture's National Agricultural Statistics Service website (2010). The wheat and wheat seed prices as well as the nitrogen prices are used to estimate the wheat grazing rates as explained later. Supplement, grass hay, and soybean meal prices are obtained from Oklahoma Agricultural Statistics (1979-2009).

A wide variety of premiums for preconditioning have been found in past literature. Avent et al. (2004) found premiums of $3.30 and $1.94 per cwt, while Ward et al. (2003) found premiums for certified preconditioned calves to range from $3.94 to $14.33 per cwt. Dhuyvetter (2004) used a conservative premium of $4/cwt in his paper on the economics of preconditioning, while Raper (2010) found the premium for certified preconditioned cattle to be an average of $14.98/cwt (or 15.6% of the selling price) for five to six hundred pound calves. With this large discrepancy in the literature, three premium levels are used for preconditioning to test the sensitivity to changing prices. The first is no premium at all, the second is a fixed $4 premium, and the third is a premium that is equal to 15.6% of the price without a premium.

Wheat grazing rates are calculated as 125 percent of the additional input costs of producing wheat if it is used for grazing (Peel 2010). The cost of grazing wheat pasture is calculated assuming that if cattle are put on a wheat field, an additional 30 pounds of nitrogen per acre is needed, an additional bushel of seed per acre is planted, and yields are decreased by about eight bushels per acre as a result of early planting (Doye et al. 2008).

Results and Discussion

A partial budget analysis yields mixed results between the different premium levels in the fall calving strategy (Table 3). The premium received after the preconditioning period has a significant impact on the optimal stopping point. Using the high premiums, selling after preconditioning yielded the highest results 29 out of 30 times. With no premiums, it was always best to sell after weaning. When a shorter preconditioning period with a more conservative premium of $4 is used, the optimal selling point is relatively evenly distributed between weaning, grass pasture, and the feedlot stage. Similar results are found in the spring calf-fed strategy (Table 4). Using the 2009 preconditioning premium the optimal selling point is always after preconditioning, while with no premium at all it is usually best to sell at weaning. With a $4 premium, the optimal selling point is split almost evenly between weaning and preconditioning.

With the spring stocker strategy (Table 5), results indicate that with the 2009 premium and a 45 day preconditioning period, the optimum selling point is usually after preconditioning. With no premium and a 45 day preconditioning period, the optimal selling point is at weaning 19 of 29 years and after the feedlot stage 9 of 29 years. With a $4 preconditioning premium and a 45 day preconditioning period, the optimal selling point is at weaning 18 of 29 years and after the wheat pasture stage seven of 29 years. When the preconditioning period for the spring stocker strategy is shortened to 21 days, the optimal selling point is after the wheat pasture stage 20 of 29 years and after the feedlot stage seven of 29 years. These results indicate that not only does the preconditioning premium level have a significant impact on the optimal decision, but the length of the preconditioning stage also has an impact. For example, the discrepancy caused by the preconditioning period length in the spring stocker strategy may indicate that the costs are lower by putting calves on wheat pasture for the extra 14 days than if they were preconditioned for those same 14 days.

It makes biological and economic sense to shorten the preconditioning period for the spring stocker and fall calving strategies. One of the main purposes of preconditioning is to allow calves to recover from the stresses of weaning. When calves are sold after preconditioning, they may be mingled with other cattle and exposed to disease. If they are given more time to recover from weaning, they are less likely to contract a disease. However, if the cattle are retained on farm, the probability of being exposed to new pathogens is smaller and the benefits of preconditioning for a longer time period are diminished. Perhaps more importantly, the producer does not capture market premiums for preconditioning when retained on farm. And, the cost of gain is lower on wheat than in preconditioning.

Price signals to determine whether to produce for several stages of production are found and tested. Since preconditioning is never the optimal selling point in the spring stocker strategy and is optimal only three times in the fall calving strategy, no signal is considered for those two stages. Similarly, since retaining through the feedlot stage in the spring calf-fed strategy is optimal only one out of 29 years, no signal is considered for that stage.

The optimal price signal for the ratio of cattle prices to feed price, *λ(feed)*, for the feedlot stage is 24 for the fall yearling strategy and 22 for the spring stocker strategy (Table 6). This means that if *λ(feed)* is greater than 24 for the feedlot stage or 22 for the spring stocker stage then the calves should be retained through that stage. A higher optimal signal may indicate that feedlot profits are more difficult to realize in the fall calving strategy than in the spring strategy.

The optimal λ*(feed)* for the wheat stocker phase of the spring stocker strategy is 20 while the signal is 16 for the grass pasture stage in the fall calving strategy and 35 for the preconditioning stage of the spring calf-fed strategy. The optimal price signal for the cattle price ratio, λ*(cattle)*, is 0.68 and 0.91 for the feedlot stage in the fall yearling and spring stocker strategies, respectively.

The signal was most successful in the feedlot stage of the spring stocker strategy, sending the correct signal 25 out of 29 times (Table 7). The least successful signal is λ*(cattle)* for the preconditioning stage in the spring calf-fed strategy. The signal was correct between 19 and 22 times for stages within the fall yearling production strategy and was correct about two thirds of the time for the wheat pasture stage in the spring stocker strategy. Overall, λ*(feed)* appears to be a better predictor than λ*(cattle)* with the number of correct signals being greater than or equal to those in λ*(cattle)* in all but one case. One explanation for this result is that λ*(feed)* accounts for both cost and revenues.

Conclusions

This paper attempts to estimate price signals that indicate which stage of production is the optimal selling point for three common retention strategies: fall calving, spring stocker, and spring calf-fed. The profitability under several assumptions for preconditioning premiums is calculated using partial budgeting. Price signals are estimated using the estimated profitability over 30 years so that the number of correct predictions is maximized.

The results in this research indicate that price signals can be used with mixed success to help producers decide when to sell their calves. The expected selling price to feed price ratio is found to be a better predictor than a ratio of expected prices at the end and beginning of each stage. This research also found that the premium level for preconditioning has a significant impact on the optimal selling point. The higher the premium, the more appealing it is to sell calves after preconditioning.

Table 1. Example Budget by Stage of Production for the Spring Stocker Production Strategy Using 2007 Prices

	Weaning	Preconditioning	Wheat Pasture	Feedlot
Ending weight (lbs)	450.00	518.00	787.00	1,318.00
Weight with shrink (lbs)	436.50	507.64	771.26	1,265.28
Sale price ($/cwt)	$127.04	$124.74	$110.06	$93.30
Sale premium ($/cwt)	$0.00	$19.46	$0.00	$0.00
Revenue	$554.53	$732.01	$848.85	$1,180.51
Commission and transportation if sold	$5.00	$10.00	$8.00	$3.00
Transportation from previous stage			$1.80	$8.50
Beef checkoff	$1.00	$1.00	$1.00	$1.00
Death loss (1%, 0.6%, and 0.25%)		$7.32	$5.09	$2.95
Feed expense		$74.36		$364.05
Grazing rate ($/lb of gain)			$0.54	
Grazing cost/head			$149.27	
Veterinary costs		$8.00	$2.00	$7.50
Labor		$1.50	$0.25	
Yardage (includes labor and other expenses)				$45.50
Other expenses		$2.50		
Interest and opportunity cost (6.5% annual)		$4.75	$15.50	$24.36
Expenses from prior stages			$94.37	$271.00
Total expenses	$6.00	$109.43	$277.28	$727.86
Net returns	$548.53	$622.58	$571.57	$452.64

Note: Values are in $/head unless otherwise specified

Table 2. Feed Cost Calculations for the Feedlot Stage of Production in the Spring Stocker Production Strategy Using 2007 Prices

Feedstuff	Proportion of Ration	% Dry Matter (DM)	Feed Price	DM price/unit	Feed Units	DM Price/lb	($/lb DM) *Proportion
Corn	0.78	88	$5.24	$5.95	bushel	0.10627	$0.083
Soybean meal	0.05	90	$523.95	$582.17	ton	0.29108	$0.015
Sorghum silage	0.05	32	$85.78	$268.07	ton	0.13403	$0.007
Alfalfa	0.05	88	$97.00	$110.23	ton	0.05511	$0.003
Supplement	0.07	90	$382.00	$424.44	ton	0.21222	$0.015
					Total ($/lb)		$0.122
					lbs of feed/day		23
					Days on Feed		130
					Total Feed Cost		$364.05

Table 3. Number of Years Out of 30 Each Stage of Production Is Most Profitable for the Fall Calving Strategy

Premium Used	Weaning	Preconditioning	Grass	Feedlot
2009 premium	1	29	0	0
No premium	30	0	0	0
$4 premium	23	7	0	0
$4 premium in short preconditioning period	8	3	11	8

Table 4. Number of Years Out of 29 Each Stage of Production Is Most Profitable for the Spring Calf-Fed Strategy

Premium Used	Weaning	Preconditioning	Feedlot
2009 Premium	0	29	0
No Premium	24	4	1
$4 Premium	15	13	1

Table 5. Number of Years Out of 29 Each Stage of Production Is Most Profitable for the Spring Stocker Strategy

Premium Used	Weaning	Preconditioning	Wheat	Feedlot
2009 premium	1	26	1	1
No premium	19	0	2	9
$4 premium	18	3	7	1
$4 premium in short preconditioning period	2	0	20	7

Table 6. Optimal Signals by Stage of Production for Three Popular Retention Strategies

Production Stage	Fall Calving		Spring Stocker		Spring Calf-Fed	
	λ(feed)	λ(cattle)	λ(feed)	λ(cattle)	λ(feed)	λ(cattle)
Preconditioning					35	0.97
Grass pasture	16	0.85				
Wheat pasture			20	0.77		
Feedlot	24	0.68	22	0.91		

Note: λ(feed) is the expected cattle price at the end of each stage divided by the price of the largest feed source in that stage and λ(cattle) is the expected cattle price at the end of each stage divided by the expected cattle price at the beginning of each stage. If the ratio in a given year is greater than the ratio shown above then the signal suggests that calves should be retained through that stage.

Table 7. Number of Correct Signals by Stage of Production for Three Popular Retention Strategies

	Fall Calving		Spring Stocker		Spring Calf-Fed	
Production Stage	λ(feed)	λ(cattle)	λ(feed)	λ(cattle)	λ(feed)	λ(cattle)
Preconditioning					24/29	16/29
Grass pasture	19/30	20/30				
Wheat pasture			22/29	20/29		
Feedlot	22/30	22/30	25/29	25/29		

References

Anderson, J. D., and J. N. Trapp. 2000. "Corn Price Effects on Cost of Gain for Feedlot Cattle: Implications for Breakeven Budgeting." *Journal of Agricultural and Resource Economics* 25(2):11.

Avent, R.K., C.E. Ward, and D.L. Lalman. 2004. "Market Valuation of Preconditioning Feeder Calves." *Journal of Agricultural and Applied Economics*. 36(1):173-183.

Bullock, J. B., and S. H. Logan. 1970. "An Application of Statistical Decision Theory to Cattle Feedlot Marketing." *American Journal of Agricultural Economics* 52(2):234-241.

Cravey, M.D. 1996. "Preconditioning Effect on Feedlot Performance." Southwest Nutrition and Management Conference, Phoenix, AZ.

DeVuyst, E. A., K. C. Raper, D. Doye, and D. Lalman. 2009. *Oklahoma Beef Calf Retained Ownership Decision Aid*. Available from http://agecon.okstate.edu/extension/category.asp?category=software_tool_full.

Dhuyvetter, K. C. 2004. "Economics of Preconditioning Calves." Kansas State University Agricultural Lenders Conference. Kansas State University.

Doye, D., J. Edwards, and R. Sahs. 2008. "Should I Buy (or Retain) Stockers to Graze Wheat Pasture." Oklahoma Cooperative Extension Fact Sheet.

Gardner, B.A., H.G. Dolezal, L.K. Bryant, F.N. Owens, and R.A. Smith. 1999. "Health of Finishing Steers: Effects on Performance, Carcass Traits, and Meat Tenderness." *Journal of Animal Science.* 77:3168-3175.

Gardner, B.A., S.L. Northcutt, H.G. Dolezal, D.R. Gill, F.K. Ray, J.B. Morgan, and C.W. Shearhart. 1996. "Factors Influencing Profitability of Feedlot Steers." Oklahoma State University. Animal Science Resource Rep. P-951:164.

Garoian, L., J. W. Mjelde, and J. R. Connor. 1990. "Optimal Stategies for Marketing Calves and Yearlings from Rangeland." *American Journal of Agricultural Economics* 72 (3):10.

Great Pacific Trading Company. 2010. Available from www.gptc.com. Accessed July 2010-November 2010.

Krehbiel, C. 2010. "Typical Feed Rations for Beef Calves." Personal Communication.

Lalman, D. 2010. "Common Retention Stategies in Oklahoma." Personal Communication.

Lambert, D. K. 1989. "Calf Retention and Production Decisions Over Time." *Journal of Agricultural Economics* 14(1).

Lawrence, J. D., C. Forristall, G. May, and W. Miller. 2003. "Implications of Grid Marketing for Retained Ownership." *Iowa Beef Center*, http://www.iowabeefcenter.org/pdfs/gridret.pdf.

King, M.E., and J.T. Seeger. 2004. "Nine-Year Trends at Superior Livestock Auction Confirm Higher Prices Go to Calves in Value-added Health Programs." *Pfizer Animal Health Tech*. Bull. SV-2004-02.

Livestock Marketing Information Center. 2010. Available from www.lmic.info.

Oklahoma Agricultural Statistics. 1979-2009. Oklahoma Department of Agriculture.

Peel, D. 2010. "Wheat Pasture Grazing Rates." Personal Communication.

Peterson, E. B., D. R. Strohbehn, G. W. Ladd, and R. L. Willham. 1989. "The Economic Viability of Preconditioning for Cow-Calf Producers." *Journal of Animal Science* 67:11.

Reisenauer, V.L., M.W. Tess, D. A. Griffith, and J.A. Paterson. 2001. “Evaluation of Calving Seasons and Marketing Strategies in Northern Great Plains Cow-Calf Enterprises.” Paper presented at Western Section, American Society of Animal Science.

Roeber, D. and W. Umberger. 2002. “The Value of Preconditioning Programs in Beef Production Systems.” Selected paper presented at Western Agricultural Economics Association Annual Meeting, Long Beach, CA.

Schroeder, T. C., and A. M. Featherstone. 1990. “Dynamic Marketing and Retention Decisions for Cow-Calf Producers.” *American Journal of Agricultural Economics* 72 (4):13.

USDA National Agricultural Statistics Service. 2010. Available from http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp.

VanTassell, Larry W., Scott M. McNeley, Michael D. MacNeil, Robert E. Short, and Elaine E. Grings. 1997. “Retained Ownership of Beef Cattle When Considering Production and Price Risk.” Paper presented at Western Agricultural Economics Association, at Reno, Nevada.

Ward, Clement E. and David L. Lalman. 2003. “Price Premiums from a Certified Feeder Calf Preconditioning Program.” Paper presented at NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, Missouri

Williams, Ed and Donald E. Farris 1971. "Feed/Cattle Price Relationships and the Optimum System and Location of Cattle Feeding in Texas." Southern Journal of Agricultural Economics 3(10):10.