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**AN EMPIRICAL INVESTIGATION
INTO THE FACTORS INFLUENCING
THE ECONOMIC INCENTIVE TO
RETAIN OWNERSHIP OF WEANED
STEER CALVES**

by

Fausti , Johnson, Epperson, and Grathwohl

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9-12-01

An Empirical Investigation into the Factors Influencing the Economic
Incentive to Retain Ownership of Weaned Steer Calves¹

By

Fausti, Johnson, Epperson, and Grathwohl

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An Empirical Investigation into the Factors Influencing the Economic Incentive to Retain Ownership Weaned Steer Calves.

ABSTRACT

Marketing and production data collected from weaned calves (628 head) in a university sponsored retained ownership demonstration program are analyzed to identify factors affecting the annualized rate of return when retaining ownership versus selling the calves at weaning. Data were collected on the following characteristics associated with the calves: 1) ranch-of-origin production management practices; 2) feedlot performance; 3) carcass merit; 4) health history; and 5) market prices.

Retained ownership until slaughter was more profitable, on average, when compared to selling calves at weaning. The calculated annualized rate of return to retained ownership versus selling calves at weaning averaged 11.5% per head. Regression analyses indicate that market prices paid for weaned calves and fed cattle have the greatest influence on the rate of return to retained ownership. The other five categories (ranch-of-origin, production management practices, feedlot performance, carcass merit, health history) also contributed to explaining the variability in the rate of return per head. Marketing and production risks were not incorporated into the regression model. However, summary statistics indicate that coefficient of variation associated with per-head retained ownership revenue is 50% higher than the estimated per-head revenue for weaned calves.

An Empirical Investigation into the Factors Influencing the Economic Incentive to Retain Ownership of Weaned Steer Calves.

I. Introduction:

The traditional production and marketing strategies of cow-calf operators in the Midwest and Northern Plains are to calve in early spring and sell at weaning in the fall. Retained ownership is a marketing/value adding strategy in which the producer continues to own the calf beyond weaning. The length of retained ownership can vary: several months of backgrounding to add additional weight, into the next year to shift taxes, or until slaughter.

Retained ownership of weaned calves has been publicized as a value-added strategy and/or a risk management strategy for calf-cow producers (retained ownership combined with a hedging strategy) by academic and commodity interest groups (e.g., NCBA 2001, Feuz and Wagner 1996, Cattle-Fax 1995, Schroeder and Featherstone 1990, Watt et al. 1987). The factors identified (in the literature) as having the greatest influence on determining the optimal retained ownership strategy are: a) profit levels, b) profit variability, c) producer risk preferences, d) marketing alternatives, e) output price risk, f) input price risk, and g) production risk.

Empirical work on retained ownership of weaned calves in the agricultural economics literature has focused primarily on calf production, retention, and marketing decisions within an optimization framework (e.g., Stokes et al. 1981, Lambert 1989, Schroeder and Featherstone 1990, Ethridge et al. 1990, Van Tassell et al. 2000). The goal of this type of study is to determine the optimal strategy, based on historical or simulated market and production conditions, for the production and marketing of calves. For the most part, these programming models conclude that some form of retained ownership is optimal except under poor market or production conditions.

Other empirical contributions to the literature have focused on the development and analysis of primary data sources to investigate factors influencing the retained ownership decision. Feuz and Wagner (1994 & 1996) analyzed feedlot data gathered from a university sponsored retained ownership demonstration program. They focused on quantifying the economic consequences of feedlot performance variability and on the profit potential of retaining weaned calves based on their physical characteristics at time-of-entry into the feedlot. They also looked at the effect of different feeding regimes on feedlot performance and profitability. They concluded that carcass characteristics at slaughter (quality grade, dressing percentage) are important determinants of profit along with production performance (average daily gain, cost of gain). Popp et al. (1998) conducted a mail survey of Arkansas beef cattle producers to gather data on production and marketing practices in an attempt determine factors that influence the producer to background instead of selling calves at weaning. Using a limited dependent variable regression model, they found that producer perceptions concerning the profitability of backgrounding and the perceived price risk associated with retaining weaned calves influenced the decision to retain ownership.

Producer decisions concerning retaining ownership are influenced and constrained by market conditions, the producer's financial condition, the ranch-of-origin production/management regime, the financial risk of retaining ownership, and the producer's economic alternative to not retaining weaned calves. All of these factors affect retained ownership profitability and/or a producer's utility from profit.

Our research investigates retained ownership profitability from a different vantage point. We view retained ownership as an investment alternative for the producer. The economic incentive to engage in retained ownership of steer calves is the rate of return earned from retained ownership. Our objective is to investigate the management, production, and market factors affecting the variability in the rate of return on the retained ownership investment.

The empirical work presented here first attempts to quantify the rate of return associated with retaining ownership of weaned calves until slaughter instead of selling the calves at weaning. The second objective is to analyze the effect of calf ranch-of-origin characteristics, calf health history, calf feedlot performance history, and carcass characteristics at slaughter on the rate of return earned from retaining ownership.

The data was collected from 628 fall steer calves entered into a university sponsored retained ownership demonstration program over a two-year period (1998-99). The contribution of this research is a unique investigation of the economic, ranch management, animal health, and animal physiology factors affecting the annualized rate of return to retaining ownership of weaned steer calves until slaughter.

II. Annualized Rate of Return to Retained Ownership:

The producer's decision to retain ownership of steer calves instead of selling them at weaning can be looked upon as an investment decision. The capital being invested is the market value of the calf at weaning. The rate of return to retained ownership is defined as the accounting profit (*AP*) earned by retaining ownership until slaughter divided by the market value of the calf (*CALFREVENUE*) when entered into feedlot.¹ The rate of return is then annualized. Summary statistics are provided in Table I.

The summary statistics (Table I) indicate that marketing calves at weaning returns, on average, less revenue (after feedlot cost are paid) to the producer than retaining the calves until slaughter. However, per-head revenue variability for the group of 628 head is greater when calves are retained.

The mean value of accounting profit, *AP*, is \$31.90 per head. The mean value of calf per-head sales revenue is \$489.08. The average per-head annualized rate of return generated from retaining ownership is 11.59%. For this group of retained steer calves, as in previous studies, a retained ownership strategy (on average) is shown to be profitable. However, annualized rate of return variability was significant, ranging from a minus 109% to a positive 86%. The coefficient

of variation is 50% higher for per-head retained ownership revenues. These results are consistent with the findings in the literature indicating that retaining ownership incurs additional financial risk relative to selling calves at weaning.

TABLE I. Mean, standard deviation, coefficient of variation, and range of revenue per head (628 head, \$/head).

Marketing Method	Mean	SD	CV	Max	Min
Steer Value After Feedlot Cost	520.98	118.88	0.2282	841.25	226.44
Weaned Calf Market Value	489.08	77.37	0.1582	676.40	318.47
Accounting Profit for Retained Ownership	31.90	70.60	2.21	259.36	-327.10
Annualized Rate of Return	11.59%	24.89	2.15	86.04	-109.28

III. Data Description:

The data used in this study were collected from 628 steers from 82 producers enrolled in South Dakota State University’s Calf Value Discovery Program (CVD) in November of 1998 and 1999. Each producer entered at least five weaned steer calves into the program. A survey at the time of entry gathered information on health and management practices at the ranch-of-origin. At entry, steers were implanted, vaccinated, ear tagged, and weighed.

Steers were finished at two South Dakota feedlots, one in the eastern and the other in the western part of the state. Health, production, cost, and marketing data were collected on each steer. Steers were marketed on a grade and yield basis, when they reached acceptable weight and finish standards, on 14 different dates during the summers of 1999 and 2000.² South Dakota State University animal and veterinary scientists collected carcass data on the kill floor after the animals were slaughtered (Box I). Variable definitions are provided in appendix A. Table II contains summary statistics for the variables of interest collected and used in the analysis.

Box I: Description of data collected.

- A) Carcass characteristics: Calculated yield grade estimates were based on ribeye area, fat thickness over 12th rib, and kidney-pelvic-heart fat measurements. Quality grade measurements are based on marbling score and a quality grade score of 2 to 8 was assigned (2 indicating a standard carcass and 8 indicating a low-prime carcass). Dressing percentage was calculated by dividing hot carcass weight by live weight at slaughter.
- B) Calf health: Data on 1) calf health, calf vaccination history, and implant history were gathered from a ranch of origin survey.
- C) Ranch of origin: Data on cow-calf ranch management practices before entry into the CVD program were collected from owners via a questionnaire. Information collected included: 1) turnout age, weaning age, backgrounding, creep feeding, herd disease rates, bunk-broken calves, calf inweight, and calf breed.
- D) Feedlot performance: Data included average daily gain, live weight when shipped to packing plant, and total feedlot cost per pound of gain. A feedlot effect variable was also included.
- E) Market variables: Included are each steer's: 1) hot carcass price per cwt. paid by the packer after adjustment for carcass characteristics; and 2) the estimated price per cwt. of each calf on the day of entry into the CVD feedlot program based on a price slide constructed from auction barn sales data.

Table II: Summary Statistics :

Category	Variable	N	Mean	Std Dev	Minimum	Maximum
Ranch of Origin Variables	CREEPFEED	628	0.3980892	0.4898942	0	1.0000000
	BUNKBROKE	628	0.7643312	0.4247544	0	1.0000000
	INWEIGHT	628	573.5334395	92.8635560	360.0000000	994.0000000
	WEANAGE	628	197.4299363	26.0133053	124.0000000	281.0000000
	BKGROUND	628	24.1035032	17.7575499	0	98.0000000
	CONTINENTAL	628	0.2181529	0.4133210	0	1.0000000
	CROSSBREED	628	0.3646497	0.4817155	0	1.0000000
	ENGCROSS	628	0.0748408	0.2633440	0	1.0000000
Ranch of Origin Calf Health Variables	HERDDZM	628	0.0987261	0.2985317	0	1.0000000
	HERDDZL	628	0.3073248	0.4617530	0	1.0000000
	VIR	628	0.8391720	0.3676651	0	1.0000000
	HAEM	628	0.6974522	0.4597273	0	1.0000000
	PAST	628	0.1990446	0.3995999	0	1.0000000
	PINK	628	0.0382166	0.1918715	0	1.0000000
	CL	628	0.9044586	0.2941956	0	1.0000000
	TURNOUTVAC	628	0.5111465	0.5002742	0	1.0000000
Calf Carcass Merit Variables	WEANVAC	628	0.5541401	0.4974564	0	1.0000000
	PREWEANVAC	628	0.7101911	0.4540352	0	1.0000000
	IMPT1	628	0.0652866	0.2472278	0	1.0000000
	IMPT2	628	0.0780255	0.2684255	0	1.0000000
	CALCYG	628	2.7590075	0.7692772	0.4400000	5.2374000
	HCW	628	758.6878981	71.4552405	574.0000000	1022.00
	FT	628	0.4402866	0.1777529	0.1000000	1.1000000
	KPH	627	1.9641148	0.5920703	0.5000000	3.5000000
Calf Feedlot Performance Variables	MARB	628	493.0732484	81.6845044	300.0000000	800.0000000
	QG	628	4.2213376	1.0996839	2.0000000	8.0000000
	DRESS	628	61.3361098	1.5091486	54.7765794	66.6934835
	REA	628	12.8039809	1.4745151	8.6000000	18.9000000
	ADGPAY	628	3.1920800	0.4326986	1.9400000	4.6309524
	DOF	628	209.7181529	25.9852465	157.0000000	277.0000000
	AVGCOST	628	0.4135482	0.0459833	0.3271584	0.6733344
	TOTCOST	628	273.4736762	40.6197567	165.3801636	495.7208741
Market Variables	PRICE	628	104.5175159	8.4864849	78.0000000	124.0000000
	CARPRICE	628	794.4581688	110.3345514	542.1900000	1122.99
	REVENUE	628	520.9844926	118.8821865	113.3991259	841.2494832
	Ap	628	31.9049453	70.6011973	-327.0982536	259.3648352
	ARR	628	11.5959288	24.8944399	-109.2889063	86.042579
	CAFPRICE	628	85.5675178	6.7820789	62.6506830	101.3861230
	CALFREVENUE	628	489.0795473	77.3712997	318.4772220	676.4001822
	FDLOC	628	0.7802548	0.4144040	0	1.0000000

IV. Empirical Methodology:

The economic and physiological factors affecting the rate of return when retaining ownership of weaned calves to slaughter are grouped into five categories: 1) carcass traits at slaughter; 2) ranch-of-origin health management characteristics; 3) ranch-of-origin production management characteristics; 4) calf feedlot performance; and 5) individual per-head market

prices. Per-head rate of return is assumed to be a function of the variables defined in these five categories.

The empirical methodology used here is OLS regression analysis. The regression equation (eq.1) to be estimated is assumed to adhere to the standard assumptions. The independent variables (x_i) comprising the five categories (listed above) are regressed on Annualized Rate of Return (ARR) to determine which variables help explain the variation in the rate of return across retained calves. Regression analysis results are in Table III. The variable ARR_i denotes the rate of return to retained ownership of weaned calves.³

$$1) \quad ARR_i = a + bx_i + e_i, \quad e_i \sim N(0, \sigma^2).$$

Table III: OLS Estimates:

Dependent Variable: ARR						
GLOBAL F TEST STAT = 605.59 P-VALUE = .0001						
REG RSQ = 0.9584			Durbin-Watson D = 1.784			
ADJ RSQ = 0.9569			Number of Obs. = 628			
Variable	DF	Parameter Estimate	Standard Error	T for HO: Par=0	Prob > T	Standard Beta Cof
INTERCEPT ***	1	-308.159	12.771	-24.13	0.0001	0.000
CREEPFED	1	-0.504	0.475	-1.06	0.2899	-0.009
BUNKBROKE ***	1	1.855	0.653	2.84	0.0047	0.032
WEANAGE	1	-0.006	0.010	-0.60	0.5477	-0.006
INWEIGHT ***	1	-0.106	0.004	-25.35	0.0001	-0.395
BACKGROUND ***	1	-0.054	0.017	-3.16	0.0016	-0.039
CONTINENTAL ***	1	4.508	0.720	6.26	0.0001	0.075
CROSSBREED ***	1	1.921	0.583	3.29	0.0010	0.037
ENGCROSS	1	1.205	0.886	1.36	0.1743	0.012
HERDDZM *	1	-1.367	0.786	-1.74	0.0826	-0.016
HERDDZL	1	-0.689	0.557	-1.24	0.2163	-0.013
TOVAC ***	1	1.747	0.501	3.49	0.0005	0.035
WEANVAC	1	-0.517	0.526	-0.98	0.3268	-0.010
PREWEVAC ***	1	1.303	0.506	2.57	0.0102	0.023
IMPT1	1	-0.702	0.963	-0.73	0.4661	-0.007
IMPT2 ***	1	2.528	0.908	2.78	0.0056	0.027
QG ***	1	1.715	0.272	6.28	0.0001	0.075
DRESS ***	1	4.790	0.185	25.86	0.0001	0.290
REA ***	1	0.820	0.185	4.43	0.0001	0.048
AVGCOST ***	1	-182.079	8.265	-22.03	0.0001	-0.336
ADGPAY ***	1	14.438	0.808	17.86	0.0001	0.251
CAFPRICE ***	1	-1.782	0.053	-33.23	0.0001	-0.486
PRICE ***	1	2.373	0.045	52.44	0.0001	0.810
FDLOC	1	1.038	0.925	1.12	0.2623	0.017

1) Three asterisks indicate the variable is significant at the 1% level. Two asterisks indicate the variable is significant at the 5% level. One asterisk indicate the variable is significant at the 10% level.

2) A test for heteroscedasticity was performed [White (1980)] and its presence was not detected.

3) Variance Inflation Factor analysis indicated that there was no evidence of multicollinearity in the model.

4) SAS (1990) software was used to conduct the statistical analysis.

V. Empirical Results:

The regression results in Table III provide statistical evidence that the five categories of economic and physiological factors do influence the rate of return to retained ownership. An overview of the regression results reveals that: 1) All five categories had at least one independent variable that was significant at the one percent level; 2) The regression model explained 96 percent of the variability in the rate of return associated with retaining ownership of weaned calves; 3) The global F test indicates the regression model is highly significant. Each of the explanatory variable categories reveals important influences on the rate of return associated with the retained ownership. Fifteen of the explanatory variables were significant at levels of less than 1%.

Market Prices:

Based on the estimated standardized *Beta Coefficients* reported in Table III, the market variables PRICE and CAFPRICE are the most influential variables in the model.⁴ Both market variables have the correct *a priori* sign. The coefficients have the following interpretation: 1) Ceteris paribus, a one dollar increase in the packer price per cwt. for a finished carcass will increase the rate of return to retained ownership of a weaned calf by 2.37%; 2) or a one standard deviation change in PRICE will cause .81 standard deviation change in the rate of return; 3) Ceteris paribus, a one dollar increase in the live price per cwt. of a weaned calf will decrease the rate of return to retained ownership of a weaned calf by 1.78%; or 4) a one standard deviation change in CAFPRICE will cause a .49 standard deviation change in the rate of return to retained ownership.

Feedlot Performance:

Feedlot production efficiency variables were highly significant in the model. Average daily gain (ADG) and average cost per pound gained (AVGCOST) have the correct *a priori* sign. A one cent increase in the cost per pound gained reduced the rate of return to retained ownership of a weaned calf by 1.82% , ceteris paribus. As for ADG, a one-tenth of a pound increase in average daily gain, ceteris paribus, increased the rate of return to retained ownership by 1.4%.

Carcass Merit:

Carcass merit variables were all significant and had the *a priori* correct sign. A one square inch increase in ribeye area, ceteris paribus, increased the rate of return to retained ownership by .82% A one percent increase in dressing percentage, ceteris paribus, increased the rate of return to retained ownership by 4.79%. A one-step increase in quality grade category, ceteris paribus, increased the rate of return to retained ownership by 1.71%.⁵

Ranch of Origin:

Ranch-of-origin/ranch management category variables included decisions in calf feeding, feedlot placement timing, and genetic/breeding. Calf breed decision variables were designed to capture a general measure of animal frame size. The dummy variable default characteristic is a straight English breed (Angus, Hereford, etc.). The alternative breeds are: 1) straight Continental breed (Simmental, Charolais, etc.), 2) English Crossbreed, and 3) Crossbreed

(English/Continental cross). The coefficients for Continental and Crossbreed were positive and significant at the one percent level. The dummy variable denoting English Crossbreed was insignificant, indicating that there was no difference in the rate of return between English steers and English Crossbreed steers.

Dummy variables were created to determine if preconditioning of calves by either creep feeding (CREEPFED) or bunk broken (BUNKBROKE) before feedlot placement had any effect on the rate of return to retained ownership. Creep feeding was insignificant, but the variable BUNKBROKE had a positive sign and was significant at the 1% level.

Information on producer perception concerning herd disease prevalence was collected, and a set of dummy variables was created to capture that effect on retained ownership profitability. The herd disease default characteristic is: herd disease is as prevalent for this year's calf crop as in previous years versus more disease or less disease. The dummy variable (HERDDZM) equals one if the producer indicated that there was a greater frequency of disease than in previous years. HERDDZM had the expected negative sign and was significant at the one percent level. The dummy variable HERDDZL indicating less disease was insignificant.

The purpose of the final group of ranch management variables included in the model is to capture calf life cycle timing decisions made by the producer: a) calf age, in days, at weaning; b) number of days a weaned calf is backgrounded before feedlot placement; and c) live inweight of calf when entered into the feedlot. The variables BACKGROUND and INWEIGHT have negative coefficients and are significant at the one percent level. The variable WEANAGE is insignificant. The implication is that increased calf weight and delayed calf entry into the feedlot reduced the rate of return to retained ownership of weaned steer calves.

Calf Health History:

The calf health history category includes both vaccination and implant information collected from producers. Calf vaccination history data were divided into two categories: a) vaccination timing, and b) vaccination-type. Both vaccination categories contain dummy variables. As a group, the set of vaccination-type dummy variables was tested for group significance using a partial F test because of the apparent lack of individual variable explanatory power.⁶ The decision, due to lack of significance, was to drop these variables from the model. Dropping this set of vaccination variables did not affect the significance levels or signs of the other explanatory variables.

Two of the three variables in the set of vaccination timing variables were significant and had a positive coefficient. Vaccinations against disease at turnout (TURNOUTVAC) and preweaning (PREWEVAC) had a positive effect on the rate of return to retained ownership relative to calves not vaccinated during this phase of their life cycle.

Two dummy variables were designed to capture the effect of implants administered prior to a calf's entry into the feedlot on the rate of return to retained ownership: a) the calf received at

least one implant injection prior to feedlot entry versus the calf did not receive any injection (IMPT1); and b) the calf received two implant injections versus zero or one injection (IMPT2). The results indicate that a calf receiving two implants before feedlot entry had a higher rate of return to retained ownership relative to those calves not receiving an implant or only one implant injection before feedlot placement.

VI. Implications for Retained Ownership:

The empirical results reported here indicate that fluctuations in the market price of slaughter cattle and the market price of weaned calves will have significant impact on retained ownership rate of return. The standardized beta coefficients for PRICE and CAFPRICE clearly indicate these variables have the greatest effect on rate of return variability. This result is not unexpected and is consistent with the findings in the optimization literature discussed earlier (e.g., Ethridge et al. 1990). The retained ownership optimization literature has suggested that market price variability will affect the retained ownership decision process.

The empirical results indicate that when considering retaining ownership of weaned calves, producers need to assess the feedlot production performance potential (*ADG*, *AVGCOST*) of the calves and weigh that against the current cost of feeding calves to slaughter weight. Feedlot performance data of previous calf crops is critical information to be used when the retained ownership decision is made. These results are consistent with the Van Tassel (2000) study, where it was found that calf progenies from “high growth potential sires” were retained more often than calf progeny from “moderate growth potential sires” in their optimization study.

Empirical evidence from previous studies (e.g., Feuz and Wagner 1994, 1996) suggests carcass merit variables do affect profit levels. The empirical evidence presented above suggests that both carcass muscling and marbling affect the rate of return to retained ownership. Quality grade, dressing percentage, and ribeye area are all significant at the one percent level and have positive coefficients. The ramification is that improving carcass merit characteristics will improve the profit potential of retaining ownership. Carcass merit data from past calf crops is necessary to make a prudent decision about retaining ownership of weaned calves.

There has been very little empirical work on the ranch-of-origin effect on feedlot performance, carcass merit at slaughter, and feasibility of retained ownership of calves. Empirical evidence presented in this study indicates that ranch-of-origin management options, including vaccination and implant strategies, do affect the rate of return of weaned calves under retained ownership. In this study, vaccination and implant strategies, prevalence of herd disease, progeny effect, and calf life cycle management options need to be considered if retained ownership is an option. This study also provides evidence that contributes to the debate on whether it is beneficial financially to feed preconditioned calves or feed calves that are not preconditioned. A number of studies in the veterinary science literature conclude that preconditioning is not economically viable (e.g., Miller and Loerch (1987), Cole (1984)). In the study by Miller and Loerch (1987), the conclusion is “the net economic impact of feeding preconditioned calves is

negative.” The results presented here suggest that there are preconditioning treatments that enhance the profitability of retaining ownership of weaned calves until slaughter.

The progeny/breed effect reported here is consistent with the study by Van Tassell et al. (2000). In the Van Tassell study, Hereford sires represented the “moderate-growth potential sires” and Charolais sires represented “high-growth potential sires.” Van Tassell reported that the Charolais progeny was retained more often than the Hereford progeny. Van Tassell’s finding is consistent with our finding that retaining ownership of straight Continental and Crossbreed progeny, on average, had higher rates of return relative to retaining ownership of straight English progeny. Our findings are also consistent with the findings of Stokes et al. (1981). In the Stokes study, “large frame cattle” produced progeny that were more profitable under retained ownership than smaller framed cattle.

The Stokes et al. study also found higher profit rates when weaned calves were placed directly into the feedlot and retained until slaughter rather than the alternatives of: 1) selling at weaning; 2) owning through the stocker stage; or 3) backgrounding and then feeding out the steer until slaughter. The negative coefficient estimates for the ranch-of-origin management variables INWEIGHT and BACKGROUND are consistent with the Stokes et al. study. The longer the delay in the weaning of steer calves, the longer weaned calves are backgrounded, and the heavier a steer calf is at time of entry into the feedlot, the lower the rate of return to retained ownership. The implication is that rate of return to retained ownership of a weaned calf declines as the calf becomes the older and heavier. The retained ownership strategy recommendation is that if a producer is thinking of retaining ownership of weaned steer calves, it is recommended that the producer place them into the feedlot at weaning.

The empirical result for the final ranch management variable, increased incidence of herd disease, is closely related to the calf health history category. The regression results indicate that if a producer indicates an increased frequency of herd disease relative to previous years, then that producer’s rate of return declines when retaining ownership.⁷ The implication is that increased herd disease reduces the incentive to retain ownership and increases the incentive to sell calves at weaning. The empirical results for the calf health history category had two significant vaccination timing variables, TURNOUTVAC and PREWEVAC. The economic implication for retained ownership is that the timing of vaccinations and not the type of vaccination has the greater impact on retained ownership profitability. The empirical evidence suggests that vaccinations given in the early stages of the calf’s lifecycle will have a positive impact on retained ownership profitability.⁸

For this group of CVD steers, retained ownership generated, on average, an annualized rate of return of 11.59% per head. This per-head rate of return represents the return on investment when a weaned steer is retained until slaughter. However, the opportunity cost to the producer of not retaining weaned calves is closer to 6.5% on an annual basis if the interest income from the sale of weaned calves is included in the calculation of the producer’s opportunity cost associated with selling calves at weaning. That is, the producer can invest the proceeds from the sale of his/her weaned calves in a risk-free interest bearing instrument (e.g.,

short-term government securities or certificates of deposits at approximately 5% annually). The issue of opportunity cost associated with selling calves at weaning allows the topic of risk to be introduced back into the discussion. The coefficient of variation for the rate of return on a risk-free asset is zero. The coefficient of variation for the rate of return to retained ownership provided in Table I is 213%. For this group of CVD steers, retaining ownership is a very risky investment relative to selling calves at weaning and collecting a risk-free rate of return on the proceeds.

Lambert (1989) noted that, although studies indicate greater profitability when a retained ownership strategy is adopted, only a small minority of conventional cow-calf producers use this management strategy, preferring instead to sell calves at weaning. This contradiction is not resolved even when an attempt is made to incorporate risk into the modeling structure employed by economists (Van Tassell et al. 1987, Rodreguez and Taylor 1988). Lambert offers three possible theories on why cow/calf producers don't engage in retained ownership more often: a) producers are more risk averse than assumed in the empirical literature; b) cash flow problems are a barrier to retaining ownership; and c) producers are satisfied with weaned calf crop profit levels.

We suggest an alternative to Lambert's risk aversion conjecture may be that retained ownership of weaned steers is a riskier investment alternative for the cow/calf producer than previously hypothesized in the literature. The increased rate of return from retaining ownership may not be enough compensation for the additional financial risk.

Summary:

The results of the study discussed here make a contribution to the literature by presenting: 1) empirical evidence of the ranch-of-origin management effects and calf health management effects on retained ownership profitability; and 2) an analysis of retained ownership profitability based on the rate of return to investment.

Specifically, empirical evidence is presented showing that the rate of return on retaining ownership of weaned calves until slaughter is positive. Market price paid at weaning and at slaughter are shown to have great influence on rate of return variability. Secondary factors affecting rate of return variability are: 1) carcass merit characteristics; 2) timing of calf vaccinations; 3) calf frame size; 4) timing of calf feedlot placement; 5) feedlot performance; and 6) ranch-of-origin management practices. While the role of risk was not directly incorporated into the regression analysis, summary statistics do indicate that per-head retained ownership revenue does have a larger coefficient of variation than per-head revenue for weaned calves. The results presented here suggest that further research is needed to identify risk sources and quantify risk and its role in the retained ownership decision process.

Appendix I: Variable Description:

A) The variable HCW is defined as the hot carcass weight of the steer at slaughter (in lbs.). The variable DRESS is defined as the dressing percentage and is equal to hot carcass weight divided by live weight at slaughter. The variable REA is defined as the size of the ribeye area in sq. inches, measured at the time of slaughter. The variable FT is defined as fat thickness in inches over the 12th rib of the steer at slaughter. The variable KPH is defined as percent kidney, pelvic, and heart fat (KPH%). The variables REA, FT, HCW, and KPH were used to estimate the carcass yield grade (CALCYG). The variable MARB is defined as the amount of fat within the muscle or intramuscular fat. Marbling score is based on intramuscular fat in the ribeye muscle at the 12th rib. The variable MARB was used to determine the quality grade category (standard to low prime) of a carcass.

B) Calf vaccination data were collected from the survey questionnaire. Information on timing of vaccinations before entry into the CVD feedlot program and the type of vaccination dispensed was converted into dummy variables. Vaccination periods are: 1) at turnout; 2) preweaning after turnout; and 3) at weaning. Types of vaccinations are: 1) Clostridial; 2) Viral; 3) Haemophilus; 4) Pinkeye; and 5) Pasteurella. Vaccination dummy variables were designed to capture the timing and type of vaccination given. The dummy variables TURNOUTVAC, PREWEVAC, and WEANVAC capture the timing-effect of vaccination. The timing-effect variables equal one if the calf was administered any one of the five listed vaccines at turnout, preweaning, or at weaning, zero otherwise. The dummy variables VIR, CL, PAST, HAEM, and PINK capture the vaccination type-effect. If the calf was administered a particular vaccine at anytime before entry into the feedlot, then the dummy variable equals one, zero otherwise. The dummy variables IMT11 and IMT22 capture the effect of implant treatments before entry into feedlot. If implanted at least once before entry, then IMT11 equals one, zero otherwise. If implanted twice before entry, then IMT22 equals one, zero otherwise.

C) The variable WEANAGE is defined as the calf's age, in days, at time of weaning. The variable CREEPFED is defined as being equal to one if the calf was creep fed before entry into the CVD program, zero otherwise. The variable BUNKBROKE is defined as being equal to one if the calf was bunk broke before entry into the CVD program, zero otherwise. The variable INWEIGHT is defined as the live weight of the calf upon entry into the CVD program. The variable BACKGROUND is defined as the number of days from calf weaning to calf placement in the CVD feedlot. The dummy variables ENGLISH, CONTINENTAL, CROSSBREED, and ENGCROSS refer to the breed type of the calf based on the calf's sire and dam. Four general categories were developed to identify the calf's breed background: English, English Cross, Crossbred, and Continental. There were no Continental crosses. The breed background gives a general indication of frame size of the calf. Data on a producer's perception on the extent of herd disease was compiled relative to years past. If the producer indicated that disease was more prevalent this year than in past years, HERDDZM equals one, zero otherwise. If the producer indicated that disease was less prevalent this year than in past years, HERDDZL equals one, zero otherwise. The default characteristic for the herd disease dummy variables is that the prevalence of disease had not changed from previous years.

D) The variable PAYWT is defined as the live weight of the finished steer at slaughter adjusted for 4% pencil shrink (in lbs.). The variable DOF is defined as the calf's number of days on feed in the CVD program. The variable ADG is defined as the average daily gain (in lbs.) of the calf during the feedlot stage of its life. The variable TOTGAIN is defined as PAYWT minus INWEIGHT (in lbs.). The variable TOTCOST is defined as all feedlot accounting costs (in \$) associated with raising the calf to slaughter weight. The variable AVGCOST is defined as total cost divided by total gain and provides the cost of per pound gained in the feedlot (in cents per pound) associated with raising the calf to slaughter weight.

E) To remove a potential feedlot effect, the variable FDLOC is defined as being equal to one if a calf was placed in a feedlot located in eastern South Dakota or zero if the feedlot location is west river. The variable CALFREVENUE is defined as the estimated market price per head for a particular calf upon entry into the CVD program based on a price slide constructed from auction barn sales data. The variable CAFPRICE is calculated by dividing CALFREVENUE by the calf's inweight and is the market price of the calf per cwt. The variable PRICE is defined as the price per cwt. the packer paid for a carcass (based on carcass characteristics).

References:

Cattle Fax, Retained Ownership Analysis, 4th ed., Cattle Marketing Information Services, Inc., Englewood, Co, August 1995.

Cole, N.A., 1984, "A Critical Evaluation of Preconditioning"; in Bovine Respiratory Disease: A Symposium. College Station, TX: Texas A&M Press, pp. 20-49.

Ethridge, D.E., P. Zhang, B.E. Dahl, R.T. Ervin, and J. Rushemeza, 1990, "Cattle Ranching Production and Marketing Strategies under combined Price and Weather Risks." *Western Journal of Agricultural Economics*, Vol. 15, No. 2, pp. 175-185.

Fausti, S.W., Feuz, D.M., and Wagner, J.J., 1998, "Value-based Marketing for Fed Cattle: A Discussion of the Issues." *International Food and Agribusiness Management Review*, Vol. 1, No.1, pp. 73-90.

Feuz, D.M. and J.J. Wagner, 1994, "The Profit Potential of Different Beef Feeding and Marketing Strategies." AES Report B719, South Dakota State University.

Feuz, D.M. and J.J. Wagner., 1996, "Retained Ownership: Understanding Performance Risk and Evaluation Marketing Alternatives." *Journal of the American Society of Farm Managers and Rural Appraisers*, Vol 60., pp. 65-71.

Lambert, D.K., 1989, "Calf Retention and Production Decisions over Time.", *Western Journal of Agricultural Economics*, Vol. 14, No. 1, pp. 9-19.

- Miller, G., and S. Loerch, "Production and Economic Differences Between Preconditioned and Non-Preconditioned Feedlot Calves." in Economics of Animal Diseases edited by E.C. Mather and J.B. Kanneene., Michigan State University, pp.156-164., 1987.
- NCBA, *Fact Sheet-Live Cattle Marketing*, National Cattlemans Beef Association, Denver, Co, March 2001.
- Pindyck, R.S., and D.L. Rubinfeld, Econometric Models and Economic Forecasts 4th ed., Irwin-McGraw Hill: Boston, MA.1998.
- Popp, M.P., M.D. Faminow, and L.D. Parsch, 1998, "Adoption of Backgrounding on Cow-Calf Farms.", Selected Paper, Annual AAEA Meetings, Salt Lake City, Utah.
- Rodriguez, A., and R.G. Taylor, 1988, "Stochastic Modeling of Short-Term Cattle Operations." *American Journal of Agricultural Economics*, Vol. 70, No. 1, pp. 122-132.
- SAS Institute, Inc. SAS/STAT User's Guide, Version 6., Cary, NC: SAS Institute Inc., 1990.
- Schroeder, T.C., and A.M. Featherstone, 1990, "Dynamic Marketing and Production Decisions for Cow-Calf Producers." *American Journal of Agricultural Economics*, Vol. 72, No. 4, pp. 1028-1040.
- Stokes, K.W., D.E. Farris, and T.C. Cartwright, 1981, "Economics of Alternative Beef Cattle Genotype and Management/Marketing Systems." *Southern Journal of Agricultural Economics*, Vol. 2., pp. 1-10.
- Van Tassell, L.W., R.K. Heitschmidt, and J.R. Conner, 1987, "Incorporating Environmental Uncertainties in a Ranch Simulation." Selected Paper, Annual AAEA Meetings.
- Van Tassell, L.W., S.M. McNeley, M.D. MacNeil, R.E. Short, and E.E. Grings, 2000, "Retained Ownership of Beef Cattle When Considering Production and Price Risk." Selected Paper, Annual WAEA Meetings, Vancouver, BC., Canada.
- Watt, D.L., R.D. Little, and T.A. Petry, 1987, "Retained Ownership is an Option for Cow-Calf Operations." *Journal of the American Society of Farm Managers and Rural Appraisers*, Vol 51., pp. 80-87.
- White, D., 1980, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*, Vol. 48, No. 4, pp. 817-836.

Endnotes:

1. The variable *CAFREVENUE* is defined as the per-head estimated market value of each calf on the day of entry into the CVD feedlot program based on a price slide constructed from multiple, state-wide, auction barn sales data. Accounting profit (*AP*) is equal to the difference of the net revenue (*REVENUE*) received for an individual steer (the actual per-head price paid at slaughter (*CARPRICE*) minus the total feedlot costs (*TOTCOST*)) minus the estimated revenue the producer would have received for selling that individual steer as a calf at weaning:
 $AP = CARPRICE - TOTCOST - CAFREVENUE.$

2. The CVD steers were sold to PM Beef in Windom, MN.

3. It is assumed for simplicity that the producer's next best alternative to selling calves at weaning is to retain ownership until slaughter. However, producers often sell weaned calves after they have been backgrounded but before slaughter. See Watt et al. (1987) or Fausti et al. (1998) for a brief discussion of the marketing alternatives available to cow-calf producers.

4. Standardized beta coefficients are computed by dividing a parameter estimate by the ratio of the sample standard deviation of the dependent variable to the sample standard deviation of the regressor. Each beta coefficient reported in Table II indicates the number of standard deviation changes in the dependent variable associated with a standard deviation change in the independent variable, ceteris paribus. The magnitudes of the beta coefficients are not affected by the scales of measurements associated with the independent variables and thus can be used to ascertain the relative importance of the effects of the independent variables on the dependent variable. See Pindyck and Rubinfeld (1998) for a complete discussion of this topic.

5. For the CVD cattle, the degree of marbling included Traces, Slight, Small, Modest, Moderate, and Slightly Abundant. A numerical number was assigned to the degrees of marbling: Traces = 300-399, Slight = 400-499, Small = 500-599, Modest = 600-699, Moderate = 700-799, Slightly Abundant = 800-899.

<u>Quality Grade</u>	<u>Marbling Score</u>	<u>QG Number</u>
Standard	300-399	2
Low Select -	400-499	3
High Select +	450-499	4
Low Choice -	500-599	5
Avg. Choice 0	600-699	6
High Choice +	700-799	7
Low prime -	800-899	8

6. The null hypothesis is: *vaccination-type* explanatory variables do not contribute to the model. The F-test statistic for this test is 2.05. The F-test statistic follows an F distribution with $v_1= 5$ and $v_2=599$ degrees of freedom. We cannot reject the null hypothesis: that this group of variables contributes nothing further toward explaining the variability in rate of return to retained ownership.

7. We are assuming the frequency of disease across cow/calf operations in any particular year is dependent on ranch management characteristics.

8. The variable acting as a proxy for the feedlot effect (*FDLOC*) was insignificant. The conclusion is that retained ownership profitability was not affected by feedlot location in this study.