Critical Control Points for Profitability in the Cow-Calf Enterprise

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Summary

Financial, economic, and biological data collected from cow-calf producers who participated in the Illinois and Iowa Standardized Performance Analysis (SPA) programs were used in this study. Data used were collected for the 1996 through 1999 calendar years, with each herd within year representing one observation. This resulted in a final database of 225 observations (117 from Iowa and 108 from Illinois) from commercial herds with a range in size from 20 to 373 cows. Two analyses were conducted, one utilizing financial cost of production data, the other economic cost of production data. Each observation was analyzed as the difference from the mean for that given year. The independent variable utilized in both the financial and economic models as an indicator of profit was return to unpaid labor and management per cow (RLM). Used as dependent variables were the five factors that make up total annual cow cost: feed cost, operating cost, depreciation cost, capital charge, and hired labor, all on an annual cost per cow basis. In the economic analysis, family labor was also included. Production factors evaluated as dependent variables in both models were calf weight, calf price, cull weight, cull price, weaning percentage, and calving distribution. Herd size and investment were also analyzed. All financial factors analyzed were significantly correlated to RLM ($P < .10$) except cull weight, and cull price. All economic factors analyzed were significantly correlated to RLM ($P < .10$) except calf weight, cull weight and cull price. Results of the financial prediction equation indicate that there are eight measurements capable of explaining over 82 percent of the farm-to-farm variation in RLM. Feed cost is the overriding factor driving RLM in both the financial and economic stepwise regression analyses. In both analyses over 50 percent of the herd-to-herd variation in RLM could be explained by feed cost. Financial feed cost is correlated ($P < .001$) to operating cost, depreciation cost, and investment. Economic feed cost is correlated ($P < .001$) with investment and operating cost, as well as capital charge. Operating cost, depreciation, and capital charge were all negatively correlated ($P < .10$) to herd size, and positively correlated ($P < .01$) to feed cost in both analyses. Operating costs were positively correlated with capital charge and investment ($P < .01$) in both analyses. In the financial regression model, depreciation cost was the second critical factor explaining almost 9 percent of the herd-to-herd variation in RLM followed by operating cost (5 percent). Calf weight had a greater impact than calf price on RLM in both the financial and economic regression models. Calf weight was the fourth indicator of RLM in the financial model and was similar in magnitude to operating cost. Investment was not a significant variable in either regression model; however, it was highly correlated to a number of the significant cost variables including feed cost, depreciation cost, and operating cost ($P < .001$, financial; $P < .10$, economic). Cost factors were far more influential in driving RLM than production, reproduction, or producer controlled marketing factors. Of these cost factors, feed cost had by far the largest impact. As producers focus attention on factors that affect the profitability of the operation, feed cost is the most critical control point because it was responsible for over 50 percent of the herd-to-herd variation in profit.

Introduction

Identifying practices to enhance profitability is an objective of any effective business manager. According to Harris and Newman, over the last century breeding objectives have progressed from being predominately based on visual appearance to criteria involving performance. The transition from selection based on performance criteria to selection based on economics is untested. Selection for improved biological performance has led to dramatic increases in growth rates of beef cattle, but has not necessarily led to increased profitability among commercial cow/calf producers.

One of the most inconsistent terms used in agriculture is the word “profit,” yet this is the most fundamental measure of business success. Using the Farm Financial Standards (1991) procedures, the appropriate definition of farm or ranch profit is the net farm or ranch income from operations minus the value of unpaid family labor and management.

In order to position beef cow herds as sustainable business entities, producers must identify production practices that maximize profit, not production. In 1994, a

SPA program was implemented in Illinois and Iowa to provide cow/calf producers with an evaluation tool to measure the biological, financial and economic performance of their operations. This program was designed in accordance with the Integrated Resource Management – Standardized Performance Analysis (IRM-SPA) Guidelines as set forth by the National Cattlemen's Beef Association (NCBA). Data collected in this program are analyzed in this paper to identify and quantify focus areas so that beef producers can enhance the profitability of their operations. Research in this area has been significantly hindered by the lack of availability of actual financial and economic cost of production data for operations. There has been research on how specific management strategies (i.e., cross-breeding systems, feeding systems, reproductive performance, and health practices) affect profit. However, a beef production system is highly complex because of the large numbers of factors affecting it and the high degree of interaction among these factors. A producer must view the beef cattle operation in its entirety and understand how its component parts interact with one another to ultimately affect profitability. One researcher utilized a computer simulation of various management factors and identified annual cost of maintaining a cow as the most influential factor determining profit followed by calf sale price and weaning weight. Another analyzed averages from farm business records of herds in North Dakota and reported that total feed costs, followed by selling price of calves and number of cows in the herd were the three most important factors explaining variation in profit.

This study will analyze actual cow-calf enterprise data to identify management areas that influence profitability. In addition, this paper will present a database of actual financial, economic, and biological production information for Midwestern cow-calf producers.

Materials and Methods

Data collected from cow-calf producers who participated in the Illinois or Iowa SPA program were used in this study. Data used were collected for the 1996 through 1999 calendar years, with each herd year representing one observation. Excluded from the final data set were purebred seed-stock producers, herds with less than 20 cows, and one herd with more than 2,000 cows. Producers who were involved with the program more than one year may be included multiple times. This resulted in a final database of 225 observations (117 from Iowa and 108 from Illinois) from 126 different producers who operated commercial herds ranging in size from 20 to 373 cows. In the stepwise regression analysis 164 observations were utilized because 61 were missing weaning percentage data.

Data were collected using the SPA Beef Cow Business Record program developed by Iowa State University in accordance with the SPA guidelines developed by the IRM Coordinating Committee of the National Cattlemen's Beef Association.

Two analyses were conducted, one utilizing financial cost of production data, the other economic findings. Financial costs are defined as cash flow costs and include debt service and hired labor. Economic costs reflect the opportunity cost of inputs and include a charge for invested capital rather than principle and interest payments, as well as the value of family and operator labor.

To alleviate the influence of factors that are generally beyond a manager's control (i.e., cyclical differences in calf price and yearly variations in weather), and thus allow for an evaluation of differences in management practices, means were developed within each year. Each observation was then analyzed as the difference from the mean for that given year.

The independent variable utilized in both the financial and economic models as an indicator of profit was return to unpaid labor and management per cow (RLM). Total annual cow cost was excluded from the analysis as a dependent variable, because previous research and preliminary analysis of this data set indicated that it would be the overriding factor influencing profit. To allow for a better understanding of how management factors may influence profit, total cost was broken down into the five factors that comprise it: feed cost (total feed cost including pasture cost), operating cost, depreciation cost, capital charge, and hired labor, all on an annual cost per cow basis. In the economic analysis, family labor (family and operator labor charge per cow) was also included. Investment (total capital investment per cow) on a market value basis was used as a dependent variable in the economic analysis whereas the financial analysis used investment on an actual cost basis. Production factors evaluated as dependent variables in both models were: calf weight (average weight of feeder calves sold), cull weight (weight of breeding stock sold per cow), weaning percentage, and calving distribution (percentage of calves born in the first forty-two days of the calving season). Calf price (price per hundred-weight (cwt) of feeder calves sold) and cull price (price per cwt of breeding stock sold) were also evaluated. Herd size (number of cows in the herd based on January 1 inventory) was also analyzed as a dependent variable. All variables were calculated according to SPA guidelines.

Average weight of feeder calves sold (calf weight) was used as an indicator of herd productivity, as opposed to weaning weight, because this was the weight at the time calf price was determined. Additionally, this data set did not include an adjusted weaning weight, thus in situations where producers wean calves early, sale weight would be more accurate than weaning weight because feed and operating costs for the calves until sale are included in the cowherd records.

Stepwise linear regression analyses were conducted according to the procedures of SPSS. Pearson correlation coefficients were calculated to determine linear associations between variables. Due to lack of significance ($P>0.10$) hired labor, family labor (economic analysis only), investment (both cost basis and market basis), cull weight, cull price, and calving distribution were excluded from the final stepwise regression models.

Results and Discussion

Means, standard deviations, minimum values, and maximum values are presented in Table 1 for all variables considered. The average herd included in this data set had a herd size of 97 cows. The standard deviation indicates a majority of the herds included in the SPA data set from Illinois and Iowa have between 40 and 160 cows. In general, most of these herds were part of a multi-enterprise farming operation.

During the four-year period studied (1996-1999), the average cow/calf producer had a -$19.91 financial RLM per cow. When economic costs were included, this became a -$80.69. The means by year indicate that 1996 was the low profitability year, and profit has been trending upward. As evidenced by calf price data, these four years include the bottom of the most recent cattle cycle, and calf prices have been increasing.

Herds in this data set had an average financial total annual cow cost of $327.77. This is lower than SPA data reported for Texas ($356.59), North Dakota ($367.00), and Colorado ($504.00). In comparing these data it is important to note that the figure reported from Texas differs from this data set in that it is adjusted for non-calf revenue. The North Dakota data utilize a fair market value for harvested feeds, as opposed to a financial cost of production. The Colorado figure is significantly higher due to the inclusion in their data set of one herd with an exceptionally high annual cow cost. The total economic cost ($446.82) was similar to Texas ($446.68) and was slightly lower than Colorado ($510.00).

Analysis of standard deviations and maximum values indicates the existence of outliers more than two standard deviations above the average for all cost figures. Although producers who fall into this category may not be profit oriented, they certainly exist, and thus it was deemed necessary to include them in these data.

Simple linear correlations among the factors used in developing the financial prediction equation are displayed in Table 2. All factors analyzed were significantly correlated to RLM ($P < .10$) except cull weight, and cull price. Correlations among economic traits are outlined in Table 3. All factors analyzed were significantly correlated to RLM ($P < .10$) except calf weight, cull weight and cull price.

The prediction equation based on financial measurements is displayed in Table 4. Results of this analysis indicate that there are eight measurements capable of explaining over 82% of the farm-to-farm variation in RLM. The prediction equation based on economic measures is shown in Table 5. In both equations the same eight dependent variables proved significant: feed cost, depreciation cost, operating cost, calf weight, capital charge, calf price, weaning percentage, and herd size, although to differing degrees.

Feed Cost

When calculated on a financial cost basis, 63% of total annual cow cost is feed cost. Feed cost in the financial analysis includes the financial cost of producing raised hay and pasture, as well as the cash cost of purchased feedstuffs. In the economic summary, feed cost is $34.00/cow higher because economic feed costs were calculated using the economic cost of production (i.e., a fair market value is assigned to owned land, equipment, and labor) for raised hay and pasture, along with the cash costs of purchased feed. There was more than $1.00 per cow per day difference in feed cost from the high cost producer to the low cost producer in this data set. Feed cost reported in this data set ($205.44) is similar to that reported by North Dakota ($216.00), but higher than that reported in Texas ($157.64).

Financial and economic feed costs were positively correlated ($P < .01$) (Tables 2 and 3) to operating cost, depreciation cost, investment, and capital charge suggesting that as actual feed cost increased, so did other expenses associated with feeding the herd.

As suggested by correlation analysis, feed cost is the overriding factor driving RLM in both the financial and economic stepwise regression analyses. In both analyses over 50 percent of the herd-to-herd variation in RLM could be explained by feed cost. This agrees with work done by one reporter who identified feed cost as the largest factor influencing profit and loss. This is not surprising because feed cost has a standard deviation of over $80.00, which is more than twice that of any other cost measure.

A number of factors seem to be driving feed cost. Investment, operating cost, depreciation cost, capital charge, and family labor are all highly correlated to feed cost ($P < .01$). This agrees with the researcher who reported that a $1.00 increase in feed cost implied a $2.48 reduction in profit, which suggests that other costs unaccounted for in that equation were positively correlated to feed cost. This finding would also indicate that herds with high feed costs are also high cost herds in other areas.

The financial regression analysis (Table 4) would indicate that a $1.00 increase in feed cost would need to result in nearly two additional lb of calf sale weight, or an increase of .5 percent in weaning percentage, while keeping all other factors the same.

Operating, Depreciation, and Capital Cost

By definition, operating cost and depreciation cost are calculated in the same manner in both the financial and economic analyses. These two expenses account for an additional $100.00/cow in the average herd (Table 1).

Financial capital charge is used for the debt service of loans pertaining to the cow/calf enterprise. In the economic analysis, capital charge provides a return to the fair market value of invested capital. On the average, capital charge was higher ($50.89) in the economic summary than the financial summary ($10.26). This relatively small amount of financial capital expense would indicate that most producers have very little debt against the cow-calf enterprise.

Operating costs, depreciation, and capital charge were all negatively correlated (P < .10) to herd size, and positively correlated (P < .01) to feed cost in both analyses. The positive correlation of these variables to feed cost suggests that there are additional expenses (i.e., manure disposal and the physical feeding of the herd) associated with stored feed usage. Operating costs were correlated with capital charge and investment (P < .001) in the financial analysis, also suggesting additional expenses associated with equipment investment and the cost of operating it.

In the financial regression model (Table 4), depreciation cost was the second critical factor explaining almost 9 percent of the herd-to-herd variation in RLM followed by operating cost (5 percent). The unstandardized coefficients and their standard errors for depreciation cost and operating cost indicate that there is essentially a 1:1 reduction in RLM for each dollar spent, therefore, increasing these costs does not increase economic return. One study showed that a $1.00 increase in operating cost resulted in a larger than $1.00 increase in total annual cost, suggesting a correlation between operating cost and other costs unaccounted for in the study's equation. Capital charge shows a $1.38 reduction in RLM for every dollar spent indicating that it is correlated with other factors that increased expenses, i.e., feed costs, operating costs, and investment costs (P < .01). This finding would suggest that equipment and machinery with money borrowed against them play a role in several major cost areas.

Even though depreciation cost is calculated the same in a financial or economic analysis, as a dependent variable it had a greater impact on the economic regression model than the financial regression model, and had a larger slope. This is due to the correlation of depreciation cost to other factors unaccounted for in the models. Depreciation cost was responsible for 12 percent of the herd-to-herd variation in RLM in the economic model. Each $1 increase in depreciation cost in the economic equation resulted in a -$1.19 RLM. Depreciation expense may be a function of investment in equipment and structures, or breeding stock. If this expense is due to equipment, spreading this cost over more cows would be a logical management alternative. The correlation between depreciation cost and herd size (P < .10) suggests that this would be an alternative in some herds.

Herd Production and Marketing

The average price of feeder calves sold for the entire database was $77.22 / cwt, with a low of $62.58/cwt in 1996 and a high of $86.43/cwt in 1999. Calf price data for this data set over these years are similar to those reported by Cattle-Fax for 1996-1999. Cattle-Fax data indicate a choice 450-pound steer (about 33 lb lighter than the average sale weight in this data set) brought $64.10/cwt in 1996, $88.93/cwt in 1997, $87.50/cwt in 1998, and $92.22/cwt in 1999. These data would indicate that the four years studied included the bottom (1996) of the most recent cattle cycle, and occurred during the liquidation phase. The upward trend seen in calf prices agrees with the upward trend seen in RLM (Table 1) indicating that calf price as a function of the cattle cycle certainly impacts profitability. In this study, individual observations were calculated as a difference from the yearly mean in an attempt to gauge differences in producer controlled marketing factors.

Calf weight had a greater impact than calf price on RLM in both the financial and economic regression models. Calf weight was the fourth indicator of RLM in the financial model (Table 4) and was similar in magnitude to operating cost, explaining about 5 percent of the herd-to-herd variation. Results of both the financial and economic equations indicate that each additional pound of calf sale weight would be expected to return 54 cents. This is intermediate to results reported by two other studies (41 and 60 cents). This figure is lower than the 77-cent average calf price reported for this data set for two main reasons. First, as calves get heavier, the sale price per pound decreases. This agrees with the negative correlation seen in this study for calf weight and calf price. Secondly, based on an 83 percent average weaning percentage, 17 percent of the cows that had costs were not marketing calves. This is the same reason that an increase of $1.00/cwt in calf price only resulted in an increased return of $3.40 per cow in the financial regression equation. This is similar to the $3.68 reported by another study.

Cull weight was correlated to cull price and weaning percentage (P < .001) in both the financial and economic analysis, suggesting a relationship between reproductive performance and culling rates. When entered into the stepwise regression models, neither cull weight nor cull price had a significant impact on RLM (P < .10), and thus were removed.

Reproductive Efficiency

The average producer had a weaning percentage of 83 percent. This is similar to data reported in Colorado (84 percent) and Texas (82.9 percent). A standard deviation of 8 percent indicates that 68 percent of the herds had a weaning percentage between 75 and 91 percent. Thus, there is less variation in the reproductive performance of these herds than in the cost data. One Texas study reported only a two percentage point (84 percent versus 82 percent) difference for weaning percentage between producers in the high net income quartile and those in the low net income quartile of the Texas SPA database.

Weaning percentage is correlated (P < .01) with RLM and had a minor impact on RLM in both regression equations. Each percentage increase in weaning percentage would be expected to increase returns $2.00 per cow. This is less than the $4.00 reported by one researcher and the $4.58 reported by another. These researchers were utilizing simulated data, and had greater variation in their data than is observed in this data set.

One study reported that pounds weaned per exposed female only accounted for seven percent of net income differences between herds. Combining weaning percentage and calf weight values seen in this study would result in a similar outcome.

An evaluation of calving distribution was made by summarizing data for the percentage of calves born in the first 42 days of the calving season. The average for all observations was 81 percent with a standard deviation of 14 percent (Table 1). Calving distribution is positively correlated (P < .01) with herd size indicating that larger operations were more successful at getting a larger percentage of calves born early in the calving season. Calving distribution also displayed a positive correlation (P < .01) to RLM; however, when included as a variable in the stepwise regression analyses it did not have a significant impact.

Investment

Investment measured on a market basis ($2350) and on a cost basis ($1506), is somewhat lower than investment figures reported in two Texas studies ($3,355 and $2,276). This is due to the enterprise analysis approach taken by this program. Producers often utilize equipment and structures in other farming enterprises. This effectively lowers the investment for the cow/calf enterprise and may illustrate the complimentary economic relationship of multiple enterprises.

Investment measured on a cost basis remained constant across years. Investment measured on a market value basis tended to increase from 1996 to 1999 as would be expected because commercial cow values increased.

Investment was not a significant variable in either regression model; however, it was highly correlated to a number of the significant cost variables. Depreciation was highly correlated (P < .001) to investment in the financial analysis (Table 2) but not in the economic analysis (Table 3). Financial investment (cost basis) is being heavily influenced by depreciable cattle and equipment investments, and most producers have a minimal cost basis in the land dedicated to the cowherd. On the other hand, economic investment (market basis) is being driven by the current market value of land, thus eliminating the correlation to depreciation. Capital charge is more highly correlated to investment in the economic analysis than the financial analysis because economic capital charge is calculated based on a fair market return to capital invested, but financial capital charge is actual debt service. Feed cost was very highly correlated (P < .001) to investment in both analyses. This would be expected because a large portion of investment consists of pasture and hay land.

Herd Size

Economies of scale have often been reported to exist in the cow/calf enterprise. Investment was negatively (P < .001) correlated to herd size in both the financial and economic analyses indicating fixed costs are being spread over more cows in larger herds. Herd size also was negatively correlated (P < .01) to feed cost and operating cost.

Herd size is negatively correlated to family labor (P < .001) in the economic analysis and positively correlated to hired labor suggesting that as herd size increased hired labor costs increased; however, family labor charge decreased per cow as it was spread over a larger herd. In general, it would be expected that labor would be negatively correlated to herd size. The positive correlation seen in this study for hired labor is due to the fact that most of the database consists of small herds with no hired labor. Only larger herds have hired labor.

The negative coefficient for herd size in this study suggests advantages for a smaller producer (Table 4) if they are able to manage the first seven variables. This might be difficult given the negative correlations seen between herd size and feed cost, operating cost, depreciation cost, and capital charge in this study, as well as the positive correlation seen between calf price and herd size. However, it does indicate that small producers that manage these factors can have an advantage over large producers. These data would indicate that economies of scale exist primarily in the form of reduced feed and operating costs.

Implications

The average cow/calf producer operating in Illinois or Iowa from 1996 through 1999 had a negative RLM. Cost factors were far more influential in driving RLM than production, reproduction, or producer controlled marketing factors. Of these cost factors, feed cost had by far the largest impact. As producers focus attention on factors that affect the profitability of the operation, feed cost is the most critical control point because it was responsible for over 50% of the herd-to-herd variation in profit.

Table 1. Means, standard deviations, maximum values, minimum values, and means by year (N=225).

Variable	Mean	SD	Maximum	Minimum	Mean by Year 1996	1997	1998	1999
Observations					48	72	56	49
Herd Size	97	66	373	20	92	98	103	95
Financial Measures								
Feed cost per cow, $	205.44	82.11	531.82	54.10	208.06	224.69	189.58	192.72
Operating cost per cow, $	67.36	32.03	207.95	10.93	65.60	71.45	64.51	66.34
Depreciation cost per cow, $	35.71	38.94	298.08	0.00	31.56	42.64	36.73	28.43
Capital charge per cow, $	10.26	16.72	131.42	0.00	8.65	11.74	10.25	9.68
Hired labor cost per cow, $	9.02	16.53	81.89	0.00	10.31	7.29	10.13	9.02
RLM per cow, $	-19.91	132.84	244.28	-488.90	-61.63	-23.33	-29.21	36.61
Economic Measures								
Feed cost per cow, $	239.04	86.33	585.54	63.83	230.19	245.99	227.85	250.31
Operating cost per cow, $	67.36	32.03	207.95	10.93	65.60	71.45	64.51	66.34
Depreciation cost per cow, $	35.71	38.94	298.08	0.00	31.56	42.64	36.73	28.43
Capital charge per cow, $	50.89	17.48	135.93	7.19	50.53	52.67	45.96	54.24
Hired labor cost per cow, $	9.02	16.53	81.89	0.00	10.31	7.29	10.13	9.02
Family labor charge per cow, $	50.98	37.88	222.73	0.00	51.66	46.89	47.82	59.92
RLM per cow, $	-80.69	150.05	286.67	-620.61	-129.63	-68.41	-98.84	-30.04
Sales Figures								
Calf weight	483	66	695	313	483	490	474	483
Calf price, $/cwt[a]	77.22	10.98	107.20	53.00	62.58	81.81	75.81	86.43
Cull weight per cow	201	137	765	0	176	205	207	209
Cull price, $/cwt	40.80	9.66	79.54	20.47	35.73	41.82	40.74	44.01
Reproductive Measures								
Weaning percentage[b]	82.8	8.3	100.0	52.9	82.4	82.7	81.9	84.1
Calving distribution [cd]	80.9	14.2	100.0	27.6	83.2	81.1	81.0	78.6
Investment Measures								
Capital investment (market basis), $	2350	1376	9895	621	2152	2269	2413	2592
Capital investment (cost basis), $	1506	787	4776	452	1513	1480	1536	1505

[a] Based on price per 100 lb
[b] N = 164
[c] Percent of calves born in the first 42 days of the calving season
[d] N = 180

Table 2. Simple linear correlations among traits used to develop financial prediction equations. [a]

	Herd size	Feed cost	Operating cost	Depreciation cost	Capital charge	Hired labor	Calf weight	Calf price	Cull weight	Cull price	Weaning percentage	Calving distribution	Investment
RLM	.16	-.75	-.49	-.47	-.32	-.14	.17	.13	-.08	.08	.18	.15	-.31
Herd size		-.20	-.20	-.13	-.12	.34	-.02	.13	.00	-.09	.01	.16	-.31
Feed cost			.36	.24	.19	.06	.06	-.05	-.07	-.03	-.01	-.03	.37
Operating cost				.13	.21	.10	.12	-.03	.13	.04	-.02	-.05	.24
Depreciation cost					.06	.00	-.05	.00	.13	.09	-.13	-.04	.24
Capital charge						-.01	.01	.01	-.07	-.04	.02	.00	.12
Hired labor							-.01	.03	.01	-.05	-.10	.02	-.10
Calf weight								-.27	.09	.08	.05	.04	.17
Calf price									-.01	.00	-.04	.08	.01
Cull weight										.40	-.21	-.03	.04
Cull price											-.01	-.08	.04
Weaning percentage												.04	.10
Calving distribution													-.12

[a] For null hypothesis that R = 0, $P < .10$ if $r > .09$; $P < .01$ if $r > .15$; $P < .001$ if $r > .21$

Table 3. Simple linear correlations among traits used to develop economic prediction equations. [a]

	Herd size	Feed cost	Operating cost	Depreciation cost	Capital charge	Hired labor	Family labor	Calf weight	Calf price	Cull weight	Cull price	Weaning percentage	Calving distribution	Investment
RLM	.13	-.72	-.46	-.47	-.37	-.14	-.25	.05	.19	-.06	.06	.16	.13	-.44
Herd size		-.19	-.20	-.13	-.30	.34	-.42	-.02	.13	.00	-.09	.01	.16	-.26
Feed cost			.30	.18	.29	.06	.33	.16	-.08	-.08	-.06	-.02	-.05	.54
Operating cost				.13	.34	.10	.23	.12	-.03	.13	.04	-.02	-.05	.16
Depreciation cost					.07	.00	-.01	-.05	.00	.13	.09	-.13	-.04	.09
Capital charge						-.03	.33	.22	-.13	.06	.07	.07	-.02	.48
Hired labor							-.30	-.01	.03	.01	-.05	-.10	.02	.02
Family labor								.13	-.13	.07	-.03	.11	.05	.19
Calf weight									-.27	.09	.08	.05	.04	.27
Calf price										-.01	.00	-.04	.08	-.20
Cull weight											.40	-.21	-.03	.04
Cull price												-.01	-.08	.03
Weaning percentage													.04	.01
Calving distribution														-.11

[a] For null hypothesis that R = 0, *P* < .10 if r > .09; *P* < .01 if r > .15; *P* <.001 if r > .21

Table 4. Stepwise regression values for financial level variables.[abc]

Variable	R^2	B
Feed cost, $	.567	-.94 ± .06
Depreciation cost, $	.653	-.88 ± .12
Operating cost, $	.702	-1.00 ± .15
Calf weight, kg	.748	1.18 ± .15
Capital charge, $	.772	-1.38 ± .27
Calf price, $/cwt [d]	.799	3.40 ± .66
Weaning percentage	.816	2.03 ± .52
Herd size	.823	-.17 ± .07

[a] Stepwise criteria: Probability of F to enter <=.050, Probability of F to remove >=.100.
[b] Intercept = 0
[c] Residual standard deviation = .983
[d] Based on price per 45.4 kg

Table 5. Stepwise regression values for economic level variables.[abc]

Variable	R^2	B
Feed cost, $	.522	-1.01 ± .07
Depreciation cost, $	.644	-1.20 ± .14
Operating cost, $	.695	-1.06 ± .18
Calf weight, kg	.719	1.15 ± .19
Calf price, $/cwt [d]	.751	4.11 ± .80
Capital charge, $	.765	-1.49 ± .35
Herd size	.782	-.32 ± .09
Weaning percentage	.794	1.91 ± .64

[a] Stepwise criteria: Probability of F to enter ≤.050, Probability of F to remove ≥.100.
[b] Intercept = 0
[c] Residual standard deviation = .969
[d] Based on price per 45.4 kg