Key Factors Contributing to Cow-Calf Costs, Profits, and Production

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Abstract

In this study, cow/calf Standardized Performance Analysis (SPA) data for Texas, Oklahoma, and New Mexico are used to analyze how total cost, production, and profitability are affected by management choices. Total cost is the financial cost associated with raising a calf through the weaning stage; profits are measured using the rate of return on assets; production is determined by pounds weaned per exposed female. Variables such as herd size, pounds of feed fed, calving percentage, death loss, length of breeding season and investment in asset groups are used in regressions. Key factors contributing to a cow/calf operation's costs, production, and profitability are identified.

Ranchers need to know how to properly manage and control costs incurred in the business, identify inefficient areas, and evaluate opportunities to lower per unit costs. Cost management becomes an even bigger concern for ranches that do not have the aid of subsidies and off-farm incomes. While advances in technology have allowed producers to become more efficient, there is still large variability in profitability of cow-calf operations. The objective of this research is to identify production and financial measures that are within the ranch manager's control and are important in determining economic cost of production, rates of returns on assets, and pounds weaned per exposed female. While new cost management strategies may be needed to increase efficiencies on an individual ranch, identifying characteristics of profitable producers could benefit the industry.

In a study of differences in cow/calf costs of production by herd size and profitability groups, Langemeier, McGrann, and Parker found economies of size, with the size advantage existing only up to 1,000 head. Short reported that production of feed and purchase of feed accounted for more than half of the total cost of production and also concluded that economies of size are a factor in cow/calf production. A USDA survey of management practices associated with profitable cow-calf herds determined that producers who worked toward optimal production rather than maximum production showed positive returns and achieved them through better herd efficiency and cost containment. According to the USDA study, the largest difference between individuals

with negative and positive returns was in capital investment, primarily real estate. Dunn analyzed 148 beef cow-calf herds in the Northern Great Plains and found that higher profit is a function of below average levels of investment and costs, and average levels of production with excellent marketing. Dunn included production measures such as pregnancy percent, weaning weight, weaned weight per exposed female, and weaning percent and input measures such as total expenses per acre, per beginning year breeding female inventory, and per hundredweight of weaned weight in regressions.

Data and Methods

Standardized Performance Analysis (SPA) is an analysis tool developed by cattlemen, researchers, and extension specialists for cow-calf producers to analyze their operations utilizing both financial and production records (McGrann, Jones, and McCorkle). It utilizes enterprise accounting concepts, focusing on the cow-calf production process through weaning the calf. Data needed for the SPA are organized into two main categories: financial and production. Financial data requirements include cash operating costs, liabilities, cost and market value of assets, changes in inventories, and expenses associated with purchased feed, pasture rents, fuel, and veterinary services in the year calves are weaned. Records used in calculating financial costs include IRS tax schedules (especially Schedule F), depreciation schedules, loan payment schedules, beginning and ending fiscal year balance sheets, and income statements.

Production data required includes cow and calf inventories, inventory reconciliation for exposed females (culls, sales, purchases, transfers, deaths), feed and grazing acres and feed use. For the production data, some records prior to the fiscal year are also necessary. Reproduction measures that are calculated include pregnancy percentage, pregnancy loss percentage, calving percentage, calf death loss, calf crop or weaning percentage, and female replacement rate, where all ratios are based on exposed females. Also, calf death losses based on calves born are needed; calving distribution information is a secondary SPA measure so data is not required but is included when available.

Standardized Performance Analysis (SPA) data compiled by Texas A&M University was used in this study. Data selected for use were from Oklahoma, Texas, and New Mexico from 1991 to 2001. 394 observations were used with 63 from Oklahoma, 293 from Texas, and 38 from New Mexico. Production systems vary widely across this geographic region, from arid land-extensive operations to more intensive operations based on improved forage in higher rainfall areas. Both commercial and seedstock operations are included. Data from the same ranch or farm but for different fiscal years or spring and fall herds are treated as separate observations. Data collected is based on individual producer records, which vary in their accuracy and completeness. Market values of assets likely contain the most variability as values are subjective.

The regional SPA database includes 119 variables in total, with 66 being production and 53 being financial (McGrann). In this study, 12 variables are used independently and in various combinations. The variables in the dataset are themselves calculations; however these calculations are extracted from individual SPA reports before storage in the database. Definitions for these variables are shown in Table 1 along with variable means, standard deviations, minimums, maximums, and number of observations.

The Models

For this study, three different models are used, each containing the same independent variables. For each model—Economic Pretax Cost Before Noncalf Revenue Adjustment Per Hundredweight (Cost), Percent Return on Assets (ROA), and Pounds Weaned Per Exposed Female (LBS)—a different dependent variable is used. In the Cost model, the dependent variable is the Economic Pretax Cost Before Noncalf Revenue Adjustment Per Hundredweight (*C*), which takes into account opportunity costs on owned assets and raised inputs. Cost on a per hundredweight basis is used to best relate production statistics with financial data. In the second model, Return on Assets is used as the profitability measure and serves as the dependent variable. In the production model, the dependent variable is Pounds Weaned Per Exposed Female. This variable represents the level of reproduction and production success within an operation, combining fertility, death loss prevention, and weaning weight performance into one variable. Table 2 shows the expected signs of variables in each model.

Table 1. SPA Variable Summary Statistics

Independent Variable	Calculation	Unit	Mean	Std. Dev.	Min.	Max.	N
Beginning Fiscal Year Breeding Cow Inventory	Number of Breeding Females at Beginning of Fiscal Year	Cows	711	1,754	10	13,884	394
Pounds of Raised/Purchased Feed Per Breeding Cow	Total Pounds of Raised and/or Purchased Feed Fed / Number of Breeding Females	Pounds	1675	1561	0	7,610	394
Calving Percentage	(Number of Calves Born / Number of Exposed Females) X 100	%	85.8	9.3	49.3	104	382
Calving Death Loss Based on Exposed Females	Number of Calves Which Died / Number of Exposed Females	%	3.5	3.5	0	23	384
Length of Breeding Season	Number of Days From Beginning to End of Breeding Season	days	133	77	11	365	394
Machinery and Equipment (Market Value)	Average Asset Value / Number of Breeding Cows	$	174	307	0	3,264	394
Real Estate Improvements (Market Value)	Average Asset Value / Number of Breeding Cows	$	1547	2208	0	16,230	394
Livestock (Market Value)	Average Asset Value / Number of Breeding Cows	$	653	300	0	1910	394
Economic Pretax Cost Before Noncalf Revenue Adjustment Per Cow	(Total Pretax Costs / Lbs. Of Weaned Calf Production Per Breeding Cow) X 100	$	412	160	138	1,717	394
Pounds Weaned Per Exposed Female	Total Pounds of Calf Weaned / Total Number of Females Exposed	Pounds	430	80	195	638	394
Percent Return on Assets (Cost Basis)	((Net Enterprise Income From Operations + Total Interest Expenses - Family Living Withdrawals) / Average Total Enterprise Assets) X 100	%	1.12	10.05	-45.08	48.54	394

Note: Data constructed from Standardized Performance Analysis Data in Oklahoma, Texas, and New Mexico from 1991-2001.

Table 2. Expected Parameter Estimate Signs

Variable	Cost	ROA	LBS
Beginning Fiscal Year Breeding Cow Inventory (*Size*)	-	+	-
Pounds of Raised/Purchased Feed Fed Per Breeding Cow (*Lbsfeed*)	+	-	+
Investment in Real Estate-Land and Improvements (*Realest*)	+	-	?
Investment in Machinery and Equipment (*Mach*)	+	-	?
Investment in Livestock (*Brdlvstk*)	+	+	+
Calving Percentage (*CalvP*)	-	+	+
Calving Death Loss Based on Exposed Females (*CalvDL*)	+	-	-
Length of Breeding Season (*Brdseason*)	+	-	-

Beginning Fiscal Year Breeding Cow Inventory is expected to be significant and have a negative parameter estimate if economies of size exist in cow-calf enterprises (as the herd size increases, the costs per cow decrease). The size parameter is expected to have a positive sign in the ROA model. Pounds weaned per exposed female may decrease with an increased herd size because management may not be as intense in managing the herd for maximum production performance.

Grazing is thought to be the most cost effective means of meeting cows' nutritional needs. Hence, low cost systems would be expected to use little purchased feed or raised feed that has been mechanically harvested, stored and hauled. The parameter estimate for Pounds of Raised/Purchased Feed Per Breeding Cow is expected to be positive in the cost model as an increase in pounds fed will increase costs. It is expected to have a negative sign in the profitability model showing that as more is fed, ROA decreases if the benefits of feeding relative to grazing do not outweigh the added costs. Pounds of Raised/Purchased Feed Per Breeding Cow is expected to have a positive sign in the Pounds Weaned model with increased feeding increasing the total pounds weaned. This could result from higher weaning weights, or better condition of cows or bulls leading to better reproductive rates.

The Investment in Real Estate (market value of land and improvements made upon it) is expected to have a positive parameter estimate in the cost model as economic costs include an opportunity cost on land valued at its rental rate. Investment in Real Estate is expected to have a negative sign in the profitability model if the return to the land generated by ranch profits is less than the return that could be generated by renting the land out. With the Pounds Weaned model, no relationship is anticipated with the Real Estate Investment variable.

The Investment in Machinery and Equipment variable is expected to have a positive sign in the cost model as the higher the investment in machinery, equipment, and vehicles, the higher the costs incurred in the operation with more repairs, fuel and lube, depreciation, and taxes plus interest on investment opportunity costs. It is anticipated to have a negative sign in the profit model showing that as the investment in machinery and equipment increases, profits decrease. As with the previous variable, no sign is anticipated for this variable in the pounds weaned model.

In the cost model, the sign on the Investment in Breeding Livestock variable is expected to be positive showing that with an increased investment, there is an increased cost in the operation. A positive sign is anticipated in the ROA model however if a higher investment in livestock results in higher profits because of greater productivity, higher weaning weights or higher sale prices. This variable is also anticipated to have a positive sign in the pounds weaned model if a greater investment in livestock results in more pounds weaned per cow. All investment data is subject to the caveat that market values are subjective, perhaps confounding statistical relationships.

Calving Percentage is a variable that could be interpreted as a proxy for production management skills and, if significant in cost and ROA models, would indicate a correlation between financial acumen and production skills. In the cost model, it is expected that the sign of the Calving Percentage parameter estimate will be negative, indicating that as the calving percentage goes up, costs go down. In the ROA model, a positive sign is expected indicating that as the calving percentage increases, so do profits because of an increase in marketable production. Calving percentage is obviously anticipated to have a positive sign in the pounds weaned model.

Calving Death Loss Based on Exposed Females is another variable that could be interpreted as a proxy for production management skills. In the cost model, this variable is expected to be positive if death losses are accompanied by increased veterinary and other costs and if poor production management skills are correlated with poor financial management skills. In the profitability model, Calving Death Loss is anticipated to have a negative sign. Calving Death Loss is also expected to have a negative sign in the pounds weaned model showing that as more calves are lost due to death, pounds weaned decreases.

In the cost model, Length of Breeding Season is expected to have a positive parameter estimate indicating that longer breeding seasons, and consequently longer calving seasons, are higher cost. This variable is anticipated to have a negative sign in the ROA model. Longer breeding seasons result in a lack of uniformity of weaned calves and potentially lower prices as calves are sold in smaller lots. In the pounds weaned model, a negative coefficient is expected showing that as the season increases, the pounds

weaned decreases because the calving season is drawn out with calves born late in the breeding season and weaned at lighter weights.

Findings and Analysis

Using SAS, each hypothesis' independent variable is regressed against common dependent variables. Tests are performed to check for dynamic and static heteroskedasticity, autocorrelation, multicollinearity, normality, and nonlinearity and measures are taken to correct for problems that may occur. A summary of the regression results is shown in Table 2. Beginning Fiscal Year Breeding Cow Inventory was significant in both the cost and ROA model, although it was not significant in the pounds weaned model. This variable showed that with increased herd size, pretax costs per hundredweight decreased suggesting economies of size. A quadratic term for the beginning fiscal year breeding cow inventory was included. It was only significant in the cost model and had a positive sign. ROA was positively related to herd size. The lower cost per hundredweight and/or increased lot sizes of weaned calves for larger herds could be contributing to the increase in ROA. Pounds weaned per exposed female was unaffected by herd size in this study.

Pounds of feed fed per breeding cow was significant in both the economic pretax cost model and the ROA model. In the cost model, pounds of feed fed had the expected positive sign indicating that as more pounds were fed, costs increased. While pounds of feed fed is important in determining costs, it did not improve production, indicated by its insignificance in the pounds weaned model. Perhaps to be significant, feed must be strategically fed to increase conception and/or weaning weights. In the ROA model, the variable had a negative sign showing that with an increase in pounds being fed, ROA

decreased. Because the ROA is being used as the measure of profitability in this model, it shows that producers who are feeding more are making less profit.

Investment in real estate-land and improvements was important in explaining costs, but not in determining ROA or pounds weaned. In the cost model, the sign was positive indicating that as the investment in real estate increases, the pretax cost per hundredweight increases. Leasing land may be less costly than land ownership in providing forage for a cow-calf operation. Thus, land ownership goals may run counter to farm profitability goals. With real estate investments, the decision to own land may be influenced more by personal goals of the producers rather than expected contribution to enterprise profitability.

Investment in vehicles, machinery, and equipment was significant in only the first model, pretax costs per hundredweight. Regressions showed that owning more machinery and equipment raised the economic costs per hundredweight; however, it did not impact ROA or pounds weaned per exposed female. This shows that machinery and equipment owned by producers in this study only contributed to an increase in costs, with no effect on profits or production. So, it could be concluded that producers should carefully consider machinery ownership, perhaps substituting custom work, to minimize costs.

Investment in breeding livestock was significant in the economic pretax cost model, increasing costs per head, as well as significant in the pounds weaned model, increasing pounds weaned per exposed female. Perhaps producers with high levels of investments in breeding livestock have higher quality livestock and wean more pounds

per cow. However, it was not significant in the profitability equation (ROA), suggesting the increased gain is insufficient to offset the higher cost.

It is interesting to note that calving percentage is the only variable significant in all three models. This finding reinforces the importance of high levels of reproduction to success and business sustainability. If successful financial management were independent of successful production, the variable would not be expected to be significant in the cost equation. Calving percentage was negatively related to pretax costs and positively related to ROA and pounds weaned. Because of its significance in all three models, it can be concluded that better management to increase live, healthy calves is an important strategy to decrease costs, increase profitability, and increase production.

Calving death loss based on exposed females was significant in two of the three models. It was shown to increase pretax costs and to decrease pounds weaned; however, it had no effect on ROA. Losing calves keeps the producer from getting back dollars invested in the cow herd and in cow maintenance by taking away the product to be marketed.

Length of the breeding season had an effect on economic pretax costs before noncalf revenue adjustment per hundredweight as well as pounds weaned per exposed female. Findings supported earlier studies (Selk) that costs were decreased by having shorter or set breeding seasons. Also, it was significant in pounds weaned per exposed female showing that the longer the breeding season, the less pounds weaned. ROA was not impacted by this variable.

Table 2. Comparative Results Between Models

		Cost	ROA	LBS
R Square Value		0.3094	0.1101	0.4998
Beginning Fiscal Year Breeding Cow Inventory (*Size*)	Parameter Estimate	-0.00634*	0.00157**	0.0008677
	Standard Error	(0.00164)	(0.000928)	(0.00556)
	t value	-3.87	1.69	0.16
Beginning Fiscal Year Breeding Cow Inventory Squared (*Sizesq*)	Parameter Estimate	3.708054E-7*	-1.00275E-7	1.188102E-7
	Standard Error	(1.291682E-7)	(7.568142E-8)	(4.537127E-7)
	t value	2.87	-1.32	0.26
Pounds of Raised/Purchased Feed Per Breeding Cow (*Lbsfeed*)	Parameter Estimate	0.00253*	-0.00066194**	-0.00186
	Standard Error	(0.00124)	(0.00034519)	(0.00207)
	t value	2.05	-1.92	-0.90
Investment in Real Estate (*Realest*)	Parameter Estimate	0.00377*	-0.000319	-0.00166
	Standard Error	(0.00082)	(0.000227)	(0.00136)
	t value	4.59	-1.41	-1.22
Investment in Machinery and Equipment (*Mach*)	Parameter Estimate	2.61997*	-0.05661	-0.21401
	Standard Error	(0.43642)	(0.04125)	(0.24729)
	t value	6.00	-1.37	-0.87
Investment in Livestock (*Brdlvstk*)	Parameter Estimate	0.01244*	-0.00256	0.02676*
	Standard Error	(0.00547)	(0.00168)	(0.01009)
	t value	2.27	-1.52	2.65
Calving Percentage (*CalvP*)	Parameter Estimate	-1.50949*	0.26965*	6.21239*
	Standard Error	(0.22877)	(0.05615)	(0.33659)
	t value	-6.60	4.80	18.46
Calving Death Loss Based on Exposed Females (*CalvDL*)	Parameter Estimate	1.39183*	-0.10497	-6.31090*
	Standard Error	(0.45168)	(0.15082)	(0.90419)
	t value	3.08	-0.70	-6.98
Length of Breeding Season (*Brdseason*)	Parameter Estimate	0.04707**	-0.01026	-0.15824*
	Standard Error	(0.02396)	(0.00655)	(0.03924)
	t value	1.96	-1.57	-4.03

Note: Statistical significance denoted by * = 0.05, ** = 0.1 alpha levels.

Summary and Conclusions

In this study, cow/calf Standardized Performance Analysis data was used to analyze cow/calf operations and how costs, production, and profitability were affected by management variables. Three models were estimated. All variables were significant in the cost model. Variables associated with increasing costs were pounds of feed fed, calf death loss, and investments in real estate, livestock, and machinery and equipment. Costs per hundredweight were negatively related to herd size, calving percentages, and length of breeding season. Thus, production and financial management both contribute significantly in explaining total costs. It was also shown that economies of size increased at a decreasing rate.

For the percent return on assets model, only three variables had a significant effect. The beginning fiscal year breeding cow inventory and calving percentage increased the return on assets, while an increase in pounds of feed fed decreased return on assets. Though not statistically significant, a negative sign on investment in livestock was not expected.

Pounds weaned per exposed female were significantly affected by four factors. Investment in livestock and higher calving percentages had positive impacts on pounds weaned while death losses and longer breeding seasons had negative impacts. While not statistically significant, unexpected results were that herd size had a positive impact on pounds weaned and that pounds of feed fed had a negative impact on pounds weaned.

Overall, hypothesized variables best explained cow-calf production, followed by cost of production. There was less success in explaining returns to assets. SPA date thus

provides some insights into cow-calf operations while yet raising other questions that may be explained only when specifics of operations are known.

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