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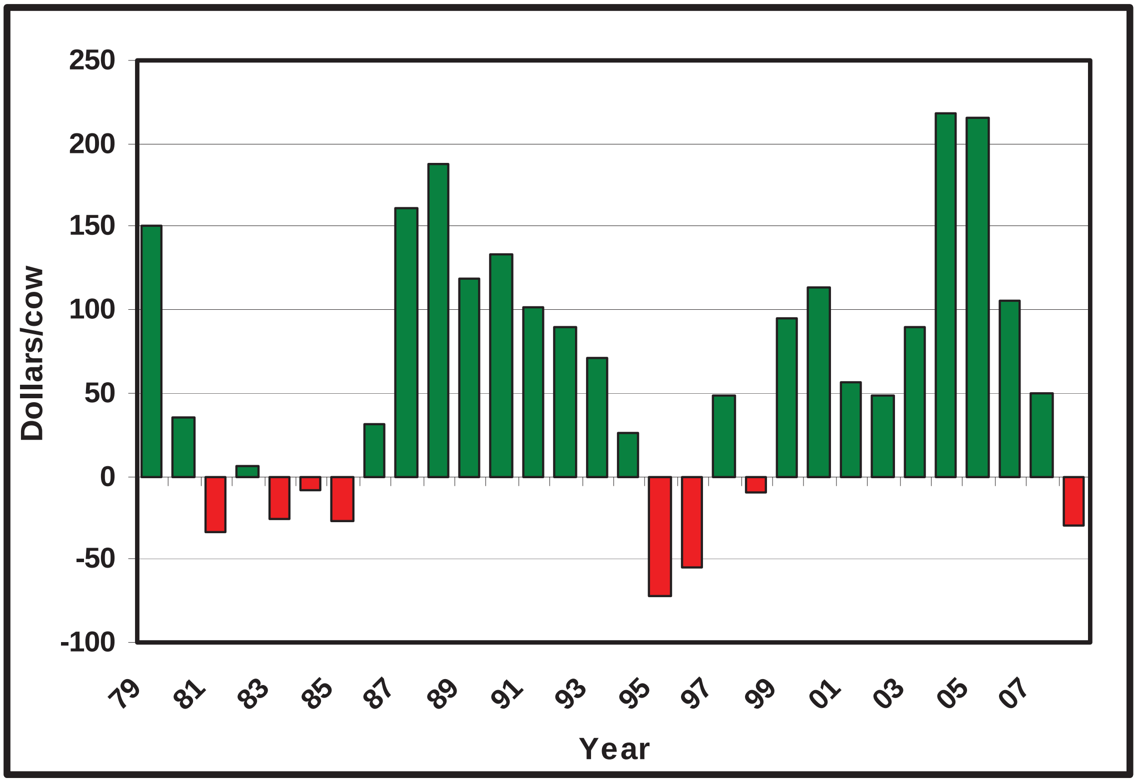
It is well known that economic returns to cow-calf producers fluctuate considerably over time. Figure 1 shows returns over variable costs, on a per cow basis, for cow-calf producers enrolled in the Kansas Farm Management Association (KFMA) program with cow-calf enterprise records. The number of producers participating in the enterprise analysis averaged 158 per year and ranged from 93 to 258 over the 30-year period. Average annual returns varied from a low of -$71.52 per cow in 1995 to a high of $218.55 in 2004 and averaged $63.06 over the entire time period. If the 30-year returns in figure 1 are sorted into thirds, the average returns for the 10-year periods are $150.65, $61.52, and -$22.99, for the top-, middle-, and bottom-periods, respectively. In other words, there is almost a $175 difference in the average returns per cow in the “good” years compared to the “bad” years.

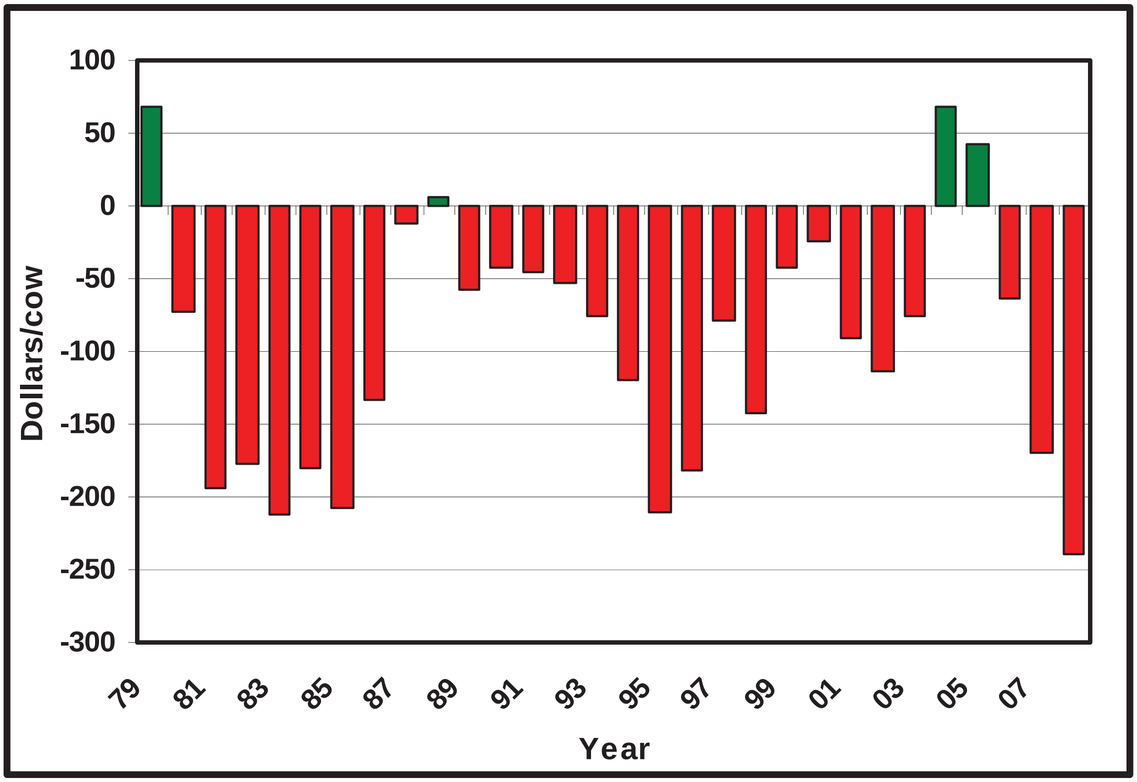
Figure 1. Returns over Variable Cost for Cow-calf Enterprise, 1979-2008



This variability of returns over time is due to many factors, but one of the biggest drivers is the cattle cycle. That is, during poor economic times producers tend to reduce the size of their herd which then leads to shorter supplies in the future. These shorter supplies lead to higher prices, which lead to producers expanding their herds creating a larger supply resulting in lower prices (and the process starts over again). Cattle cycles are not perfectly predictable because factors other than price also influence producers’ decisions to expand or contract their herds (forage availability, input costs, etc.). For example, the declining returns in recents years (e.g., 2007 and 2008) were not the result of herd expansion, but were due more to increasing input costs and weakening beef demand. While some producers try to maintain a "counter cyclical" strategy, it is difficult to avoid the variability in returns depicted in figure 1 because this variability is driven by macro economic factors that impact all producers similarly. Given that factors at the macro level (e.g., interest rates, trade policies, consumer demand) are basically uncontrollable by producers, it stands to reason that variability of returns over time is inherent to the industry.

Figure 2 shows similar data as figure 1 only it reflects returns over total costs rather than returns over variable costs. That is, depreciation, real estate taxes, unpaid operator labor and an interest charge on assets have been included in the costs. The average returns over total costs over the 30-year period are -$94.41 and ranged from -$239.75 to $68.21 (only positive four years out of 30). At first glance one might ask why anybody is in the cow-calf business if returns over total costs are almost always negative. However, it is important to recognize that the value assigned to unpaid labor and assets used in the operation reflect opportunity costs and these can vary significantly between operations. The point of figure 2 is that, similar to figure 1, regardless of how we might measure returns, they are highly variable across time. Sorting the 30-year returns over total costs into thirds results in the following 10-year averages: -$3.35, -$88.31, and -$191.57, for the top-, middle-, and bottom-periods, respectively. In other words, there is almost $190 difference in the average returns over total costs per cow from the "good" years to the "bad" years.

Figure 2. Returns over Total Cost for Cow-calf Enterprise, 1979-2008



Figures 1 and 2 show the variability in annual average returns across time, where the annual averages are calculated across producers. It was pointed out that this variability across time is due largely to macro economic factors that producers have limited ability to manage. However, what do the returns for individual producers look like at a point in time? That is, how much variability is there in the returns across individual producers in good or bad years? The answer to this question is important from a management perspective because while producers might not be able to influence overall market conditions, they do have more control of profitability at the farm level relative to other producers. That is, while numerous factors beyond the producer's control impact the *absolute* level of profitability, producers' management abilities impact their *relative* profitability. In a competitive industry that is consolidating, such as production agriculture, relative profitability will dictate which producers will remain in business in the long run. Thus, it is important to recognize which characteristics determine relative farm profitability between producers. Specifically, it is important to be able to answer the following questions. Does size of operation impact profitability? Do profitable farms sell heavier calves or receive higher prices? Do they have lower costs? If they have lower costs, in what areas are their costs lower?

To consider these questions, cow-calf enterprise costs and returns from the Kansas Farm Management Association (KFMA) Enterprise Analysis were divided into three profitability groups, high, middle, and low, based on the per cow return to management.[1] A potential problem with analyzing the returns from a group of producers in a given year is that differences could be due more to chance than management. For example, if a producer in one part of the state received little or no summer rain, he might have lower weaning weights or higher feed costs (due to supplemental feeding) and hence have lower returns due to weather conditions as opposed to poor management. Similarly, a producer that happens to sell calves in the fall and then the market subsequently rallies might have lower returns than producers that sold their calves 2-3 weeks later, but this difference is likely more due to chance as opposed to management. To alleviate the problem of random differences in returns across producers in a given year, a multi-year average is used for each producer. Specifically, we examined the returns for any producers that had a minimum of three years of data over the 2004-2008 time period.[2] Operations with an average selling weight greater than 700 pounds were excluded from the analysis as this likely would represent operations that backgrounded calves and the focus of this analysis is on the cow-calf enterprise. In addition to being excluded from the analysis because of insufficient years of data (i.e., less than three years from 2004-2008), operations also were excluded from the analysis if they had less than 10 cows, if they had not recorded production, if their cattle purchases were greater than 20% of their herd in any one year, or if their net sales (sales less purchases) of breeding stock were greater than 20% in any one year. After these "filters" were applied, there were 65 operations with multi-year average returns to analyze (13 had five years of data, 24 had four years of data, and 28 had three years of data). These multi-year averages of individual producers' returns should do a better job of characterizing profitability differences that are due to management abilities as opposed to random returns, which might be the case if only a single year were considered.

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[1] The words profitability and profit used in this paper refer to the Net Return to Management measure reported in the Kansas Farm Management Association Enterprise *PROFITCENTER* Summary reports. Net Return to Management is gross income less total costs, which includes unpaid labor, depreciation, and a charge for owned land.

[2] Ideally, we would like to have examined the returns for all producers having three or five years of continuous data, however, when we used that stipulation our sample size dropped significantly because not all cow-calf producers conduct an enterprise analysis every year. For example, there were only 13 operations that had data each year from 2004-2008. Likewise, there were only 26 operations that had data each year from 2006-2008.

To allow for easier comparisons, a number of the income and expense categories reported in the KFMA cow-calf enterprise report were aggregated. Gross income per cow is the sum of cattle (calves and breeding stock) sales and other miscellaneous income less cattle purchases. Expense categories considered were feed, vet, marketing, labor, depreciation, machinery, interest, and other.[3] In addition to the variables from the cow-calf enterprise analysis, a variable representing the amount of labor allocated to livestock was pulled from the KFMA whole-farm database. While this percentage is not reported for beef cows specifically, i.e., it includes all livestock, it should represent a reasonable proxy of total labor on the farm that is allocated to the cow-calf enterprise for this subset of farms. This variable provides an indication as to the relative importance of the cow-calf enterprise to the total farm. A high percentage indicates a farm specializes in beef cow-calf, whereas, a low percentage indicates the operation relies relatively more on crop enterprises.

Multi-year averages were calculated for all variables (e.g., returns, herd size, costs) for each of the 65 operations with a minimum of three years of data. The operations were sorted from high to low based on the average return to management (return over total costs) and then classified as high-, mid-, and low-profit farms. Average returns and costs for all 65 operations and for each of the three profit categories are reported in table 1. Also reported are the differences between the high and low 1/3 groups both in absolute terms and percentages. High profit farms were larger on average and had slightly heavier calves.[4] They also had a higher percentage of their farm labor allocated to livestock than other operations (i.e., they were more specialized in livestock). The mid-profit farms had slightly higher prices compared to the high- and low-profit operations. High-profit operations generated almost $85 (+17%) more revenue per cow than the low-profit operations. Differences in costs between operations were much larger than the revenue differences. High-profit operations had almost a $287 per cow advantage over low-profit farms (-34%) and a $110 advantage over the mid-profit farms. With the exception of veterinary costs, where costs were essentially the same for all three categories, high-profit operations had a cost advantage in every cost category compared to the low-profit operations. This was similar when compared to the mid-profit operations with the exception of depreciation (i.e., mid-profit was slightly lower than high-profit). The average year for the high-profit operations was 5.98, where 2004=4, 2005=5, and so on, compared to 6.23 for the mid-profit farms and 6.18 for the low-profit farms. While these means were not statistically different from each other at the 10% level, there was a tendency for fewer high-profit farms to have data in the most recent years. Thus, part of the profitability differences is due to a year effect, but this impact is relatively small (this is discussed more in a later section).

Combining the gross income and cost advantages for the high-profit farms results in a net return advantages of $371.47 and $128.52 per cow compared to the low-profit and mid-profit farms, respectively. Thus, even though figure 2 suggests that the average cow-calf producer participating in the KFMA enterprise analysis seldom covers their total costs, the information in table 1 indicates that some producers might consistently earn positive returns. That is, even when the macro economic conditions led to an average loss of $152.20 per cow over this time period, a third of the producers were able to realize a positive return of $15.05 per cow. In other words, even though

[3] Disaggregated income and expense categories in the enterprise reports can be seen in historical reports available at http://www.agmanager.info/KFMA/.

[4] While we have attempted to focus strictly on the cow-calf enterprise by excluding operations with average weights greater than 700 pounds, it is possible that operations with heavier weights fed their calves for a short time perod (i.e., preconditioned their calves). However, given that the weight differences are relatively small, the heavier weights could also be due to better management and better genetics.

returns are highly variable over time due to hard-to-manage macro economic factors, the variability across producers at a point in time is even larger. These larger differences can potentially be managed and therefore represent opportunities.

Given the large differences in returns across producers, a logical question is what are the factors that lead to these differences? Looking at the data in table 1, it is fairly obvious that cost differences represent a much larger portion of net return differences than differences in income. Over three-fourths (77.2%) of the average difference in net return to management between high- and low-profit farms is due to cost differences. The other 22.8% is due to differences in gross income per cow. This is not unexpected in a commodity market where producers are basically price takers, i.e., the ability to differentiate oneself financially from the average is typically done through cost management.

Table 1. Beef Cow-calf Enterprise Returns and Costs, 2004-2008 (minimum of three years)*

		Profit Category			Difference between	
	All	High 1/3	Mid 1/3	Low 1/3	High 1/3 and Low 1/3	
	Farms	Head / $	Head / $	Head / $	Absolute	%
Number of Farms	65	22	21	22		
Labor allocated to livestock, %	38.1	48.0	35.4	30.7		
Number of Cows in Herd	124	170	137	65	105	161%
Number of Calves Sold	114	156	129	58	97	168%
Weight of Calves Sold	583	591	584	573	18	3%
Calf Sales Price / Cwt	$109.12	$108.73	$109.99	$108.68	$0.05	0%
Gross Income	**$539.29**	**$573.90**	**$555.38**	**$489.33**	**$84.56**	**17%**
Feed	$312.02	$274.36	$316.05	$345.83	-$71.47	-21%
Interest	$117.00	$94.09	$117.00	$139.90	-$45.81	-33%
Vet Medicine / Drugs	$15.70	$15.85	$15.73	$15.54	$0.30	2%
Livestock Marketing / Breeding	$10.08	$8.15	$11.44	$10.72	-$2.56	-24%
Depreciation	$37.23	$26.36	$25.28	$59.51	-$33.16	-56%
Machinery	$66.73	$47.71	$63.34	$88.99	-$41.28	-46%
Labor	$92.87	$69.48	$84.90	$123.88	-$54.41	-44%
Other	$39.85	$22.85	$35.10	$61.38	-$38.53	-63%
Total Cost	**$691.49**	**$558.84**	**$668.84**	**$845.75**	**-$286.91**	**-34%**
Net Return to Management	**-$152.20**	**$15.05**	**-$113.46**	**-$356.42**	**$371.47**	

* Sorted by Net Return to Management (Returns over Total Costs) per Cow

Figures A1-A13 in Appendix A are scatter graphs showing the relationship between different sets of variables for all 65 operations. The high-, mid-, and low-profit operations are identified with different symbols in all figures (red triangles are bottom 1/3, blue squares are middle 1/3, and green diamonds are top 1/3). The correlation between the variables is reported in the figure title. The correlation is a statistical measure of how well two variables move together and is bounded by -1.0 and 1.0. A value of -1.0 would indicate the two variables move together perfectly, but in opposite directions and a value of 1.0 indicates two variables move up and down together proportionately. Values close to zero indicate the two variables have little relationship to each other. The following is a brief discussion of the different figures.

Gross Income

Profit and gross income are positively correlated as might be expected (figure A1) indicating that operations generating greater income tend to be more profitable. However, with a correlation of 0.57, clearly having high gross income does not guarantee high profit. This can also be seen where a number of the bottom 1/3 operations had high gross income. Likewise, some of the most profitable operations had moderate gross income levels. Remembering that gross income was a compilation of all income, it still stands to reason that it will be heavily influenced by price and weight. The data for gross income versus price and gross income versus weight are plotted in figures A2 and A3, respectively. There is almost no relationship between price and gross income, but there is a positive relationship between gross income and weight. That is, producers that sell more pounds tend to generate more income, but those getting higher prices may or may not actually have higher income. Thus, strictly from a gross income standpoint, this would suggest producers would be better off to focus on production (i.e., pounds sold per cow) than on price. However, it is also important to remember that the relationship between gross income and return over total costs (profit) was not particularly strong and thus there may be even more important variables, such as cost items, to focus management efforts on.

Total Costs

Figure A4 shows the relationship between total costs and profit. This relationship is negative as expected, i.e., higher costs lead to lower profits, and is very strong (correlation of -0.90). This result confirms what was shown in table 1 – the majority of the differences in returns are due to costs and not due to income. Given that cost management is so important, the next question is what drives differences in costs across operations? Figure A5 shows feed costs versus total costs. These costs are positively correlated as would be expected. While feed costs represent almost half of the total costs, it is clear that other costs are important as some of the top 1/3 operations have higher feed costs than some of the bottom 1/3 operations. We typically would expect that operations that market calves at heavier weights would have higher feed costs per cow, however, the relationship between feed costs and calf selling weight is very weak (figure A6). Figure A7 shows the relationship between feed costs and the size of the cow herd. The negative relationship indicates that, on average, larger operations have lower feed costs per cow. While the data used in this analysis do not allow us to know exactly what is causing this, it is likely that larger operations rely less on purchased feeds and they receive volume discounts on the feed they do purchase.

Higher labor costs per cow and higher depreciation and machinery costs per cow are associated with higher total costs per cow as would be expected (figures A8 and A10). Furthermore, the relationship between depreciation and machinery costs and total costs is quite strong (stronger even than feed costs). As with feed costs, both labor and depreciation and machinery are negatively related to operation size (figures A9 and A11). That is, operations with larger cow herds tend to have lower costs per cow in both of these categories. The negative relationship between operation size and depreciation and machinery costs is stronger than with the other cost categories. This is not surprising given the “fixed cost” nature of depreciation and machinery. That is, feed and labor costs per cow are generally considered to be variable costs and thus will not vary with operation size, on a per cow basis, as much compared to depreciation and machinery which are more fixed on a whole-farm basis.

Figure A12 plots the total costs against the number of cows in the herd. The negative relationship indicates that economies of size exist, i.e., producers with larger operations tend to have lower costs per cow. However, several points should be made. First, there are only a few herds in this analysis with over 300 cows so we cannot say much about the costs for very large operations. That is, while it appears that costs decrease, on average, as herd sizes increase from 50 to 250 cows, we cannot say what they might be for herds with 1,000+ cows. Second, there is a tremendous amount of variability in costs for a given herd size, which suggests that simply being a "large" operation does not guarantee one of having low costs. In other words, while economies of size exist on average, there are smaller operations that compete quite well with larger operations. Figure A13 plots the percentage of labor allocated to livestock (measure of specialization) against total costs. The negative relationship suggests that those producers that specialize in livestock, i.e., have a higher percent of their total farm labor allocated to livestock, tend to have lower costs and hence be more profitable compared to operations who have relatively more of their labor allocated to crops. While this relationship is not particularly strong, it does hint at the advantage to specializing.

Characteristics Impacting Profit and Cost Differences

Figures A1 through A13 and table 1 provide some indication as to the factors impacting profit and costs, however, correlations only reflect relationships between two variables rather than accounting for multiple factors simultaneously. Additionally, while it is interesting to examine relationships such as feed costs versus total costs, it is more important to think about causal relationships. That is, what are the characteristics of an operation that lead it to being more profitable or having lower costs? Accordingly, the following equation was statistically estimated using multiple regression to identify factors affecting profit differences between operations

$$[1] \quad Profit_i = A_0 + A_1(Cows_i) + A_2(Cows^2_i) + A_3(Weight_i) + A_4(Price_i) + A_5(Feed\%_i) + A_6(Labor_i) + A_7(Years_i),$$

where *Profit* is the profit (return over total costs) per cow, *Cows* is the number of cows in the herd (head), $Cows^2$ is the number of cows squared, *Weight* is the average selling weight (lbs/cow), *Price* is the average selling price ($/cwt), *Feed%* is the percentage of total costs represented as feed (%), *Labor* is the percentage of total farm labor allocated to livestock (%), *Years* is the average of the years included in the multi-year average, where 2004=4, 2005=5, and so on[5], *i* is an index for individual operation, and A_0 through A_7 are parameters to be estimated. All variables are multi-year averages based on the number of years of data each operation had over the 2004-2008 time period. It is expected that the coefficient on *Feed%* (A_5) will be positive because operations that have feed costs as a high percent of total are doing a good job of minimizing non-feed costs and thus are expected to have higher profits. Based on data in figure A12, it is expected that the coefficient on *Labor* will be positive. The variable *Years* is included to account for slightly different time periods included in the multi-year averages between the operations.

Similar to equation [1], the following equation was estimated to identify factors leading to cost differences between operations

$$[2] \quad Cost_i = B_0 + B_1(Cows_i) + B_2(Cows^2_i) + B_3(Weight_i) + B_4(Feed\%_i) + B_5(Labor_i) + B_6(Years_i),$$

[5] Defined this way, the *Years* variable is bounded by 5.0 (3-year average including years 2004, 2005, and 2006) and 7.0 (3-year average including years 2006, 2007, and 2008). If a producer had data for all five years, the *Years* variable would take on a value of 6.0 (average of 2004, 2005, 2006, 2007, and 2008). The average value of *Years* across all 44 operations was 6.13.

where *Cost* is the multi-year average total cost per cow, the other variables are as previously defined, and B_0 to B_6 are parameters to be estimated. *Price* is not included in equation [2] because there is no reason to expect that price received for cattle would have any impact on costs per cow.

Table 2 reports the results of estimating equations [1] and [2]. The coefficients on all of the variables were significant at the 10% level with the exception of *Years*, which was only moderately significant (p=0.121). This value was negative indicating that operations with more years later in the sample period had lower profits compared to operations with data in the earlier years, all else equal. An operation with data from 2004-2006 (*Years*=5.0) would have been $104.82 more profitable than an operation with data from 2006-2008 (*Years*=7.0), all else equal. However, applying this regression "year effect" to average years for operations in the high- and low-profit thirds (5.98 and 6.18, respectively), only results in a difference in profit of $10.32 per head. Thus, the results presented in Table 1 would only change slightly when year differences are accounted for and the general conclusions would not change. The coefficients on *Cows* and $Cows^2$ were positive and negative, respectively, indicating that profit increases at a decreasing rate as herd size increases up to 345 cows at which point profit begins to decrease. Profits are positively related to selling weight and price as expected. Each additional 10 pounds of weight sold would be expected to increase profit per cow by $7.55. Likewise, each $1/cwt increase in the price increases profit by $5.12 per cow. However, because of price slides (i.e., negative correlation between price and weight where price/cwt decreases as weight increases) these two factors will typically be moving in opposite directions. The coefficient on *Feed%* is positive and highly significant indicating that producers who have relatively more of their costs as feed (i.e., relatively less in other categories) are more profitable. For every 1% higher this variable is, profit increased $10.68 per cow, all else equal. The average of this variable across all producers was 46% and it ranged from 31% to 63% indicating the ability to manage non-feed costs can have a huge impact on profitability. The coefficient on *Labor* was positive as expected indicating that producers who specialize more on livestock production, relative to crop production, tend to be more profitable. The R-square value for Equation [1] was 0.5091 implying that roughly 51% of the variation in the dependent variable (profit/cow) was explained by variability in the independent variables.

Fewer of the variables were statistically significant in the cost model (table 2). The coefficient on *Weight* was positive suggesting producers selling heavier cattle have higher costs, but this was not statistically significant. Likewise the coefficients on *Labor* and *Years* were not statistically significant. It is not surprising that years included in the average was not important from a cost standpoint because costs tend to be much more stable from year to year compared to revenue. However, it is unclear why the amount of labor allocated to livestock enterprises impacts profit but not costs. Thus, this somewhat weakens the earlier finding of the benefit of specializing. The coefficients on *Cows* and $Cows^2$ were negative and positive, respectively, indicating that cost decreases at a decreasing rate as herd size increases up to 388 cows at which point costs begin to increase (keep in mind that there were only two operations with more than 350 cows and thus it is likely inappropriate to make strong statements about costs increasing for very large herds). As with the profit equation, the coefficient on *Feed%* is highly significant (negative in this case as expected) indicating that producers who do a good job managing non-feed costs have considerably lower total costs and hence will be more profitable. For every 1% higher this variable is, total costs decreased $8.19 per cow, all else equal. The R-square value for Equation [2] was 0.4520 implying that roughly 45% of the variation in the dependent variable (cost/cow) was explained by variability in the independent variables.

Table 2. Regression Results for Profit and Cost Models (Equations [1] and [2])

	Profit ($/cow)		*Cost* ($/cow)	
Variable	Coefficient	p-value*	Coefficient	p-value*
Intercept	-1524.91	(0.004)	911.40	(0.001)
Cows	1.4621	(0.012)	-1.3867	(0.006)
Cows ^{2}	-0.00212	(0.054)	0.00179	(0.061)
Weight	0.7553	(0.031)	0.3082	(0.234)
Price	5.1233	(0.067)	0.0000	0.000
Feed%	10.6786	(0.000)	-8.1919	(0.001)
Labor	1.9544	(0.033)	-0.7394	(0.342)
Years	-52.408	(0.121)	21.782	(0.456)
R-square**	0.5091		0.4520	

* p-values associated with hypothesis test that coefficient is significantly different from zero. A value of 0.05 would imply we are 95% confident that value is significantly different from zero (0.01 implies 99% confidence, and so on).

** R-square represents the proportion of variability in the dependent variable (*Profit* and *Cost*) that is explained by variation in the independent variables.

Summary

There are some significant conclusions to be drawn from the information discussed above. The economic returns to beef cow-calf producers vary significantly over time due to the cattle cycle and other factors. For example, over the last 30 years there has between $175-$190 difference in returns, depending on how returns are calculated, between good (top 1/3) and the bad (bottom 1/3) years. This is a significant amount of variability, but unfortunately this risk is difficult to manage because it is due to macro economic factors and conditions that are typically beyond the control of individual producers. However, what is much more important is that the variability across producers at a point in time is much larger than the variability over time. In other words, even in the "good years" some producers are losing money and even in the "bad years" some producers are making money. This is important from a management perspective because that means there are things producers can possibly do to improve their operations.

This research suggests that while both production (weight) and price do impact profit, they are much less important in explaining differences between producers than costs. In the data analyzed here, economies of size exist such that larger operations tend to have lower costs and hence are more profitable than smaller operations. However, it is important to point out that being a large operator does not guarantee low costs and high profits as a number of mid-sized to smaller operations were competitive. Operations that specialized more in livestock enterprises, relative to crop enterprises, based on their labor allocation tended to be slightly more profitable. However, this result did not show up in the form of lower costs. Thus, until this issue is examined further, we would conclude that specializing appears to have some benefit, but it is not a major factor. The factor that is extremely important regarding profit and cost differences between producers is how well they manage/control their non-feed costs. Producers that had a high percentage of their total costs as feed (i.e., a low percentage as non-feed) had significantly lower costs and hence significantly higher profits. One of the ways to manage these non-feed costs is operation size as larger operations tended to have lower costs per cow for labor and especially for machinery and depreciation.

As the data reported here clearly show, there is tremendous variability across producers, which means there is room for people to improve their relative situations. However, before one can improve their situation they need to know where they stand relative to other producers. Thus, benchmarking and identifying ones strengths and weaknesses is the first step to deciding where to focus management efforts.

Appendix A. Scatter Plots of Various Variables for 65 Beef Cow-calf Operations

Figure A1. Profit versus Gross Income (correlation = 0.57)

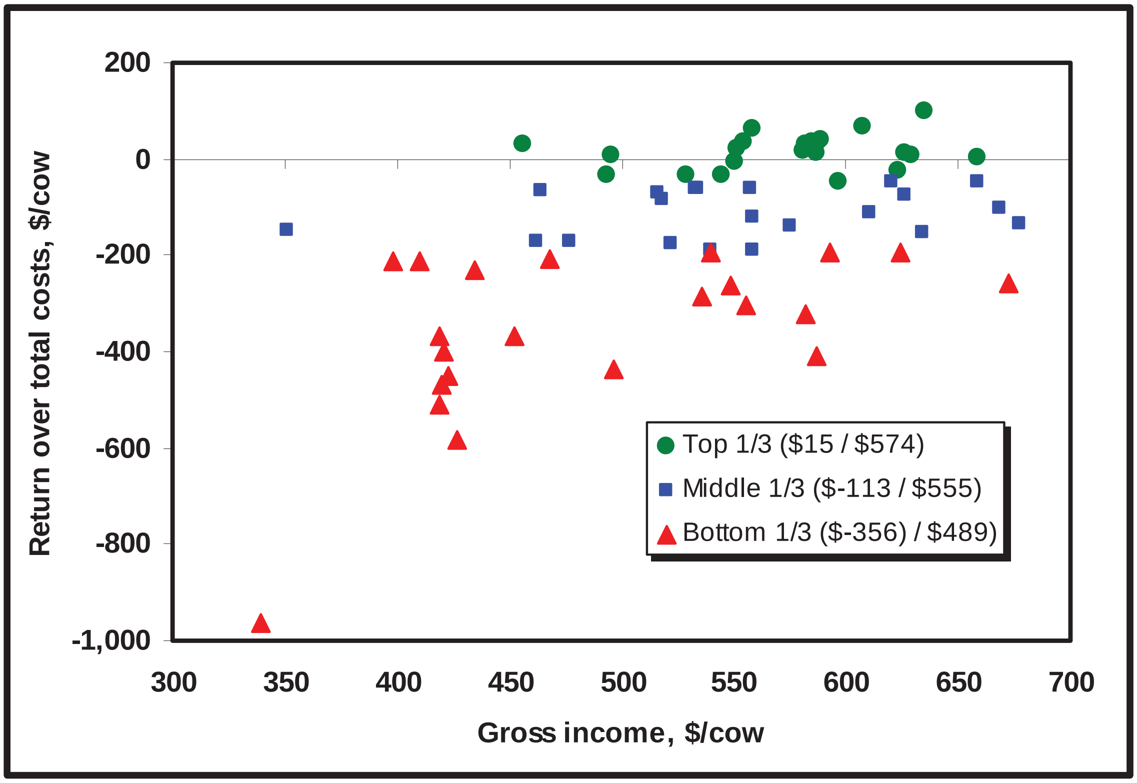

Figure A2. Gross Income versus Selling Price (correlation = 0.06)

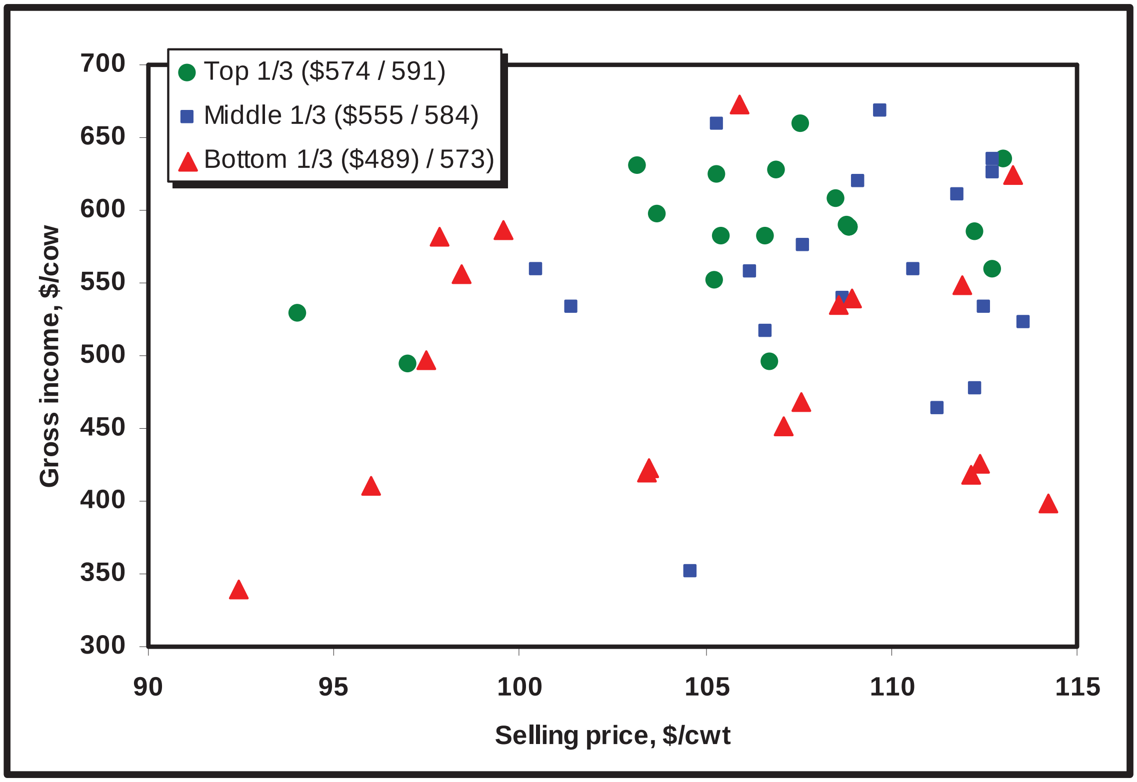

Figure A3. Gross Income versus Calf Selling Weight (correlation = 0.53)

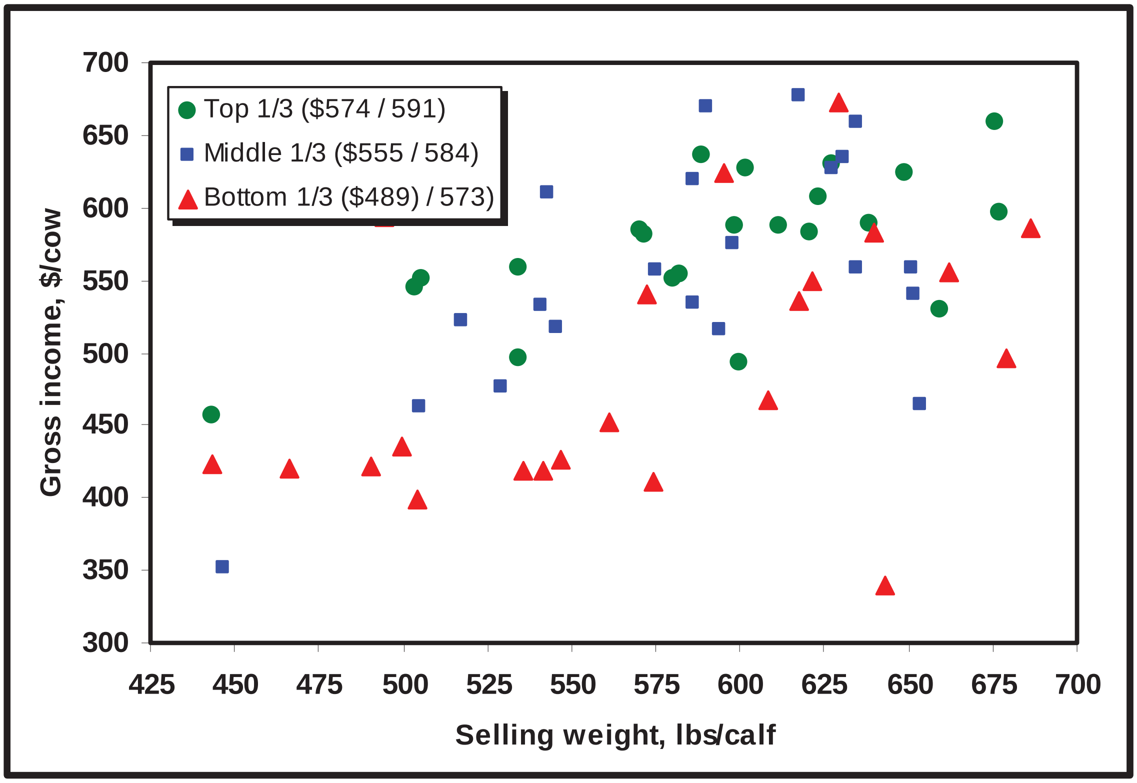

Figure A4. Profit versus Total Cost (correlation = -0. 90)

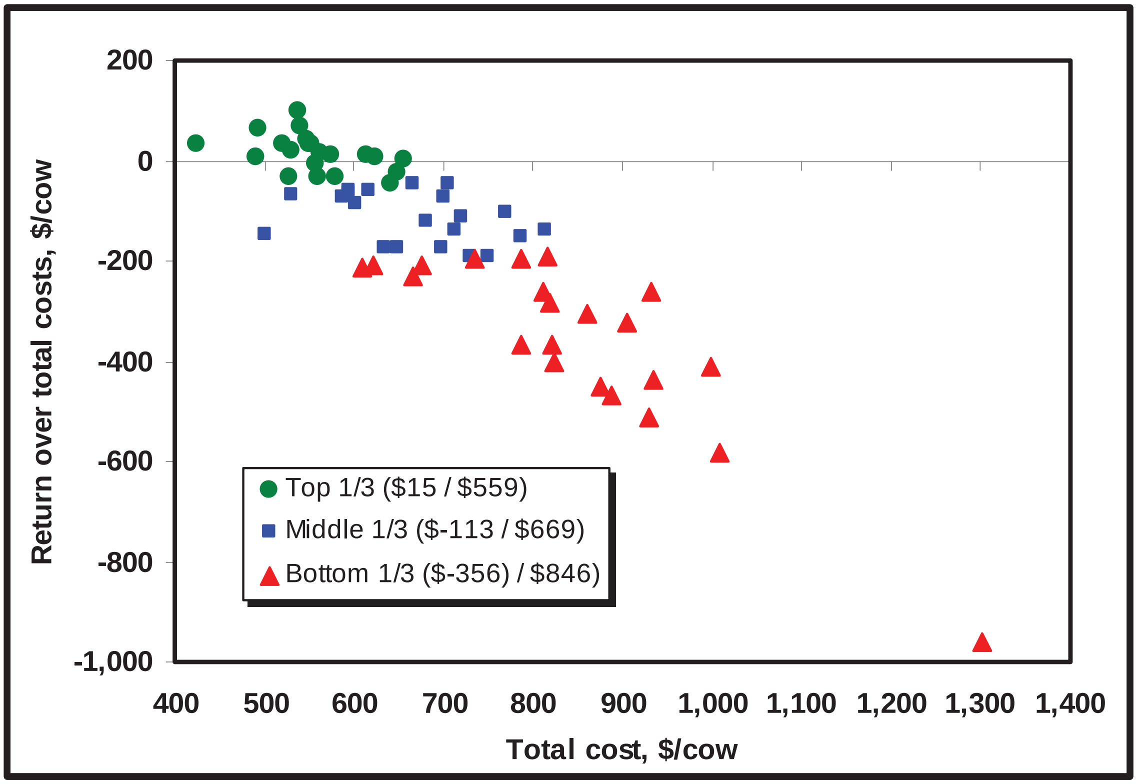

Figure A5. Total Cost versus Feed Costs (correlation = 0.64)

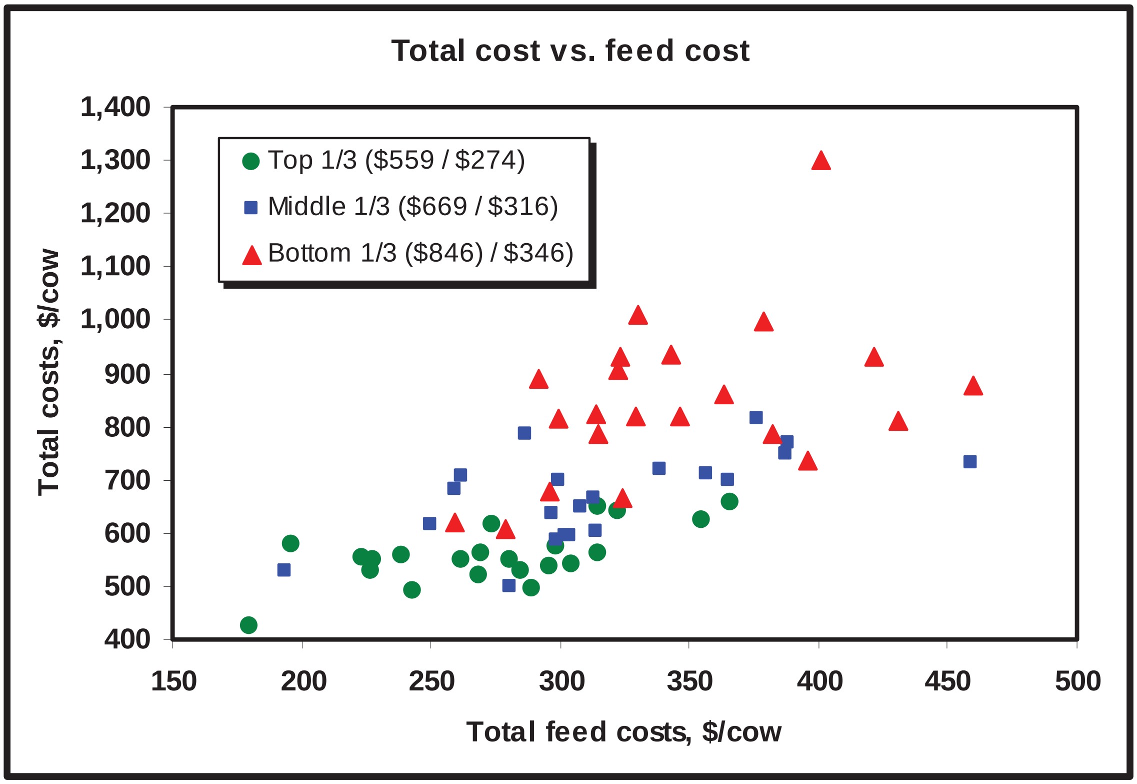

Figure A6. Feed Costs versus Calf Selling Weight (correlation = 0.15)

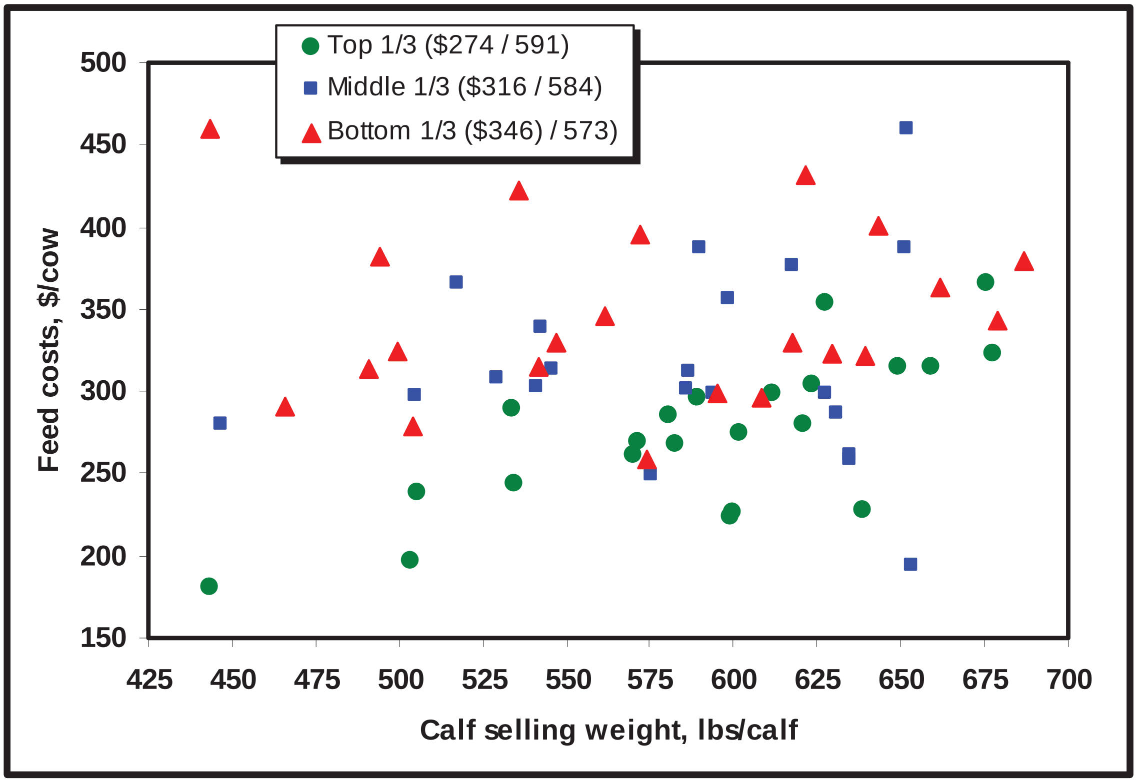

Figure A7. Feed Costs versus Size of Cow Herd (correlation = -0.29)

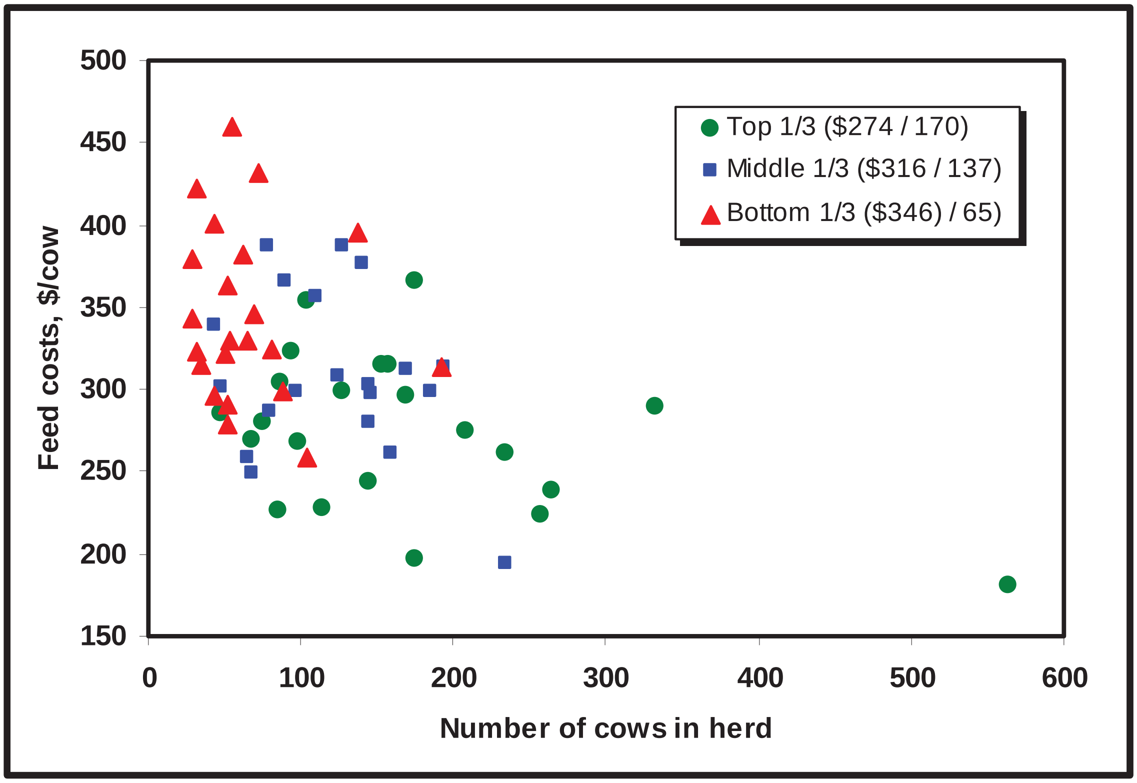

Figure A8. Total Cost versus Labor Cost (correlation = 0.58)

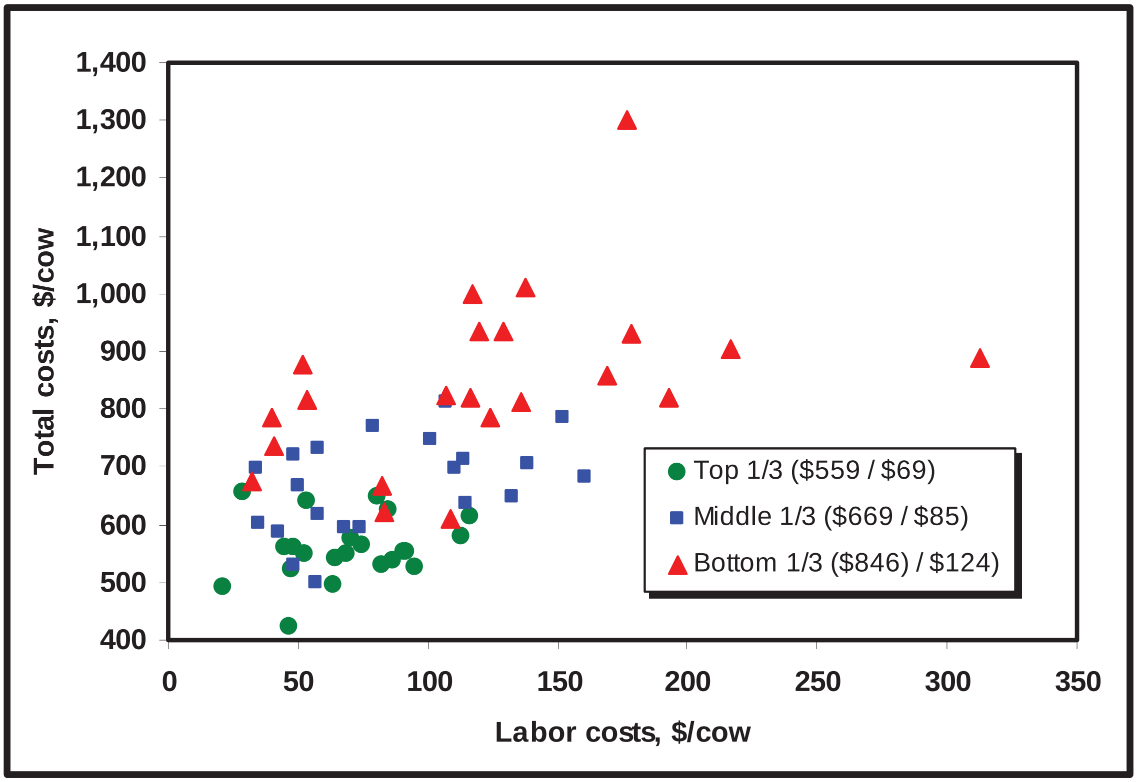

Figure A9. Labor Cost versus Size of Cow Herd (correlation =-0.34)

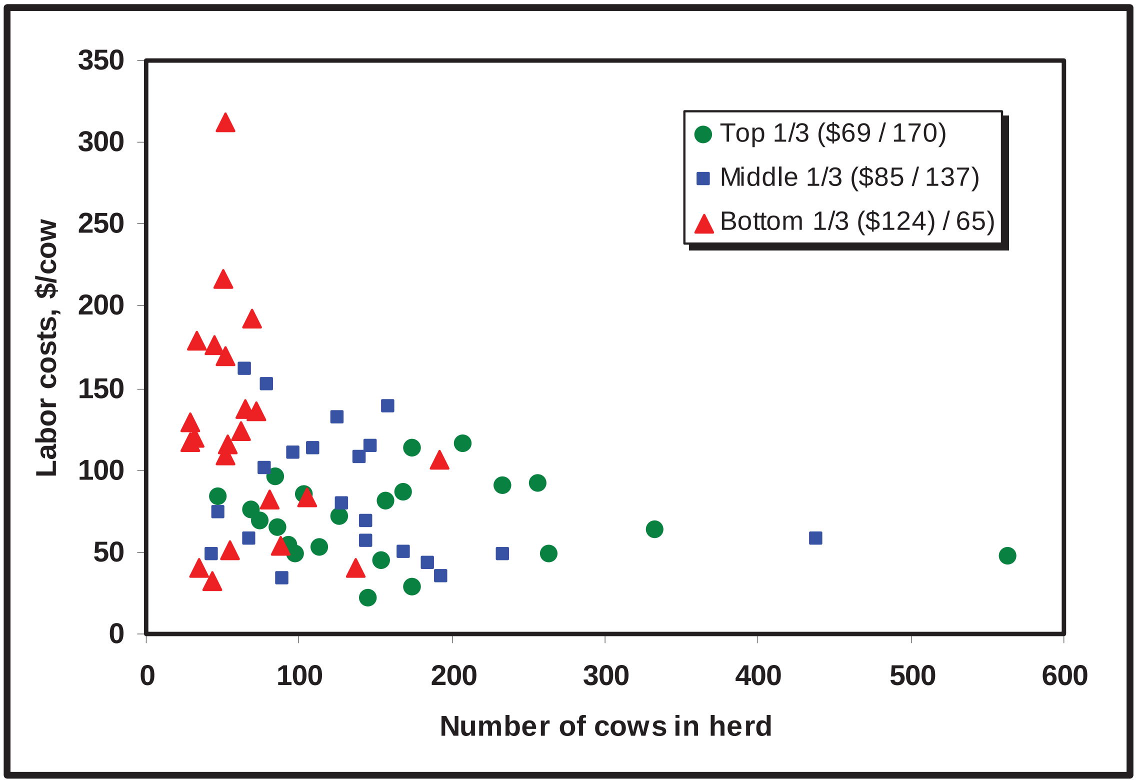

Figure A10. Total Cost versus Depreciation and Machinery Costs (correlation =0.81)

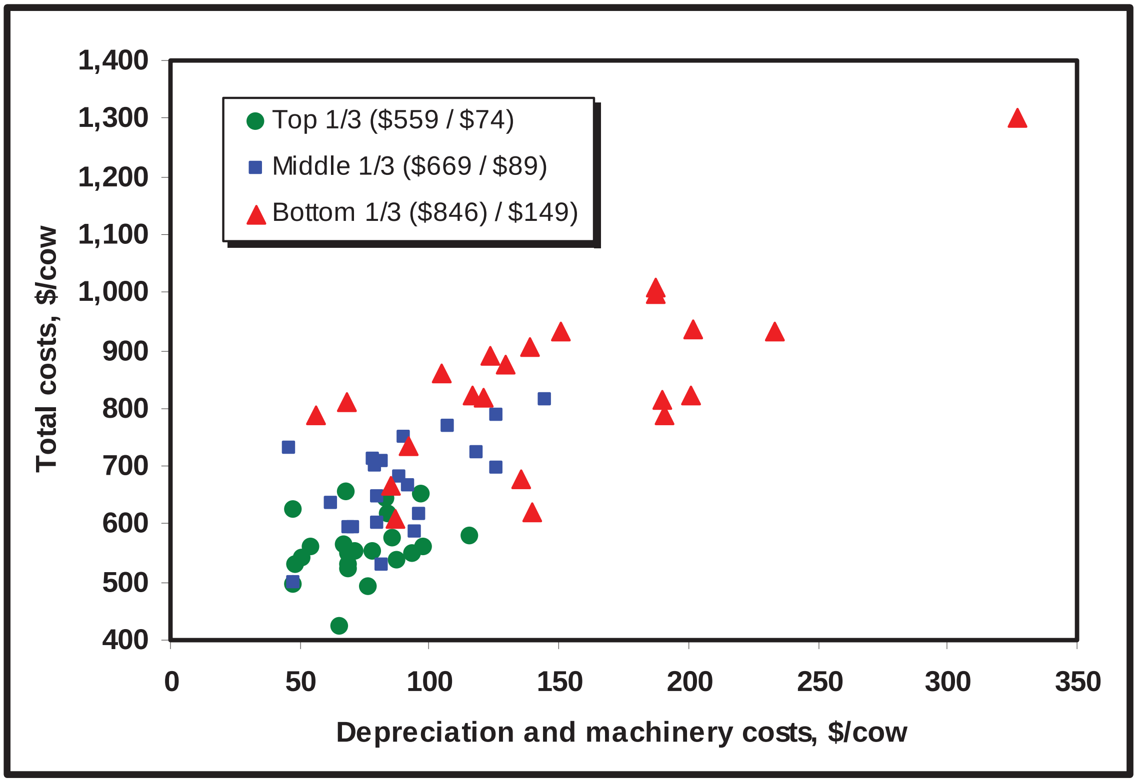

Figure A11. Depreciation and Machinery Costs versus Size of Cow Herd (correlation = -0.37)

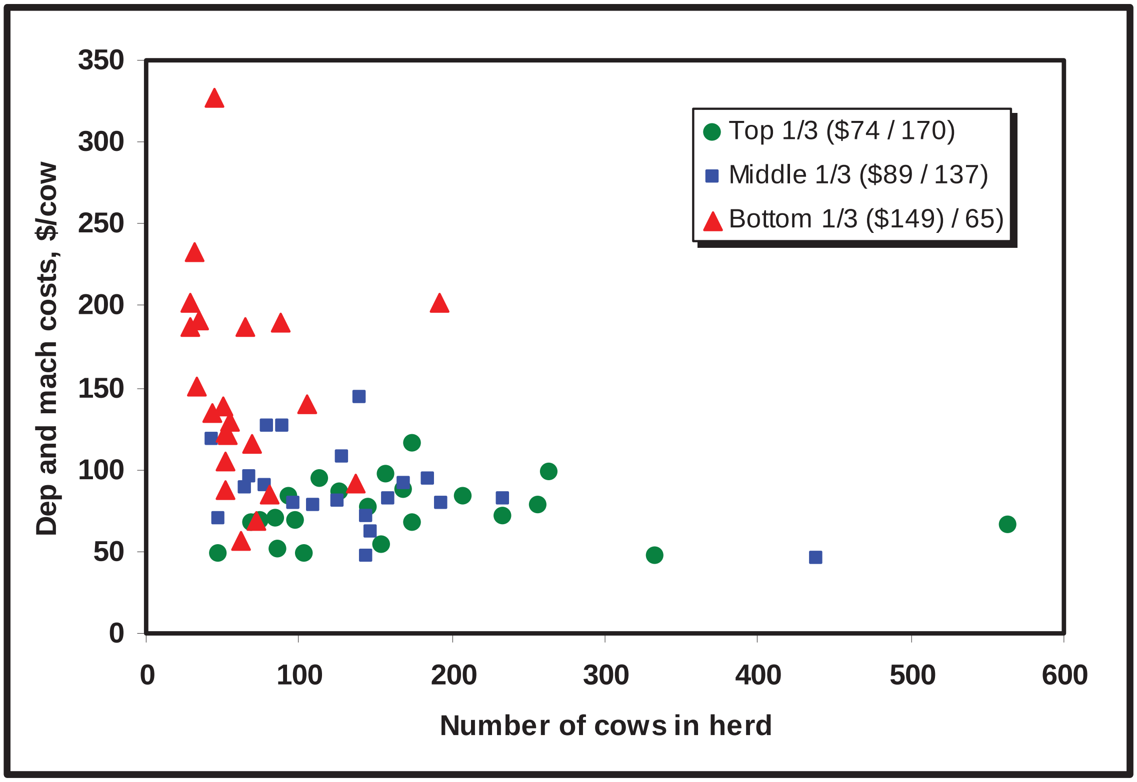

Figure A12. Total Cost versus Size of Cow Herd (correlation = -0.48)

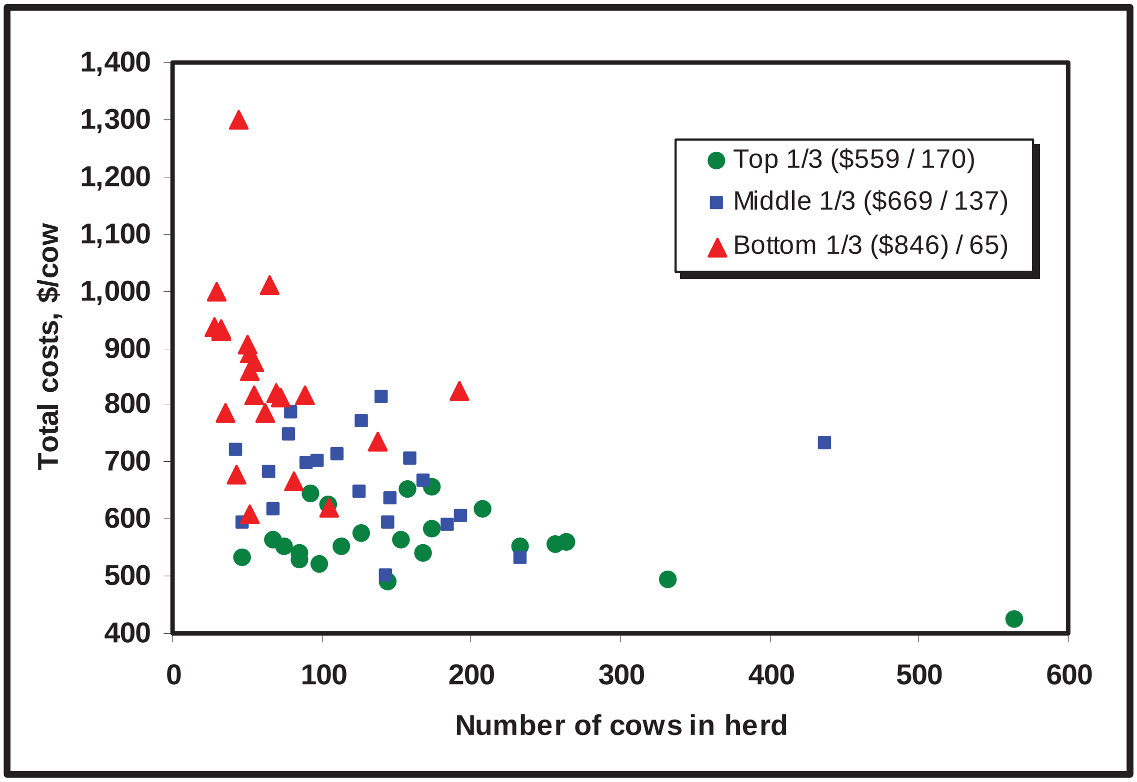

Figure A13. Total Cost versus Labor Allocated to Livestock (correlation = -0.25)