MEASURING COW-CALF PROFITABILITY AND FINANCIAL EFFIECIENCY

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Introduction

Efficiency is defined as the ratio of the useful energy delivered by a dynamic system to the energy supplied to it (Webster's, 2002). Efficiency represents an output/input relationship. It is a ratio often expressed as a percent. There are two standard definitions of profit (Webster's, 2002). The first and most widely used in previous papers and discussions concerning the economic efficiency of beef cattle production is the excess revenue over expenditures, or net income (NI). Net Income in itself is not a complete measure of efficiency (Heady, 1952). The second definition, which is the primary measure of economic efficiency used in business applications, is the ratio of NI for a given fiscal period to the amount of capital invested, commonly known as return on assets (ROA). In order to properly evaluate the economic efficiency of a business activity, a profit measurement that includes both NI and the assets necessary to create NI is required.

There are several critical steps for the accurate measure of efficiency using ROA. The first is that in the calculation of NI, accrual adjustments to income and expenses must be made. Secondly, due to policy changes outside the control of management, NI should be calculated pre-tax. The third is that assets should be recorded at their financial, or cost, basis. It is inappropriate to use market values or opportunity costs (Hawkins et al., 1993, Oltmans et al., 1992, Van Horne, 1995). The careful use of the Standardized Performance Analysis (SPA) guidelines as adopted by the cattle industry in 1992 (NCA) allows for the calculation of NI and ROA in methodology that meets these generally accepted business guidelines.

Calculation of Profit: Net Income

Net Income is calculated with SPA by using the simple equation in Figure 1. Net Income represents dollars available for family living and a return to capital with both revenue and expenses adjusted for changes in inventory.

$NI = [(Total lbs. X $/lb.) +/- $Inventory Adj.] – ($Total Cost +/- $ Inventory Adj.)

Figure 1. Formula for calculating net income.

The biological efficiency and levels of production of beef cattle will have an effect on annual costs and impact NI. However, NI does not account for the differences in the capital investment necessary to support various production systems or

different levels of production within systems. A cow-calf operation can generate $50,000 of NI with an investment of $1,000,000 or $2,000,000. As an investment opportunity, the business that can generate the highest NI with the lowest investment is the most attractive and competitive. Net Income by itself does not provide the sensitivity for that evaluation. Heady (1952) said it this way:

"Net profit can no longer be used as a gauge of whether resources are used efficiently."

NI is also not sensitive to differences in marginality. For example, a $1.00 increase in NI can result from increasing gross revenue $2.00 and total expenses $1.00 or by increasing gross revenue $2000 and total expenses by $1999. The largest increase in NI that results from the smallest change in revenue and cost is the most attractive and competitive.

An example of the limitations of NI would be the contrast between a February versus June calving season for a cow-calf production system. In the past, the discussions about the advantages of each of these systems have centered on production issues, annual costs, and marketing. Depending on the geographical location of the operation, one could also predict dramatically different requirements for buildings, other improvements, and equipment. The presence of additional buildings, improvements, and the equipment necessary to mitigate the affects of cold weather and precipitation represents a different level of capital investment and may also drive an increase in operational costs like depreciation, utilities, and maintenance costs. This would be reflected in an increase in total annual costs, but NI would not capture the increased investment.

When managers rely solely on NI as feedback for profit, unexpected outcomes may occur. If an operation finds itself without enough NI to cover family living, or debt service and repayment, a common response is to either increase in size or to look for off-farm job opportunities. An increase in size of an inefficient operation can serve to only magnify problems rather than solve them. Off-farm employment can lead to a drop in overall production efficiency.

In summary, because it is not sensitive to differences in level of investment or marginality, NI is not a good choice to use as a measure of efficiency for beef cattle operations. The use of NI as the sole measure of profit may also have unexpected outcomes that affect the entire firm.

Calculation of Profit: Return on Assets

The rate of return on total assets provides a measure of management efficiency for the use of the total assets of a firm. Return on Assets is calculated with SPA using the equation in Figure 2.

$$\text{ROA, \%} = \frac{\$NI + \$\text{ Interest} - \text{Family Living}}{\text{Total \$ Invested in Land, Cattle, Buildings, Improvements and Equipment.}} \times 100$$

Figure 2. SPA formula for calculating ROA.

Return on Assets is calculated before taxes and before interest expense since interest represents a return to creditors, not the manager. Return on assets is usually calculated for a fiscal year, but can be calculated for periods. Assets are included at cost, thus depreciation is included. Family living is subtracted from NI. This is a very comprehensive measurement of the firm's ability to generate profit.

While ROA is an inclusive measure of managerial efficiency, it is indifferent to the source of capital and does not reflect levels of equity or debt. It should not be confused with return on equity, which takes into consideration debt.

It is important to recognize that ROA is not an evaluation of past investment decisions in terms of their present value. ROA is an evaluation of past management decisions but is a reflection of those decisions on the present earning capacity of a production system created with those investments.

Since ROA is a reflection of the impact of past decisions on present performance, including opportunity costs is inappropriate because they represent decisions not made. Return on Assets evaluates the impact of actual decisions made by management.

Profit: A Set of Relationships

When considering profit, it may be helpful to use a factory and machine analogy. An example would be a business that produces widgets. The production of widgets requires a factory. The factory represents a productive capacity that requires an investment in land, buildings and facilities, equipment, and machinery. A portion of the investment would represent owner's equity. The portion not covered by owner's equity would be debt. The operation of the factory in the production of widgets requires the expenditure of dollars to pay for annual operating expenses. The company receives income from the sale of widgets. The economic efficiency of the firm is dependent on many factors including the efficiency of the individual machines in the plant. However, in a larger context, the total investment of the plant and the ability to sell widgets into the market place are also very important.

A simplified formula may help in understanding the relationships between the different major components of ROA (Figure 3).

$$\text{ROA, \%} = \frac{\text{(Lbs. X \$) - \$ Total Costs}}{\text{\$ Assets}} \text{ X } 100$$

Figure 3. Simplified formula for ROA

High levels of profit as defined by ROA can come from many combinations of levels of production, the value of that production in the market place, the annual expenses required for production, and the level of investment required to build and maintain the productive capacity of the firm (Figure 4).

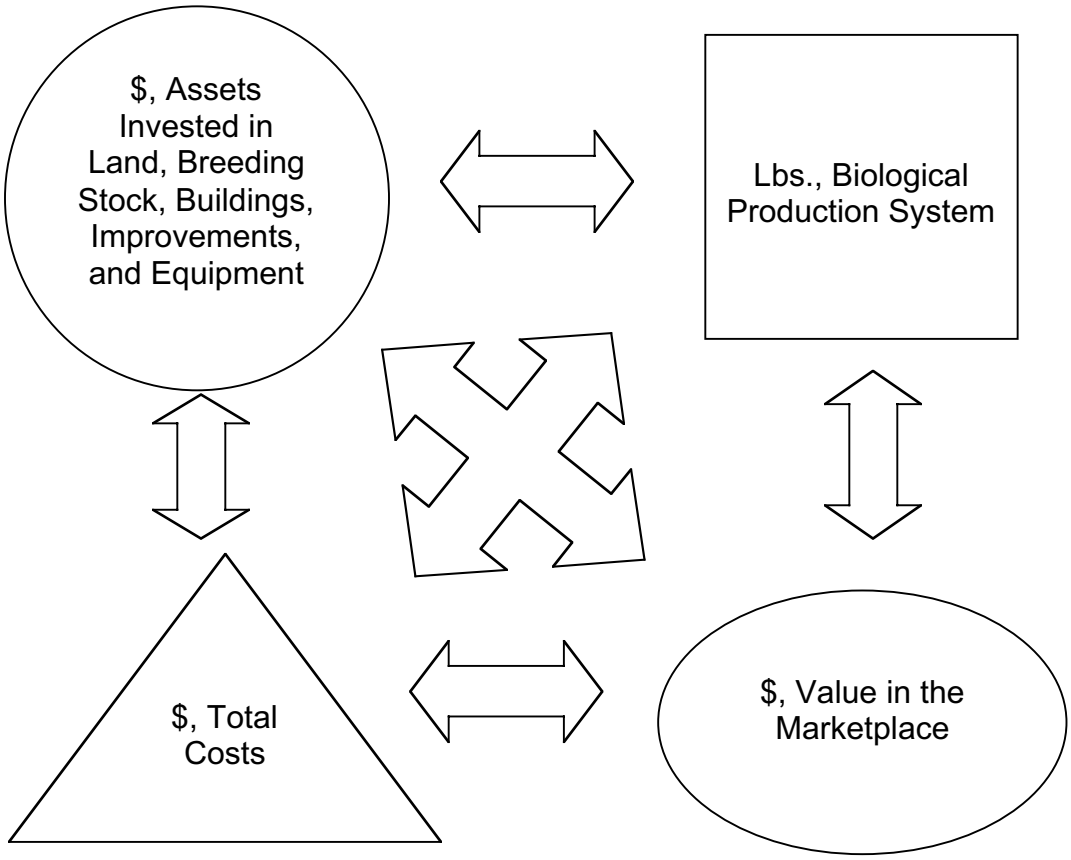

Figure 4. Profit is a set of relationships.

It is possible to have high levels of profit with a variety of scenarios. For example:

- High annual expenses, and either or both high levels of productivity or high levels of income and low levels of investment.
- Low levels of productivity if expenses are low or the value in the marketplace is high with low levels of investment.
- High levels of investment with high levels of production and value in the marketplace with low annual costs.
- Low levels of investment and high levels of productivity and value in the marketplace with low annual expenses.

The examples above make setting generic targets for investment, expenses, production, and income, commonly known as benchmarking, extremely difficult for cow-calf production. Beef cattle in the United States are produced in a wide variety of environments and production systems representing many different goals.

Another benefit of looking at profit as a set of relationships is that it may provide insight into what part of the equation is driving the others. For example, does the production system drive investment and annual costs? Or perhaps the marketing decisions drive the production system, which in turn drives other segments. Perhaps the cash flow drives marketing, as loan payments are due at a specific time and cash is required. This type of insight is critical for successful management.

The results of a field study of 148 beef cow-calf enterprises in the Northern Great Plains (Dunn, 2000) indicate that high levels of profit as measured by ROA are a function of below average levels of investment, average levels of production, low annual costs, and excellent marketing (Table 1). High profit herds had the same output per cow as measured by pounds weaned per cow exposed as Medium Profit herds, but had lower annual costs, higher revenue, lower investment, and higher NI and ROA.

In terms of risk management, low levels of annual expenses would seem to be a natural place for managers to focus their energy and effort. However, there should also be a high level of sensitivity to the general relationship of inputs and outputs as shown in Figure 5. A reduction in total costs is desirable if production is not impacted beyond a certain threshold. By the same token, the point of diminishing returns is an extremely important point to identify in all production systems. Beyond the point of diminishing returns, additional inputs do not result in corresponding levels of output. These thresholds may not be readily visible in a complex system like beef cattle production.

Table 1. SPA measurements for Low, Medium, and High Profit herds (Dunn, 2000)

	Low Profit	Medium Profit	High Profit
Lbs. weaned/cow exposed	413	455	455
$ Total income/beginning year breeding female	390.75[g]	423.08[g]	495.35[h]
$ Total cost/beginning year breeding female	637.68[d]	386.87[e]	270.23[f]
$ Net income/beginning year breeding female	-247.02[a]	36.29[b]	225.13[c]
$ Total investment/beginning year breeding female	1538[g]	2308[h]	1397[g]
ROA, %	-15.5[a]	2.88[b]	18.16[c]

[abc] Means within the same row with different superscripts differ (P < 0.01).
[def] Means within the same row with different superscripts differ (P < 0.05).
[gh] Means within the same row with different superscripts differ (P < 0.10).

Dunn (2000) looked at fifteen output/input relationships for a variety of production measures including pregnancy percent, weaning weight, weaned weight per exposed female, and weaning percent, and used total expenses per acre, per beginning year breeding female, and per cwt. of weaned weight as measures of input and found no statistical relationships. If the relationships can be identified, the slope of the production function curve in Figure 5 may also vary with different criteria. For example, the slope of the curve representing a production function could be fairly steep for traits relating to reproduction, but relatively flat for a trait like weaning weight. Isolating these relationships for various traits, and within different geographical regions, would be extremely valuable to all segments of the industry. Certainly more investigation is necessary.

Valuation of Assets: Financial Versus Economic

One of the most confusing and controversial topics in the analysis of the profitability of a beef cattle enterprise is in the determination of the value of assets on the balance sheet and in the income statement. SPA provides two methodologies for analysis, and they value assets differently. They are used for

different purposes. The first is a financial analysis, which values assets at their cost or depreciated value (book value). The second is an economic analysis, which values assets at their market value. The only appropriate use of a financial analysis is to evaluate managerial efficiency (Hawkins et al., 1993, Oltmans et al., 1992, Van Horne, 1995). The only appropriate use of an economic analysis is to evaluate an entry or exit strategy for a business (Hawkins et al., 1993, Oltmans et al., 1992, Van Horne, 1995). When using an economic analysis, deferred taxes must be included. It is inappropriate and confusing to mix the methodologies.

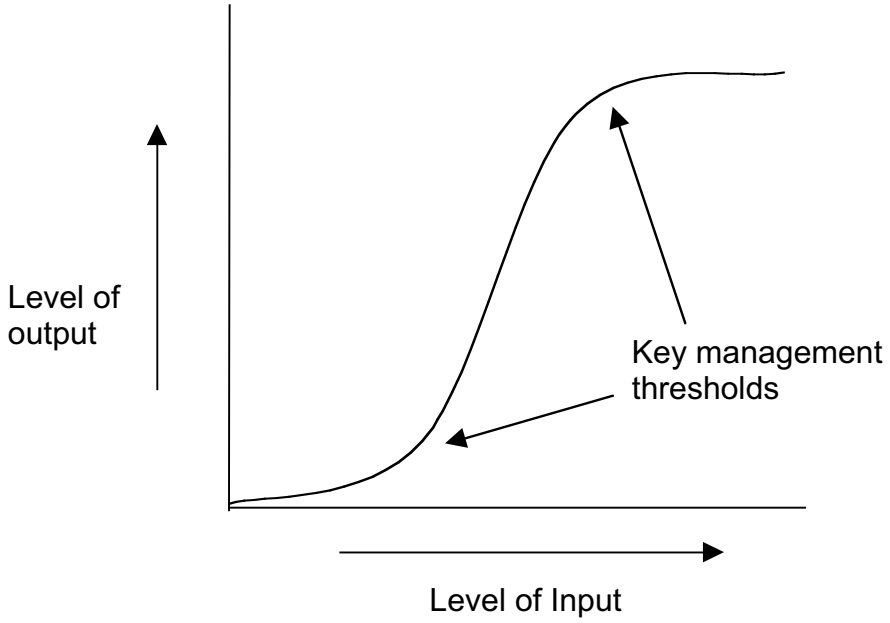

Figure 5. Classic input/output relationships as described by a production function (Heady, 1952).

A financial analysis can be viewed with a timeline highlighting the cumulative activity that is impacting the fiscal year under examination (Figure 6). The effect of the managerial activity from many decisions over what may be a long period of time is being measured during a specific fiscal year. The examination actually takes place after the year is complete. In the example in Figure 6, the year under examination is 2001. The examination is taking place in 2002. The activity and decisions that led up to the performance in 2001 actually took place over a long period of time. Some of the events may have been passive, such as the inheritance of property. Others were the direct result of management decisions,

like buying land, turning out the bulls for the breeding season, or purchasing a baler.

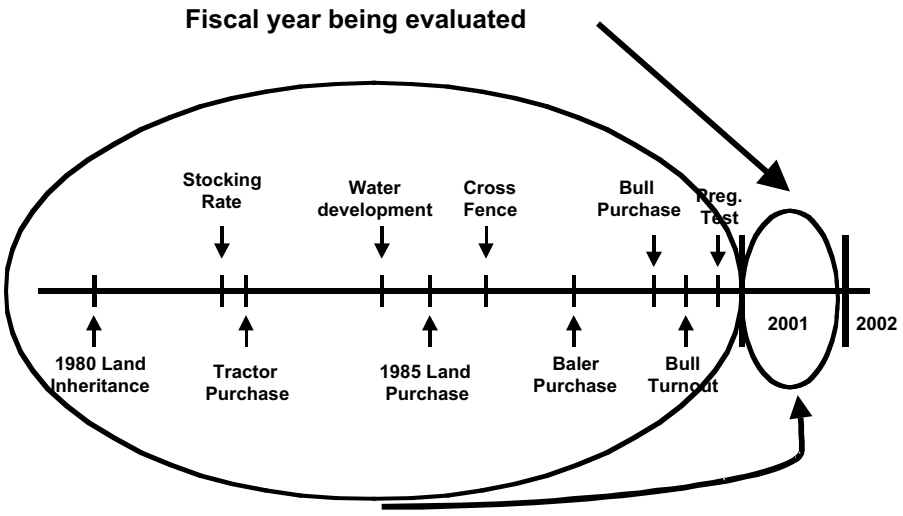

Figure 6. Timeline of a financial analysis. Assets valued at cost or depreciated value. Cumulative affect of management.

In contrast to a financial analysis, an economic analysis records the value of all assets at their market value on the dates chosen for the analysis (Figure 7.). While the manager has chosen the mix of assets and made the marketing decisions, the affect of which is being analyzed, the actual value of the asset mix is extremely sensitive to influences outside the manager's control. For example: inflation, deflation, the weather, governmental policies, and world events.

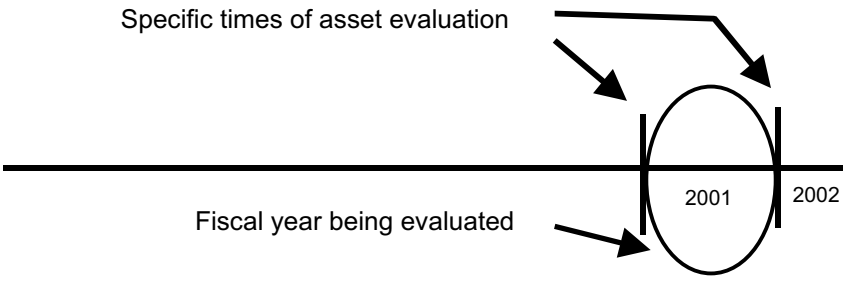

Figure 7. Economic analysis. Assets valued at market value at time of evaluation.

An example of the confusion created by using market values and mixing methodologies in the analysis of managerial efficiency is provided in Table 2. Based on a financial analysis, the example operation is profitable, showing a positive NI of $33 per beginning year breeding female. In the economic analysis, the market value of hay has increased in value to $300 per beginning year breeding female due to a regional change in supply or demand. For this example, the value of all other assets remains the same and depreciation drops to $0.00. With the addition of the deferred taxes of $100, the operation is then losing $241 per beginning year breeding female.

When methodologies are mixed, depreciation is added in along with the increased value of hay, but not deferred taxes, and the loss is $192 per beginning year breeding female. Is the business profitable? If calculated correctly, yes it is. But that determination must be made using the correct methodology.

Another problem using market values when evaluating profitability is that using opportunity costs suggests that the manager is willing to “take” the opportunity. In the previous example, if the cost of the hay necessary to maintain a cow for a year was $75 and the market value of that hay was $300, and the manager decided to sell the hay to capture the increased market value of the hay, the corresponding decision that then must be made is to sell the cows and exit the business. In this example, the original analysis was to evaluate profitability. It did not begin as a decision to stay in or exit the business.

Charging an opportunity cost for pasture is another common practice that misleads people. If $120 is added in for an opportunity cost of pasture, the loss in Table 2 for the mixed methodology balloons to $312 per beginning year breeding female. But renting the pasture was not part of the manager’s decision and has no place in this analysis. Although anecdotal, there are many real life examples of the above scenarios where misusing the tools of analysis has led to inappropriate decisions.

Table 2. An example of confusion created using mixed methodologies for the determination of net income. Costs are on a dollar per beginning year breeding female basis. For economic and mixed analysis, raised feed changed to market value. All assets remain the same value over the fiscal year.

	Financial Analysis	Economic Analysis	Mixed	Opportunity costs
Total Revenue	430	430	430	430
Vet Med.	19	19	19	19
Depreciation	51	0	51	51
Labor	33	33	33	33
Purchased Feed	62	62	62	62
Raised Feed	75	300	300	300
Pasture Rent	0	0	0	120
Inventory Adj.	18	18	18	18
Other Costs	100	100	100	100
Deferred Taxes	0	100	0	0
Interest	39	39	39	39
Total Cost	397	671	622	742
Net Income	33	- 241	- 192	- 312

Per What? The Importance of Using the Right Denominator.

Using efficiency measurements in beef cattle management can be a very important management tool (Jacobs, 1984). Income, costs, and investment can be expressed per cwt. of weaned calf just as market figures are presently. They can also be expressed on a per cow basis as shown in Tables 1 and 2. What is the most appropriate and sensitive denominator to express differences in managerial efficiency? Perhaps a unit of land would be better. Perhaps per cwt. of weaned calf as suggested by Harlan Hughes (2000) is the best measure. Dunn (2000) evaluated SPA records on a per beginning year breeding female, per acre, and per cwt. of weaned calf basis. The most statistically sensitive measure to differences in managerial efficiency was on a per cwt. of weaned calf basis.

Expressing efficiency ratios on a per cow or per acre basis can be misleading. For example, if the breakeven cow costs on a ranch were $400 per beginning year female and the cows weaned 400-pound calves, then the breakeven per cwt. is $1.00. If the same cows weaned 600-pound calves, then the breakeven per cwt. is $0.67. If the ranch being analyzed used an expression on a per acre

basis, the same type and magnitude of problem may arise. Expression of a breakeven on a per cwt. basis allows for a clear interface with the marketplace. However, some measurements using different denominators are very useful. Total investment per cow is widely used when pricing or buying a ranch property. Stocking rate is on a per acre basis. Total pounds weaned per acre does provide useful information concerning productivity. However, this is a case where if it is low, does it reflect a problem with the cow-herd or an ecological limitation? Reproductive performance of the cowherd is easily communicated on a per cow exposed basis as outlined by SPA (NCA, 1992).

Summary

The careful use of the Standardized Performance Analysis (SPA) guidelines as adopted by the cattle industry in 1992 (NCA) allows for the calculation of measurements critical to the successful management of a beef cattle enterprise. Knowledge of the definitions and an understanding of how the measurements are calculated are both critical for the correct use and application by management.

Net income by definition is not a measurement of managerial efficiency. Return on assets is a comprehensive measure of profit and managerial efficiency. It is calculated with accrual adjustments, on a financial basis, and using pretax net income. The use of market values or opportunity costs is inappropriate in the development of a financial analysis. Profit as defined by return on assets is a relationship between the production, marketing, annual expenses, and investment of a beef cattle business. Profit can arise from many combinations of these four basic units. Due to the extreme variation in the geographical and ecological regions where beef cattle are raised, and the different goals and objectives under which cattle are raised, care should be taken when developing benchmarks for biological or financial performance. However, there is strong indication that in consideration of risk and opportunity, a management strategy of low levels of investment, average levels of production, low levels of total annual costs, and above average marketing will help cattlemen achieve profitability and financial efficiency. The concept of diminishing returns needs to be carefully considered when making decisions concerning investment and annual expenditures.

The expression of efficiency measures should be in units that are most sensitive for the expressed purpose. The use of measurements on a per cwt. basis can be a powerful tool for management intervention for the improvement of many important facets of beef cattle production.

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