Economic Tools to Evaluate Herd Liquidation Decisions for Breeding Cattle

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The extremely dry conditions that we are experiencing in most of Texas are forcing producers to make very tough choices with respect to how they should handle their current investments in breeding cattle. The last time we were faced with this problem was in the spring and summer of 1996. However, market conditions and expectations of future prices were much different in 1996 than today. In the spring of 1996 we were faced with the lowest cattle prices since the mid-1970's, along with grain and forage prices that were historically very high, and set to move higher. What is the same now, as in 1996, are the economic and financial analysis tools and how they should be used to make a sound disinvestment or investment decision for breeding cattle. Decisions such as keeping or selling an asset like a cow, keeping a heifer for replacement or selling the potential replacement hinge on the *expected* value of that type of animal in your herd when compared with what the market is currently offering you for that type of animal.

How do you decide what a cow is worth in your herd? The answer is not always as simple as what you have to pay for a like age and quality cow over the scale at your local auction barn. In fact, a cow is just like a machine in a factory, and as such she has both a productive value and a salvage value. She is really worth the sum of all the cash she can earn over her lifetime less all the expenses she creates, which includes her salvage value as a cull cow. As you would expect, the net cash flows the cow can generate over her life time depends on the future prices of calves, the ranch's cost structure and the eventual salvage value of the cow. Not only do the size of the cash flows impact the value of the cow, the timing of when the cow generates income and expenses is important in determining the cow's value because money has earning power of its own. Drought causes sharp increases in short run costs, which greatly influence the pattern of these expected net cash flows related to breeding cattle.

The primary economic analysis tool to determine the value of the animal in your herd is the capital budget. The capital budget takes the net cash flow calculated in the enterprise budget, which includes revenue and cost information expected to be generated over the time the animal is in the herd, and calculates the economic feasibility of the investment. The are several types of capital budgeting tools, and the one we are using in this example to calculate the maximum feasible economic bid price for a cow is called the net present value.

Investment Analysis Methods - There are several methods of capital budgeting that are commonly used. The investment analysis methods that are discussed in this publication and incorporated in the associated decision aid include: (1) payback period, (2) net present value and (3) internal rate of return. An extension of the net present value method called the maximum feasible bid price will also be discussed. These methods are designed to help the decision maker organize relevant data into information that is used to make liquidation decisions with respect to breeding livestock.

Payback period is a simple investment analysis technique. Payback period analysis estimates the number of planning periods (usually months or years) that are required for an investment to pay for itself. To utilize the payback period method in our breeding stock decision problem, we need to gather data that include the initial cost of the breeding animal, and the projected cash flows net of all costs the animal generates by period. The payback period is calculated by finding the period in which the accumulated net cash flows equal the initial investment in the breeding animal. An investment alternative (breeding animal) with the shortest payback period is preferred.

Net present value is a slightly more complicated investment analysis technique, but is a superior investment analysis tool when compared with payback period. The net present value gives a truer picture of the profitability of a potential investment by explicitly taking into consideration the size and timing of all cash flows associated with the proposed investment, and the opportunity cost of capital. The data needed to carry out the net present value analysis is the initial investment, the net cash flows generated by the breeding animal, the salvage value of the animal, the discount rate (opportunity cost) for future cash flows and the length of the planning horizon. The net present value is calculated by subtracting the initial investment from the sum of the discounted

cash flows. The investment with the largest net present value is preferred, and if that investment has a positive net present value, it is accepted or undertaken. In the case of drought management, this tool can aid in deciding the order of liquidation within the herd (i.e., should young or medium aged cows be sold first?).

Internal rate of return analysis is closely related to the net present value analysis. The internal rate of return analysis requires the same data to be gathered as the net present value analysis, with the exception of the discount rate. The internal rate of return analysis calculates the discount rate that equates the initial investment with the sum of the discounted cash flows. The investment alternative with the highest internal rate of return is preferred, and if that investment has a higher internal rate of return than the decision maker's required rate of return, it is accepted.

Maximum feasible bid price analysis is also closely related to the net present value analysis. The maximum feasible bid price requires the same data to be gathered as the net present value analysis, with the exception of the initial investment value. The maximum feasible bid price analysis calculates the initial investment value that equates the net present value to zero given the decision makers required discount rate or opportunity cost of capital. The maximum feasible bid price provides a benchmark to compare with current market prices. If current market prices are below the calculated maximum feasible bid price, then retention of breeding livestock would be in order. If current market prices are above the calculated maximum feasible bid price, purchases of replacement animals would be deferred or the livestock should be sold.

Interpretation of Results - Correct interpretation of investment analysis results relating to breeding stock investment is critically related to proper management of the culling and replacement process. An example of output from a computerized decision support aid can be seen in Table I, and will be used to illustrate some of the important factors that enter the valuation of breeding stock .

The output shown in Table I is built to address the question of calculating what can be afforded to be paid to maintain a cow through the current drought. Data related to the physical productivity of the cow is represented by steer and heifer weaning weights for calves that are expected to be produced by that cow. The cow's salvage value and projected calf market prices are also needed. The desired discount rate is also required input data.

The analysis shown in Table I is an example evaluation for a cow that currently has a calf and is expected to produce five more calves over her useful life. It is also assumed that this cow has been raised, which makes the total value of the cow taxable at capital gains rates. The data used for this analysis include the price and cost information shown in Table I. Long term price projections for steers and heifers were developed by Dr. Ernie Davis, Extension Economist-Livestock Marketing for the Texas Agricultural Extension Service. Cow maintenance costs are based on survey data generated by the Farm and Ranch Extension Management Group, and inflated over the six year planning horizon by 3% annually. The base value for maintenance costs in this example was $270 per cow per year. This cost structure is representative of the average of the lowest cost producers (classified by the size of operation) in the survey for the state of Texas.

The cow price in Table I ($556 per pair) represents the after tax and commission value for the top priced young to middle aged pairs at auctions in South Texas during the week of July 6th, 1998. This value was based on a pair sold for $650, less a 5% commission on total value and taxed at a rate of 10%. This value will be used as the "benchmark" for the liquidation decision for the class of cow described above. This analysis illustrates a modification of the previously described maximum feasible bid price approach to investment analysis. To calculate the maximum dollar amount we can pay to maintain this cow through the current drought, we fix the market price of the pair (Using the after tax and commission value of $556 per pair) and adjust the cow maintenance cost in year one up or down until we arrive at a net present value (Shown at the bottom right of Table I) which is very near zero.

The information contained in the Table I indicates that for the cow described above, we can spend no more than a total of $450 to maintain the animal in the current year. This would be $180 greater than what would expected to be spent in a "normal" situation. In year one this expenditure is expected to result in a -$75.00 net

return above operating costs, and result in an additional $11.25 in income tax savings as a result of the net negative cash flow. This leads to an after tax projected cash flow of -$63.75 for the current year, if we spend $450 maintaining this cow. The after tax cash flows for the subsequent years two through six are shown at the bottom of Table I, with year six including the expected salvage value of the cow. As shown in Table I, the after tax cash flows for years one through year six total $826.18 before discounting. However, the discounting of these cash flows at a pre-tax discount rate of 10% leads to a net present value of $0.34 when compared with the "benchmark" pre-tax and commission price of $650 per pair. This result indicates that we would be better off by selling the pair for $650 (before commission and taxes) if we have to spend more than a total of $450 (an additional $180) for maintenance in response to the drought.

Decision rules - Using the net present value of the cash flow that a breeding animal generates as the measure of its worth can form the basis of culling and replacement decision rules. In general, the net present value of the stock in the herd, and replacement alternatives should be ordered by magnitude of their net present values. Replacement and culling decisions can then be made by selecting the animals (which is really a portfolio of alternative investments) that have the highest net present value.

Risk analysis - Risk (uncertainty) can be introduced into the replacement stock analysis decision in several ways, with discount rate adjustment and sensitivity analysis being two popular approaches. Discount rate adjustment involves increasing the discount rate used in the net present value calculations. This increased discount rate reflects not only the opportunity cost of money that is not received until the future but also the return for the assumption of risk by the decision maker. Higher expected profits will be required to accept an investment alternative with a higher discount rate, thus forcing the investment to compensate the decision maker for the increased risk. Sensitivity analysis is carried out by calculating net present values for not only the expected outcome of the investment, but also optimistic and pessimistic outcomes. For example, the scenario illustrated in Table I could be re-calculated using alternative calf crop or price assumptions in order to determine "best case" or "worst case" outcomes. The alternative investments can then be ranked under each scenario and subjectively weighted by the decision maker.

As you can see, the expected value of different types of cows in your herd depends on a lot of factors that are uncertain. Because of this uncertainty, many people totally ignore planning or use of economic analysis tools and consider the time spent on planning efforts to be wasted. Granted, it is highly unlikely that the future will unfold exactly as planned. However, that cattle market conditions have never been stable over any extended period of time, so expecting that current conditions will prevail for the future is unreasonable. It should also be pointed out that the result of the planning process does not have to be an exact prediction to have value.

There are no hard and fast rules of thumb that will consistently provide the best culling or replacement strategy. Given the age composition of different herds along with the different physical resources for a particular ranch, the "cull half" and "cull to pay feed" may not be nearly aggressive enough for a younger herd or may be far too aggressive for an older herd. However, the use of these tools that we have discussed can provide benchmarks to calculate what might be best to do with the hand that you as a cattle producer have been dealt. This analysis should be carried out for your particular situation, because the "right" answer depends on the cost structure (including taxes) for your ranch and what you expect future cattle prices to be. These decision support tools are available through your local County Extension office.

Table I. Maximum expected maintenance cost calculation.

Steer Weight (Pounds)	500	**Cull Cow Sale Weight (Pounds)**	900 Lb.
Heifer Weight (Pounds)	480	**Marginal Income Tax Rate**	15.00 %
Cow Price ($/Head)	$556	**Capital Gains Tax Rate**	10.00 %
Expected Number of		**Self Employment Tax Rate**	**15.30 %**
Calving Opportunities	**6**	**Discount Rate**	**10.00 %**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Calf Crop or Weaning %	**100**	**100**	**100**	**100**	**100**	**100**
Steers Price ($/Cwt)	**$80**	**$93**	**$102**	**$105**	**$95**	**$85**
Heifer Price ($/Cwt)	**$73**	**$85**	**$94**	**$97**	**$87**	**$77**
Cull Cow Price ($/Cwt)	**$34.00**	**$46.66**	**$50.80**	**$52.18**	**$47.58**	**$45.00**
Gross Receipts (Calf Sales)	**$375**	**$437**	**$481**	**$495**	**$446**	**$397**
Cow Operating Cost/Year	**$450**	**$278**	**$286**	**$295**	**$304**	**$313**
Net Above Operating Cost	**($75)**	**$159**	**$195**	**$200**	**$142**	**$84**
Taxable Income	**($75.00)**	**$159.00**	**$195.00**	**$200.00**	**$142.00**	**$84.00**
Income Taxes	**($11.25)**	**$23.85**	**$29.25**	**$30.00**	**$21.30**	**$12.60**
Self Employment Taxes	**$0.00**	**$24.33**	**$29.84**	**$30.60**	**$21.73**	**$12.85**
Net Cash Flow	**($63.75)**	**$110.82**	**$135.91**	**$139.40**	**$98.97**	**$58.55**
Tax Basis in Cow	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Cow Salvage Value	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$384.75**
Salvage Value (After Tax)	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$346.28**
Tax Adjusted Discount Rate	**8.50**					

After Tax Cash Flows

Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Net Present Value
($556)	**($63.75)**	**$110.82**	**$135.91**	**$139.40**	**$98.97**	**$404.83**	**$0.34**

Comments regarding this investment scenario.

The positive net present value indicates this is an economically feasible investment.
This investment has an internal rate of return of 8.5%.
This investment has a payback period of six years.
This investment may not be financially feasible due to negative cash flow in year one.