DEPARTMENT OF AGRICULTURAL ECONOMICS

Analyzing Replacement Stock Alternatives

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The economic decision rules that are used to determine whether to keep or replace a cow or any other breeding animal are pretty straightforward. The basis of replacement management strategies is to compare the values of breeding stock you currently own with the value of potential replacements, and then choose the investment with the highest expected worth. While the decision rules are simple comparisons of values, the calculation of those values is more complicated and is of critical importance to livestock producers. When you make decisions on breeding stock replacement, you are actually making investment decisions that will affect you for some time.

How do you decide what a cow is worth? 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, which includes her salvage value as a cull cow, less all the expenses she generates. As you would expect, these net cash flows the cow produces over her life depend not only on her ability to produce a calf, but also 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, but because money has earning power of its own, the timing of when the cow generates income and expenses is important in determining its value.

Capital budgeting, or *investment analysis* is used to evaluate the effects of investment decisions on the ranch's profitability, risk, and liquidity position. Since breeding stock are capital items that do not last forever, the breeding stock replacement decision is a good application for investment analysis. Investment analysis is a process in which investment alternatives are identified and compared using an appropriate investment analysis method. After selecting the desired investment analysis method, relevant data is collected, analyzed and interpreted (Barry, et al.). The remainder of this fact sheet develops the application of capital budgeting to the replacement decision for breeding stock.

Investment Alternatives - Because the portfolio of alternative investments varies from producer to producer, the ability to consolidate large quantities of information and to make well founded investment decisions is important. For many cow-calf producers, the replacement decision involves several alternatives. For example, the producer could sell the cow that is currently in the herd and replace that cow with a purchased replacement or possibly a raised replacement. There may be alternative ages of replacements available for purchase, resulting in alternative remaining useful lives to consider. The producer could also sell the cow and not reinvest in another breeding animal, choosing to place the proceeds in an alternative investment or enterprise. It is very likely that after carrying out the investment analysis, the producer could decide to keep the current cow in the herd and reevaluate at a later date. An alternative investment opportunity could be the purchase of any cost reducing or income increasing asset.

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 data into information that is used to accept or reject alternative investment opportunities.

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.

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 purchase of replacement animals would be in order. If current market prices are above the calculated maximum feasible bid price, purchases of replacement animals would be deferred.

Interpretation of Results - Correct interpretation of investment analysis results relating to replacement stock investment is critically related to proper management of the 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 around the investment opportunity of paying $750 for a breeding cow and calf, that has the potential to calve six more times (Note that in this example the cow fails to wean a calf in year 4). All numbers shown in Table I that are surrounded by a box are required input data. Data related to the physical productivity of the cow through weaning weights of calves is required. The cow's salvage value and projected calf market prices are also needed. The desired discount rate, which should be the decision maker's required return on equity capital, is also required input data.

The investment analysis output shown in Table I employs a return to equity approach. This approach generates cash flows that include financing considerations, to account for the impact of interest and debt repayment on cash flows. Tax considerations related to the potential investment are also taken into account. Since financing and tax consequences are considered, the decision support aid output can also address financial feasibility issues.

The information contained in the Investment Analysis Decision Aid Output can be used to illustrate the results of each of the previously mentioned investment analysis methods. For example, the payback period is calculated using the projected net income above operating costs, along with the projected tax consequences resulting from the investment. In year one the investment is expected to result in $132.00 net return above operating costs, and result in an additional $0.84 in income tax savings as a result of depreciation for a net positive projected cash flow of $132.84. Adding the projected net cash flows from subsequent years reveals that the initial investment of $750.00 is not fully returned until year 7, when the after tax salvage value of the cow can be included as a positive net cash flow. If a decision maker required that the proposed replacement pay out in less than seven years, this investment would be rejected.

Table I. Investment Analysis Decision Aid Output

Bid Price for Beef Cows Including Financing and Tax Implications
COWBIDR 08/15/97

Steer Weight (Pounds)	500		**Cull Cow Sale Weight (Pounds)**	900	Lb.
Heifer Weight (Pounds)	480		**Marginal Income Tax Rate**	28	%
Cow Price ($/Head)	$750		**Capital Gains Tax Rate**	20.00	%
Expected Number of			**Self Employment Tax Rate**	15.30	%
Calving Opportunities	7		**Discount Rate**	10.00	%

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Calf Crop or Weaning %	100	100	100	0	100	100	100
Steers Price ($/Cwt)	$84	$88	$93	$102	$105	$95	$88
Heifer Price ($/Cwt)	$76	$80	$85	$94	$97	$87	$80
Cull Cow Price ($/Cwt)	$46.48	$48.36	$50.71	$54.94	$56.35	$51.65	$48.36
Gross Receipts (Calf Sales)	$392	$412	$437	$0	$495	$446	$412
Cow Operating Cost/Year	$260	$268	$276	$284	$293	$302	$311
Net Above Operating Cost	$132	$144	$161	($284)	$202	$144	$101

Financial Information

Equity Requirement (%)	20.00	Equals **$150.00**	Per Head
Length of Note (Years)	5		
Interest Rate (%)	10.00		

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Totals
Interest Payment	$60.00	$50.17	$39.36	$27.47	$14.39	$0.00	$0.00	**$191.39**
Principal Payment	$98.28	$108.11	$118.92	$130.81	$143.89	$0.00	$0.00	**$600.01**
Debt Service Requirement	$158.28	$158.28	$158.28	$158.28	$158.28	$0.00	$0.00	
Depreciation %	10.00	20.00	20.00	20.00	20.00	10.00		
Depreciation Expense	$75.00	$150.00	$150.00	$150.00	$150.00	$75.00	$0.00	
Taxable Income	($3.00)	($56.17)	($28.36)	($461.47)	$37.61	$69.00	$100.94	
Income Taxes	($0.84)	($15.73)	($7.94)	($129.21)	$10.53	$19.32	$28.26	
Self Employment Taxes	$0.00	$0.00	$0.00	$0.00	$5.75	$10.56	$15.44	
Cash Flow Available for Debt Service	$132.84	$159.73	$168.94	($154.79)	$185.72	$114.12	$57.24	
Net Cash Flow	($25.44)	$1.45	$10.66	($313.07)	$27.44	$114.12	$57.24	
Tax Basis in Cow	$675.00	$525.00	$375.00	$225.00	$75.00	$0.00	$0.00	
Cow Salvage Value	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$435.24	
Salvage Value (After Tax)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$348.19	
Tax Adjusted Discount Rate	**7.2**							

	Cash Flows							Net Present
Year 0	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Value**
($150.00)	($25.44)	$1.45	$10.66	($313.07)	$27.44	$114.12	$405.43	($57.17)

Comments regarding this investment scenario.

The negative net present value indicates that the price of $750 per head is too high.
This investment has an internal rate of return of 3.4%.
This investment has a payback period of seven years.
This investment may not be financially feasible due to negative cash flow in year one.

The net present value results are generated based on the projected cash flows shown at he bottom of Table I. In this case the initial investment is broken down into two components, the negative $150.00 equity requirement in year 0, and the principle payments in each of the first 5 years that make up the remainder of the $750.00 replacement price. The net present value of this stream of projected cash flows is shown to the right of the series, in this case a negative $57.17. The negative result indicates that the proposed investment is not economically feasible at the assumed discount rate, and should be rejected under the net present value analysis method. As pointed out in the analysis section at the bottom of Table I, the proposed purchase price of $750.00 is too high.

The after tax internal rate of return calculated from the stream of projected cash flows at the bottom of Table I is 3.4%. This return is lower than the assumed after tax discount rate, so for this decision maker the investment would be rejected. A decision maker who is willing to accept a return of 3.4% on equity capital might find this proposed investment acceptable.

The maximum bid price is calculated using the decision aid by plugging in alternative replacement cow prices until the net present value equates to 0. Under assumptions used in this example, a replacement price of $671 results in a net present value of $0.00, suggesting that this is the maximum bid price that is projected to be economically feasible.

Financial feasibility is also discussed in the analysis section at the extreme bottom of Table I. Financial feasibility relates to ability of the investment to generate sufficient after tax cash flow on a period by period basis to meet debt repayment requirements. The proposed investment shown in Table I would require outside sources of funding in years 1 and 4 to meet debt repayment requirements. This may rule out the investment for decision makers who might find the low level of return to equity capital acceptable for this investment.

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 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 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 1 could be recalculated 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.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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