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Risk Management

Analyzing Replacement Stock Alternatives

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The economic rules used to determine whether to keep or replace a cow or any other breeding animal are fairly straightforward. Replacement management strategy involves comparing the values of breeding stock you currently own with the values of potential replacements, and then choosing the investment with the highest expected worth. Calculating those values can be complicated, but it is critical to livestock producers. When you make decisions on breeding stock replacement, you are actually making investment decisions that will have to be lived with 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 cow of similar age and quality at your local auction barn. In fact, a cow is just like a machine in a factory in that 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, including her salvage value as a cull cow, less all the expenses she generates, expressed in current dollars. As you would expect, the net cash flow the cow produces over her lifetime depends not only on her ability to produce calves, but also on the future prices of calves, the ranch's cost structure, and the eventual salvage value of the cow. The value of the cow is determined not just by the amount of cash she generates but also by the timing of the income and related expenses, because money has earning power of its own.

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 last for several years, 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 method. After selecting an investment analysis method, relevant data are collected, analyzed and interpreted. The following information shows how capital budgeting is used in making replacement decisions 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 a cow currently in the herd and replace that cow with a purchased or a raised replacement. Replacements of various ages might be available, each with a different "useful life." The producer could also sell the cow and not reinvest in another breeding animal, placing the proceeds in an alternative investment or enterprise. In general,

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an alternative investment opportunity could be the purchase of any other cost-reducing or income-increasing asset. After carrying out the investment analysis, the producer could decide to keep the current cow in the herd and re-evaluate at a later date.

Investment Analysis Methods

There are several capital budgeting methods that are commonly used. The investment analysis methods discussed here and incorporated in the associated decision aid are 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, also will be discussed. These methods help the decision maker organize and evaluate relevant data 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 use the payback period method in our breeding stock decision, we need to know the initial cost of the breeding animal and the projected net cash flows the animal will generate, 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 it is usually superior to the payback period method. Net present value gives a more accurate picture of the profitability of a potential investment by explicitly considering the size and timing of all net cash flows associated with the proposed investment, as well as the opportunity cost of capital. The data needed to carry out the net present value analysis include 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 net 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 and requires the same data, 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 net 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 and requires the same data, 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 maker's required discount rate or opportunity cost of capital. The maximum feasible bid price is a benchmark that can be compared with current market prices. If current market prices are below the calculated maximum feasible bid price, then purchasing the replacement animal would be in order. If current market prices are above the calculated maximum feasible bid price, the purchase would be deferred.

Interpretation of Results

The correct interpretation of investment analyses is critical to the proper management of the replacement process. An example of output from a computerized decision support aid titled "Bid Price for Beef Cows Including Financing and Tax Implications" can be seen in Table 1. It will be used to illustrate some of the important factors in the valuation of breeding stock.

The output shown in Table 1 is built around the investment opportunity of paying $1,150 for a breeding cow and calf, when the cow has the potential to calve six more times. All the numbers in Table 1 that are within boxes

are required input data. Data about the cow's productivity, as indicated by 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 1 uses a return to equity approach. This approach generates cash flows that include financing considerations to account for the effect 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 also can address financial feasibility issues.

The information in Table 1 illustrates the results of each of the 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 net $398 above operating costs, and produce an after-tax cash flow available for debt service of $306.84 after adjustments for debt service, income taxes and self-employment taxes. Adding the projected net cash flows from subsequent years reveals that the initial investment of $1,150 is not fully returned until year seven, 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 7 years, this investment would be rejected.

The net present value results are based on the projected after-tax cash flows shown at the bottom of Table 1. In this case the initial investment is broken down into two components, the negative $345 equity requirement in year zero, and the principle payments in each of the first 5 years that make up the remainder of the $1,150 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 positive $60.46. The positive result indicates that the proposed investment is economically feasible at the assumed discount rate, and should be accepted under the net present value analysis method.

The after-tax internal rate of return calculated from the stream of projected cash flows at the bottom of Table 1 is 7.9 percent. This return is higher than the assumed tax-adjusted discount rate of 5.76 percent, so for this decision maker the investment would be accepted.

The maximum bid price is calculated 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 $1,230 results in a net present value of $0.07 (which is as close to zero as rounding error will allow the spreadsheet to calculate), suggesting that $1,230 is the maximum bid price that is economically feasible.

Financial feasibility is also discussed in the analysis section at the extreme bottom of Table 1. Financial feasibility relates to the 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 1 would require outside sources of funding in years one through three to meet debt repayment requirements. This may rule out the investment for decision makers who find the low level of return to equity capital unacceptable.

Decision Rules

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

Risk Analysis

Risk (uncertainty) can be introduced into the replacement stock analysis decision in

Table 1. Bid price for beef cows including financing and tax implications.

Steer weight (pounds)	525		Cull cow sale weight (pounds)	1,000	Lb.		
Heifer weight (pounds)	500		Marginal income tax rate	28.00	%		
Cow price ($/head)	$1,150		Capital gains tax rate	20.00	%	Net present value*	
			Self-employment tax rate	15.30	%	$60.46	
Expected number of calving opportunities	7		Discount rate	8.00	%		

Year	2008	2009	2010	2011	2012	2013	2014	
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
Calf crop or weaning %	100	100	100	100	100	100	100	
Steer price ($/cwt)	127	131	125	127	127	127	130	
Heifer price ($/cwt)	121	125	119	121	121	121	124	
Cull cow price ($/cwt)	$52.10	$52.97	$51.66	$52.10	$52.10	$52.10	$52.76	
Receipts–calf sales	$636	$656	$626	$636	$636	$636	$651	
Cow operating cost year	$238	$475	$489	$504	$519	$535	$551	
Net above operating cost	$398	$181	$137	$132	$117	$101	$100	
Financial information								
Equity requirement (%)	30.00	Equals	**$345.00**	per head				
Length of note (years)	3							
Interest rate (%)	9.00							Totals
Interest payment	$72.45	$50.35	$26.26	$0.00	$0.00	$0.00	$0.00	**$149.06**
Principal payment	$245.57	$267.67	$291.76	$0.00	$0.00	$0.00	$0.00	**$805.00**
Debt service requirement	$318.02	$318.02	$318.02	$0.00	$0.00	$0.00	$0.00	
Depreciation %	10.00	20.00	20.00	20.00	20.00	10.00		
Depreciation expense	$115.00	$230.00	$230.00	$230.00	$230.00	$115.00	$0.00	
Taxable income	$210.55	($99.35)	($119.51)	($97.93)	($113.05)	($13.62)	$100.34	
Income taxes	$58.95	($27.82)	($33.46)	($27.42)	($31.65)	($3.81)	$28.10	
Self-employment taxes	$32.21	$0.00	$0.00	$0.00	$0.00	$0.00	$15.35	
Cash flow available for debt service	$306.84	$208.82	$170.21	$159.49	$148.60	$105.19	$56.89	
Net cash flow	($11.18)	($109.20)	($147.81)	$159.49	$148.60	$105.19	$56.89	
Tax basis in cow	$1,035.00	$805.00	$575.00	$345.00	$115.00	$0.00	$0.00	
Cow salvage value	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$527.60	
Salvage value (after tax)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$422.08	
Tax adjusted discount rate		5.76						

	Cash flows							
Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Net present value
($345.00)	**($11.18)**	**($109.20)**	**($147.81)**	**$159.49**	**$148.60**	**$105.19**	**$478.97**	**$60.46**

*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 7.9 percent.
This investment has a payback period of 7 years.
This investment may not be financially feasible because of negative cash flow in year one.

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 not only for the expected outcome of the investment, but also for optimistic and pessimistic outcomes. For example, the scenario illustrated in Table 1 can 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.

Reference

Barry, P.J., J.A. Hopkin and C.B. Baker, Financial Management in Agriculture. Interstate Printers and Publishers, Inc., Danville, IL.

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