

Net Present Value of Beef Replacements

Sensitivity Analysis Summary

November 2013

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As cattle producer interest in possible beef herd expansion grows, it is important to recognize what resources are available to guide these investment decisions and to appreciate key variables that drive expected investment returns. The purpose of this factsheet is to provide a brief overview of an available Excel based decision aide and to highlight the impact production costs, output prices, and interest/discount rates have on projected values of replacement females.

Available Decision Aide and Key Sensitivities

A user-friendly spreadsheet has been created and posted online to assess the economic situation presented by a given producer purchasing an available replacement female for their breeding herd.¹ When it comes to projecting the net present value (NPV) offered by purchasing a replacement female, a number of assumptions about the future must be made providing key inputs into this decision aide. Default values are provided to assist producers but each user is encouraged to adjust inputs (in the spreadsheet “blue” values reflect inputs that can be modified by any user) to best reflect one’s own situation. In this factsheet the impacts of varying assumed production costs, discount rates, and calf sales prices, are highlighted.

¹ This spreadsheet (*KSU-Beef Replacement*) is available online at: <http://www.agmanager.info/livestock/budgets/production/default.asp>. Users are encouraged to regularly return to this website and obtain the most current version as updates are periodically made.

Table 1. Net Present Value of Beef Replacements, Sensitivity Analysis Summary*

Year	Number of Calves	Base Case	10% Lower Cow Costs/yr	10% Lower Discount Rate	10% Higher Calf Prices
2014	1	\$1,107	\$1,177	\$1,107	\$1,288
2015	2	\$1,233	\$1,359	\$1,239	\$1,484
2016	3	\$1,323	\$1,493	\$1,335	\$1,628
2017	4	\$1,357	\$1,562	\$1,373	\$1,701
2018	5	\$1,379	\$1,611	\$1,399	\$1,754
2019	6	\$1,407	\$1,662	\$1,430	\$1,808
2020	7	\$1,425	\$1,697	\$1,451	\$1,846
2021	8	\$1,443	\$1,729	\$1,470	\$1,879
2022	9	\$1,458	\$1,755	\$1,487	\$1,907
2023	10	\$1,466	\$1,772	\$1,497	\$1,925

Key Inputs Varied Across Scenarios**:

Annual cow costs, \$/year		\$700	\$630	\$700	\$700
Discount rate, interest rate		7.50%	7.50%	6.75%	7.50%
Calf Price, \$/cwt	2014	\$168	\$168	\$168	\$185
	2015	\$171	\$171	\$171	\$189
	2016	\$171	\$171	\$171	\$189
	2017	\$164	\$164	\$164	\$181
	2018	\$159	\$159	\$159	\$176
	2019	\$161	\$161	\$161	\$177
	2020	\$162	\$162	\$162	\$178
	2021	\$165	\$165	\$165	\$182
	2022	\$168	\$168	\$168	\$185
	2023	\$168	\$168	\$168	\$186

* NPV is Net Present Value (\$/head) of a replacement expected to produce the number of saleable calves listed in the "Number of Calves" column before a cow is culled for age-related reasons.

** Annual cow cost, discount rate, and calf price assumptions were varied with all other inputs set at their default settings as of 11-1-13.

Table 1 provides a summary of base case results presented by default values as well as 10% improvements in key inputs of interest. The base case depicts a situation of a producer having \$700/year annual cow costs who is willing to accept a 7.50% expected return on investment and is anticipating calf prices to be consistent with those projected in February of 2013 by USDA ERS. In this base situation, the NPV of buying a replacement expected to provide one saleable calf in 2014 and then be sold is \$1,107. Stated differently, a producer in this situation could pay

\$1,107 and realize an expected rate of return of 7.50% on the investment. Similarly, if this base case producer was considering the purchase of a heifer expected to provide saleable calves for 10 years the NPV rises to \$1,466 reflecting the longer revenue stream offered by the investment.

Holding other inputs and assumptions constant, any purchases at \$/head levels lower (higher) than these NPV levels would provide better (worse) expected returns. In addition to keeping a replacement in the herd for a longer time period, producers with lower (higher) annual cow costs, producers who charge lower (higher) discount rates, and producers expecting higher (lower) calf prices in the future can pay higher (lower) prices for replacements to achieve the same expected rate of return. Stated differently, producers with lower annual cow costs, lower investment discount rates (i.e., targeted rate of return), or higher expectations for feeder cattle markets will see higher economic value in replacements available for purchase and hence are the producers more likely to make these herd expansion investments. This is summarized in table 1 to provide context on the relative influence of costs, discount rates, and calf prices on attractiveness of replacement investments.

A producer with 10% lower production costs could pay \$306 more (\$1,772 vs. \$1,466) for a replacement expected to produce 10 calves. It is further important to appreciate that the broader cow-calf industry is characterized as having notable variation in production costs such that this 10% sensitivity understates real-world variability present in the industry. As an example, there is over \$300/cow differences in estimated total costs between the top 1/3 and bottom 1/3 of cow-calf producers in the Kansas Farm Management Association (KFMA).² Recognizing this variation, if a \$150/cow difference in profitability is considered, note that a producer with \$850/cow annual costs would perceive a NPV of \$811 for a replacement providing 10 years of calf production (data not shown), which is substantially lower than the base case NPV of \$1,466.

A producer who either has access to more favorable investment capital or is most comfortable with the investment environment would likely pay more for a given replacement. For instance, a reduction in discount rates from 7.50% to 6.75% increases the NPV of a replacement providing

² A full report on KFMA cow-calf producer profitability and sources of profit variability is available online: [http://www.agmanager.info/livestock/budgets/production/beef/Cow-calf_EnterpriseAnalysis\(Aug2013\).pdf](http://www.agmanager.info/livestock/budgets/production/beef/Cow-calf_EnterpriseAnalysis(Aug2013).pdf)

10 years of calf production by \$31 (\$1,497 vs. \$1,466). Conversely, a producer who is less comfortable with the current environment of profitability risk and uncertainty may charge a higher discount rate in assessing a candidate replacement purchase. For instance, if a 15% discount rate is used to reflect a risk premium charged by a concerned or conservative producer the NPV of a replacement providing 10 years of calf production declines to \$1,222 (data not shown), which is \$244 lower than the base value of \$1,466.

Any investment return is a function of both revenue and costs so further consideration of calf price assumptions corresponding to the production lifespan of a given replacement is also in order. Table 1 illustrates how producers expecting 10% higher calf prices will place more value in any given replacement. Narrowly, if a replacement heifer expected to be in the herd for 10 years is considered, producers with 10% higher calf price expectations would place \$459/head higher NPV estimates on a candidate investment (\$1,925 vs. \$1,466). While producer expectations on cattle prices certainly have a role in replacement investment decisions, it is important to recognize that across producers the variation in revenue is regularly estimated to be lower than the variation in production costs. That is, the underlying variation in production costs probably warrants more attention as an input that users should update to reflect their own situation as the industry is characterized by more diversity in production costs than in realized revenue.

Conclusions

There are a number of opportunities and challenges on the horizon for cow-calf producers. This segment of the broader beef industry is in a period of seriously considering expansion. In the current operating situation of higher production costs, higher revenue streams, and overall increased variability in many aspects influencing profitability, producers are encouraged to utilize available resources to help them make decision such as the spreadsheet highlighted in this factsheet. Moreover, producers are encouraged to deeply reflect on how their situations differ from the scenarios considered here to best reflect the economic opportunity presented by any candidate investment in beef replacements.