HOW DO CURRENT MARKET INCENTIVES AFFECT GENETIC SELECTION DECISIONS?

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Introduction

The combination of historically tight beef cattle supplies, reduced feedstuffs prices, and stronger than perhaps expected beef demand have underpinned historically high prices and profit margins for many segments of the beef cattle industry. Expected cow-calf returns for 2015 exceed $400/cow when previously returns over cash costs greater than $100 characterized very favorable years (LMIC, 2015). How should $400+/head cow-calf returns affect cow-calf producer decisions? The market signal is pretty clear—more calf production is needed and will be rewarded.

Producers should consider whether current market values should prompt management changes. The sharp jump in revenues this year (marginal benefits) implies that producers should consider a host of marginal changes in production and costs. This may mean producers doing more of something they have already done or beginning to do something they have not done in the past. Although not an all-inclusive list, some examples include pre-breeding exams, bolstering health programs, increasing the body condition of the cowherd, and putting more pressure on weaning weight through genetic selection or increasing feed substrates.

That said, it is important to keep in mind return on investment. Consider this question, for example: What is the optimal pregnancy rate for a cowherd? While we do not often think about it, the optimal level is not 100%. Could we achieve 100% pregnancy rate? Probably yes or something very close to it, but the last few pregnancies gained would likely require extreme measures such as drastically extending the breeding season, for which the costs exceed the benefits and thus is not optimal. However, the increase in calf values this year means that additional efforts to increase pregnancy rates are warranted compared to what was optimal in the past. This illustrates the economic principle that every producer should be examining now—adjust production activities until the marginal benefits equal the marginal costs.

For many producers, periods of profitability may be motivation for expanding the cow herd. However, it is future rather than current profit that should be of interest and, therefore, future costs and payments that must be considered along with the circumstances of today. Thus, a sound investment in expanding the cow herd will ultimately produce profitability over the entire investment period (i.e., initiation through end of useful life), whether short- or long-term. Selection and management decisions will affect the future productivity and profitability of an entire cowherd. Careful considerations of the economics of production and the reproductive status, breed type, and genetic make-up of the herd need to be considered.

This paper reviews some economic considerations related to beef cattle herd expansion and the relationship with management and genetic selection decisions, and outlines several important variations in individual ranch considerations.

Beef Cattle Herd Dynamics and Genetic Selection Decisions

Beef cattle production in the U.S. is a vertically connected system that spans from cow-calf operations producing feeder cattle for the nation's stocker and feedlot operations, which combine to feed cattle to heavier weights for eventual slaughter. Retail beef supplies are heavily

dependent on cow-calf production decisions, namely the retention of heifers as replacements and the holding of cows for further breeding service, as these decisions dictate the size of subsequent calf crops (Schmitz, 1997). As Melton (1980) states "probably no single aspect of modern beef herd management is as complicated, or has as potentially great an economic impact, as the cow culling and replacement decision." Buhr and Kim (1997) illustrate how changes throughout the industry are associated with significant and vertically-connected adjustment costs. For instance, breeding herd expansion decisions directly influence the volume of transactions at auction markets and the number of calves available for feeding in commercial feedlots and processing by packing plants.

Beyond the volume of transactions and calves available, characteristics of cattle within a vertically connected system can ultimately impact the success of expansion. A survey of Iowa cow-calf producers and feedlot operators was conducted in February 2014 (Schulz, Gunn, and Loy, 2015a; 2015b). Some key findings include 77% of cow-calf respondents indicating genetic selection was important or very important for improving cost of production on their operation. This genetic merit was further buttressed by 70% of cow-calf respondents indicating that changing their genetic selection program would expand their marketing opportunities. However, only 29% of feedlot respondents indicate specific sire and/or genetic information was important or very important for the feeder cattle they buy. These responses signal a host of points, but perhaps most significant is the need for more transparency and enhanced information flow between the cow-calf and feeding sectors of the industry.

The U.S. is the world's largest producer of beef and the world's largest consumer of beef in terms of total pounds. In 2014, beef and beef variety meat exports amounted to 1.197 million metric tons worth $7.135 billion. Approximately 14% of U.S. beef and variety meat production was exported in 2014 (USMEF, 2015). Over the next 10 years, global meat consumption is projected to grow by 1.6% annually, with exports of beef projected to rise even quicker at a rate of 2.7%/year (USDA ERS, 2015). This growth in beef demand results from an increasing human population, rising per capita incomes, changes in consumer preferences, and improvements in product characteristics such as convenience, tenderness, food safety, health, and nutrition, etc. (Schroeder et al., 2013). The projection of beef exports to grow faster than base consumption presents a favorable opportunity to major beef exporters. To capitalize on current and expected beef demand strength, many analysts indicate the U.S. needs to increase overall beef production, which is inherently initiated by expanding breeding herds.

It is useful to characterize the varied views on how much expansion may occur by comparing two different forecasts. The USDA Economic Research Service (2015) in February of 2015 released projections of 16.5% herd growth between 2015 and 2024 (33.7 million head in total by 2024). Conversely, the Food and Agricultural Policy Research Institute (2015) published projections in March of 2015 of the herd in 2024 only being 2.6% larger than in 2015 (30.3 million head in total by 2024). The difference in these economic projections, and the broader uncertainty of aggregate industry expansion, is only magnified at the individual level. That is, the list of possible reasons for expansion is extensive across a group as heterogeneous as the U.S. cow-calf sector.

Individual, Ranch-Level Considerations

As cattle producer interest in 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. Sensitivity analyses regularly highlight the critical role of production costs, investment returns being targeted, and expectations regarding future cattle prices. Producers are highly heterogeneous in these and other characteristics, which, in turn, magnify the range of interest in herd expansion and the varied approaches to accomplish expansion, etc. This situation is precisely the reason existing decision support tools regarding beef herd expansion have been developed and are regularly updated. For instance, available resources include partial budgets for assessing if an operation should buy or raise heifers and net present value analyses to estimate what price an operation can consider paying for a given targeted rate of return.

Raising Versus Buying Heifers for Beef Cow Replacement

Selecting the most economical source of replacement females may be one of the more important decisions confronting a cow-calf producer, as this decision has major implications for effectively using resources, controlling costs, and long-run business viability. As indicated by a BEEF survey (BEEF, 2014), producers utilize heifer retention and purchasing of external females to expand their breeding herd. USDA APHIS indicates that 83% of operations expand by retaining and raising their own heifers (USDA APHIS, 2008). Whether to use raised or purchased replacements can be a complex issue, because each alternative has both advantages and disadvantages. To assist producers in making the 'raise vs. buy' decision, Excel spreadsheets *Buying Heifers for Beef Cow Replacement* and *Raising Heifers for Beef Cow Replacement* can be used to determine which management strategy is best in any given year.[1]

Although most producers raise herd replacements, purchasing replacements sometimes can be an attractive alternative. To illustrate this using the *Buying Heifers for Beef Cow Replacement* spreadsheet to analyze whether to continue raising replacements or purchase them, consider the following example. A cow-calf producer is considering selling raised heifer calves at weaning time and buying pregnant heifers at 22 months of age (2 months prior to calving). Heifer calves average 485 lbs. per head at 6 months of age and can be sold for $2.60 per lb., net of selling costs. The interest rate is 4%, which is based on the returns realized from the investment of returns (or reduction in borrowing) from the sale of the heifer calves. The feed, non-feed, and fixed costs assumed for a heifer raised during the 16 month period between weaning and the arrival of a purchased heifer on the farm are $499.00, $289.82, and $233.30 per head, respectively. It is assumed that a bred heifer at 22 months of age can be purchased for $2,700 per head, net of purchase costs (e.g., transportation). Using this information, a producer can determine if buying replacement heifers will increase farm net income.

For added returns, the example cow-calf producer expects to realize $1,328.25 if the heifer calf is sold and a replacement heifer is purchased 16 months later. Those returns stem from the sale of the heifer calf at weaning ($1,261.00) and interest earned or saved on that amount ($67.25), assuming an annual rate of 4% and a term of 16 months. The producer estimates there will be no increase in genetic improvement if heifers are purchased; if there were any multi-year gain in genetics, added returns would increase. For reduced costs, the producer eliminates the cost of raising a replacement heifer during the 16 month development period by purchasing a replacement. These cost reductions sum to $1,022.12 per head. Included in the cost savings are feed, non-fed, and fixed costs. The total added returns from buying rather than raising replacements is the sum of the added returns and reduced costs, $2,350.37 per head. Turning to the total added costs, the only added cost projected by the producer is the $2,700

[1] These spreadsheets and video tutorial are available at: http://www.iowabeefcenter.org/heiferdevelopment.html.

purchase cost for the bred heifer. The producer estimates there will be no reduced returns (e.g., less genetic control, less control over disease). Subtracting total added costs ($2,700) from total added returns ($2,350.37) shows a net income decrease of -$349.63 per replacement if the producer switches from raising to buying replacement heifers. However, if the heifer purchased for $2,700 can garner $350 in added genetic merit over females that would have been developed internally through increased weaning weight, improved heifer progeny pregnancy, or improved stayability, then purchasing replacements becomes a more competitive decision.

The above analysis assumes a market return on surplus home-grown forages, operating capital, operator labor and management, and no return on the existing investment in buildings, equipment, and facilities made available for use when heifers are no longer raised on the farm. To the extent these resources can be diverted to an alternative use (e.g., herd expansion) with returns exceeding these assumed levels, the analysis would understate the economic benefits (i.e., reduced costs) of buying heifers.

Net Present Value of Beef Replacement Females

Before decisions regarding purchasing or retaining replacement females are made, producers may want to consider the economic value of a replacement entering the herd. A cattleman's objective is to maximize the present value of the stream of residual earnings from cows in the herd (Melton, 1980; Melton and Colette, 1993). The *Net Present Value of Beef Replacement Females* Excel spreadsheet evaluates the economic situation presented by a given producer purchasing an available replacement female for their breeding herd.[2] When it comes to projecting the net present value (NPV) offered by purchasing or retaining a replacement female, a number of assumptions about the future must be made, providing key inputs into this process. These include: purchase price of replacement female (if any), number of calving opportunities, number of marketable calves, weaning weights of calves, sale prices of calves, annual cow costs, annual heifer development costs (if any), weight of cow when culled, sale price of cull cow, and discount rate.

To provide an example of this NPV analysis, a $2,700 purchase price of a replacement female, long-run projected cattle prices guided by USDA's Economic Research Service 10-year projections, annual cow costs of $750, and a discount interest rate of 5% are assumed. Using these default values, the NPV of replacement females expected to provide calves over the next seven years is $49. The total of the discounted earnings is $2,749, which is greater than the initial investment of $2,700, thus this investment is profitable at this time. If a producer in this base situation paid more (less) than the max bid price of $2,749, he or she effectively would be initiating an investment with an expected rate of return less (more) than 5%.

To illustrate the impact of production costs, reducing annual cow costs to $600 from the base value of $750 increases the NPV to $916, consistent with the fact that each calf yields a greater net return per year, facilitating operations with lower annual costs to pay more for replacements. Conversely, adjusting the base case from a discount rate of 5% to 15% reduces the NPV to -$754, highlighting how producers more concerned with increased volatility and uncertainty may be less aggressive in purchasing or retaining replacement females. Increasing expected output (calf and cull cow) prices by 5% increases the NPV to $403, reflecting more optimistic future profitability expectations. Finally, increasing calf weaning weights by 4% increases the NPV to $302, reflecting more optimistic future production expectations. These scenarios clearly illustrate how varied cost structures, heterogonous comfort with the risk

[2] This spreadsheet and video tutorial is available at: http://www.iowabeefcenter.org/heiferdevelopment.html.

environment, and diverse views on future cattle prices and output each notably impact NPV analyses.

Summary

The entire U.S. beef cattle industry is in the middle of several structural changes with herd expansion at the heart of each current and possible industry adjustment. The net impacts of these adjustments will dictate the collective make-up of the U.S. beef cattle industry for years to come. The future size and structure of the U.S. beef cow herd will be determined by the individual decisions of over 700,000 cattle owners (USDA NASS, 2014). These owners are very diverse, not only in their physical operational characteristics and lifestyles, but also in their perceptions and acceptance of the economic factors impacting herd expansion. Where individual operations fall on this varied continuum will drive individual interest in herd expansion and, hence, directly impact the future size and composition of the U.S. cow-calf industry. Similarly, the aggregate industry's ability to recognize and act upon the importance of ongoing beef demand growth is critical for the broader industry's ability to both expand in size and improve overall economic well-being.

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