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J. Fanning

T. Marsh

R. Jones

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Abstract

The effects of beef cow herd inventory management strategies on net income were evaluated in a historical simulation of a representative Kansas beef-cow herd. Constant inventory, counter-cyclical, and dollar-cost averaging strategies were compared to an optimal heifer replacement strategy. Results indicate that price and inventory signals can be used to time replacement heifer acquisition to improve profitability of the average Kansas producer.

Keywords

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ALTERNATIVE REPLACEMENT HEIFER INVESTMENT STRATEGIES

J. Fanning[1], T. Marsh[1], and R. Jones[1]

Summary

The effects of beef cow herd inventory management strategies on net income were evaluated in a historical simulation of a representative Kansas beef-cow herd. Constant inventory, counter-cyclical, and dollar-cost averaging strategies were compared to an optimal heifer replacement strategy. Results indicate that price and inventory signals can be used to time replacement heifer acquisition to improve profitability of the average Kansas producer.

(Key Words: Replacement Heifer, Market Timing, Cattle Cycle, Economics.)

Introduction

Cost and timing of replacement heifer investment is an important factor in cow-calf producer profitability. "What to pay?" and "when to buy or retain?" depend on the specific strategy chosen to acquire or retain replacement heifers. Kansas cattle producers face both profitable and unprofitable periods within a cattle cycle. In addition to cyclical cattle prices, costs of production are important determinants of net revenues. Breakeven costs determine the crossover between profitable and unprofitable years in the cattle cycle.

Timing is also important for a cost-minimizing producer. Replacement heifers either retained or acquired toward the end of the high-price phase of the cattle cycle often produce calves during the low-price phase, implying that these heifers may be less profitable over their productive life. Conversely, replacements placed in service just prior to, or at the beginning of, the high-price phase of the cattle cycle tend to yield above average profits.

Recently, inventory management strategies have been recommended that are not necessarily profit-maximizing, but none of these strategies fully utilize price information. The objective of this study was to compare alternative inventory management strategies relative to a profit maximizing or optimal cow inventory and replacement strategy for a representative Kansas producer.

Experimental Procedures

A dynamic optimization model was formulated to simulate replacement strategies and enterprise profits, based on historical input costs (feed, labor, utilities, interest, etc.), calf and cull cow prices, and historical production measures (weaning weight, weaning percent, cull rate, and death loss). A Kansas beef-cow enterprise was simulated for the 1975-1999 period under 1) constant inventory, 2) counter-cyclical inventory and 3) dollar-cost averaging replacement investment strategies. These strategies are then compared to an *economically optimal* replacement investment strategy. The *economically optimal*

[1]Department of Agricultural Economics

replacement strategy maximized the Net Present Value (NPV, the discounted value of the stream of future net incomes plus the salvage value of the cow-herd) of net income and ending inventory value of the cow herd for the study period. A *constant inventory* strategy assumes the number of cows and replacements in the herd are held constant over time. The *counter-cyclical* strategy alters bred cow inventory inversely with U.S. January 1 beef-cow inventory; when the U.S. inventory increases 1%, the producer decreases his inventory 1%. The *dollar-cost averaging* strategy retains the same dollar value of replacement heifers each year. The beginning cow-herd for each strategy consisted of 100 bred females. Inventory levels are constrained to no more than 120 hd. In addition to comparing replacement strategies from 1975 to 1999, optimal inventory levels are predicted using 2001 Federal Agricultural Policy Research Institute (FAPRI) price projections through 2010.

Results and Discussion

Using the NPV of investment as the criteria of comparison from 1975 to 1999, *dollar-cost averaging*, with a NPV of $116.32/hd over the 25-year simulation period, outperformed *constant inventory* and *counter-cyclical inventory* management strategies by $30.34/hd and $31.78/hd, respectively.

The NPV was heavily impacted by the value of the herd at the end of the study period. Thus an alternative comparative measure such as annual net income, is likely more useful in evaluating the differences between strategies. Using average Gross Domestic Product deflated net income as the criteria from 1975 to 1999 instead of NPV, the *counter-cyclical* management strategy with average real net income of $8.95/hd is $4.03/hd more than *constant inventory* and $0.51/hd more than the *dollar-cost* strategy. Figure 1 shows the Gross Domestic Product deflated income levels of the alternative strategies in comparison to the *economically optimal* replacement strategy. Profit maximizing with *economically optimal* heifer replacement yielded a NPV of $284.69 and average real net income of $26.10/hd, which outperformed the other strategies.

Bred cow inventories over time from the alternative strategies are presented in Figure 2. The *economically optimal* strategy maximized or minimized inventory during profitable or unprofitable periods of the cattle-cycles, adjusting replacements (purchased or raised) according to price signals (Figure 3). The alternative strategies invested in replacements each year, regardless of price and inventory signals. The *economically optimal* bred cow inventory fluctuated greatly compared to the inventory management strategies studied. The effect of ill-timed investment in replacement females of the alternative strategies is to reduce long-run net returns.

These results suggest there is potential to improve profitability by using heifer replacement strategies that incorporate price and fundamental signals. However, practical implementation of variable-rate replacement management strategies requires resource flexibility. For example, the *economically optimal strategy* requires that another enterprise, such as a stocker enterprise, be available to utilize the forage not consumed by the liquidated cowherd, or that this forage be rented out. It is also important to acknowledge that the *optimal* solution is unattainable because perfect foresight of prices is not possible. Nevertheless, the *optimal* strategy sheds light on the decision criteria.

Interestingly, the profit maximizing strategy with optimal replacement began retaining replacement heifers when the U.S. cow inventory began liquidation and the percent change in steer calf price increased. Enough heifers were retained or purchased each year to attain or maintain

the maximum herd size until price and inventory signals indicate the top of the cattle cycle is approaching. At the top of the price cycle, the *optimal* strategy no longer kept any replacements if (1) the percent change in U.S. beef cow inventory increased significantly (about 1.5%) or became positive and (2) the percent change in steer price was less than its three year moving-average. Re-simulating the model using these two ad hoc decision rules resulted in average real net income of $19.10/hd, which is only $7/hd less than the optimal strategy, and still surpassed the counter-cyclical strategy in average real net income by $10.15/hd, further emphasizing the role of price and inventory signals in decision making. This specific ad hoc decision rule is only valid for a producer with costs equal to that of the average Kansas producer. Therefore, it is essential that individual producers evaluate their specific cost situation before deriving enterprise- specific criteria.

Ignoring price signals in the *dollar-cost-averaging*, *counter-cyclical*, and *constant-inventory* strategies limits net returns for the average Kansas producer. The results of this study suggest a cost minimizing cow-calf producer can benefit from incorporating output and input price signals into the timing and rate of their heifer replacement decisions. Projections of optimal inventories, using 2001 FAPRI price projections, indicate that the average Kansas cow-calf producer should maintain full inventory levels until 2005. Of course, replacement projections are only as reliable as price projections and need to be continuously updated to refine production plans.

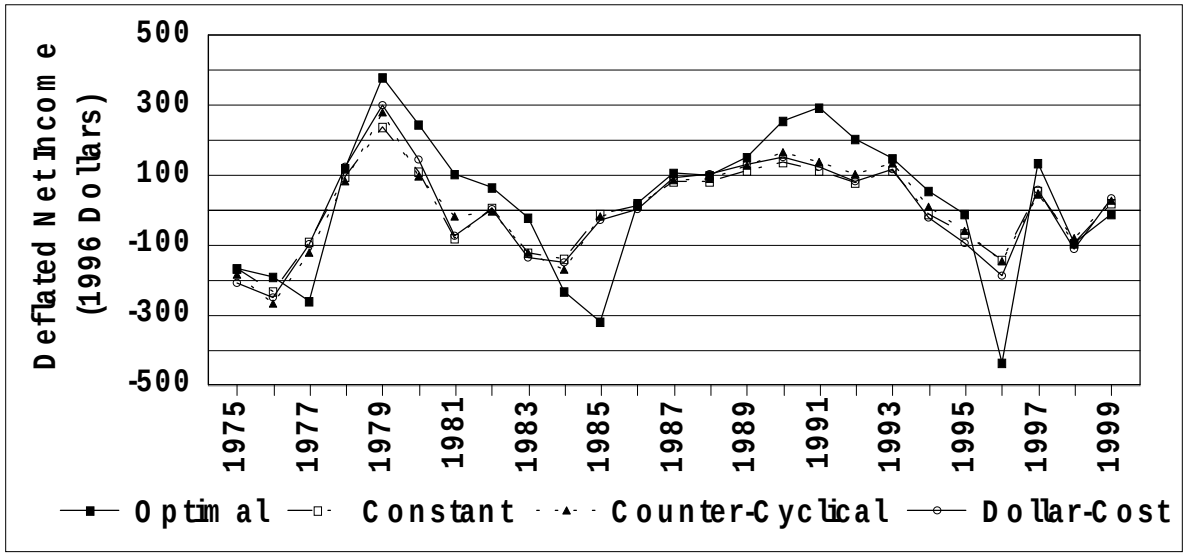

Figure 1. Real Net Income for Alternative Replacement Strategies.

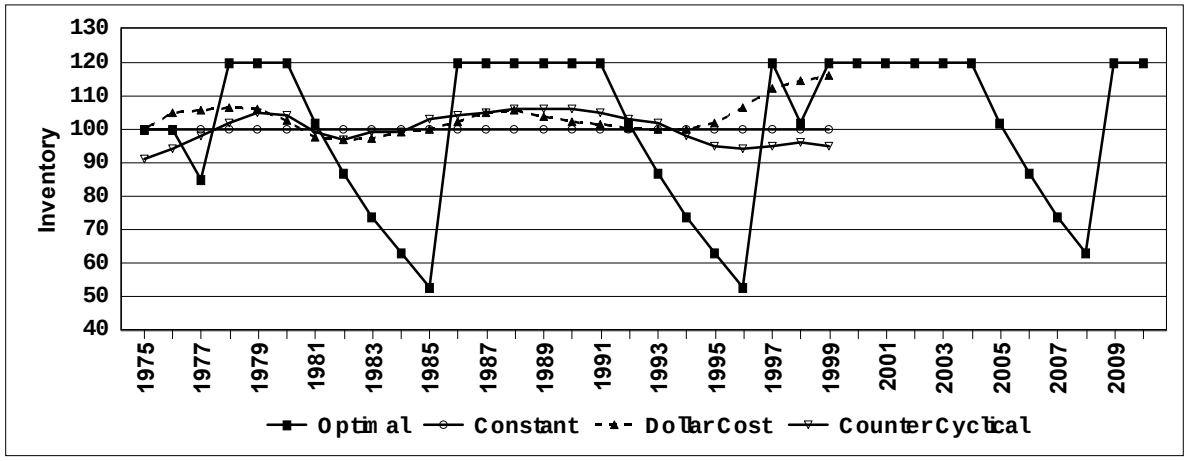

Figure 2. Bred Cow Inventory Levels of Alternative Inventory Management Strategies.

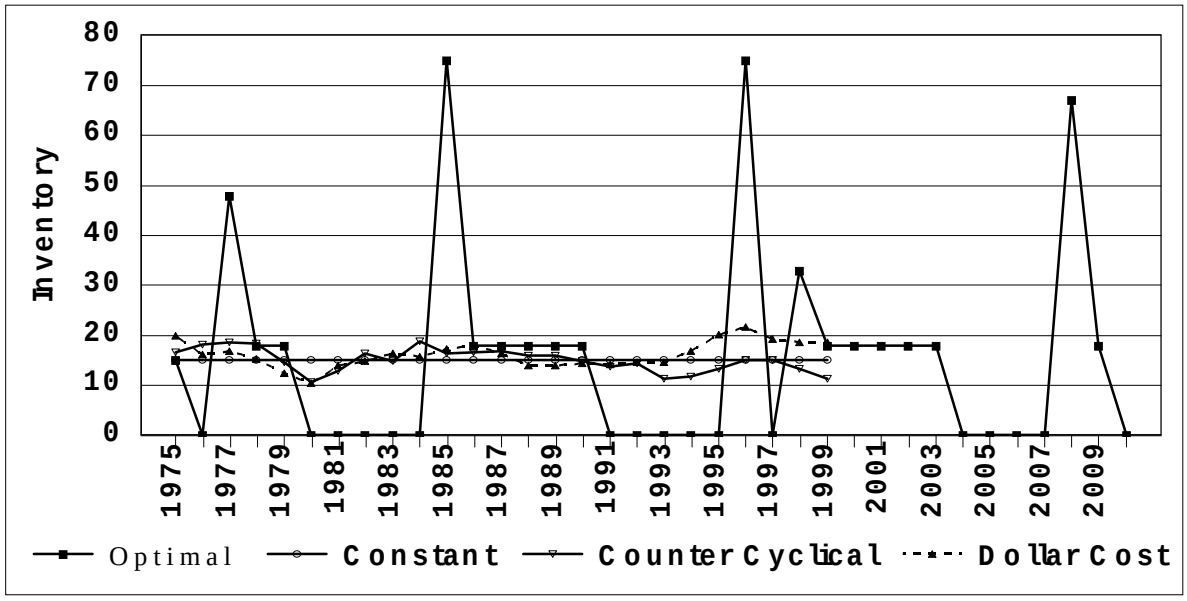

Figure 3. Bred Heifer Inventory Levels of Alternative Replacement Investment Strategies.