Profiting from the Cattle Cycle: Alternative Cow Herd Investment Strategies

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Summary

Beef cow herd owners can benefit from incorporating price signals into their heifer retention decisions. Whereas a perfect forecast of calf prices over the productive life of the heifer added to the herd would be ideal, such information is not available. However, simple decision rules that incorporate current or recent prices and the knowledge that the cattle cycle likely will repeat itself can help producers improve their investment decisions. A dollar cost averaging strategy that retains the same dollar value of heifers each year and a rolling average value strategy that retains a 10-year average value of heifers out performed strategies that sought to maintain a constant herd size or a constant cash flow.

Introduction

Beef cow herds are capital-intensive enterprises and should be viewed as other capital investments. Like other assets there is an initial investment followed by a stream of future earnings that provides a return on the original investment. Heifers are retained and developed or purchased and produce calves over the coming years to produce income. And like many other businesses, the cattle industry is cyclical. When you invest impacts your return because the cycle impacts the investment cost and future earnings.

Can producers use knowledge of the cattle cycle to make more profitable investment decisions? Yes, if two basic principles of economics are applied. First, "buy low and sell high," and second, "find out what everyone else is doing and do the opposite." Although easier said than done, this paper will evaluate alternative heifer retention strategies to put the principles into practice in order to profit from the cattle cycle.

The cattle cycle is largely driven by the economics of the beef cow enterprise. One explanation is that producers form the naïve expectation that current calf prices will continue into the future. They think that when calves are high priced, that must mean they will stay high priced in the future; so ranchers save back heifers to produce more calves. When calves are low priced, ranchers think they will stay low priced. Therefore, ranchers don't want to produce as many, and they reduce their herd size. Another possibly more plausible explanation is that cash flow needs drive heifer retention decisions. When calves are low priced, ranchers sell more calves (steers and more of the heifers) to meet cash flow obligations. As prices increase, they do not have to sell as many to meet their needs and can thus retain more heifers.

Regardless of the reasoning, as more heifers are retained for the breeding herd there is a smaller supply of feeder cattle available for the feedlot. Ultimately the supply of beef declines, and prices increase encouraging more heifer retention. At some point, approximately 2 ½ years after the heifer was weaned and retained in the breeding herd, the supply of beef stops declining and begins to increase due to the additional calves coming to market as Choice steers. Prices begin to level off and then decline as supplies build causing an increase in cow herd liquidation and the number of heifers going into the feedlot rather than the breeding herd. And thus the cycle continues.

Materials and Methods

This analysis evaluates four alternative heifer retention strategies over the 30-year period between 1970 and 1999, using annual returns and wealth produced over the period. Four alternative heifer retention strategies are modeled for a representative beef cow-calf producer. The starting point for all strategies is a January 1, 1970, inventory of 82 bred cows, 18 bred first calf heifers, 21 virgin heifers being developed and 5 bulls. University extension budgets for each year were used to determine non-feed variable costs, the amount of inputs used, hay prices and bull purchase price (Iowa State University Extension). Table 1 summarizes the budgeted weights and nominal prices and costs for 1999 as a point of reference.

Livestock sales and grain purchases were based on USDA reported prices for 1970-1999 (USDA, AMS). Prices and expenses were deflated using the GDP deflator with 1996=100. Steer and heifer calves, cull cows, heifers and bulls were assumed sold in November at the monthly average price. January herd inventory value is based on November prices but with expected weight gains. Bred cows and heifers were valued 50 percent over the cull value.

Performance assumptions in the model were as follows: conception rates for cows and heifers, 85 percent; death loss for calves, 4 percent; and death loss for cows, 2 percent. The culling rate for cows was 16 percent annually inclusive of the open cows. The number of breeding females per bull did not exceed 25:1. Market weights of calves and cull heifers and cows were based on university budgets, but were averaged from year to year to reflect the trend in weights rather than periodic increases as budgets were updated. Retained heifers were expensed into the herd at their cost of production rather than their market value opportunity cost.

Because the focus of the analysis is to compare heifer retention strategies, some simplifying assumptions were made. First, the model ignores weather variability that can impact forage availability. Second, initially it is assumed that the rancher has a flexible land base that can be increased or decreased at the going rental rate. This assumption is relaxed later to determine if the results hold for producers with a fixed land base.

Table 1. Beef cow budget values, 1999 values.

Revenue	Amounts	**($/cwt)**
Cull cows	1150	37.88
Steer calves	551	90.98
Heifer calves	511	80.41
Open Cull Heifers	907	74.76
Percent calf crop	90%	
Operating cost per cow		
Pasture (acres)	2.5	$26.50
Corn (Bu)	4	$1.80
Supplement (lbs.)	50	$0.16
Hay (tons)	2.1	$67.00
Vet & health		$15.00
Mach & equip, fuel		$15.00
Marketing/misc		$20.00
Interest		9.0%
Labor	7.0	$6.00
Fixed cost per cow		
Mach, equip, fences		$27.00
Interest, insurance		$87.00
Bull deprec/repl		$10.00

Four alternative strategies

Steady size (SS): The producer retains the same number of heifers each fall to maintain the same sized cow herd year after year. This strategy is fairly common among cattle producers who have a fixed land base and manage the cow herd to match the land resource. The SS strategy is used as the baseline for comparison to the other strategies.

Cash flow (CF): This producer's objective is to maintain the same cash flow each year. All steer calves, cull cows and bulls are sold. Next, enough heifers are sold to reach the cash flow objective, and the remaining heifers are retained for the breeding herd. If there are not enough heifers to achieve the cash flow objective additional cows are sold to achieve the needed income. The annual cash flow is equal to the average annual cash flow of the SS strategy. When calf prices are high revenue from steer calf sales are higher, and more heifers are retained for the breeding herd. When calf prices are low, more heifers are sold to generate additional income and fewer heifers are retained.

Dollar cost averaging (DCA): This strategy follows the time-tested method for stock market investments in pension plans. The producer retains the same *dollar value* of heifers each fall. When calf prices are low the producer retains a higher number of heifers. When calf prices are high fewer heifers are retained. Because of the cyclical nature of cattle prices, the lower priced heifers tend to produce higher priced calves and vice versa. The annual amount of investment in heifers is equal to the average SS investment in heifers. Thus, over the 30-year period the same amount is invested in heifers, but the timing of the investment is different.

Rolling average value (RAV): The producer retains the 10-year average value of heifers each fall. The annual investment is equal to the 10-year average value of 21 head of heifers; the same numbers as the SS strategy. Like the DCA strategy, RAV uses the value of heifers based on prices to determine how many heifers to retain each year for the breeding herd.

Results and Discussion

Table 2 summarizes the animal inventories by strategy. The SS strategy retained 21 heifers each fall as designed. The DCA and RAV strategies kept an average of one more heifer than SS, but there was much greater variation from year to year. The range was from 15 to 43 a year for DCA and 13 to 33 for RAV. The CF strategy had the greatest variation in the number of heifers retained, zero to 55 head a year, and on the average it kept fewer heifers.

Table 2. Heifers retained, cows calving, and animal units by strategy, 1970-1999.

	Average	Minimum	Maximum	Ending
	Heifers retained per year			
SS	21	21	21	21
CF	15	0	55	0
DCA	22	15	43	21
RAV	22	13	33	23
	Number of cows calving per year			
SS	100	100	100	100
CF	85	32	144	32
DCA	106	86	138	104
RAV	100	91	120	120
	Annual animal units			
SS	159	152	170	170
CF	132	47	229	47
DCA	169	142	215	179
RAV	160	139	206	206

The number of cows calving was constant for the SS herd. RAV also calved an average of 100 cows, but had a range of 91 to 120 head. The DCA strategy averaged more cows calved, had a wider range in number calving, 86 to 138, and ended the 30 year period with four more cows than the SS herd. The CF herd averaged fewer cows calving and ended with the smallest herd.

The number of animal units (AU) is a measure of feed needs for the entire herd and reflects the inventory of all cattle. An AU is based on 1,000 pounds of body weight. Bred cows and heifers were assumed to have the same weight as cull cows sold. Virgin heifers weights were the cull heifer weight. Bulls were assumed to be 1.5 Aus, and calves were 0.3 AUs. Notice that the AUs in the SS herds increased over time reflecting the move to genetically larger cattle over the 1970-1999 time frame. There is much greater variation in AUs in the DCA, RAV, and CF strategies compared with the SS because of the variable investment decisions. It is assumed that the producer rents pasture by the AU rather than by the acre, which may be an important restriction. The analysis will address this issue later in the paper.

Table 3 shows the gross revenue and returns over economic and cash costs by strategy. The SS strategy generated average revenues of $43,676 and had the smallest range in revenue. DCA had the largest average revenue and the largest range in revenue. Most of the variation came on the upside with revenues as high as $96,218. CF had the lowest average revenue and had revenue as low as $14,002.

Table 3. Annual revenue, return over economic cost and return over cash cost, by strategy, 1970-1999.

	Average	Minimum	Maximum	Ending
	Total revenue			
SS	$43,676	$26,877	$64,707	$39,564
CF	36,417	14,002	65,081	14,002
DCA	47,374	24,710	96,218	41,773
RAV	43,853	22,504	75,119	49,221
	Return over total economic cost			
SS	-$1,817	-$16,332	$19,406	$545
CF	-924	-11,172	2,872	2,666
DCA	108	-21,146	37,465	1,740
RAV	-449	-17,577	27,792	3,097
	Return over cash cost			
SS	$4,869	-$7,861	$27,178	$5,900
CF	4,152	2,873	6,387	4,757
DCA	6,474	-14,900	48,054	7,135
RAV	5,581	-12,399	35,934	8,356

All of the strategies had a long-run average return over total economic costs near zero. Although disappointing, this result should not be surprising given the declining demand the beef industry suffered from 1980 through the late 1990s. Also, economic cost includes a payment to all resources used in the enterprise, including depreciation and interest on owners' equity. SS had the lowest average return and a range of more that $35,000 from the lowest year to the highest year. DCA had the highest average return, but the largest range of more than $58,000. CF had the smallest range in returns, but the lowest maximum. Also, note that the CF returns came in part from selling off the cow herd; the ending inventory in Table 2 was only 47 cows.

Return over cash costs more closely reflects the rancher's checking account and potentially his/her decision framework although this measure does not include debt service. DCA had the highest average cash return (33 percent over SS) and the widest range, near $63,000. RAV had the second highest average (15 percent over SS), a slightly higher minimum, but lower maximum. SS was next in the average and did have a higher minimum. CF had the lowest average return over cash cost (15 percent under SS), and was the most stable. However, the objective of the CF strategy was to produce a targeted level of cash flow each year. Although the model was not able to perfectly match the target each year, the cash flow was much more stable than the other strategies.

A stable, or at least predictable, cash flow is an admirable objective for producers and particularly for their lenders. Risk and risk management are important issues in agriculture. However, the variability or range in returns alone is not a good measure of risk. A more meaningful measure is the downside variation. How large are the losses and how long do they last? The DCA and RAV strategies' minimum was $7,000 and $4,500 less than the worst SS return, making them more risky. At least a portion of this lower cash return is due to retaining more heifers at low calf prices meaning there is less income and more expense from developing additional heifers at a time of low calf prices. Producers using one of these strategies with higher average returns must be financially prepared to weather periods of larger losses in order to be in a position for higher returns in the good years.

Another economic comparison of the strategies is to compare the change in net worth resulting from following each strategy over the 30-year period. Table 4 reports the accumulated cash over the 1970-1999 period and the value of the cattle inventory at the end of 1999. The accumulated cash results from returns over cash costs compounded annually at the annual real interest rate. As expected, the strategies with the largest returns over cash cost also had the largest increase in accumulated cash and herd net worth. Compared with SS, DCA had 34 percent higher accumulated cash and 30 percent higher herd net worth. RAV produced 21 percent higher accumulated cash and ended with 23 percent higher inventory value. CF ended with the least amount of cash and inventory value.

Given that the performance variables are the same for all strategies, where does the difference in returns come from? As is shown in Table 5, the DCA and RAV strategies sold more total cattle and at higher average prices than the SS and CF strategies because of the timing of investment in heifers. DCA sold more cattle than the other strategies, and CF sold the fewest. RAV sold about the same number of steers but fewer heifers and cows than SS. Cattle sold in the DCA strategy received a higher average price suggesting that it sold more cattle during the high price period of the cycle and fewer during the low price period than did the other strategies. This was particularly true of heifer prices. The RAV strategy was second highest on steer and heifer values.

Table 4. Accumulated cash and herd net worth, 1970-1999, by strategy.

	Accumulated cash	Value of inventory	Herd net worth
	Values at the end of 1999		
SS	$492,110	$70,846	$562,955
CF	383,853	15,576	399,429
DCA	659,843	74,308	734,150
RAV	596,510	86,974	683,484
	Compared to steady size		
CF	-22%	-78%	-29%
DCA	34%	5%	30%
RAV	21%	23%	21%

Table 5. Total animals sold and average value per head, by strategy, 1970-1999.

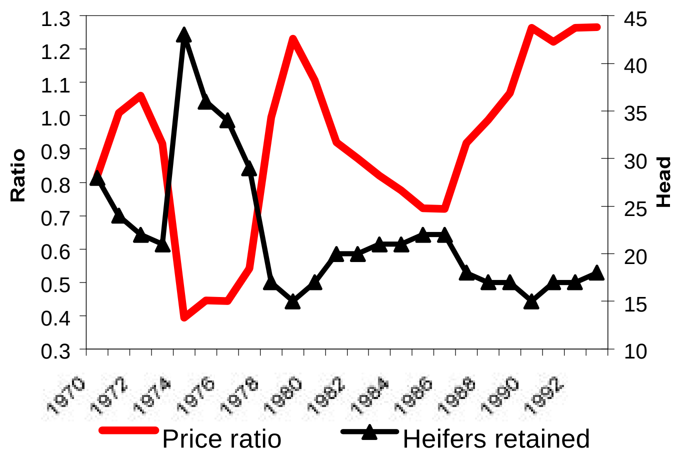
	Steers	Heifers	Cows
		Total number sold	
SS	1440	810	480
CF	1221	762	399
DCA	1532	858	503
RAV	1443	788	473
		Average value per head	
SS	468	370	534
CF	459	329	541
DCA	471	391	542
RAV	469	383	531

Another way to see the buy low, sell high concept behind the DCA strategy is shown in Figure 1. The vertical axis on the left is the price ($/cwt) of the heifer retained for the breeding herd divided by the 5-year average price of steer calves that would be produced by this heifer and sold 2 to 7 years later. The vertical axis on the right is the number of heifers kept for breeding each fall. The series ends with heifers kept in 1993 to reflect calves sold in year 7, 1999. Note that more heifers are kept in years that the heifer price is low relative to her offspring. Likewise, fewer heifers are kept when their price is higher than the calves they produce. This simple graph ignores the costs of developing the heifer and producing the calves, but it illustrates the idea of having a low cost asset producing large dividends.

Fixed land base

Most cow herds have a fixed land base rather than a flexible one as modeled above. The producer owns or rents a specific area of pasture (acres). Often this land base is difficult to increase or decrease, and if additional land is available it is often in "lumpy" proportions rather than one AU at a time. The SS strategy matches a fixed land base because it keeps the herd the same size each year. The DCA and RAV strategies have higher average returns and net worth growth, but vary the herd size and the required land base over the cattle cycle. If the land base is fixed are the returns to DCA and RAV still as high?

Figure 1. Retained heifer price as percent of offspring price and number of heifers retained.



Because it is not likely to be as profitable to under utilized pasture during part of the cattle cycle, a stocker enterprise was added to compare the DCA and SS strategies. The stocker operation adds flexibility to a fixed land base because the number of stockers purchased each spring can be adjusted to match available forage. If the cow inventory declines, more stockers are purchased. If the cow inventory increases fewer stockers are purchased.

The stockers were assumed to be purchased in April and sold in September at the monthly average price, respectively. It was also assumed that they gained 200 pounds during this period. The returns for this analysis were based on the change in grow value less $25 per head.

For the analysis including stockers it was assumed that the land base was fixed at 215 animal units. The SS heard maintains the same cow herd size and buys the same number of stocker cattle each year. (Note that the number of stockers purchased actually declines over time as animal size increases on a fixed number of acres, but changes in the SS herd are gradual.) The 215 AUs were chosen because this is the maximum herd size for the DCA strategy if no stockers are bought.

On the average, DCA calved more cows and purchased fewer stockers than did the SS herd (Table 6). As with the earlier analysis, the DCA enterprise produced higher average revenue and returns over total economic and cash costs (Table 7). However, the advantage was not as large with the fixed land base and stockers as it was with full land flexibility. The DCA generated returns over cash costs 22 percent higher than SS compared with 33 percent higher in the earlier analysis. An evaluation of accumulated cash and herd net worth showed similar results. DCA generated more wealth over the 30 years, but its advantage was only 22 percent higher than SS rather than 33 percent with a flexible land base.

Table 6. Number of stockers purchased and cows and heifers calving.

	Average	Min	Max	Last
		Stockers Purchased		
DCA	30	0	47	23
SS	36	29	41	29
		Cows and heifers calving		
DCA	106	86	138	104
SS	100	100	100	100

Table 7. Economic returns to the DCA and SS strategies with a stocker enterprise.

	Average	Min	Max	Last
		Total revenue		
DCA	49,393	22,860	96,461	44,005
SS	46,112	24,710	66,062	42,378
		Return over total cost		
DCA	1,585	-19,486	37,468	3,924
SS	-151	-15,455	19,669	3,334
		Return over cash cost		
DCA	7,931	-13,248	48,059	9,316
SS	6,511	-7,217	27,450	8,687
		Accumulated cash		
DCA	261,260	3,151	750,012	750,012
SS	218,248	5,099	615,598	615,598
		Herd net worth		
DCA	363,794	88,738	824,320	824,320
SS	314,588	88,383	686,443	686,443

This analysis suggests that the DCA and possibly the RAV strategies that factor cattle market prices into the heifer retention decision outperform the SS strategy even with a fixed land base if stocker cattle are purchased to utilize forage not needed by the cow herd. Although this analysis focused on the cowherd investment, and used stockers as a residual, operations with a larger stocker enterprise could use the same strategy to shift investment between cows and stockers over the cattle cycle.

Purchased cows or heifers

The analysis described previously was developed for producers retaining heifers rather than buying bred cows or heifers. Although the timing between the investment and the birth, production and sale of offspring is a year quicker with the purchase of bred females, the price sensitivity may be greater. This analysis valued retained heifer investment at cost of production plus heifer development expenses. As was seen by the large losses during the low price years, it is possible to buy heifers at less than the cost of production. Although there is not a good data series for bred female prices, there are clearly times when these animals can be bought for less than the cost to produce them. Likewise, there are times when the selling price has a substantial premium built into it. The DCA concept should guide a producer's investment decision for purchased females as well as it does for raised heifers.

The DCA and RAV concepts should also work for purchased open heifers. The decision of how many to retain was based on the market value, but the actual investment was based on the cost of producing the heifer. Actually buying the heifer at market value would reduce investment cost during low calf prices and increase investment cost during high calf prices and should result in at least as large, if not a greater, advantage to the DCA and RAV strategies.

Implications

The dollar cost averaging and rolling average strategies produced higher average annual revenue, higher returns over economic and cash cost, and greater accumulated cash and herd net worth than the other strategies. These results hold for producers who have a fixed land base if a stocker enterprise can be used as a shock absorber for excess forages because the size of the cow herd fluctuates based on investment decisions. However, producers who retain and develop more heifers when calf prices are low and produce more calves and retain fewer heifers when calf prices are high, also have greater variation in returns. Producers who implement these strategies must be prepared financially to weather wider swings in cash flow.

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