EXAMINING COST OF GAIN IN KANSAS FEEDLOTS

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Summary

This study had three primary objectives: 1) to examine the effects that individual performance and ingredient price factors have on cost of gain; 2) to quantify the annual and/or seasonal trend in cost of gain in Kansas feedlots; and 3) to examine the difference in cost of gain between steers and heifers. For both steers and heifers, corn price was significant and positive, indicating that as the price of corn increases so does cost of gain. The price of hay, which is a feedstuff in the majority of feedlot diets, has a positive, but insignificant, effect on feeding cost of gain. As average daily gain increased, predicted cost of gain decreased for both steers and heifers, but the result was only significant in steers. Death loss had a positive impact on cost of gain, but may be a more important factor when feeding steers. The trend over time was positive. Feed conversion is positive and highly significantly related to cost of gain for both steers and heifers. As feed conversion (feed/gain) increases, the cost of gain increases. There seems to be a significant negative trend over time in the difference between steer and heifer cost of gain, and the difference seems to be seasonal.

Introduction

Cost of gain has a direct impact on the profitability of cattle feeding, and there are many factors that affect profitability indirectly through cost of gain. Previous studies have demonstrated that corn price, feed conversion, and average daily gain explain the majority of variability in cost of gain. Other factors, such as length of the feeding period, yardage rates, etc., will impact feeding costs. In addition, factors such as death loss may or may not have a direct impact on cost of gain, but do have a direct impact on feed conversion, which could indirectly affect cost of gain. It is important for feedlots to understand these relationships and have an idea of their relative magnitudes so they are able to prioritize, focusing management attention on the most important factors to maximize profits.

In this study we examined cost of gain for a sample of feedlots in Kansas. Our objectives were to determine which factors significantly contribute to cost of gain, to quantify the seasonal trends, and to explore the differences between the cost of gain for steers and heifers.

Procedures

Data for this study were obtained from Kansas State University, Department of Animal Sciences, *Focus on Feedlot* report that is published monthly, dating back to the early 1980s. For the purpose of this study, the 1992 to 2004 time frame was used. The first year that the report recorded percentage of death loss was 1992. The survey was based on a consistent sample of approximately eight feedlots from the cattle feeding region of Kansas. All numbers are reported at closeout, and in-

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clude number of cattle, final weight, average days on feed, average daily gain, dry matter feed conversion (feed/gain), percentage of death loss, average cost per cwt of gain, projected cost of gain for replacement cattle, corn price, and alfalfa price. The reported figures are the mean of individual feedlot monthly averages. Corn and hay prices are the current inventory prices. The actual survey is conducted with each individual feedlot over the telephone. Our measure of “cost of gain” is an industry-accepted measure technically referred to as “feeding cost of gain,” which captures all costs except interest on a pay-weight in to pay-weight out basis. Adding interest cost results in a measure referred to as “total cost of gain.”

The analysis for this study was performed by estimating two generalized least squares regressions. The first regression model specified the natural log of cost of gain (LnCOG) as a function of a series of seasonal and time-period dummy variables, the natural log of corn and hay price (LnCORN, LnHAY), the natural log of average daily gain and feed conversion (LnADG, LnFCONV), the natural log of the percentage of death loss (LnDL), and a monthly time trend. The model was estimated separately for steers and heifers.

From the first regression, two questions can be examined. First, is there a seasonal trend in cost of gain? Second, do the independent variables have an effect on cost of gain? The base month for the monthly dummy variable is January, which cannot be included in the regressions for statistical reasons. The interpretation of the results is then relative to January closeouts. In addition, an extra time period (Nev) is included as a seasonal dummy variable. This dummy variable is for the time period of January 1993 through June 1993. This is a period of time when there were abnormal weather conditions, and many of the performance variables were more than two standard deviations from the mean. Previous studies have “dummied out” this same time period when examining feedlot performance. Corn and hay prices were lagged by a weighted average of prices over the previous five months because the data are by closeout month, such that the relevant price at closeout would be the price of corn and hay over the past five months. Average daily gain, feed conversion, and death loss are all measured at time t, the closeout month for the observation pen. The trend variable was used to examine a possible change over time in cost of gain. This trend will tell us if it has become more expensive to feed an animal from placement weight to closeout over the time period of the data set.

The second model was formulated by subtracting the heifer cost-of-gain data for each observation (month) from the steer cost-of-gain data, and regressing it against the time-trend variable, along with seasonal and time-period performance dummy variables. The purpose of this model is to explore differences in cost of gain between steers and heifers, and to determine if that difference has changed over time. In this model, the dependent variable is defined as the difference between the natural logs of steer cost of gain and heifer cost of gain for a particular time period (LnSCOG – LnHCOG).

All the regressions were corrected for autocorrelation by using the Cochrane-Orcutt method. For this reason, generalized least square regressions were used.

Results and Discussion

Tables 1 and 2 summarize the results of cost of gain for steers and heifers, respectively. Previous research has found that corn price (a proxy for all energy sources) has a major influence on cost of gain, and this research supports that conclusion. Because the model is estimated in log-log form, most of the coefficients can be directly interpreted as "elasticities". For example, for steers, a 1% increase in corn price will result in a 0.5744% increase in cost of gain, holding all else constant. The average corn price over the sample period was $2.83/bushel, and cost of gain was $53.12/cwt. A 1% increase in corn price would result in a corn price of $2.86/bushel. This three-cent increase in corn price causes the cost of gain to jump to $53.43. With respect to the heifers, the same 1% increase in the price of corn will result in average cost of gain going from $55.72/cwt to $56.02/cwt. This $0.30/cwt may not seem like much but, on average, the feeder would be increasing costs by $1.49 per steer and $1.33 per heifer with the 1% increase in the corn price (calculated by multiplying the change in cost of gain by the average weight gained). Furthermore, corn prices routinely change in very short time periods by much more that the 1% illustrated in this example. The price of alfalfa hay has a positive coefficient, but it is relatively small and not significant in impacting the cost of gain for either steers or heifers.

The results for average daily gain are different between steers and heifers. The coefficients for both are negative, but the average daily gain coefficient is significant for steers and not for heifers. For the steers, a 1% increase in average daily gain results in a 0.1789% decrease in cost of gain, holding all else constant. The average daily gain for steers is 3.30 lb/day, so the average daily gain after the 1% increase is 3.33 lb/day. The average cost of gain is $53.12, so, if it decreases by 0.1789%, the new value is $53.02. For every 0.03 lb/day increase in average daily gain, a producer, on average, saves an extra $0.10/cwt on feeding costs.

Dry feed conversion has a positive and significant coefficient, although a positive coefficient results in an economically detrimental effect on cost of gain. When feed conversion (feed/gain) increases, a producer must feed the animal more feed to get a pound of gain, and the cost of gain will increase. For steers, a 1% increase in feed conversion results in a 0.5942% increase in cost of gain, holding all else constant. To put this in perspective, if you have a 1% increase in feed conversion, 6.23 pounds of feed per pound of gain on average would increase to 6.29 pounds of feed per pound of gain. Cost of gain will go from $53.12/cwt to $53.44/cwt. For the heifers, a 1% increase in feed conversion results in a 0.6605% increase in cost of gain, holding all else constant. The average feed conversion for heifers is 6.45 pounds of feed per pound of gain. With a 1% increase, this would increase to 6.52 pounds of feed per pound of gain. This increase will cause cost of gain to go from $55.72/cwt to $56.09/cwt. This could have a significant impact on the profitability of a feeding program. The aforementioned examples would result in additional costs of $1.38 per steer and $1.78 per heifer.

Results from Tables 1 and 2 reveal that that there is a trend in cost of gain for both heifers and steers. When interpreted for heifers, this means that each additional year results in a 0.6% increase in feeding cost of gain (0.05% monthly trend multiplied by 12). This is a significant trend, but the magnitude is relatively small. The steer trend coefficient is also relatively small and is interpreted as each additional year resulting in a 0.48% increase in feeding cost of gain (0.04% monthly trend multiplied by 12). Recognizing that this trend exists will help feeders make adjustments in their break-even calculations when considering cattle-feeding programs.

The results in Tables 1 and 2 indicate that death loss is significant in the steer regression and not significant in the heifer regression. Although the magnitude of death loss seems to be small in our model, keep in mind that a small percentage change in death loss could have a significant impact on feeding cost of gain.

Results reported in Tables 1 and 2 reveal little significant seasonality when it comes to cost of gain, only a few months are statistically different from the base month of January. For steer closeouts, the months of June and July are statistically significant, with cost of gain being less in these two closeout months than in January. The most likely reason the model showed little seasonality is the use of the base month January. When looking at Chart 1 and 2, it is easy to see that there is seasonality in the data. January is more in the middle of the data as far as cost of gain is concerned. If another base month were used, there is a possibility that more of the months would be statistically significant. It could also be true that seasonality in cost of gain is being captured in average daily gain, feed conversion, or possibly in the price of corn. This would explain why many seasonal dummies are not statistically significant. The variable Nev is significant, meaning that cost of gain for heifers was higher during the early-1993 closeout time period than during the average January.

Table 3 summarizes the comparison of steers and heifers (the difference model) with respect to cost of gain. The primary variable of interest in this study is the trend variable. Results indicate that there is a significant trend over time in the difference between steer and heifer cost of gain. The coefficient is negative, so the difference in cost of gain has been increasing over time. Multiplying the monthly trend elasticity reported in Table 3 (0.02%) by 12 months/year reveals that the difference between steer and heifer cost of gain has been growing by an average of 0.24% per year. Monthly dummy variables were also included. All of the dummy variables are negative, indicating that other months (and the early-1993 time period) have a greater difference between steer and heifer cost of gain than the average January closeout period does.

When a feeder is evaluating cost of gain, which directly affects profitability, a few factors stand out as important considerations. From this study, the important factors are the two variables with coefficients that are significant and fairly big in magnitude. The feeder must be cognizant of the price of feed grains, and feed conversion, because both could play a significant role in their cost of gain. The cost of gain of steers and heifers individually does not seem to be seasonal with our model (perhaps because of the use of January as the base month or the possibility that other variables in the models are already capturing the underlying seasonality). The difference between the cost of gain of steers and heifers does have a seasonal component, however, a consideration for those feeders faced with the choice of feeding steers or heifers.

Table 1. Estimated log-linear results for feeding cost of gain for steers

Independent Variable	Coefficient	Standard Error	P-statistic
Constant	2.1743	0.2850	<0.01
LnCORN[1]	0.5744	0.0388	<0.01
LnHAY	0.0683	0.0445	0.12
LnADG	-0.1789	0.0699	0.01
LnFCONV	0.5942	0.0758	<0.01
Time (month)	0.0004	0.0002	0.09
LnDL	0.0142	0.0055	0.01
February[2]	0.0032	0.0050	0.53
March	-0.0005	0.0070	0.95
April	-0.0081	0.0095	0.39
May	-0.0202	0.0106	0.06
June	-0.0229	0.0095	0.02
July	-0.0214	0.0085	0.01
August	-0.0036	0.0083	0.67
September	0.0074	0.0080	0.35
October	0.0098	0.0074	0.19
November	0.0013	0.0065	0.05
December	0.0083	0.0048	0.08
Nev	0.0237	0.0132	0.07
RHO	0.8716	0.0394	<0.01

[1]LnCORN = Natural log of weighted average of previous five months corn prices in dollars per bushel.
LnHAY = Natural log of weighted average of previous five months hay prices in dollars per ton.
LnADG = Natural log of average daily gain in pounds per day, at time t.
LnFCONV = Natural log of dry feed conversion in pounds of feed per pound of gain, at time t.
Time (month) = Monthly trend, with 1 representing the first month of the data sample.
February through December = monthly dummy variables.
Nev = dummy variable for the time period of January 1993 through June 1993.
RHO = Coefficient that is used to correct for autocorrelation.
[2]The “January” dummy variable cannot be included directly in the model for statistical purposes (perfect multicollinearity). Therefore, all results are interpreted relative to the base seasonal period, January closeouts.

Table 2. Estimated log-linear results for feeding cost of gain for heifers

Independent Variable	Coefficient	Standard Error	P-statistic
Constant	1.9074	0.2638	<0.01
LnCORN[1]	0.5440	0.0409	<0.01
LnHAY	0.0835	0.0474	0.08
LnADG	-0.0870	0.0603	0.15
LnFCONV	0.6605	0.0663	<0.01
Time (month)	0.0005	0.0002	0.04
LnDL	0.0075	0.0051	0.15
February[2]	0.0051	0.0048	0.29
March	0.0058	0.0072	0.42
April	0.0007	0.0092	0.94
May	-0.0037	0.0098	0.71
June	-0.0115	0.0091	0.21
July	-0.0130	0.0087	0.13
August	-0.0008	0.0083	0.92
September	0.0075	0.0080	0.35
October	0.0079	0.0073	0.28
November	0.0072	0.0064	0.25
December	0.0030	0.0048	0.54
Nev	0.0341	0.0136	0.01
RHO	0.8843	0.0375	<0.01

[1]LnCORN = Natural log of weighted average of previous five months corn prices in dollars per bushel.
LnHAY = Natural log of weighted average of previous five months hay prices in dollars per ton.
LnADG = Natural log of average daily gain in pounds per day, at time t.
LnFCONV = Natural log of dry feed conversion in pounds of feed per pound of gain, at time t.
Time (month) = Monthly trend, with 1 representing the first month of the data sample.
February through December = monthly dummy variables.
Nev = dummy variable for the time period of January 1993 through June 1993.
RHO = Coefficient that is used to correct for autocorrelation.
[2]The "January" dummy variable cannot be included directly in the model for statistical purposes (perfect multicollinearity). Therefore, all results are interpreted relative to the base seasonal period, January closeouts.

Table 3. Estimated log-linear results for feeding cost of gain (data for steers minus heifers)

Independent Variable	Coefficient	Standard Error	P-statistic
Constant	-0.0143	0.0061	0.02
Time (month)[1]	-0.0002	0.0000	<0.01
February[2]	-0.0018	0.0060	0.77
March	-0.0081	0.0067	0.23
April	-0.0109	0.0069	0.11
May	-0.0290	0.0069	<0.01
June	-0.3831	0.0069	<0.01
July	-0.0370	0.0068	<0.01
August	-0.0349	0.6823	<0.01
September	-0.0279	0.0068	<0.01
October	-0.0217	0.0068	<0.01
November	-0.0068	0.0066	0.30
December	-0.0023	0.0060	0.70
Nev	-0.0303	0.0099	<0.01
RHO	0.2438	0.0779	<0.01

[1]Time (month)= Monthly trend, with 1 representing the first month of the data sample.
February through December = monthly dummy variables.
Nev = dummy variable for the time period of January 1993 through June 1993.
RHO = Coefficient that is used to correct for autocorrelation.
[2]The "January" dummy variable cannot be included directly in the model for statistical purposes (perfect multicollinearity). Therefore, all results are interpreted relative to the base seasonal period, January closeouts.

Chart 1: Cost of Gain (Steers)

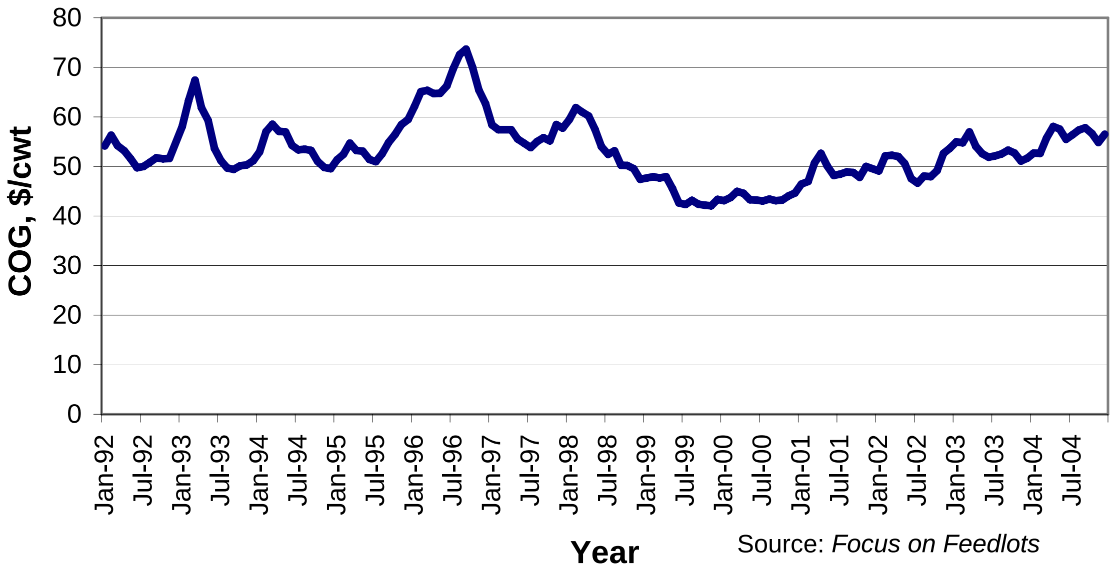

Chart 2: Cost of Gain (Heifers)