1993

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EFFECT OF SLAUGHTER CATTLE MARKETING METHOD ON THE PRODUCTION SIGNALS SENT TO BEEF PRODUCERS

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CATTLE 93-19

Summary

Data collected from 759 steer calves that were consigned to the South Dakota Retained Ownership Demonstration were utilized to examine the effect of slaughter cattle marketing methods on production signals sent to beef producers. Marketing systems examined included basing price on live weight (LW), dressed weight (DW), grade and dressed weight (G and Y), or Excel Corporation's proposed muscle scoring system (MS). Profitability per head averaged $6.64, $23.54, $26.00, and $27.09 for the LW, DW, G and Y, and MS marketing systems, respectively. For the LW pricing system, average daily gain, cost of gain, initial feedlot weight, and days fed accounted for 86.6% of the variation in profitability. For the DW pricing system, average daily gain, dressing percentage, cost of gain, initial feedlot weight, and days fed accounted for 92.9% of the variation in profitability. Average daily gain, dressing percentage, quality grade, cost of gain, and days fed accounted for 83.1% of the variation in profit for the G and Y marketing system. Average daily gain, dressing percentage, cost of gain, days fed, carcass fatness, quality grade, and rib eye area explained 75.6% of the variation in profitability for the MS pricing system. Only the MS pricing system rewarded production of muscle and penalized the production of carcass fat. Current fed cattle pricing systems used in the industry fail to transfer consumer demand for lean beef to beef producers.

Key Words: Feedlot Profitability, Retained Ownership, Value Based Marketing, Consumer Demand

Introduction

Research at the retail level has shown that consumers demand a leaner and more consistent cut of beef at a competitive price. Currently, an average of 88 pounds of excess fat is on each steer slaughtered in the United States adding up to over 2 billion pounds at a cost to the industry of about $2 billion annually. Excess fat production is stimulated by a marketing system that places the same value on trimmable fat as on edible lean.

Research has shown that, in 1979, 98% of the cattle in the Southern Plains and 82% of the cattle in the western corn belt were marketed on a live weight basis. The trend seems to be toward more cattle being marketed "in the beef" or grade and yield, but in 1986 still less than one-third of all cattle were marketed on a grade and yield basis. In the Southern Plains less than 10% of the cattle were marketed grade and yield.

The objective of this paper is to determine the production factors and/or carcass quality and cutability factors that are rewarded under various marketing methods. Four marketing methods are examined. They included 1) selling on a live weight basis, 2) selling on a carcass weight basis (in the beef), 3) selling on a dressed weight and grade basis (grade and yield), and 4) selling

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under a value based marketing system (Excel muscle scoring system[3]).

Materials and Methods

In October of 1990, 69 groups of 5 steer calves representing 53 producers and, in October of 1991, 84 groups of 5 steer calves representing 57 producers were placed on feed as part of the South Dakota State University Retained Ownership Demonstration Project. Initial data such as weight, hip height, and fat thickness[4] were measured and recorded for each of the steers. Producers filled out questionnaires concerning breed type and pre-feedlot arrival management. Age, sire breed, dam bred, and whether or not the calves were creep fed, vaccinated, or weaned for more than 5 days prior to feedlot arrival were recorded for each steer. Initial value for each steer was calculated using the following equations:

Price Fall 1990 ($/cwt) = 135.4826 - .06226 x pay weight

Price Fall 1991 ($/cwt) = 163.3314 - .1806 x pay weight + .000107 x pay weight^2

where pay weight equals feedlot arrival weight times 1.04. These equations were generated by regressing price on pay weight for feeder cattle auctions across South Dakota held in October of each year.

Cattle were fed at a custom feedyard[5] in Central South Dakota. Feeding management procedures were typical for commercial feedyards. Cattle were fed rolled corn and corn silage based diets in open pens that had windbreaks, mounds, fence-line feed bunks, and feeding aprons. Cattle were weighed full at 5 to 6-week intervals and feed intake for individual steers was calculated using body weight, daily gain, and ration energy density according to net energy equations.

The groups of five cattle were each marketed on a grade and yield basis when three steers out of each group of five were estimated to have over .4 in. of fat over the 12th rib. Opinions of South Dakota State University Beef Cattle specialists and the commercial feedyard operator were used to determine which groups of cattle were sold on a particular date. The choice market price and discounts for Select, Yield grade 4 ($10-12/cwt), heavy ($10/cwt) or light ($12/cwt) carcasses were negotiated with a commercial cattle buyer in a competitive market. The average live and dressed weight market prices for similar types of steers were obtained from Data Transmission Network Corporation for the western corn belt region for each marketing date. Prices were obtained for the value based marketing approach proposed by Excel Corporation by applying premiums and discounts to the choice and select carcass prices. Those premiums and discounts were a $2/cwt premium if fat thickness was less than .45 in. and rib eye area/cwt carcass weight exceeded 1.8 in.^{2}, $1/cwt discount if fat thickness was between .6 and .8 in. or if rib eye area ratio was between 1.4 and 1.7 in.^{2}, and $10/cwt discount if fat thickness was greater than .8 in. or if the rib eye ratio was less than 1.4 in.^{2}. Market prices for the various marketing methods are shown in Table 1.

Profit for each steer was calculated using prices generated for all four marketing techniques. Regression procedures were used to identify which variables best explained the variation in profit under each marketing method. Forward selection regression was used to partition the coefficient of determination (R^2) into a partial R^2 which measures the additional variation each variable is explaining as it is entered into the model.

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[3]Excel Corporation, Wichita, KS.
[4]Determined by ultrasound.
[5]R and L Feedyard, Kimball, SD

Table 1. Market prices (dollars per cwt) for the various marketing methods

Marketing date	Live weight	Dressed weight	Grade and yield	
			Choice	Select
First year 1991:				
April 10	80.00	127.50	130.00	125.00
May 2	78.75	125.50	129.00	122.00
May 8	78.00	124.00	128.00	120.00
May 9	78.00	124.00	128.00	120.00
June 20	72.00	115.00	119.00	111.00
Second year 1992:				
March 31	76.75	124.00	125.00	123.00
April 14	76.65	123.00	126.00	124.00
April 23	75.00	120.00	122.00	119.00
May 19	75.00	118.50	125.00	119.00

Results and Discussion

Table 2 displays the initial and feedlot performance data for the steers. Cattle averaged 547 lb at 204 days of age when they entered the feedlot. The variation in weight, frame, and age was tremendous. Straightbreds or crosses involving 23 breed types were utilized in the study.

Slaughter data for each steer are shown in Table 3. Steers averaged 1,123 lb, ranging from 804 to 1,406 lb. None of the carcasses exceeded 950 lb and thus were not subjected to heavy weight carcass discounts. Several carcasses, however, were penalized for being too light. Throughout the study, carcasses less than 550 lb were discounted $12 per cwt. Fat thickness averaged .44 in. and 65% of the steers had greater than .4 in. of fat cover, indicating that the slaughter endpoint objective was met.

Profitability of the cattle under each of the four marketing methods is shown in Table 4. Profits were estimated to be at the lowest level when cattle were marketed on a live weight basis. Under a live pricing system, the buyer must estimate grade, dressing percentage, cutability, and carcass defects or trim. It appears as if the price offered is low enough to protect the buyer from inaccurately estimating one or more of these factors.

Marketing cattle on a dressed weight basis was slightly less profitable than marketing grade and yield or according to a value based system. Buyers purchasing cattle "in the beef" do not need to estimate dressing percentage to establish price. Under grade and yield marketing or by purchasing cattle according to a value based marketing system, the buyer does not run the risk of inaccurately estimating grade, dressing percentage, cutability, or carcass trim. Therefore, prices offered for cattle may be higher than those offered under live or dressed weight pricing. However, the risk does not disappear. Risk of inaccurately estimating carcass value is transferred to the seller. As one moves from live pricing toward value based marketing, the variation in profit also increased. The variance in profit, an indicator of risk, was nearly twofold larger for grade and yield or value based pricing as for live pricing.

Results from the forward selection regression procedures are displayed in Table 5. For the live

Table 2. Initial and feedlot performance data for steers in the South Dakota Retained Ownership Demonstration

Variable	Average	Standard deviation	Minimum	Maximum
Initial height, in.	44.14	1.97	38.50	50.00
Initial fat, in.	.074	.039	.000	.200
Initial weight, lb	547	72	346	790
Initial age, days	204	20	145	293
Days fed	195	18	166	242
Average daily gain, lb	2.96	.36	1.54	4.16
Feed cost of gain, $/cwt	40.59	3.22	31.78	60.07
Total cost of gain, $/cwt[a]	54.43	4.53	41.77	93.48

[a]Includes feed, yardage, veterinary, interest on operating capital, death loss, trucking to slaughter, and marketing expenses. Excludes interest on the calf.

Table 3. Slaughter data for the steers marketed from the South Dakota Retained Ownership Demonstration

Variable	Average	Standard deviation	Minimum	Maximum
Live weight, lb	1123	104	804	1406
Hot carcass wt, lb	718	74	464	936
Dressing percent	63.89	1.91	57.39	70.43
Marbling score, units[a]	4.74	.59	3.00	8.00
Yield grade, units[b]	2.81	.68	.49	5.06
Fat thickness, in.	.44	.15	.10	1.10
Rib eye area, sq. in.	12.50	1.60	8.70	18.60
Rib eye area/100 lb carcass weight	1.74	.16	1.29	2.38

[a]4.00 = Slight^{0}, 5.00 = Small^{0}. Forty-one percent of the cattle graded low choice or higher.
[b]Calculated from fat thickness, hot carcass weight, kidney fat, and rib eye area.

Table 4. Mean profit ($/head) and the dispersion about the mean under each of the four marketing methods

Method	Profit	Variance	Minimum	Maximum
Live	6.64[c]	1206	-127.49	140.10
Rail	23.54[d]	1742	-129.95	130.97
G and Y[a]	26.00[e]	2594	-150.83	163.73
MS[b]	27.09[e]	2330	-147.16	185.90

[a]Grade and yield.
[b]Muscle score.
[c,d,e]Means in same column with different superscripts differ (P<.05).

weight pricing procedures, average daily gain explained 55.5% of the variation in profit. For every .1 lb increase in daily gain, profitability was predicted to improve by $3.23 per head. Total cost of gain came into the model second and explained an additional 20.5% of the variation in profit. Initial weight entered the model third and days fed entered fourth. These variables accounted for an additional 7.6 and 3.1% of the variation in profit, respectively.

Average daily gain accounted for 35.1% of the variation in profit and also entered the dressed weight pricing model first. However, dressing percentage entered the model second and explained an additional 37.5% of the variation in profit. Total cost of gain, initial weight, and days fed entered the model in that order and accounted for 11.48, 4.9, and 4.0% additional variation in profit, respectively.

Average daily gain and dressing percentage were the first and second variables entering the grade and yield pricing model and accounted for 29.2 and an additional 30.7% of the variation. Quality grade accounted for an additional 16% of the variation in profit. If a carcass graded choice or better, profit was improved by $38.91 per head as compared with carcasses grading select or lower. Total cost of gain and days fed were the fourth and fifth variables to enter the model and explained an additional 4.2 and 1.5% of the variation in profitability, respectively. Hot carcass weight was the final variable to enter and accounted for an additional 1.5% of the variation in profit.

For the muscle scoring system method of pricing, gain and dressing percentage entered the model first and second, accounting for 29.3 and an additional 27.2% of the variation in profit, respectively. Total cost of gain and days fed accounted for an additional 6.3 and 3.3% of the variation, respectively. The carcass traits of fat thickness, quality grade, and rib eye area were the next variables to enter the model explaining an additional 3.4, 5.0, and 1.0% of the variation, respectively. For each .1 in. of additional fat cover over the 12th rib, profitability was reduced by $5.72 per head. If a carcass graded choice or better, profit was improved by $23.48 as compared to carcasses grading select or lower. For each additional 1 $in.^2$ of rib eye area, profit improved by $4.47 per head.

These data clearly show that feedlot production variables are important contributors to profitability. However, their importance decreases as one moves from live pricing toward a value based pricing system. The muscle scoring system appears to do the best job of rewarding producers for high quality, lean beef production. It was the only pricing system that rewarded carcass muscling and penalized carcass fat. Under the grade and yield system, discounts are also applied to excessively fat carcasses. However, they are not applied until a carcass reaches a yield grade that is greater than 3.99.

Table 5. Summary of regression statistics for equations predicting dollars per head profit

Variable	Parameter	Standard deviation	Partial R^2
Live weight method, R^2 = .866:			
Intercept	209.80	12.41	
Average daily gain, lb	32.27	1.69	.555
Total cost of gain, $/cwt	-6.00	.15	.205
Initial weight, lb	.18	.01	.076
Days	-.35	.03	.031
Dressed weight method, R^2 = .929:			
Intercept	-709.54	17.31	
Average daily gain, lb	37.43	1.48	.351
Dressing percent	14.61	.24	.375
Total cost of gain, $/cwt	-5.63	.13	.114
Initial weight, lb	.17	.01	.049
Days	-.49	.02	.040
Grade and yield method, R^2 = .831:			
Intercept	-645.55	46.29	
Average daily gain, lb	26.48	4.71	.292
Dressing percent	12.62	.56	.307
Quality grade[a]	38.91	1.64	.160
Total cost of gain, $/cwt	-4.17	.25	.042
Days	-.70	.06	.015
Hot carcass weight, lb	.19	.02	.015
Muscle Scoring System, R^2 = .756:			
Intercept	-651.32	40.55	
Average daily gain, lb	44.26	3.39	.293
Dressing percent	13.53	.58	.272
Total cost of gain, $/cwt	-3.83	.23	.063
Days	-.77	.06	.033
Fat thickness, in.	-57.15	6.89	.034
Quality grade[a]	23.48	1.88	.050
Rib eye area, sq. in.	4.47	.84	.010

[a]Data entered as 0 = Select or lower, 1 = Choice or higher.

Average daily gain and days fed contribute to profitability in two ways. First, they have a direct effect on cost of gain. Rapid gains dilute out maintenance feed costs and lead to reduced days on feed. Fewer days on feed generally result in less yardage and interest costs accruing against the cattle. The second area that gain and days fed play a role is in determining market price. In the first year of this study prices were higher when cattle first started going to market. Prices declined significantly by the final marketing date. In both years of this study, the choice-select price margin widened at later marketing dates. Cattle having heavier initial weights, rapid gain, and reduced days on feed generally received greater market prices at slaughter and were thus more profitable.

In order to gain insight on how the decreasing market may have impacted the regression analysis, average prices for all of the cattle were calculated and the analysis was run again. Prices used were $76.55 and $122.13 per cwt for the LW and DW marketing methods, respectively. Base choice and select prices used for the G and Y and MS marketing systems were $125.66 and $120.45. A discount of $12 per cwt was applied for light, heavy, or yield grade 4 carcasses for the G and Y method. The same premiums and discounts that were used previously for the MS system were used again.

Table 6 displays the results from the regression analysis after the influence of the declining slaughter cattle market was removed. When variations in market price associated with time are removed, each model explains a higher percentage of the variation in profit. The R^2 is improved by 6.7, 3.6, 8.3, and 16.7 units for the LW, DW, G and Y, and MS marketing methods, respectively.

For the LW method, average daily gain continues to be the most important factor explaining profitability. Over 70% of the variation in profitability is explained by daily gain. For each .1 lb improvement in gain, profit improves by $6.43 per head. Previously, days fed was negatively related to profit (regression coefficient = -.35) and only explained 3.1% of the variation. Days fed are now positively related to profit and account for 15.2% of the variation. For each additional day on feed, profit is improved by $.54 per head. Additional days on feed, provided cattle are continuing to gain weight rapidly and convert feed efficiently, tend to dilute out costs such as veterinary expenses, death loss, marketing expenses, trucking, and the initial calf costs over more pounds of gain, therefore improving profitability.

Previously, average daily gain also was the first variable to enter each of the marketing methods where carcass prices were used. When the variation associated with the declining market is removed from the data, hot carcass weight is the first variable to enter the model. The importance of daily gain is greatly reduced. Partial R^2 for gain is reduced from .351 to .054 for the DW marketing method model and gain does not account for any of the variation in profit for the G and Y and MS marketing method models. Initial weight explains an additional 33.0, 22.9, and 23.7% of the variation in profit for the DW, G and Y, and MS marketing methods, respectively. For each additional pound of initial weight, profit is reduced by $.21, $.33, and $.36 per head for the DW, G and Y, and MS systems, respectively. For cattle with lighter starting weights, maintenance energy requirements are less and are diluted out over more pounds of total gain, thus improving profit.

Dressing percentage is a significant source of variation for only the G and Y and MS pricing methods. However, the partial R^2 is considerably lower than what it was previously (.047 and .047 vs .307 and .272 for G and Y and MS, respectively). For the DW pricing method, hot carcass weight is positively related to profit (partial R^2 = .489) and finish weight is negatively related to profit (partial R^2 = .069). Hot carcass weight divided by finish weight define dressing percentage. Therefore, dressing percentage is being rewarded by this marketing method.

Carcass quality grade appears to be slightly more important for G and Y and MS systems

Table 6. Summary of regression statistics for equations predicting dollars per head profit assuming a stable slaughter cattle market

Variable	Parameter	Standard deviation	Partial R^2
Live weight method, R^2 = .933:			
Intercept	-180.27	7.18	
Average daily gain, lb	64.34	1.91	.702
Days fed	.54	.02	.152
Total cost of gain, $/cwt	-2.02	.07	.079
Dressed weight method, R^2 = .965:			
Intercept	-79.39	5.45	
Hot carcass weight, lb	1.20	.01	.489
Initial weight, lb	-.21	.01	.330
Finish weight, lb	-.56	.01	.069
Average daily gain, lb	28.97	1.20	.054
Total cost of gain, $/cwt	-1.85	.08	.024
Grade and yield method, R^2 = .914:			
Intercept	-489.51	18.77	
Hot carcass weight, lb	.54	.01	.414
Initial weight, lb	-.33	.02	.229
Quality grade[a]	37.97	1.07	.181
Dressing percent	7.32	.33	.047
Total cost of gain, $/cwt	-1.97	.16	.031
Days fed	-.35	.03	.013
Muscle Scoring System, R^2 = .923:			
Intercept	-458.36	17.70	
Hot carcass weight, lb	.55	.01	.419
Initial weight, lb	-.36	.01	.237
Quality grade[a]	37.22	1.03	.139
Dressing percent	7.71	.31	.047
Fat thickness, in.	-68.91	3.37	.031
Total cost of gain, $/cwt	-2.02	.15	.034
Days fed	-.42	.03	.018

[a]Data entered as 0 = Select or lower, 1 = Choice or higher.

once market price decline is removed from the data. Fat thickness accounted for an additional 3.1% of the variation in profitability for the MS system. As fat thickness increased by .1 in., profitability was reduced by $6.89.

Implications

As more calves and fewer yearlings continue to be placed on feed, seasonal patterns in slaughter cattle prices will likely continue with the high price perhaps occurring in April. Therefore, feedlot production variables of average daily gain and days fed will continue to be important determinants of profitability. If the feedlot owns the cattle, perhaps selling on a live basis is warranted as feedlot production variables are rewarded to the exclusion of carcass quality and cutability. For retained ownership cattle, selling according to a value based marketing system is warranted if the cow-calf producer has successfully selected for carcass merit as part of the breeding program. Since most cattle are sold on a live basis and selling on a live basis rewards feedlot production, it is understandable that most beef producers have to date concentrated their efforts on growth rate and related traits. Current slaughter cattle pricing methods favor the production of excess fat and do not transmit the desire of the consumer for lean beef to the producer. Of the four methods examined in this paper, only the MS method discouraged fat production. A value based marketing system is needed before beef producers will seriously consider producing the consistent and lean product apparently desired by consumers. The current yield grade system may work if the appropriate premiums are paid for yield grades 1 and 2 cattle and discounts are assessed for yield grades 3.6 or greater.