Strategies for Optimizing Value of Finished Cattle in Value-Based Marketing Grids

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Summary

Performance and carcass data from 624 steers in three experiments were used to evaluate potential strategies that might be used with incoming feeders to remove animals that produce low value carcasses when cattle are sold in a value-based grid. Removing 10% of the carcasses with the lowest net value from each group increased the overall average net value of the remaining carcasses $17.50 to $21.09. Carcass weight was found to be the most significant factor determining net value of the carcass. Gain of the steers during the first 3 to 5 weeks of the feeding period was significantly related to average final gain and carcass value, but accounted for a small portion of the overall variation in gain or carcass value. Use of initial gain was successful in identifying ten of the sixty-four carcasses with least net value in a value-based grid. Adding frame score and measurement of initial thickness of backfat along with initial gain did not significantly improve identification of the low-value carcasses. Sorting the steers as feeders based on frame score and initial thickness of backfat resulted in differences in performance and carcass measurements. The low-value carcasses tended to be concentrated in the smaller-framed steers.

Introduction

Marketing finished cattle in value-based grids results in premiums being paid for some carcasses and discounts being applied to others. In most loads of cattle removing the bottom 10% of the carcasses with the least value significantly improves the economic value of those remaining. In many grids carcasses are discounted because of inadequate marbling, too much fat or age, and for heavy and light carcasses. If cattle were sorted either as feeders or shortly before marketing it might be possible to reduce the number of carcasses that are discounted. The practical options for sorting cattle are visual appraisal, weighing, physical measurements such as hip height, performance during the first month, or use of technology such as ultrasound for evaluation. One objective of this report was to determine the benefits of sorting feeder cattle based on frame size established from hip height and known birthdays and initial backfat as measured by ultrasound. A second objective was to compare the gain of steers during the first three to five weeks with gain over the total finishing period and with carcass measurements. A third objective was to relate measurements of feeder cattle with gain and carcass parameters of significance in value-based marketing grids.

Methods

Two groups of Angus steers were sorted as feeders in this study. Group I consisted of steers with known birthdays (180 head) purchased in late October as calves from two joining ranches with an average weight of 610 lbs. A few light steers from these herds were not purchased in the group. The calves had not been weaned and were fed hay and some grain during the first two weeks. Whole plant corn silage was then introduced into the ration, and the feed was changed over the course of six weeks to the finishing ration. In early December, hip height was determined with a calibrated tape measure fastened in the top of the restraining chute and backfat was measured with ultrasound. The calves were sorted into smaller, medium and larger frame scores as calculated from hip height and age using the Beef Improvement Federation equation for heifers. Within each frame score the calves were sorted into two groups with more or less backfat. These steers were implanted with Ralgro while nursing, then implanted with Component E-S on January 15, and reimplanted with Component ET-S 100 days later. The steers were fed the finishing ration an average of 186 days. These steers were sold in two groups on June 16 and 23.

Group II steers with known birthdays (180 head) and with an average weight of 825 lbs. were purchased from one ranch in February. The calves were sorted from a large group of steers based on groups to represent sires rather than uniformity of weight or frame score. In early March hip height and thickness of backfat were measured as described, the steers were sorted into three frame scores, and each frame-size was divided into two groups with more or less backfat. These steers were early weaned (about five months of age), were not castrated until after weaning, and had not been implanted. They were implanted with Revalor-S on March 31. These steers were fed an average of 115 days and were sold June 24 through July 7. Finishing diets for both groups of Angus steers contained on a dry basis 77 % rolled corn, 12% corn silage and 11% supplement. The ration contained Rumensin® at 30 g/ton. All the steers were fed in groups of six per pen.

Group III steers were of mixed breeding (264 head) and were purchased from a backgrounding yard in July at an average weight of 900 lbs. The steers were sorted from a larger group of steers to improve the uniformity of weight. The implant history of these steers was not known. They were implanted with Revalor-S or Component ET-S and allotted to pens (six steers per pen) from outcome groups based on weight. These steers were initially fed a diet containing on a dry basis 81% rolled corn, 6% corn silage, 3% chopped grass hay and 10% supplement containing Rumensin® to provide 30 g/ton in the complete feed. After 64 days, chopped hay replaced corn silage; therefore 8.4 parts chopped grass hay and 91.6 parts corn and supplement were fed until the steers were finished. The steers were fed 107 days and sold November 4.

All the cattle were sold at commercial beef packing plants. The carcasses from the first two groups were chilled for 48 hours prior to being graded by a federal grader. The carcasses of the third group were chilled for 24 hours before being graded, but some of the carcasses were held an additional 24 hours and were regraded. Thickness of backfat was measured and ribeyes were traced on acetate paper between the 12^{th} and 13^{th} ribs. Yield grade was calculated using the standard equation.

One group of Angus steers was sold on a grid, and the other group was sold with an "in the beef" bid. However for comparative purposes the value of each steer in both groups was calculated using the grid that follows: a par price of $108.25 for Choice Y 3A carcasses; yield grade premiums and discounts of $3.50 for 1, $3.00 for 2A, $2.50 for 2B, -$1.00 for 3B, and -$15.00 for 4; quality grade premiums and discounts of $4.00 for Prime, $2.00 for certified Angus, -$12.25 for Select, and -$15.00 back of Select for Standard; and carcass weight discounts of $8.00 for 950 to 999 lbs, $30.00 for over 1,000 lbs and $15.00 for 500 to 549 lbs. The group of mixed steers was sold as one group on the following grid: a par price of $114.00 for Choice Y 3 carcasses; yield grade premiums and discounts of $2.00 for 1, $1.00 for 2, and -$15.00 for 4; quality grade premiums and discounts of $5.00 for Prime, $2.00 for certified Angus, and -$13.00 for Select, and carcass weight discounts of $30.00 for over 950 lbs.

Pen means were used as the experimental unit in the statistical analysis to evaluate the effectiveness of sorting the Angus steers as feeders. Data were analyzed by analysis of variance. Treatment means and probabilities of difference due to sorted group are presented in Tables 4 and 5. The relationships of initial gain or other measurements with overall gain or carcass value were evaluated by regression analysis of data from individual steers. The regression equations and probabilities of significance are presented in Tables 1, 2 and 3. Linear regression equations were $y = a + bx$, and multiple regression equations were $y = a + bx + cz$, where a = a constant, b and c = regression coefficients or rate of change in y related to changes in x and z, x and z = independent variables and y = a dependent variable.

Results

The relationships of net economic value of individual carcasses with various carcass measurements are given in Table 1. Based on the grid used it is not surprising that carcass weight, marbling, and yield grade (or thickness of backfat and area of ribeye) each significantly contributed to net carcass value. Of these independent variables, carcass weight accounted for most of the variation in economic value of the carcass. Adding marbling and yield grade in the equation slightly improved the relationship (correlation coefficient).

The analysis in Table 1 suggests that increasing cattle gain should have the greatest impact on net carcass value. Beginning weights, frame score, thickness of backfat and initial gain were measured on the steers in Groups I and II. Beginning weight and early gain were measured on the steers is Group III. The relationships of these initial measurements with overall gain of the steers in the three groups are shown in Table 2. Early gain was significantly related to overall gain of steers in each of the studies, but accounted for only a small portion of the variability in gain (correlation coefficient significantly less than 1). Initial gain alone seemed to account for more of the variation in total gain of the older steers (Groups II and III) compared with the younger steers (Group I). Adding starting weight to the equation did not improve the prediction of total gain. Adding frame score tended to be significantly related to gain. Adding a measure of initial backfat thickness was significant for Group I steers but not for Group II.

Early gain of steers in the feedlot was not highly correlated with carcass quality or yield grade measurements that are important in establishing value in value-based grids (Table 3). In several comparisons the regression coefficients were significant, but there were no consistent trends among the three groups of cattle. Early gain was significantly related to net carcass value in each of the three groups because of the positive relationship of early gain with overall gain and consequently carcass weight. However early gain accounted for a limited portion of the variation in net value (low correlation coefficient). Early gain seemed to be more significantly related to net carcass value of the older steers in Groups II and III compared with the steers in Group I.

The average net value of the carcasses from Group I was $870.50. The value of the lowest 10% ranged from $431.65 to $754.35. Removing these from the group increased the average value of the remaining carcasses to $891.59. Using the initial 28-day gain to predict net carcass value (equations in Table 3) identified two of the low value carcasses. For groups II and III, respectively, average net value, range of low 10%, average carcass value with low 10% removed, and number of low value carcasses identified with use of early gain were $835.79 & $897.34; 324.60 to $742.60 & $552.6 to 783.83; $856.52 & $914.83; and 2 & 6. The highest valued carcasses in each respective group were $1,084.65, $1,041.18 and $1,036.20. Addition of the measures of initial backfat or frame score did not improve identification of the low-value carcasses in Groups I and II.

The effects of sorting steers in Groups I and II at the beginning of the feeding period on performance and carcass measurements are summarized in Tables 4 and 5. Sorting on frame score resulted in differences in starting and ending weights but no difference in rate of gain. The larger framed

Table 1. Multiple regression equations relating total dollar value of individual carcasses with carcass measurements.[a]

Equation	Constant	---------------Independent variable---------------					--R[b]--
		Carcass wt	Marbling	YG	BF	REA	
Group I							
1	**-12.677**	**1.067**					**.777**
	.814	.001					
2	**74.473**	**1.019**	**.258**	**-50.683**			**.856**
	.106	.001	.001	.001			
3	**-68.293**	**.840**	**.263**		**-138.036**	**14.920**	**.856**
	.171	.001	.001		.001	.001	
Group II							
1	**-77.558**	**1.186**					**.849**
	.074	.001					
2	**-45.867**	**1.269**	**.167**	**-57.193**			**.904**
	.199	.001	.001	.001			
3	**-189.996**	**1.141**	**.171**		**-190.471**	**12.710**	**.913**
	.001	.001	.001		.001	.001	
Group III							
1	**-82.773**	**1.218**					**.747**
	.126	.001					
2	**-180.028**	**1.166**	**.357**	**-6.960**			**.851**
	.001	.001	.001	.085			
3	**-188.382**	**1.176**	**.367**		**-53.248**	**-.158**	**.854**
	.001	.001	.001		.011	.942	

[a]The net value of the carcasses can be predicted from the equations shown in bold print. The probability of each constant or regression coefficient being different from zero is shown in the line below each equation. Probability less than .05 is statistically significant.
[b]Correlation coefficient, 1 = perfect fit, 0 = no relationship between dependent variable and independent variable(s).

steers consumed more feed and used feed less efficiently for gain. Larger framed steers had heavier carcasses with larger ribeyes but no significant differences in thickness of backfat, marbling or quality and yield grades. Sorting the steers as feeders based on thickness of backfat resulted in the fatter steers having slower rates of gain. The fatter steers in Group I consumed less feed whereas those in Group II consumed the same amount of feed as the steers with less fat and were therefore less efficient. The steers with more initial backfat had more backfat at the end of the trial and tended to have fewer yield grade 1 and 2 and more yield grade 4 carcasses. The steers with more initial backfat in Group I did not finish with more marbling or higher average quality grades. The steers in Group II with more initial backfat finished with more marbling and an increased number of Prime carcasses. In Group I the steers with less initial backfat had a greater average net value per carcass, primarily because of heavier carcass weights and somewhat improved quality grades. Group II steers with less initial backfat had somewhat heavier carcasses with superior yield grades but poorer quality grades, and, therefore, on the average had an $8.20 per carcass advantage. Of the 18 carcass with the lowest net value in Group I, 11, 5 and 1 were in the smaller, medium and larger frame groups, respectively. Of the 18 carcass with the lowest net value in Group II, 16, 1 and 1 were in the smaller, medium and larger frame groups, respectively.

In this analysis of performance and carcass data from 624 steers, removing 10% of the carcasses with the lowest net value from each group increased the overall average net value of the remaining carcasses $17.50 to $21.09. Gain of the steers during the first 3 to 5 weeks of the feeding period was significantly related to average final gain, but accounted for a small portion of the overall variation in gain. Use of initial gain was not successful in identifying the carcasses with least net value in a value-based grid. Sorting the steers as feeders based on frame score and initial thickness of backfat resulted in differences in performance and carcass measurements, but use of these two measurements along with initial gain did not significantly improve identification of the low-value carcasses. The low-value carcasses however tended to be concentrated in the smaller-framed steers.

A successful management strategy might be to feed the steers with more initial backfat fewer days to improve feed efficiency and to improve yield grade if the cattle are to be sold in a grid paying premiums for yield grade. For the smaller framed cattle, which seemed to include more of the lesser value carcasses, it might be beneficial to use management strategies to increase carcass weight such as prolonged backgrounding period prior to finishing and a more aggressive implant program.

Implications

If 10% of carcasses with the least value could be removed, the value of the remaining carcasses increases about $20 per animal. Rate of gain during the first three to five weeks of the finishing period is related to overall rate of gain and carcass value, but does not accurately identify the animals that produce low value carcasses.

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Table 2. Multiple regression equations relating daily gain with measurements taken from cattle at the beginning of the finishing period.[a]

Equation	Constant	---Coefficient of independent variable---				---R [b]---
		Early gain	Start wt	Frame score	Back fat	
Group I						
1	**3.014**	**.135**				**.253**
	.001	.001				
2	**2.675**	**.130**	**.000534**			**.267**
	.001	.001	.248			
3	**2.68**	**.124**		**.0795**	**-2.309**	**.382**
		.001		.037	.001	
4	**2.688**	**.119**	**.000616**	**.0484**	**-2.601**	**.389**
		.002	.285	.311	.001	
Group II						
1	**2.140**	**.294**				**.536**
	.001	.001				
2	**1.424**	**.291**	**.00084**			**.542**
	.013	.001	.201			
3	**1.582**	**.285**		**.0957**	**.296**	**.547**
	.001	.001		.098	.659	
4	**1.337**	**.284**	**.000407**	**.0813**	**.188**	**.548**
	.021	.001	.588	.201	.789	
Group III						
1	**2.693**	**.252**				**.519**
	.001	.001				
2	**2.218**	**.252**	**.000527**			**.523**
	.001	.001	.258			

[a]Average daily gain of the steers can be predicted from the equations shown in bold print. The probability of each constant or regression coefficient being different from zero is shown in the line below each equation. Probability less than .05 is statistically significant.
[b]Correlation coefficient, 1 = perfect fit, 0 = no relationship between dependent variable and independent variable(s).

Table 3. Regression equations relating selected carcass measurements (dependent variable) with initial gain (independent variable).

--------Variable-------- Dependent	Independent	Constant	---P [a]---	Slope	---P [a]---	---R [b]---
Group I						
Dressing %	Gain, 28 d	62.5	.001	.361	.044	.151
Marbling	Gain, 28 d	367.1	.001	29.070	.011	.189
Back fat	Gain, 28 d	.404	.001	.0288	.052	.146
Ribeye area	Gain, 28 d	12.66	.001	.0573	.661	.033
Yield grade	Gain, 28 d	2.77	.001	.158	.006	.204
$/carcass	Gain, 28 d	786.215	.001	24.593	.038	.155
Group II						
Dressing %	Gain, 22 d	63.2	.001	.192	.098	.125
Marbling	Gain, 22 d	531.3	.001	8.525	.365	.068
Back fat	Gain, 22 d	.518	.001	.00988	.328	.074
Ribeye area	Gain, 22 d	11.47	.001	.281	.001	.300
Yield grade	Gain, 22 d	3.18	.001	.0379	.296	.079
$/carcass	Gain, 22 d	744.771	.001	30.736	.001	.363
Group III						
Dressing %	Gain, 35 d	62.2	.001	-.053	.531	.039
Marbling	Gain, 35 d	398.8	.001	9.604	.125	.095
Back fat	Gain, 35 d	.348	.001	.00237	.796	.016
Ribeye area	Gain, 35 d	13.45	.001	.0797	.396	.052
Yield grade	Gain, 35 d	2.29	.001	.0476	.285	.066
$/carcass	Gain, 35 d	814.245	.001	16.746	.001	.289

[a]Probability less than .05 is statistically significant.
[b]Correlation coefficient, 1 = perfect fit, 0 = no relationship between dependent variable(s) and independent variable.

Table 4. Performance and carcass data of steers in Group I in relation to sorting on frame size and initial thickness of backfat.

	--------Frame--------			-----Backfat-----		-----P [a]-----	
	Smaller	Medium	Larger	Less	More	Frame	Backfat
Initial frame score	5.0	5.5	5.9	5.6	5.2		
Initial backfat, in	.10	.12	.12	.08	.14		
Starting wt, lbs	601	667	737	666	671		
Ending wt, lbs	1228	1293	1378	1320	1280		
Days fed finishing diet	183	183	183	186	180		
Gain, lbs/d	3.43	3.42	3.50	3.52	3.39	.539	.049
Feed intake, lb DM/d	19.5	21.0	22.3	21.4	20.4	.001	.007
Feed/gain	5.68	6.14	6.37	6.09	6.03	.001	.545
Carcass wt, lbs	776	827	881	844	811	.001	.009
Dressing percentage	63.1	64.0	63.9	64.0	63.4	.160	.065
REA, sq in	12.3	12.6	13.3	12.9	12.6	0.001	0.12
Backfat, in	0.47	0.52	0.51	0.47	0.53	0.11	0.005
Marbling[b]	454	457	479	475	452	0.64	0.33
Quality grades							
Prime	2		1	3			
Choice	45	48	52	77	68		
Select	11	11	7	8	21		
Standard	2			1	1		
Certified Angus Beef	11	10	15	20	16		
Yield grades							
1	1			1			
2	29	19	17	36	29		
3	27	33	36	47	49		
4	3	7	7	5	12		
Avg calculated YG	3.13	3.34	3.37	3.21	3.35	.195	.335
Grid value, $/head	821.02	854.54	921.43	891.54	839.78		

[a]Probability that treatment means are different. Statistical difference is achieved when the probability is 0.05 or less.
[b]Marbling score of 300 = Small^0, 400 = Modest^0, etc

Table 5. Performance and carcass data of steers in Group II in relation to sorting on frame size and initial thickness of backfat.

	--------Frame--------			-----Backfat-----		-----P [a]-----	
	Smaller	Medium	Larger	Less	More	Frame	Backfat
Initial frame score	4.6	5.2	6.1	5.3	5.3		
Initial backfat, in	.24	.25	.26	.20	.30		
Starting wt, lbs	828	859	895	847	874		
Ending wt, lbs	1178	1210	1248	1219	1205		
Days fed finishing diet	118	114	114	118	112		
Gain, lbs/d	3.03	3.13	3.15	3.21	3.00	0.53	0.03
Feed intake, lb DM/d	19.7	20.7	22.1	20.9	20.8	0.001	0.95
Feed/gain	6.56	6.63	7.05	6.52	6.97	0.08	0.02
Carcass wt, lbs	750	775	805	781	772	0.001	0.37
Dressing percentage	63.5	64.0	64.5	63.9	64.2	0.06	0.40
REA, sq in	12.0	12.4	12.5	12.6	12.9	0.08	0.001
Backfat, in	0.55	0.56	0.57	0.50	0.62	0.78	0.001
Marbling[b]	584	578	571	531	625	0.91	0.002
Quality grades							
Prime	8	12	11	9	22		
Choice	48	46	42	72	64		
Select	2		7	6	3		
Standard	1			1			
Yield grades							
1			1	1			
2	20	14	18	36	16		
3	36	39	32	47	60		
4	3	5	9	4	13		
Avg calculated YG	3.23	3.31	3.34	3.10	3.49	0.88	0.001
Grid value, $/head	793.31	855.21	858.79	839.91	831.71		

[a]Probability that treatment means are different. Statistical difference is achieved when the probability is 0.05 or less.
[b]Marbling score of 300 = Small^0, 400 = Modest^0, etc