Impact of Alternative Grid Pricing Structures on Cattle Marketing Decisions

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Practitioner's Abstract

Quality grade, yield grade, and other feedlot performance factors explain much of the variation in profit under grid pricing. Thus, feedlot owners can change profits by adjusting time on feed to influence these performance factors. This research uses growth models, logistic regression, and an optimization process to determine how the optimal number of days on feed changes under different grid pricing structures. It was found that large quality or small yield discounts increases the optimal number of days on feed and small quality or large yield discounts result in fewer days on feed. Losses associated with a grid having large quality discounts are minimized as cattle fed for more days are able to obtain Choice premiums despite the discounts for more Yield Grade 4 and 5 carcasses. Given small quality discounts, cattle fed for a shorter length of time can obtain the Yield Grade 1 and 2 premiums without a large loss in revenue due to grading Select or Standard. Under cash pricing, cattle are fed for very long periods because there are no discounts applied to the carcasses and, therefore, the more weight they gain, the more revenue they generate. During periods of low feed prices, cattle can be fed longer so more cattle grade Prime but also have more Yield Grade 4 and 5 cattle.

Keywords: grid pricing, profits, animal growth, logistic regression, days on feed.

Introduction

Between 1980 and 1995, the percentage of cattle marketed on a carcass basis increased from 29% to more than 46% (Grain Inspection, Packers and Stockyards Administration). Fewer cattle are being sold on a pen basis for an average price. Rather, a price per hundredweight of carcass weight is computed for each individual animal and the price received is dependent on specific carcass characteristics. Therefore, decisions relating to the marketing of slaughter cattle have become more complex.

Grid pricing applies premiums and discounts to a base price given carcass weight, quality grade, and yield grade. However, the length of time a given pen of cattle is on feed affects weight, quality grade, and yield grade. Weight, both live and carcass, increases with days on feed. Thus, the probability of receiving a discount for a heavy carcass increases with days on feed. Length of time on feed will have a positive effect on quality grade. The longer an animal is on feed, the more likely it is to grade Choice or Prime and the more likely it is to acquire a premium. A negative relationship exists between yield grade and days on feed. An animal is more likely to achieve a Yield Grade 4 or 5 and a discount as days on feed increases. However, it is important to note that the larger premiums received from quality grade increases may not affect the premium losses and discounts associated with simultaneous yield grade declines. Additionally, the longer cattle are on feed, the less efficient they become at converting feed into weight gains.

Given the quality grade and yield grade trade-off and the steady increases in the cost of gain per pound, the total effect of added days on feed under grid pricing is dependent upon a rather complex set of relationships between weight, feeding costs, and the grid premiums and discounts for quality and yield grades.

Given differences in age, frame size, and genetics/breed, cattle have different biological endpoints to which it is economical to feed them. Additionally, economic conditions will also influence when the optimal endpoint occurs. Previous research on fed cattle pricing has considered only the revenue impacts of alternative pricing systems (Feuz, Fausti, and Wagner; Feuz; Schroeder and Graff). However, as revenue only considers price and not costs, high selling prices do not necessarily equate to high profits. As the best economic indicator of the appropriate endpoint is profit, this study will augment past studies on grid pricing by considering cost changes associated with obtaining different quality and yield grade levels.

Objective

The main objective of this paper is to increase the profitability of cattle feeding operations by determining the effect of different grid pricing structures on the optimal number of days on feed. To achieve this objective, the probability of achieving each USDA Yield and Quality Grade will be ascertained. Additionally, daily revenue and cost information will be generated using growth function relationships estimated by previous research to determine how net daily profit changes over time.

The first section of this paper discusses background information relating to animal growth and grid pricing. Next, the animal growth model and logistic model used in this research is detailed. Then, the data, results, and sensitivity analysis for the optimization problem using different grid structures are presented. Lastly, the implications of the findings for the cattle feeding industry are considered.

Animal Growth and Grid Pricing Theory

Animal Growth Theory

In 1963, G.P. Lofgreen and W.N. Garrett introduced a system designed to measure the net energy requirements of beef cattle in the growing and finishing phases of production. The authors argue that a net energy system must differentiate net energy for maintenance requirements (NE_m) from net energy for gain requirements (NE_g) because the total net energy of a feed (NE_{m+g}) varies with the level of feed. The NE_{m+g} of a feed will be highest at low levels of feeding and decreases as feeding levels rise. The system designed by Lofgreen and Garrett assumes that feed will be used to satisfy maintenance requirements and intake beyond the maintenance requirement will be available for gain. Therefore, a system based on NE_m and NE_g separately will yield more accurate estimates of energy requirements.

D.G. Fox and J.R. Black used Lofgreen and Garrett's net energy system but included adjustments for factors that affect the net energy requirements of cattle. While cattle in a given pen enter the feedlot on the same day, several different factors will result in animals being fed different lengths of time and, therefore, achieving different quality and yield grades at slaughter.

In addition to time, body size, stage of maturity, use of growth and feed stimulants, feed quality, and intake are some additional factors that affect growth. All the factors that affect growth and the relationships between these factors are displayed in Figure 1.

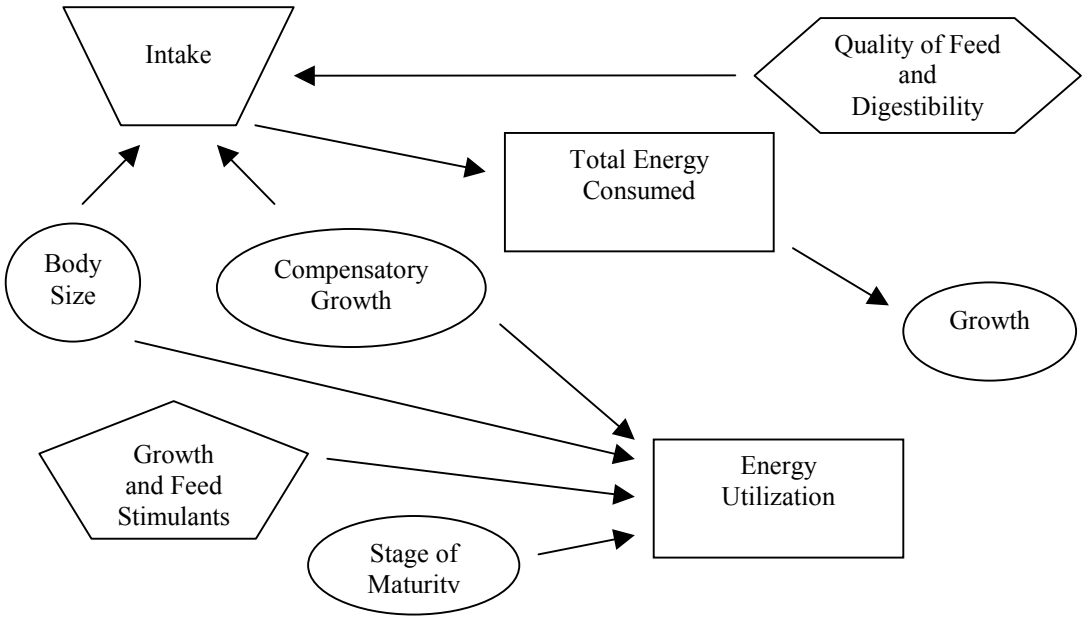

Figure 1. Factors affecting cattle growth

Given these effects and relationships, the system used to estimate the growth and performance of feeder cattle must account and adjust for these factors. Fox and Black developed a system of continuous equations that adjust for time on feed, weight, rate of gain, frame size, breed, sex, use of growth stimulants, and the nutritional management system. This will essentially make use of Fox and Black's system of growth equations.

Grid Pricing

Under live weight pricing, heavier animals typically generate more revenue and profit for the feeder and producer. However, consumer demand for leaner beef forced packers to change their buying strategies. Packers saw potential in grid pricing to improve the consistency and quality of beef (Schroeder et al.). Unlike live pricing, which prices animals based on averages, grid premiums and discounts convey consumer preferences back to producers via market prices. Additionally, the intent of grid pricing is to provide producers an incentive to invest in leaner genetics and to encourage feeders to alter management practices (Boland, Preckel and Schinckel). Therefore, the premiums and discounts associated with grid pricing improve the likelihood that packers will receive uniform carcasses and consumers will receive the leaner product they desire.

Grid pricing determines the values of individual carcasses by applying discounts and premiums to a base price according to quality grade, yield grade and dressed weight. The term grid refers to the matrix of premiums and discounts. The rows of the matrix consist of the USDA quality

grades and the columns consist of the USDA yield grades. Most grids use the value of a Choice, Yield Grade 3 carcass weighing 550-950 pounds as the base price. There are several base prices that are typically used: weekly plant average prices, highest reported price in a specific geographic region, boxed beef cutout value, futures market price, or a negotiated price. Quality grades for steers or heifers are Prime, Choice, Select, and Standard. Quality grades, which are indicative of the eating quality of the meat, are assigned based on the amount of marbling in the ribeye and the age of the animal. Prime carcasses have more marbling so they receive premiums. As the degree of marbling in Select and Standard carcasses is less, these carcasses get discounted. Yield Grades 1-5 are the expected percent of boneless, closely cut trimmed retail cuts from the round, loin, rib, and chuck on a carcass weight basis. Yield grades are formula determined based on four factors: thickness of fat over the ribeye, area of the ribeye muscle, percentage of kidney, pelvic, and heart fat, and carcass weight. Carcasses with a Yield Grade 1 or 2 have the highest percentage of lean cuts and the least amount of fat so they receive premiums. Having more fat and lower cutability, Yield Grades 4 and 5 earn discounts.

Data

Serial slaughter data for 467 large frame, mixed breed - primarily British and Continental - steers were obtained from Oklahoma State University's Department of Animal Science (Gill). Cattle were randomly assigned to one of 24 pens. Six pens were slaughtered after 117 days on feed with remaining pens being slaughtered in groups of six after 131, 145, 159 days on feed. After the carcasses were chilled 36 hours, USDA graders assigned quality and yield grades.

The carcass characteristics of animals by days on feed are presented in Table 1. Hot carcass weight, percent low and premium choice, ribeye area, and average yield grade increased with days on feed. The percentage of Yield Grade 1 and 2 carcasses decreased over time and the percentage of Yield Grade 4 and 5 carcasses increased with days on feed.

Table 1. Effect of Days on Feed on Carcass Characterisitics

	Days on Feed			
Trait	117	131	145	159
Hot Carcass Weight (lb.)	755	807	541	887
Dressing Percent	62.3	63.4	63.6	64.9
Percent Low Choice	39.47	46.90	53.41	61.79
Percent Premium Choice	7.67	7.85	18.16	18.34
Ribeye Area (sq. in)	12.79	12.90	12.52	13.61
Average Yield Grade	2.78	3.17	3.59	3.70
Percent Yield Grade 1 and 2	61.55	42.58	22.07	15.05
Percent Yield Grade 4 and 5	.83	2.63	6.95	17.49

In this study, cattle were purchased for $86.90 per hundredweight. This is the average cost of feeder cattle weighing 700 to 800 pounds during January of 2000. Purchase prices for animals outside this range were adjusted accordingly. The price adjustment factors used are the average price differentials for cattle sold in Nebraska between August 1999 and January 2000. The

adjustment figures used appear in Table 2. The net energy for maintenance of the ration is 2.21 Mcal per kilogram of dry matter, the net energy for gain of the ration is 1.49 Mcal per kilogram of dry matter, and the dry matter of the ration is assumed to be 100%. A feed cost of $135.79 per ton was used in the base analysis. Also, one analysis used a feed price of $145.00 per ton (high) and another analysis used a feed price of $105.00 per ton (low). Additionally, the model assumed an interest rate of 8.75 percent, yardage costs at $.05 per day, an 0.93 percent death loss, a checkoff of $1 per head sold, freight costs of $1 per head, and veterinary medicine costs of $8.36 per head. Other production costs for utilities, fuel, electricity, telephone, depreciation, taxes, insurance, and hired labor totaled $2 per head.

Table 2. Purchase Price Adjustment Factors

Purchase Weight	Adjustment Factor
500-599	1.104
600-699	1.045
700-799	1.000
800-900	.9202
>900	.8886

A base grid price of $113.50 per hundredweight, a cash price of $68.00 per hundredweight, and a dressed price of $108 per hundredweight were used in this analysis. The base grid price is an average boxed beef cutout value for Choice carcasses between 550 and 850 pounds. All the prices used in this study were average prices reported during January 2000. Several grids were used in this analysis. All the grids used in this study are presented in Table 3 and 4. Grids 1 – 7, which appear in Table 3, are seven actual grids used by the seven major packers on November 17, 1997. Grid 7 pays high premiums for Prime but average premiums for YG1 and YG2. Grid 3 pays very little for Prime and nothing for YG1 and YG2. The other grids in this series fall somewhere in between. The last grid (NCA), is based on the average premiums and discounts published in the *National Carcass Premiums and Discounts for Slaughter Steers and Heifers* between October 1996 and January 2000. The grids appearing in Table 4 are examples of the "new era" grids that provide significant premiums to Prime, Yield Grade 1 and Yield Grade 2 cattle. Four of the grids are variations of the Base Grid. Two of the grids narrow or widen the Choice/Select and Choice/Standard spread and the remaining two grids narrow or widen the Yield Grade 3/4 and Yield Grade 3/5 spread.

Some grids apply only the smallest discount and other grids only apply quality and yield premiums to carcasses within a certain weight range. In addition, there are grids that pay the same price for Standard carcasses regardless of yield grade. Many of the grids require a certain percentage of Choice carcasses before any premiums are applied. This analysis applies all quality, yield and weight premiums and discounts to each animal; however, this method should give realistic grid values.

Table 3. Seven Actual Grids in effect on November 17, 1997 and the Average National Carcass Premiums and Discounts Grid between October 1996 and January 2000 ($/cwt.)

	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6	Grid 7	NCA Grid
P	4.00	6.00	3.00	8.00	6.00	3.00	10.00	5.52
S	-9.00	-10.00	-11.00	-10.00	-9.93	-10.00	-9.00	-7.77
St	-19.00	-30.00	-22.00	-20.00	-19.93	-18.00	-9.00	-17.39
Y1	1.00	2.00	0.00	2.00	3.00	2.00	2.00	1.70
Y2	0.00	2.00	0.00	1.00	1.25	1.00	1.00	0.85
Y4	-18.00	-10.00	-20.00	-12.00	-20.00	-12.00	-22.00	-14.66
Y5	-23.00	-15.00	-25.00	-17.00	-25.00	-17.00	-27.00	-19.94
400-500	-30.00	-25.00	-25.00	-15.00	-20.00	-14.00	-23.00	-20.99
500-550	-25.00	-15.00	-15.00	-15.00	-20.00	-12.00	-21.00	-16.91
950-1000	-10.00	-20.00	-25.00	-10.00	-20.00	-18.00	-22.00	-16.21
>1000	-25.00	-20.00	-30.00	-10.00	-20.00	-23.00	-22.00	-20.88

Table 4. New Era Base Grid and New Era Grid with changes in the Choice/Select and Yield Grade 3/4 Spreads ($/cwt.)

	Base Grid	Narrow C/S Grid	Wide C/S Grid	Narrow Y3/Y4 Grid	Wide Y3/Y4 Grid
P	10.00	10.00	10.00	10.00	10.00
S	-6.50	-4.00	-16.00	-6.50	-6.50
St	-15.00	-19.00	-22.00	-15.00	-15.00
Y1	6.50	6.50	6.50	6.50	6.50
Y2	2.50	2.50	2.50	2.50	2.50
Y4	-17.00	-17.00	-17.00	-12.00	-20.00
Y5	-17.00	-17.00	-17.00	-17.00	-25.00
400-500	-17.00	-17.00	-17.00	-17.00	-17.00
500-550	-17.00	-17.00	-17.00	-17.00	-17.00
950-1000	-17.00	-17.00	-17.00	-17.00	-17.00
>1000	-17.00	-17.00	-17.00	-17.00	-17.00

Procedures

Animal Growth

To estimate the economics of cattle feeding over time, several biological relationships need to be quantified. The system used summarizes and applies factors known to influence body

composition and feedstuff utilization. This net energy system was developed by G.P. Lofgreen and W.N. Garrett in 1963 and later modified by D.G. Fox and J.R. Black and the National Research Council (NRC). To calculate animal growth it is necessary to determine daily gain, dry matter intake, and the associated total cost of feeding the animal on a specific day. Given the detailed nature of the growth model used in this study, the equations used are not presented in this paper. This information can be obtained directly from the authors.

Logistic Estimation for Yield and Quality Grade Classifications

Estimating cattle growth and costs using the growth model will result in each placement weight following a unique growth path and slaughter weight. To calculate daily revenue, it is necessary to relate a probability to each of the five yield grades and the four quality grades that an animal will achieve on a specific day. As the outcome variable (yield grade or quality grade) is a discrete variable, the estimated probabilities are generated using an ordinal logit model. Ordinal logit is a statistical model that is nonlinear in the parameters and examines the relationship between response probability and explanatory variables. The explanatory variables used to estimate the associated yield grade probabilities and quality grade probabilities are actual placement weight logged and total number of days on feed logged. The calculation of the probabilities is a two-stage process: (1) Maximum Likelihood intercept and slope parameters are calculated by regressing logged slaughter weight and total number of days on feed, which is squared and logged, for each animal against the USDA yield grade or USDA quality grade assigned to each animal and (2) the parameters calculated in the first stage and combined with the actual placement weight and current days on feed, t, to assign yield or quality grade probabilities. In this research, the logistic procedure in SAS™ was used to complete the first stage. In the second stage, yield and quality grade probabilities are assigned to each animal by:

$$
\begin{aligned}
& GF_i = Int_i + BPW_i * LCW_j + BDOF_i * LSt \\
& P_{i=1} = \frac{e^{GF_i}}{1+e^{GF_i}} \\
& P_{i=2\cdots i=k-1} = \frac{e^{GF_i}}{1+e^{GF_i}} - \frac{e^{GF_{i-1}}}{1+e^{GF_{i-1}}} \qquad i = 1,2,\cdots,k \\
& P_{i=k} = 1 - \frac{e^{GF_{i-1}}}{1+e^{GF_{i-1}}} \qquad j = 1,2,\cdots,n
\end{aligned}
\tag{1}
$$

where GF_i is a grading function, Int_i is an intercept parameter generated in SAS™, BPW_i and $BDOF_i$ are the slope parameters estimated in SAS™, LCW_j is the current weight of animal j, LSt is the current day on feed that is squared and logged, e=2.718282, P_i is the probability of animal j achieving a specific yield or quality grade on day t, k=5 for yield grades and k=4 for quality grades, and n=467. Yield grade probabilities are calculated such that on day 1 all the animals have a 100% probability of being a Yield Grade 1. Over time, the Yield Grade 1 probability declines and the probability of attaining a Yield Grade 5 increases. This same process occurs in

the quality grade probability calculation – animals initially grade Standard but over time the probability of grading Prime increases.

An Excel spreadsheet and Visual Basic macro were developed to simulate the growth of the cattle. Using the calculated yield and quality grade probabilities from (1), the grids in Table 3 and 4, and the total cost of feeding an animal generated in the growth model, the profit on day *t* can be calculated. Using this profit information, one can identify the number of days on feed that maximize profits under a specific cost and grid pricing structure.

Results

Days on Feed

The number of days on feed that maximize profits when all 467 animals are sold under the seven actual grids, the National Carcass Premium and Discount Average Grid, and under dressed and cash pricing appear in Figure 2. This graph identifies two significant differences that affect cattle management decisions under grid pricing. The first is the significant difference in the number of days that cattle are on feed when they are sold under a grid pricing system and a cash/dressed pricing system. Current industry practice appears to be to feed "grid" cattle longer in the hopes of earning prime premiums; however, this research indicated that cattle sold under a cash/dressed system should be on feed for significantly more time than cattle sold on a grid pricing system. As cash pricing pays an average price for all cattle without applying any discounts at least explicitly, feeders benefit from putting more weight on the animal. This research shows that for this given pen of cattle profits will be maximized after 200 days on feed under a cash/dressed system. However, these same cattle will be fed, on average, only 141 days under a grid pricing system. Feeders have an incentive to feed cattle for shorter periods because of the discounts on Yield Grade 4, Yield Grade 5, and heavy carcass animals.

The second difference is the considerable variation in the number of days on feed among the different grids. Cattle sold under Grid 7 will only be feed 131 days; however, under Grid 2 these same cattle would be fed 151 days. Grid 7 pays large premiums for Prime cattle but applies substantial discounts to cattle having Yield Grades 4 or 5. Grid 2 pays a moderate premium for Prime cattle, applies a small discount for Yield Grades 4 or 5 and a large discount for Select and Standard cattle. This finding concurs with the idea that the magnitude of the Yield Grade 4 and 5 and Select and Standard discounts determines the number of days on feed.

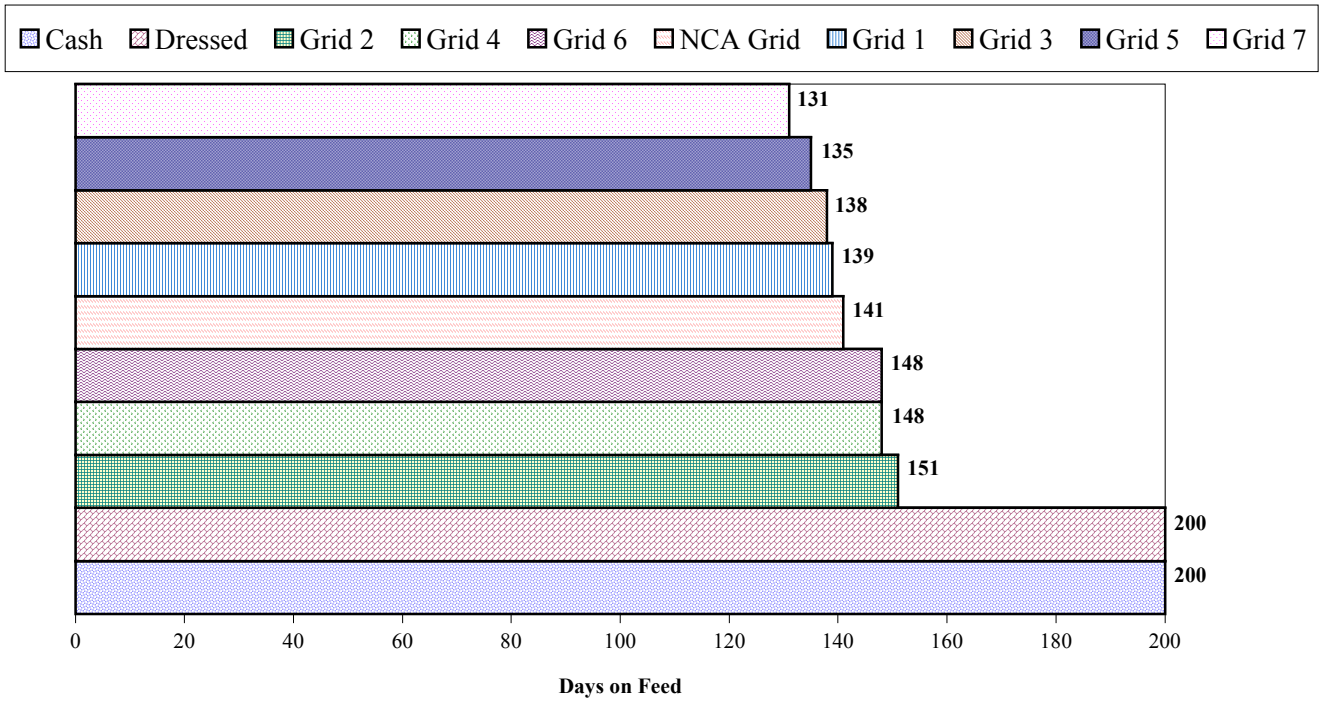

Figure 2. Distribution of Days on Feed using Seven Actual Grids from November 17, 1997, the Average National Carcass Premiums and Discounts Grid, and Cash and Dressed Pricing

A sensitivity analysis was conducted to see what changes in a specific grid will have the greatest effect on the number of days on feed. The base grid used in the base analysis is a 'new era' grid advocated by IBP. This new grid gives significant premiums to Prime cattle and moderate yield grade discounts. The first sensitivity analysis changes the Choice/Select and Choice/Standard discount spreads. The effects of these changes on the number of days on feed appear in Figure 3. Cattle sold under the base grid would be feed 132 days. When the number of Select and Standard cattle being slaughtered is large, the Choice/Select and Choice/Standard spreads will widen. Using a grid with wider spreads means that poor quality cattle receive greater discounts than under the base grid. Increasing these spreads, all else constant, causes the number of days on feed to increase to 141 days. Additionally, when the number of Select and Standard cattle being slaughtered is small, the Choice/Select and Choice/Standard spreads will narrow. Narrow spreads place small discounts on lower quality cattle; therefore, there is less incentive to avoid these discounts so the number of days on feed decreases to 130.

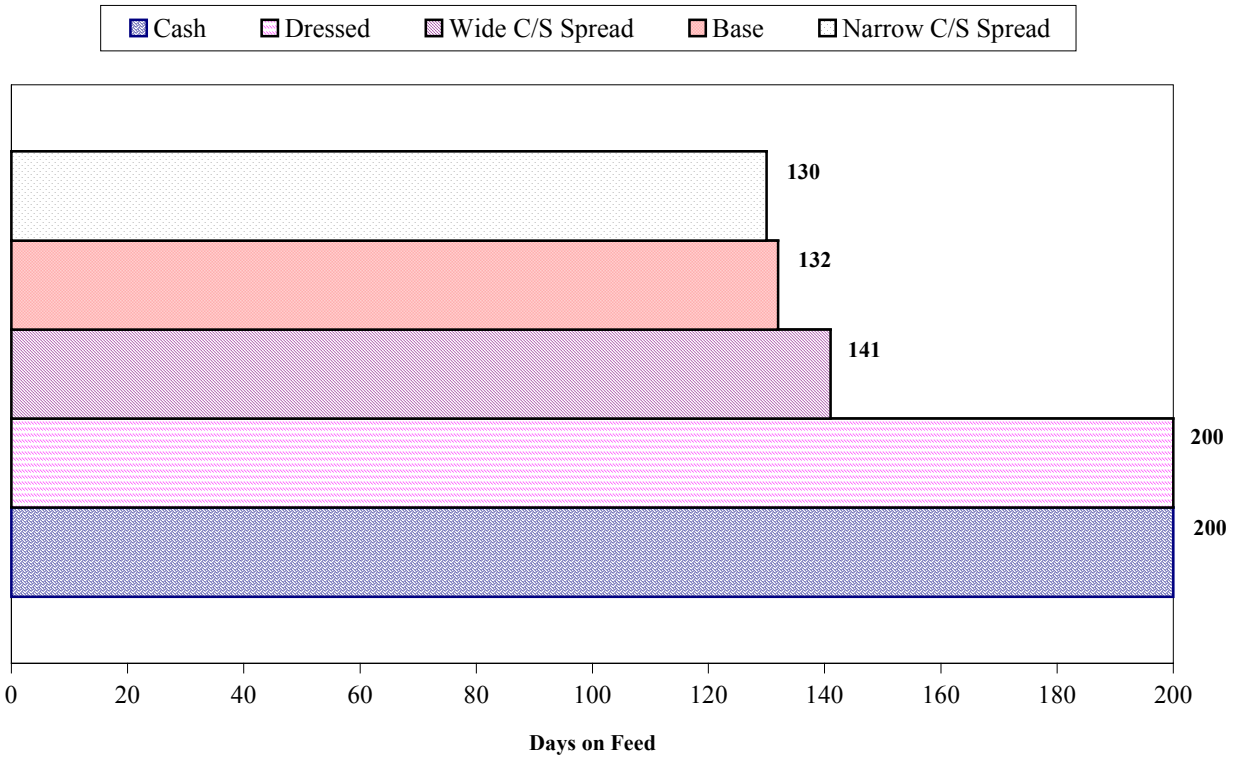

Figure 3. Days on Feed Distributions for 'New Era' Base Grid, Base Grid with Modifications to the Choice/Select Spread, and Cash and Dressed Pricing

The second sensitivity analysis, which appears in Figure 4, changes the Yield Grade 3/4 and Yield Grade 3/5 discounts. Narrow Yield Grade 3/4 and 3/5 spread grids, all else constant, place smaller discounts on low yielding carcasses and, thus, the number of days on feed decreases to 127 days. Likewise, the larger discounts found in grids with wide Yield Grade 3/4 and 3/5 spreads result in cattle being fed to 139 days as feeders attempt to avoid a loss in revenue.

Figure 5 shows how the number of days on feed changes given high and low feed costs. While this change does not affect the grid itself, it logically has an effect on the number days animals are on feed. As it becomes more costly to feed cattle, cattle will remain on feed for a shorter period before profits are maximized. The opposite is true as the cost of feeding cattle decreases.

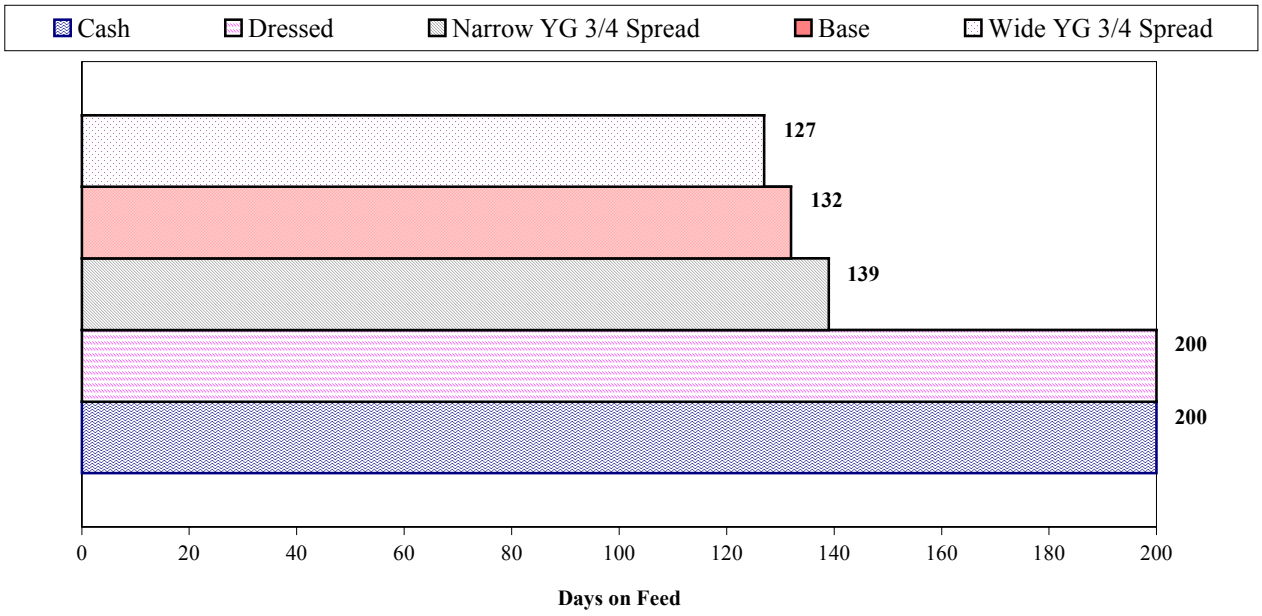

Figure 4. Days on Feed Distributions for 'New Era' Base Grid, Base Grid with Modifications to the Yield Grade 3/4 Spread, and Cash and Dressed Pricing

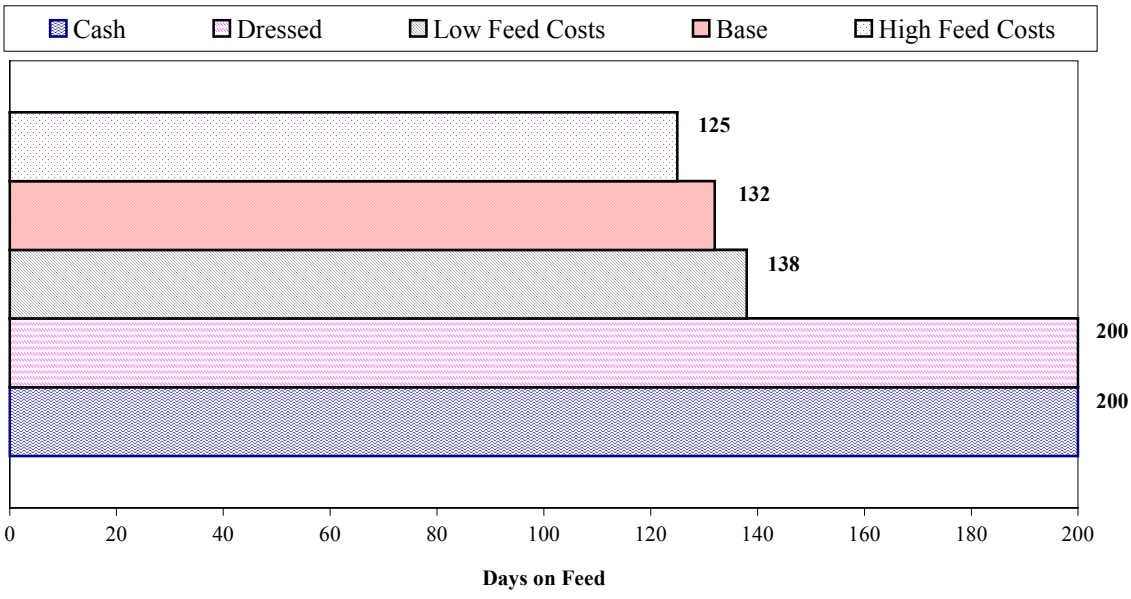

Figure 5. Days on Feed Distribution for 'New Era' Grid, Cash and Dressed Pricing assuming Higher and Lower Feed Costs

Cattle Feeding Profits

This research does not focus on the absolute value of the profits; rather, it focuses on the behavior of profits over days on feed. As shown in Figure 6, cash and dressed pricing systems cause profits to increase slowly but steadily. Unlike the relatively flat cash and dressed profit curves, the base grid profit curve has sections where profits increase at an increasing rate, then increase at a decreasing rate, then stay within a narrow window for several weeks before profits begin falling. The base grid profit curve indicates that there is a 1 (+/-) week window where cattle can be sold without significant changes in profits. Behind the scenes but reflected in the profit curve is the marginal costs of feeding cattle. The marginal cost of feeding cattle is declining all the time because of the frame size and efficiency of the cattle used in this research.

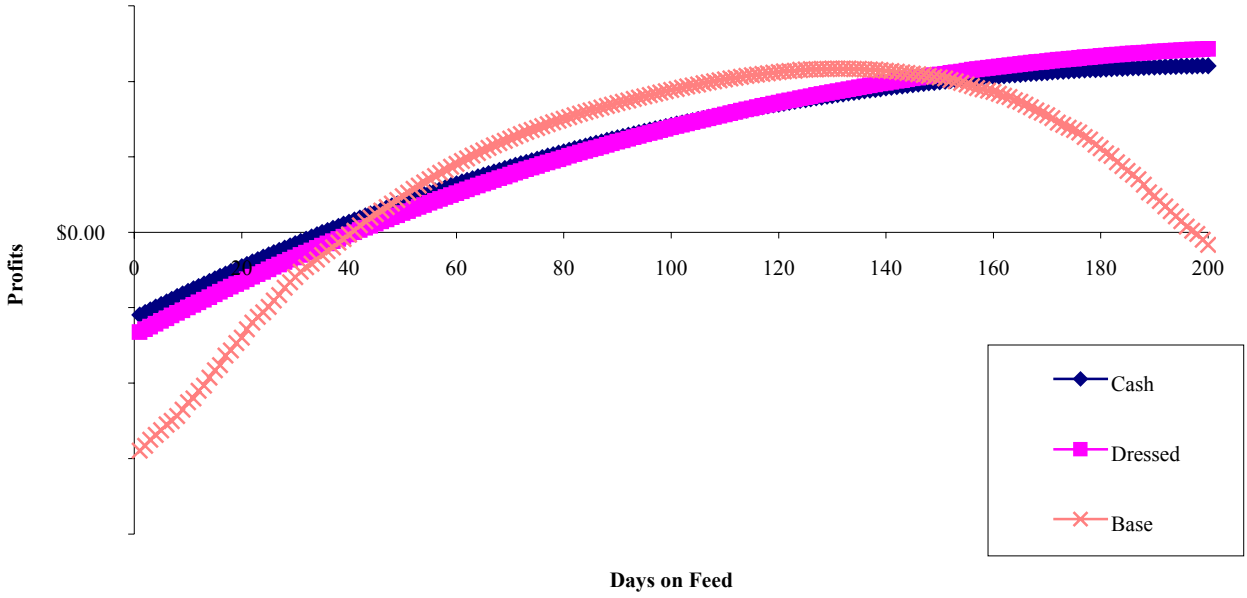

Figure 6. Profit Curves for the Base 'New Era' Grid and Cash and Dressed Pricing

As cattle go from Standard to Select to Choice, revenue and marginal revenue are increasing. However, at the beginning of the window, discounts for Yield Grade 4 and 5 carcasses take effect. From this point on, premiums for quality are less than the discounts on quality so marginal revenue begins decreasing. Another view of this relationship is shown in Figure 7.

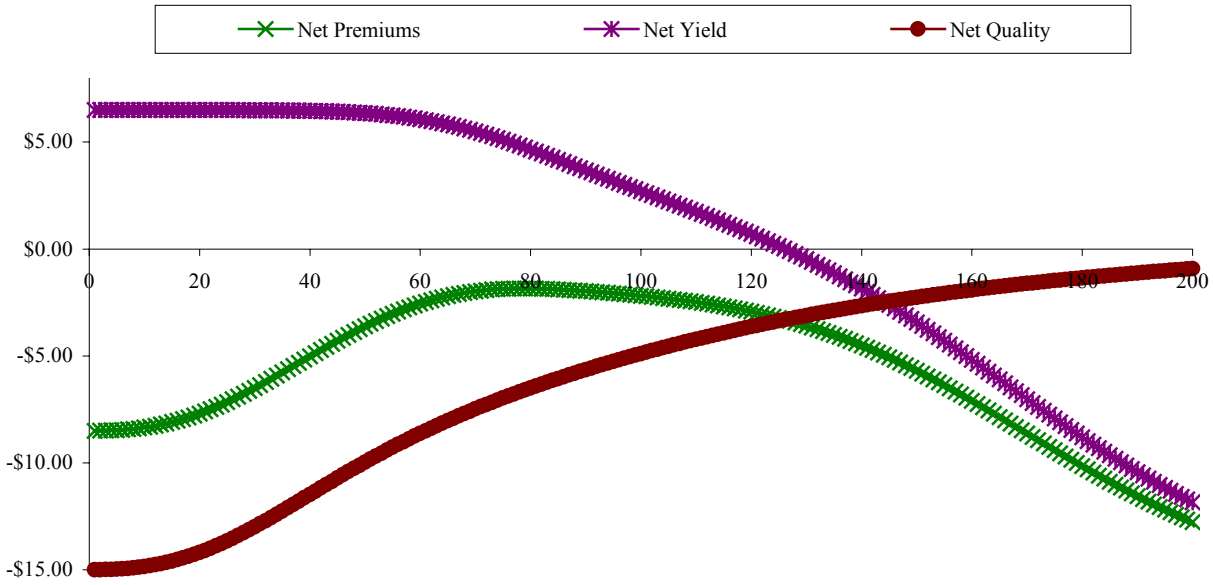

Figure 7. Net Yield Grade, Net Quality Grade and Net Premiums for the Base 'New Era' Grid

Carcass Characteristics

Table 5 shows how different grids affect the distributions of several carcass characteristics. When compared to the base grid, cattle sold under narrow Choice/Select or wide YG 3/4 grids will not be fed as long and, therefore, fewer cattle will achieve a quality grade of Choice or better. Cattle are fed for a shorter period because cattle feeders can achieve cost reductions that are larger than the changes in revenue. As cattle are fed longer under wide Choice/Select and narrow YG 3/4 grids, more cattle grade Choice or better. Cash cattle achieve the highest percentage of Prime and Choice cattle merely because of the number of days they are on feed. During periods of high (low) feed costs, the number of cattle grading Select or Standard increases (decreases).

The effect of different grids on yield grade distributions follows the same pattern. As shown in Table 5, more cattle will achieve Yield Grades of 4 and 5 when priced under wide Choice/Select and narrow YG 3/4 grids. On the other hand, when compared to the base grid, the percentage of cattle with Yield Grades of 1, 2, or 3 increases under narrow Choice/Select and wide YG 3/4 grids. Cash cattle achieve significantly high levels of Yield Grades 4 and 5. During periods of low feed costs, cattle will be fed longer and, therefore, more cattle will achieve Yield Grades 4 and 5. During high feed costs, the opposite is true.

Table 5. Summary Statistics of Days on Feed, Yield Grade, Quality Grade, Light/Heavy Carcasses, and Average Weight for Various Pricing Methods

		New Era Grid and Modifications						
	Cash	Base	Narrow C/S Spread	Wide C/S Spread	Narrow YG3/4	Wide YG3/4	Base w/ High Feed Costs	Base w/ Low Feed Costs
Days on Feed	200	132	130	141	139	127	125	138
Yield Grade 1	0.21%	4.21%	4.68%	2.65%	2.93%	5.50%	6.13%	3.09%
Yield Grade 2	3.05%	35.51%	37.62%	26.66%	28.51%	40.83%	42.96%	29.46%
Yield Grade 3	26.54%	49.13%	47.58%	54.01%	53.24%	44.97%	43.07%	52.78%
Yield Grade 4	53.69%	10.14%	9.22%	15.09%	13.88%	7.94%	7.17%	13.30%
Yield Grade 5	16.50%	1.00%	0.90%	1.60%	1.44%	0.76%	0.68%	1.37%
Prime	2.48%	0.69%	0.66%	0.85%	0.81%	0.61%	0.58%	0.79%
Choice	81.19%	57.70%	56.58%	62.44%	61.43%	54.84%	53.64%	60.92%
Select	15.07%	37.13%	38.08%	33.04%	33.92%	39.53%	40.51%	34.37%
Standard	1.26%	4.47%	4.68%	3.67%	3.83%	5.02%	5.26%	3.92%
Light Carcasses	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Heavy Carcasses	37.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Average Weight	1,472	1,300	1,294	1,326	1,321	1,285	1,279	1,318

The last carcass trait that is affected by the number of days on feed is weight. The only group to have heavy carcasses is the cash priced cattle. The average weight of the 467 animals was 1,472, which explains why 37.04% of these cattle had carcass weights greater than 950 pounds. The remaining groups had weights in the high 1,200's and low 1,300's. Average weight increased with days on feed but none of these groups were classified as heavy carcasses.

Summary and Implications

Cattle have a natural physical endpoint to which it is economical to feed them. Grid pricing introduces quality grade, yield grade, and other feedlot performance variables into the price discovery process. Thus, under grid pricing, profits are more variable and this variability causes feedlots owners to identify those marketing strategies that will allow them to maximize profits.

This research uses growth models, logistic regression, and an optimization routine in Excel to determine the effects of grid pricing on various marketing decisions. More specifically, the research determines what effects different grid structures have on the number of days on feed that maximize profits.

Several pricing methods and structures were used: (1) cash, (2) dressed, (3) a base grid with high Prime premiums and Yield Grade 3/4 and 3/5 discounts, (4) grids with large and small discounts for Select and Standard carcasses, and (5) grids with large and small discounts associated with Yield Grade 4 and 5 carcasses. The important effects of grid structure on fed cattle marketing decisions are:

(1) Large quality or small yield discounts increases the number of days on feed and small quality or large yield discounts result in fewer days on feed.
(2) Losses associated with a grid having large quality discounts are minimized as cattle fed for more days are able to obtain Prime premiums despite the discounts for more Yield Grade 4 and 5 carcasses.
(3) Given small quality discounts, cattle fed for a shorter length of time can obtain the Yield Grade 1 and 2 premiums without a large loss in revenue due to grading Select or Standard.
(4) Under cash pricing, cattle are fed for very long periods because there are no discounts applied to the carcasses and, therefore, the more weight they gain, the more revenue they generate.
(5) During periods of low feed prices, cattle can be fed longer so more cattle grade Prime but also have more Yield Grade 4 and 5 cattle.

Implications

Grid pricing not only brings complexity into the marketing system but it also improves pricing accuracy. As price and profit are important signals to feedlot owners to change marketing decisions, viable marketing decisions will depend on whether price incentives are present. This research indicates that adjusting days on feed is a viable marketing decision for feedlot owners. Current industry practices seem to involve feeding grid cattle longer in hopes of earning prime premiums. However, as the length of time on feed differs depending on the grid being considered, efficiency in the beef industry should improve as cattle are fed and targeted at specific grids. This, however, requires knowledge of the growth capability and carcass characteristics of each animal.

Future Improvements

This research is by no means exhaustive. The results are based on one pen of experimental data. Further research needs to look at the effects of breed, frame size, and environmental conditions on marketing decisions. Additionally, adjustments can be made to the energy content of the diet, the base grid price, and the purchase price of feeder cattle to see how these changes impact profitability and days on feed. Also, it may be necessary to account for imperfect knowledge/risk in predicting grades, cost of gain, etc.

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