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Fed Cattle Profit Determinants Under Grid Pricing

R. Allen McDonald and Ted C. Schroeder

This study determines the relative effects of price, cattle quality, and feeding performance factors on profit per head for fed cattle marketed via a grid structure. Two different data sets of cattle that were marketed in two different grid pricing systems are used in the analysis with comparisons of results made between grids. Grid base price and feeder cattle price are the most important determinants of profit over time in both grids. However, considering only nonprice variables, the cumulative quality of cattle in a pen is also an important profit determinant.

Key Words: cattle feeding profit, grid pricing, robust regression

JEL Classifications: L15, Q12, Q13

The beef industry faced 20 years of declining consumer demand and loss of market share relative to pork and poultry from 1980 through the late 1990s (Purcell). The decline in consumer demand occurred for a number of reasons,[1] but inconsistency in beef quality related to pricing fed cattle on averages was a contributing factor (Schroeder et al. 1998; Smith et al.). Recently, the beef industry has responded by attempting to increase vertical coordination throughout the sector and ultimately change the way cattle are produced and marketed. One of the more dramatic changes is the rapid adoption of grid pricing. Results of a recent cattle feeder survey indicated 16% of fed cattle were sold using a grid in 1996 and 45% in 2001, and this was expected to increase to 62% by 2006 (Schroeder et al. 2002).[2] In a grid pricing system, each animal potentially receives a different price reflecting its individual carcass merit so producers that market higher quality animals receive premiums and producers who market lower quality cattle receive discounts. Such changes in pricing methods can markedly affect cattle sales revenue and therefore feeding profit.

Previous research estimated that fed and feeder cattle price variability explained about 50% and 25%, respectively, of the variation in cattle feeding profit over time (Langemeier, Schroeder, and Mintert; Mark, Schroeder, and Jones). Corn prices, feed conversion, and average daily gain were also important profit determinants. With adoption of grid pricing, producers face an expanded set of factors that potentially affect cattle feeding profit and profit variability across pens and over time (Feuz; Feuz, Fausti, and Wagner 1993, 1995; Ward, Feuz, and Schroeder). In particular, premiums

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[1] Including food safety concerns, health and nutrition perceptions, form of product offering, changes in consumer demographics, changes in relative prices, beef quality inconsistency (mainly lack of tenderness), and others.

[2] This was for feed yards located primarily in Iowa, Kansas, Nebraska, and Texas.

and discounts for individual carcasses that vary over time potentially increase variability in selling price both temporally and across pens of cattle. To better manage this increased risk, cattle feeders need to understand the relative importance of grid pricing components and other cattle feeding profit determinants.

The objective of this paper is to determine the relative effects of prices, cattle quality, and feeding performance factors on profit per head for fed cattle marketed using price grids. The analysis is conducted for cattle marketed using two distinctly different grid structures to establish whether relative importance of profit determinants change from one grid structure to another. This study extends earlier work by Feuz, Fausti, and Wagner (1993) by considering profit variability over time as prices and other factors fluctuate. With grid pricing adoption increasing, there is a strong need to quantify profit variability determinants for fed cattle sold under grids. Results provide cattle feeders with an increased understanding of the relative importance of grid pricing components and feeding cost variability so they can develop appropriate marketing, production, and risk management strategies.

Grid Structures

Grid pricing mechanisms are set up differently under different agreements and vary across packers (Ward, Feuz, and Schroeder). The two grids (grid A and grid B) used in this analysis are outlined here.[3]

As with all grids, a base price is the starting point from which premiums and discounts for carcass characteristics are applied. Grid A uses a weighted-plant-average base price. Price paid for, and carcass characteristics of, cattle bought live during the previous week are used to derive a base price for cattle delivered on a grid in the current week. The base price in grid B is based off the western Kansas direct weekly fed cattle price as reported by the USDA, converted to a dressed price using the plant-average hot yield for the previous week.

Premiums and discounts for quality and yield grade characteristics are added to the base price to determine the grid dressed price received. In grid A, the same premium is paid for yield grades 1 and 2. Yield grades 4 and 5 have separate discounts. Prime carcasses receive a premium, and Select carcasses receive a discount. The discount for Select carcasses follows the USDA boxed beef cutout Choice-to-Select price spread. Norolls (i.e., carcasses that are not assigned a quality grade) receive the same discount as Select carcasses in this grid. Miscellaneous-grade carcasses (dark cutters, stags, heiferettes, etc.) and heavyweight (>950 lbs.) and lightweight (<525 lbs.) carcasses receive sizable discounts. The same discount is assessed for light- and heavyweight carcasses regardless of quality or yield grade. The premiums and discounts in this grid are additive. For example, a yield grade 2, Select carcass is paid a premium for yield grade and levied a discount for quality grade. Table 1 summarizes the premium/discount schedule for grid A. A Choice, yield grade 3 carcass is the base and does not receive a premium or discount. Premiums and discounts in Table 1 are at a point in time and can change.

Grid B pays premiums only on the percentage of a pen above thresholds for desirable quality traits (discounting pens below target) and discounts pens having undesirable traits present above target levels. No premiums or discounts are applied to Select, yield grade 3 carcasses. The targets and associated premium or discount are reported in Table 2. The premiums or discounts have been consistent over time, except for the premium for Choice or higher quality grade, which closely follows the USDA Choice-to-Select price spread for wholesale boxed beef. The total premium or discount is the difference between the actual percentage and target percentage multiplied by the particular premium or discount for each

[3] These two grids were selected for several reasons. First, they represented a large percentage of the cattle being marketed under grids at the time, with each being offered by two of the largest four beef packers. Second, data were available for cattle sold under these grids, which is a binding constraint for some grids. Third, the two grids are different enough from each other to provide some important contrasts. To maintain confidentiality, the grids are referred to here simply as A and B.

Table 1. Premium/Discount Schedule by Yield Grade for Grid A at a Point in Time

	Yield Grade			
Quality Grade	1 and 2	3	4	5
	Premium/Discount ($/cwt carcass)			
Prime	11.00	10.00	−2.00	0.00
Choice	1.00	Base	−12.00	−10.00
Select[a]	−5.00	−6.00	−18.00	−16.00
Miscellaneous	−19.00	−20.00	−32.00	−30.00
Heavyweight (<550 lbs.)	−12.00			
Lightweight (>950 lbs.)	−25.00			

[a] Noroll carcasses are included with Select.

quality attribute. For example, if a pen exceeds the threshold for Choice or higher quality grade, a premium is paid on the percentage of cattle grading Choice or higher exceeding 55% of the pen. However, a discount is assessed if the pen has fewer Choice cattle than the target.

Model

To determine cattle feeding profit variability determinants under grid pricing, we need to closely examine in what ways grid pricing affects profitability. Profit per head for a pen of fed cattle is defined as

$$(1)\quad profit = P_{\text{fed cattle}} \times Q_{\text{fed cattle}} - P_{\text{feeder cattle}} \times Q_{\text{feeder cattle}} - cost\ of\ gain - other\ costs,$$

where $P_{\text{fed cattle}}$ is the price of fed cattle, $Q_{\text{fed cattle}}$ is the quantity of fed cattle, $P_{\text{feeder cattle}}$ is the feeder cattle price, $Q_{\text{feeder cattle}}$ is feeder cattle quantity, *cost of gain* is the feeding cost of getting cattle from feeder to finished weight, and *other costs* are nonfeed costs of finishing cattle. When fed cattle are sold on a grid, the price received can be formulated in a hedonic pricing framework. In other words, price is a function of the characteristics of the cattle in the pen. In particular, the hedonic model can be stipulated as

$$(2)\quad dresspr = f(base,\ dressing\ percent,\ quality\ grade,\ yield\ grade,\ out\ carcasses),$$

where *dresspr* is the dressed price of the cattle (*dresspr* times dressing percentage equals $P_{\text{fed cattle}}$), *base* is the live-weight base price for a specified quality grade and yield grade, *quality (yield) grade* is the quality (yield) grade distribution of the pen, and *out carcasses* are the percentage of carcasses that are excessively heavy- or lightweight or have other undesirable traits.

Cost of gain for a particular pen of cattle is

Table 2. Target Percentages and Premiums/Discounts for Grid B

Carcass Characteristics	Pen Target Threshold (%)	Premium/ Discount ($/cwt carcass)[a]
Quality Grade		
Choice and higher	>55	Varies[b]
Prime	>1	8.00
CAB[c]	>5	3.50
Select	0	0.00
Noroll	<5	−2.00
Yield Grade		
1	>5	3.00
2	>35	1.50
3	>56	0.00
4 and 5	<3.5	−12.00
Carcass Weight (lbs.)		
<550	0	−10.00
>950	0	−10.00

[a] Pens of cattle that exceed the pen target threshold receive the stated premium or discount for only the percentage of carcass weight (as a percentage of total pen carcass weight) that exceeds the threshold for that trait.
[b] Varies with USDA boxed beef cutout Choice-to-Select price spread over time.
[c] Certified Angus Beef.

(3) $\textit{cost of gain} = \textit{average daily gain} \times \textit{feed conversion} \times \textit{feed price}.$

Substituting Equations (2) and (3) into Equation (1) gives

(4) $\textit{profit} = f(\textit{base, quality grade, yield grade, out carcasses}) \times Q_{\text{fed cattle}} - P_{\text{feeder cattle}} \times Q_{\text{feeder cattle}} - \textit{average daily gain} \times \textit{feed conversion} \times \textit{feed price} - \textit{other costs}.$

In Equation (4), the price of fed cattle (i.e., the components of the pricing grid), the price of feeder cattle, and feeding costs of gain vary over time and potentially across pens at a point in time. Equation (4) is a general specification of the equation to be estimated to determine how variation in grid components, cost of feeder cattle, and cost of gain affect cattle profit variability over time across pens of cattle.

Procedures

Regression analysis is used to explain variability in profit per head (*profithd*) for fed cattle sold on a grid. Profit is modeled as a function of dressed price (*dresspr*), hot yield (*hyld*), cost of feeder cattle (*costin*), and *cost of gain* (*other costs* in Equation (4) are assumed constant and are reflected in the intercept and random error).

(5) $\textit{profit} = f(\textit{dresspr, costin, cost of gain, hyld}).$

The net dressed price received can be further broken down into its grid components. Grid pricing mechanisms differ across agreements and packers (Ward, Feuz, and Schroeder); therefore, determinants of dressed price and marginal values of carcass attributes can change from one grid to the next. However, common components include the base price (*base*), the percentage of carcasses having different quality (*prime, choice, certified programs, select, noroll*) and yield (*yg*1, *yg*2, *yg*3, *yg*4, *yg*5) grades, dressing percentage (*hyld*), the percentage of miscellaneous (*misc*) and condemned (*cond*) carcasses, and the percentage of lightweight (*light*) and heavyweight (*heavy*) carcasses. The following equation summarizes the price components[4]

(6) $\textit{dresspr} = f(\textit{base, prime, choice, select, noroll, yg1, yg2, yg3, yg4, yg5, misc, cond, light, heavy, hyld}).$

The factors in the grid that determine dressed price can be substituted into Equation (5) to yield

(7) $\textit{profit} = f(\textit{base, prime, choice, select, noroll, yg1, yg2, yg3, yg4, yg5, misc, cond, light, heavy, costin, cost of gain, hyld}).$

Equation (7) is the primary equation of interest. Of particular interest are the relative effects of each regressor on profitability. The magnitudes of individual regression coefficients are not directly comparable and do not provide much insight regarding relative importance of independent variables because their units differ. To determine the relative importance of the independent variables, each of the variables were normalized to have a mean of zero and variance of one. Regressing the normalized dependent variable as a function of the normalized independent variables yields unitless coefficients called standardized beta coefficients (SBCs). The model takes the following form

$$(8)\qquad \frac{Y_i - \bar{Y}}{S_Y} = \sum_j \beta_j^* \frac{X_{ji} - \bar{X}}{S_{x_j}} + \epsilon,$$

where Y is the dependent variable, S is the

[4] The base price is the previous week's plant average price for grid B and the previous week's local USDA-negotiated cash price for grid A. Thus, the base price is predetermined and is not endogenous with the dressed price or profit per head.

Table 3. Summary Statistics for Cattle Fed and Marketed Under Grid A and Grid B[a]

	Grid A		Grid B	
Variable	Mean	SD	Mean	SD
Profit ($/head)	2.17	67.37	−10.65	80.06
Grid dressed price ($/cwt carcass)	107.89	9.35	102.66	5.82
Base price ($/cwt carcass)[b]	108.28	9.02	101.57	5.56
Cost of feeder cattle ($/cwt)	77.20	13.00	69.92	8.69
Hot yield (%)	63.71	0.83	63.76	0.87
Carcass weight (lb.)	758.20	66.78	761.82	64.92
Yield grade 1 (%)	14.83	9.22	4.32	5.00
Yield grade 2 (%)	43.26	11.25	35.17	15.54
Yield grade 3 (%)	38.13	12.59	55.46	16.00
Yield grade 4 (%)	3.55	3.47	5.04	5.29
Yield grade 5 (%)	0.23	0.52	0.003	0.054
Prime (%)	1.14	1.57	2.96	4.28
CAB (%)[c]	N/A	N/A	19.18	11.63
Choice (%)	55.33	14.44	43.54	10.08
Select (%)[d]	42.35	15.55	32.59	14.53
Noroll (%)	N/A	N/A	1.73	2.60
Miscellaneous (%)	1.18	4.17	N/A	N/A
Condemned (%)	0.01	0.05	N/A	N/A
Heavy carcasses (%)	1.88	3.38	1.81	3.82
Light carcasses (%)	1.54	3.47	0.93	2.66
Choice-to-Select spread ($/cwt)	7.01	3.72	6.22	3.04
Number of observations (pens)	3,483		1,011	

[a] Grid A (1992–1998) and grid B (1995–1998).
[b] USDA-reported western Kansas direct slaughter steer live price converted to a dressed price by multiplying by 0.626 for week prior to slaughter was used as base price in grid A.
[c] Certified Angus Beef.
[d] Norolls are included in Select for grid A.

standard deviation, X_j is the jth independent variable of interest, and β_j^* is the SBC for the jth independent variable. The SBCs estimated in this manner are equivalent to multiplying the beta coefficient for each independent variable (β_j) by the ratio of the standard deviation of the independent variable divided by the standard deviation of the dependent variable from the original untransformed data (Pindyck and Rubinfeld). The calculation of the SBC is

$$(9) \quad \beta_j^* = \beta_j \frac{S_{x_j}}{S_Y}.$$

To interpret the SBC, if the base price SBC has a value of 1.5 for example, an increase of one standard deviation in base price would lead to an increase of 1.5 standard deviations in profit per head at the data means. These coefficients are proportions and thus can be used to rank the relative importance of the independent variables.

Data

Determinants of profit variability are analyzed using two distinct data sets for cattle sold using two different grid pricing systems (grid A and grid B). Cattle sold using grid A were marketed by a large midwestern feeding operation from January 1992 to December 1998. Feedlot closeout data and kill sheet data for 3,483 pens of cattle comprise this data set. The data set corresponding to grid B is for cattle fed and slaughtered under an alliance in western Kansas from May 1995 to September 1998. These data consist of feedlot closeout data and kill sheet data for 1,011 pens of cattle.

Feedlot closeout data associated with cattle sold using grid A include profit per head, cost of feeder cattle, average daily gain, dry matter feed conversion, and days on feed for individual pens. Kill sheet data include percentage of yield grade 1, 2, 3, 4, and 5 carcasses, as well as percentage of carcasses in the pen grading Prime, Choice, Select (including noroll), and miscellaneous. The data also include percentage of light- and heavyweight carcasses, percentage of condemned carcasses, hot yield, and grid dressed price. Table 3 presents summary statistics of cattle sold under grid A.

The actual base price for cattle sold under grid A was a packing plant average price from the week prior to the cattle being delivered. This price series was confidential and was not available. The packing plant in question procures fed cattle from a wide market area but the plant is located in western Kansas. Therefore, the USDA weekly average western Kansas direct fed steer price was used as a proxy for the base price for this grid.[5] The base price averaged \$108.28/cwt, ranging from \$88.50 to \$136.34/cwt across the 3,843 pens (Table 3). Profit had an average of \$2.17/head and a range from a loss of \$258/head to a profit of \$243/head (Table 3).

Feedlot data for cattle sold using grid B include individual pen data for profit per head, cost of feeder cattle, average daily gain, dry matter feed conversion, and days on feed. Kill sheet data include percentage of carcasses in yield grades 1, 2, 3, 4, and 5 and percentage of carcasses in the pen grading Prime, Certified Angus Beef, Choice, Select, and noroll. Kill sheet data also include percentage of light- and heavyweight carcasses, hot yield, base price, and grid dressed price. Table 3 includes summary statistics of cattle sold under grid B. Profit averaged −\$10.65/head, ranging from a loss of \$272 to a profit of \$209 (Table 3).

[5] Because the plant procures cattle from a wide geographic region, the model was also estimated using the average dressed price from the weekly five-market region (Texas–Oklahoma, Kansas, Colorado, Nebraska, and Iowa–southern Minnesota). Results were nearly identical to those presented, and implications were the same.

Results

Two slightly different empirical models were estimated for the two grids because of differences in specifications of the grids. For grid A, the model was

$$(10)\quad \begin{aligned} profithd &= \beta_0 + \beta_1 base + \beta_2 yg12 + \beta_3 yg4 + \beta_4 yg5 \\ &\quad + \beta_5 prime + \beta_6 select + \beta_7 misc \\ &\quad + \beta_8 cond + \beta_9 light + \beta_{10} heavy \\ &\quad + \beta_{11} costin + \beta_{12} cost\ of\ gain + \beta_{13} hyld \\ &\quad + \epsilon, \end{aligned}$$

where ϵ is the error term. Equation (10) differs some from the model presented in Equation (7). The base quality and yield grade for grid A is a Choice, yield grade 3 carcass. Hence, these variables are left out of Equation (10) (i.e., they are the default categories). Yield grades 1 and 2 receive the same premiums in grid A. Therefore, *yg*1 and *yg*2 are added together in Equation (10) as *yg*12. Finally, grid A discounts Select and noroll carcasses at the same rate. Thus, *select* in Equation (10) is the sum of Select and noroll carcasses.[6]

The model for grid B was

$$(11)\quad \begin{aligned} profithd &= \beta_0 + \beta_1 base + \beta_2 yg1 + \beta_3 yg2 + \beta_4 yg45 \\ &\quad + \beta_5 prime + \beta_6 cab + \beta_7 noroll \\ &\quad + \beta_8 chsprd + \beta_9 heavy + \beta_{10} light \\ &\quad + \beta_{11} costin + \beta_{12} cost\ of\ gain + \beta_{13} hyld \\ &\quad + \epsilon, \end{aligned}$$

[6] Ideally the discount for Select carcasses would be allowed to vary with the Choice-to-Select price spread since the spread has the most variation over time of all of the grid premiums and discounts. This could be accomplished by multiplying the spread by percentage of Select carcasses, then using that variable in Equation 10 instead of *select,* as is done for grid B. This would allow the "value" of each percent Select to vary with the spread. However, because the USDA-reported fed cattle price used as a proxy for the base price is a mixture of Choice and Select grade cattle, the spread is partially captured in the base price. Thus, percent Select alone is used in the model.

where ϵ is the error term. For grid B, a Select, yield grade 3 carcass is the base quality and yield grade; thus, pens with these attributes represent the default. Grid B has the same discount for yield grades 4 and 5, so these variables were added together (*yg*45). This grid pays a premium for Certified Angus Beef, so the percentage of cattle that attained this certification is included (*cab*). Because of the thresholds present in this grid (with the threshold for Choice reflecting approximately the percentage of Choice versus Select cattle present in the cash market that is used for the base price), variability in the Choice-to-Select price spread is not captured in the base price as it is in the base price for grid A. Therefore, the addition of a variable that is the percentage of Select cattle times the Choice-to-Select spread (*chsprd*) reflects the change in pen value associated with the changing price spread. Finally, grid B has thresholds for each carcass attribute (Table 2) that must be attained before premiums and discounts apply. Therefore, thresholds for each characteristic are subtracted from the percentages of cattle in each category to obtain the percentage of cattle that received a discount or premium. For example, *yg*1 is the percentage of cattle with a yield grade 1 minus the 5% threshold value for yield grade 1.

Collinearity was a concern in estimation of Equations (10) and (11). The variance decomposition procedure suggested by Belsley, Kuh, and Welsch was conducted to determine whether collinearity was problematic.[7] The only potentially degrading collinearity was detected between dressing percentage (*hyld*) and the intercept in both models. Because dressing percentage did not vary much across pens, this finding was not surprising. Dropping dressing percentage from each model had very little effect on the remaining estimates and no changes in implications; only the intercept changed appreciably. Therefore, dressing percentage was left in both models.

Table 4. Profit Equation Robust Regression Estimates for Cattle Fed and Marketed Under Grid A, 1992–1998

Independent Variable	Parameter Estimate	SE	Standardized Coefficient
Intercept	−134.640	63.650	
base	6.999**	0.109	0.936
*yg*12	−0.114	0.091	−0.026
*yg*4	−0.835**	0.417	−0.043
*yg*5	−3.734*	1.979	−0.029
prime	1.188*	0.638	0.028
select	−0.448**	0.069	−0.103
misc	−0.490**	0.201	−0.030
cond	−7.316	14.490	−0.006
light	−0.529*	0.275	−0.027
heavy	−0.678**	0.269	−0.034
costin	−5.597**	0.089	−1.080
cost of gain	−400.790**	9.121	−0.652
hot yield	1.132	0.973	0.014
Average R^2	0.76		
Observations	3,483		

Note: Statistically different from zero at the .05 (**) and .10 (*) level.

Initial estimation of Equations (10) and (11) using ordinary least squares resulted in rejection of normally distributed errors for both models using the Jarque–Bera test (Jarque and Bera). In both models, kurtosis was the primary reason for rejection of normality. To account for this, the models were estimated using the multivariate t-errors robust estimation with three degrees of freedom assuming independent residuals (see Judge et al. and Zellner for details of this procedure). Estimated results are reported in Tables 4 and 5 for Equations (10) and (11), respectively. The models explained 76% (grid A) and 93% (grid B) of the variability in profit per head. To test stability of results, the data set for grid A was randomly split into three different subsets of 1,161 observations, the data set for grid B was randomly split into two data sets of 505 and 506 observations, and the models were estimated for each of these separate subsets. Across the different data subsets for each grid, the parameter estimates were very similar and the conclusions were identical to those report-

[7] This procedure diagnoses degrading collinearity under two conditions: (1) a condition index >30 and (2) a variance decomposition proportion for two or more coefficient estimates that is >.5 (Belsley, Kuh, and Welsch).

Table 5. Profit Equation Robust Regression Estimates for Cattle Fed and Marketed Under Grid B, 1995–1998

Independent Variable	Parameter Estimate	SE	Standardized Coefficient
Intercept	−684.220**	89.480	
base	7.597**	0.199	0.528
yg1	−0.106	0.217	−0.007
yg2	0.042	0.082	0.008
yg45	−0.707**	0.218	−0.047
prime	0.840**	0.267	0.045
cab	0.281**	0.114	0.041
chsprd	−0.274	0.401	−0.009
noroll	0.044**	0.013	0.057
heavy	−0.383	0.255	−0.018
light	−0.436	0.390	−0.015
costin	−7.392**	0.121	−0.803
cost of gain	−472.700**	16.340	−0.383
hot yield	10.692**	1.241	0.116
Average R^2	0.930		
Observations	1,011		

Note: Statistically different from zero at the 0.05 (**) and 0.10 (*) level.

ed from the combined full data sets. This suggests results are robust across data subsets.

Signs on coefficients match expectations for all independent variables except for yield grade 1 in both models. This coefficient was not statistically different from zero in either model. This could be a result of small percentages of yield grade 1 cattle (Table 3). In addition, yield grade 1 cattle can tend to be underfinished, resulting in premiums for yield grade 1 cattle being offset by lower profit associated with other factors not fully captured in the models by changes in quality grade, cost of gain, or both.

The majority of coefficient estimates are significantly different from zero at the 0.05 level with a few exceptions. In Table 4, percentages of yield grade 1, condemned carcasses, and hot yield were not statistically different from zero. In Table 5, percentages of yield grade 1 and 2, the Choice-to-Select spread variable, and heavy- and lightweight carcasses were not statistically significant. The heavy- and lightweight carcasses were discounted more severely under the grid A than grid B (Tables 1 and 2) scheme, which might explain differences in significance of out-weight carcasses on profit across the two grids.

For both grids, the largest effect on profit per head was the feeder cattle purchase price (*costin*) with SBCs of −1.08 and −0.80 for grid A and grid B, respectively. The next most important factor (ranked by the magnitude of the SBC) was the base price, with SBCs of 0.94 (grid A) and 0.53 (grid B). The larger effect of the base price in grid A in part could be because the base price includes variability in the Choice-to-Select price spread in grid A, whereas under grid B, this variability is captured somewhat in the *chsprd* variable. These results are generally consistent with previous work that found fed and feeder cattle prices were the two most important cattle feeding profit determinants (Langemeier, Schroeder, and Mintert; Mark, Schroeder, and Jones), although the base price is only one component of fed cattle revenue. Cost of gain had the next most important effect on profit for each model (SBC = −0.65 for grid A; SBC = −0.38 for grid B). Earlier studies have generally concluded that cost of gain (or cost of gain components of corn price, feed conversion, and average daily gain) is secondary to fed and feeder cattle prices but is still an important cattle feeding profit determinant (Albright, Schroeder, and Langemeier; Langemeier, Schroeder, and Mintert; Mark, Schroeder, and Jones).

Aside from the base price, individual grid components tend to have less influence on profit per head, with individual SBC < 0.15. Results from both grids indicate that USDA quality grade has the most effect on profitability, with cumulative absolute values of SBCs for cattle quality and yield of 0.16 and 0.10 in grid A and 0.15 and 0.06 in grid B, respectively. This is consistent with Schroeder and Graff, who indicated that variability in quality grade had a larger effect on revenue per head than yield grade or any of the other grid components. Feuz, Fausti, and Wagner (1993) essentially used cross-sectional data and found quality grade to be the most important determinant of profit per head.

When considering only cross-sectional factors (i.e., ignoring feeder price and base price and cost of gain), the sum of absolute values of all the grid components result in a cumulative SBC of 0.34 for grid A and 0.36 for grid B. This indicates that cattle quality and yield grade factors collectively have about half the effect of cost of gain for cattle that were sold using grid A and roughly the same as cost of gain for cattle sold using grid B. Feuz, Fausti, and Wagner (1993) reported that cost of gain was one the least important factors. However, in their work, average daily gain was the second most important determinant of profit and some of the effect of cost of gain would be captured in daily gain. Feuz, Fausti, and Wagner evaluated 345 head of cattle that were all fed across the same time period, resulting in essentially cross-sectional data. The present study includes >1 million head of cattle marketed between 1992 and 1998 and demonstrates that temporal price and performance variability exceeds and overshadows premiums and discounts attributable to cross-sectional cattle quality variability.

The implications of these results are that, over time, market fundamentals affecting grid base prices and feeder cattle prices are of major importance in explaining profit variability, even for cattle feeders selling cattle with grid pricing systems. This has not been clearly demonstrated in grid pricing research, and it indicates that standard techniques for managing these risks are valuable and should not be abandoned when cattle are sold using grids. However, past studies clearly demonstrate increased variability in revenue is realized by cattle feeders when they sell cattle using grids. Results here demonstrate that, cumulatively, quality grade and yield grade performance variability of cattle sold using grids are important profit variability determinants, just considerably less so than aggregate cattle market fundamentals. These results are based on pens of cattle that were managed and targeted for particular grid premium and discount schedules. Because of the sizable discounts "out" cattle (e.g., dark cutters or heavyweight carcasses) receive, lax management of cattle traits would certainly make carcass quality attributes more important profit determinants than demonstrated here.

Conclusions

Cattle feeding profitability is highly variable over time and across pens. When cattle feeders sell cattle on grids with premiums and discounts for varying animal quality attributes, profit variability increases. Grid pricing is increasingly becoming the marketing method of choice for cattle feeders, and with this new pricing method comes increased risk. This study quantified profit determinants for fed cattle sold using grid pricing. Feeder cattle price and grid base price had the greatest effect on profit per head over time in two different grid structures. This suggests that intense management of these price factors offers the largest opportunity for managing profit risk over time. Feeding cost of gain was the next most important factor. However, grid factors taken together were also important profit determinants. For cattle produced and sold under grid A, the grid components together had about one-half the effect of cost of gain, whereas for grid B, they had nearly the same magnitude of effect on profit as cost of gain.

Results of this study have important implications for producers feeding and marketing cattle using grid pricing. Fed cattle, feeder cattle, and corn price risks are the most important profit determinants to manage over time, as with cattle sold using traditional live cash markets. Thus, traditional forward pricing strategies will address much of the profit risk faced by grid sellers. However, fed cattle price risk is enhanced noticeably as a cattle feeder moves to grid pricing because dressing percentage and quality and yield grade variability and their associated premiums and discounts are all fully borne by the producer. Price risk management that focuses solely on traditional price risk will not provide the same level of protection as it would under live weight average pricing. Intensively (e.g., ultrasound, sorting, etc.) managing cattle to reduce the probability of huge discounts for undesirable "out" carcasses is the most effective method to manage this risk. Variability in the Choice-to-Select price spread is the most important added price risk relative to those selling cattle using a grid pricing scheme relative to traditional live-weight marketing. Development of a forward market for this spread would provide another price risk management tool for cattle feeders to compliment those that are already well established.

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