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The revenue risk of value-based pricing for fed cattle: a simulation of grid vs. average pricing

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Abstract

The reluctance to adopt value-based pricing stems from a fundamental problem created by the system: increased revenue uncertainty *and* variability. The literature suggests that inconsistent carcass characteristics cause revenue variability under grid pricing. The possibility that the grid pricing structure, regardless of cattle quality variations, also causes revenue variability has been recognized but not fully analyzed. This study quantifies the impact of grid variability over time, pen quality differentials, and quality grade price discounts on average revenue per head for a pen of fed cattle. Grid pricing revenue results are compared to average pricing results.

1. Introduction

It is often argued that the adoption of a value-based marketing system, such as grid pricing, would benefit the cattle industry by boosting the demand for beef and the efficiency of the beef industry (Fausti, Feuz, & Wagner, 1998; Schroeder, Ward, Mintert, & Peel, 1998; Ward, Feuz, & Schroeder, 1999). Value-based marketing refers to a system in which animals are priced individually based on carcass merits, typically quality grade, yield grade, and carcass weight. Grid pricing applies discounts and premiums to individual carcasses to reflect the value of desired traits. This system should give cattle producers the incentive to produce the type of beef demanded by consumers. Value-based pricing has been around for over two decades, yet less than 50% of all cattle are marketed in this way (GIPSA, 1996).[1] Average-based pricing, such as live weight, is still the norm. As (Feuz, 1999) notes, some

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large feedlots still sell their entire show list (all pens of cattle ready for slaughter) at one price.

Many authors have discussed obstacles to the adoption of value-based marketing (e.g., Fausti et al., 1998). The reluctance to adopt value-based pricing primarily stems from the fundamental marketing risk created by the system: increased revenue uncertainty and variability.[2] The expected price for cattle under grid pricing is much more difficult to predict than under live weight pricing. When cattle are sold, the seller decides on a pricing option (e.g., live weight or grid) before they are slaughtered. With live weight pricing, producers receive an average price for the entire pen (price per hundred weight) based on an estimated average carcass quality prior to slaughter. With grid pricing, each carcass is ranked by its merits, typically weight, quality grade (standard, select, choice or prime, with prime representing the highest grade) and yield grade (1.0 to 5.0, with 1.0 being the highest grade). Premiums and discounts, reflecting how high or low the carcass scores across the three rankings, are applied to an established base price to arrive at the grid price. The seller will not know the price received for a carcass until after the animal has been slaughtered, dressed, and graded. Since the quality of the animal cannot be known with certainty until after slaughter, the seller must simply guess at how the carcass will rank on a grid pricing scheme or any other non-live weight option.

The practice of pen-level payments increases revenue variability under grid pricing. Regardless of how they are priced, cattle are delivered (and sellers are paid) at a pen level—not individually. Within each pen, some amount of variability in the cattle's weight, quality grade, and yield grade exists. Since live weight pricing uses an average price for the entire pen, variations in individual cattle carcass quality are essentially hidden. Since grid pricing evaluates and assigns a price to individual carcasses, the increase in pricing accuracy results in greater price variability per pen (Ward et al., 1999). Graff and Schroeder (1998) note that, "as more cattle are priced on individual carcass grade and yield, price variability across carcasses definitely increases and price variability across pens of cattle may also increase" (p. 217). The literature suggests that carcass weight explains the majority of revenue variability under a grid pricing system (Greer & Trapp, 1999; Feuz, 1998). Quality grade (the percentage of cattle grading choice or higher) and yield grade are less significant factors, although still important (Feuz, 1998; Feuz, Fausti, & Wagner, 1993).

The logical possibility that the grid pricing structure, regardless of cattle quality variation, also causes revenue variability has been recognized but not fully analyzed.[3] The base price as well as the premiums and discounts usually vary across plants and across time since they are frequently adjusted to reflect both market and plant conditions (Feuz, 1998, 1999; Graff & Schroeder, 1998).[4] Schroeder (1998) and Feuz (1999) each found substantial differences in grid pricing results when several different packer grids were compared. Feuz (1998) found at least 25 grid-pricing systems in use and no industry standard. Feuz and others have shown that under a value-based marketing system, revenue variability is correlated with the timing of cattle marketing (Feuz, 1998, 1999; Graff & Schroeder, 1998). As Feuz (1999) concludes, "present grid pricing practices are sending different price signals to producers across grids, and some signals may vary over time" (p. 340). The cyclical nature of cattle prices may also increase the sensitivity of revenue variability to market timing. As a result, fed cattle sellers potentially face a difficult task in predicting grid-pricing results.

Motivated by these issues, this study focuses on quantifying the revenue variability differential between grid and live weight pricing. This also clearly involves a comparison of revenue levels. Previous studies comparing value-based pricing to average pricing have found that the latter typically results in lower revenues (Feuz, Fausti, & Wagner, 1995; Schroeder & Graff, 1999). Packers can be expected to deflate price estimates in consideration of carcass quality estimation error (Schroeder, Ward, Mintert, & Peel, 1997). By comparing revenue levels, the study makes a contribution to this growing body of literature. Since live pricing is the average pricing method most commonly used by fed cattle producers in the southern plains region (the source of data for this analysis) this study compares live and grid pricing. This comparison provides a useful follow-up (using an expanded and updated time series of pricing data) to many earlier grid pricing studies which included comparisons of live to grid pricing (e.g., Feuz et al., 1995; Schroeder, 1998; Schroeder & Graff, 1999; Greer & Trapp, 1999).

The contribution of this study is enhanced by the unique data utilized for the analysis. Many previous studies have relied on a single South Dakota data set to establish cattle characteristics (see work by Fausti & Feuz). This analysis relies on simulated data, based on parameters defined by cattle marketing data from Kentucky-raised cattle fed and slaughtered in western Kansas, for cattle characteristics. Although simulated data certainly has its own pitfalls and is not as realistic, in this case its use may provide additional insight into previous studies (i.e., how closely are previous results tied to a certain data set of cattle) and more robust estimates. This research also incorporates a lengthier time series of grids (previously unavailable) than previous research. Most previous studies have utilized very few, and sometimes only one, marketing time period, creating results tied to a specific time period. The time-series utilized in this study should therefore provide more robust results in terms of expected prices and price variances.

To be more realistic, and to make a further contribution to the literature, comparisons between the pricing options will be made at the pen level. At this level of analysis, and using simulated data sets representing different cattle quality groups, the revenue impact across pricing options of pens with cattle of varying quality can be clarified. As already noted, prior research indicates that pen quality variability may affect the revenue received (and its variability) from grid pricing. Finally, this analysis attempts to further refine sources of revenue differences and variability under alternative pricing options by quantifying the impact of changes in the select discount (the discount applied to carcasses grading USDA select). Fausti et al. (1998) found that farmers received lower revenues (average revenue per head) under the grid system than with the dressed weight alternative primarily because the set of cattle priced on a grid contained a lower percentage of high quality carcasses (i.e., choice or higher). Low quality cattle are usually highly discounted, which may explain the relatively poor performance of grid pricing, as opposed to live or dressed weight pricing, for some cattle data sets (Feuz, 1998; Greer & Trapp, 1999).

2. Carcass data simulation

A simulated set of cattle data—six pens of cattle (500 head each) with varying carcass characteristics—was generated. Each head of cattle is characterized by distinct quality

Table 1
Descriptive statistics of carcass data used to define simulation parameters

	Entire data set	Choice carcasses	<Choice carcasses
Yield grade	2.57 (0.78)	2.91 (0.70)	2.37 (0.75)
Live weight	1,188 (107.0)	1,199 (102.6)	1,182 (109.2)
Carcass weight	762 (76.3)	773 (74.7)	755 (76.5)
No. of observations	1,157	434	723

Note: Standard deviations are given in parentheses.

grade, yield grade, carcass weight, and live weight levels. The simulated data were based on the physical characteristics at slaughter of 1,157 fed cattle enrolled in the Kentucky Feedlot and Carcass Tests (FACTS) program from 1993 to 1998. Descriptive statistics on the Kentucky FACTS data are presented in Table 1.

This carcass data were also used to find correlations between the relevant carcass characteristics. For example, it is unlikely that a carcass grading choice would also be a 450 lb, yield grade 1 carcass. Most choice carcasses are heavier and have higher yield grades. Naylor, Balintfy, Burdick, and Chu (1966) outlines a procedure for correlating normally distributed random variables in a computer simulation using information from the covariance matrix. This methodology was extended by Clements, Mapp, and Eidman (1971) to develop farm simulation models. Trapp (1989) further adapted the methodology to a spreadsheet simulation environment, which is employed here. Naylor's procedure utilizes the mathematical relationship between standard normal deviates and multivariate normal deviates. (For a detailed explanation and justification, see Krzanowski, 1988, pp. 204–205.) Specifically, if $\boldsymbol{z}$ is an $n \times 1$ vector of standard normal deviates, $\boldsymbol{\mu}$ the $n \times 1$ vector, and $\boldsymbol{A}$ is any $m \times n$ matrix of rank $n \leq m$, then

$$\boldsymbol{x} = \boldsymbol{\mu} + \boldsymbol{A}\boldsymbol{z} \tag{1}$$

and

$$\boldsymbol{x} \sim N_n(\boldsymbol{\mu}, \boldsymbol{A}\boldsymbol{A}'). \tag{2}$$

In the context of simulating correlated random variables from a normal distribution with known parameters, this procedure begins with a Cholesky decomposition of the covariance matrix ($\boldsymbol{\Sigma}$) for the variables in question. The coefficients of the resulting square root matrix ($\boldsymbol{A} = \boldsymbol{\Sigma}^{1/2}$) can then be used along with mean values and randomly generated standard normal deviates to create correlated observations. In matrix notation:

$$\boldsymbol{C} = \overline{\boldsymbol{C}} + \boldsymbol{A}\boldsymbol{R}, \tag{3}$$

where $\boldsymbol{C}$ is an $n \times 1$ vector of random correlated observations generated by the simulation, $\overline{\boldsymbol{C}}$ an $n \times 1$ vector of expected values for the variables being generated, $\boldsymbol{A}$ an $m \times n$ matrix of coefficients derived from the covariance matrix, and $\boldsymbol{R}$ is an $n \times 1$ matrix of random standard normal deviates.

To estimate a covariance matrix of correlated carcass merits, FACTS carcass and live weight data were first divided into two quality grade groups: (1) carcasses grading choice and higher (i.e., choice and premium carcasses); and (2) carcasses grading less than choice

Table 2
Correlation among carcass attributes for FACTS cattle and simulated cattle

	Choice and premium carcasses			Select and standard carcasses		
	Yield grade	Live weight	Carcass weight	Yield grade	Live weight	Carcass weight
Covariance matrix of FACTS carcass attributes						
Yield grade	0.49	17.42	14.60	0.56	20.19	14.26
Live weight		10532.8	6033.8		11917.1	6920.7
Carcass weight			5581.4			5845.6
Covariance matrix of simulated carcass attributes						
Yield grade	0.47	15.71	12.84	0.57	15.41	11.23
Live weight		10438.3	5884.2		11716.8	6624.1
Carcass weight			5302.3			5643.5

(i.e., select and standard carcasses). Within each quality grade subset, a covariance matrix including yield grade, carcass weight, and live weight was calculated. In each of the quality grade data subsets, the three carcass characteristics were all found to have approximately normal distributions (the distribution assumed in the Naylor correlation procedure). The covariance matrices used to generate correlated yield grade, live weight, and carcass weight attributes are presented in Table 2. (Covariance data for simulated cattle is also included in this table.) After selecting a random quality grade value (prime, choice, select, or standard) correlated yield grade, live weight, and carcass weight attributes were generated using the appropriate FACTS covariance matrix for the designated quality grade.

To create pens of cattle with varying degrees of quality, six different sets (or pens) of data were generated. Each set (containing 500 individual animal observations) is defined by the percentage of cattle grading choice or higher: 45% to 95% in 10% increments. The selection of 500 observations was somewhat arbitrary; however, this sample size should be large enough to provide statistical validity and yet still remain manageable for the pricing model discussed.

The carcass simulation process was somewhat complicated by the relationship among different quality grades. A larger proportion of carcasses can be expected to grade select rather than standard as the percentage of choice or higher carcasses increases. Likewise, as the percentage of choice or higher carcasses increases, a larger proportion of carcasses should be expected to grade prime. Hicks et al. (1987) and Van Koevering, Gill, Owens, Dolezal, and Strasia (1987) defined this relationship based on data from two serial slaughter studies conducted at Oklahoma State University. Table 3 describes the percentage of carcasses in each quality grade category for the six simulated pens generated for the analysis presented here.

3. Empirical pricing model

Per head revenue for each animal in the six simulated pens was calculated weekly on both a live and grid basis during the period October 1996–May 2001 (241 sets of prices).[5] Grid

Table 3
Percentage of simulated cattle (by pen) in each USDA quality grade category

Pen (% choice)	USDA quality grade			
	Prime	Choice	Select	Standard
45	0.0	44.2	45.6	10.2
55	0.0	56.4	37.6	6.0
65	0.0	65.2	34.2	0.6
75	0.0	74.8	25.2	0.0
85	1.4	83.0	15.6	0.0
95	2.0	94.4	3.6	0.0

prices were derived from the USDA Agricultural Marketing Service's (USDA-AMS) *National Carcass Premiums and Discounts for Slaughter Steers and Heifers* report (weekly grid premiums and discounts are conveyed) for the time period October 1996–May 2001. The weekly USDA boxed beef cut-out value (BBCV) for choice 550 lb to 850 lb carcasses during October 1996–May 2001 was used for a base price. The BBCV has been used in other studies (Greer & Trapp, 1999) and is a common base price for packers (Schroeder et al., 1998). For pricing cattle on a live weight basis, weekly western Kansas direct fed cattle

Table 4
Summary of grid premiums and discounts and base and live prices ($/cwt): October 1996–May 2001

	Mean	SD	Minimum	Maximum
Quality grades				
Prime	5.64	0.54	3.83	7.91
Choice	0.00	0.00	0.00	0.00
Select	−7.84	3.44	−19.32	−2.00
Standard	−17.58	2.82	−27.46	−11.87
Yield grades				
1.0–2.0	1.94	0.43	1.67	4.30
2.0–2.5	0.91	0.20	0.71	2.17
2.5–3.0	0.88	0.14	0.25	1.44
3.0–3.5	−0.15	0.03	−0.22	0.00
3.5–4.0	−0.30	0.04	−0.33	0.00
4.0–5.0	−15.40	2.16	−21.29	−11.29
>5.0	−20.46	1.74	−24.50	−16.71
Carcass weights				
400–500	−21.57	1.22	−27.50	−20.14
500–550	−17.34	1.21	−22.33	−13.60
550–600	−0.04	0.26	−2.44	0.00
600–900	0.00	0.00	0.00	0.00
900–950	−0.01	0.07	−0.71	0.00
950–1,000	−15.78	2.10	−18.67	−7.00
>1,000	−21.23	2.16	−24.50	−16.00
Prices				
Boxed beef cut-out value	109.61	10.27	92.31	134.43
Western Kansas direct steer price	66.98	5.07	56.36	81.89

prices for choice 1,100 lb to 1,300 lb steers during the same period were used. All of the price and grid data used in this study were obtained from the Livestock Marketing Information Center (2002). Descriptive statistics for base and live prices and for USDA-AMS grid premiums and discounts for the 1996–2001 period are reported in Table 4. To investigate the impact of the select discount, live and grid revenue per head calculations were calculated using four different ranges of a select discount: (1) greater than −$4.33/cwt; (2) −$7.84/cwt to −$4.33/cwt; (3) −$11.35/cwt to −$7.84/cwt; and (4) less than −$11.35/cwt. The ranges were specified by adding or subtracting one standard deviation (3.51) to the mean select discount (−7.84). For example, −4.33 represents one standard deviation above the mean.

4. Results and discussion

Results of the weekly pricing of the six pens of cattle are presented in Table 5. The table is divided into three sections. The first section presents results from the entire time period. The second and third sections present results from two sub-periods. The division of data were made to explore the impact of market timing. With the entire data set (first section), grid pricing generates greater revenue per head than live weight pricing, regardless of pen quality level. This is a somewhat surprising result that is not consistent with many previous studies

Table 5
Average revenue level and variability from grid and live pricing

Pen (% choice)	Average grid revenue	SD	CV	Average life revenue	SD	CV
October 1996–May 2001						
45	795.09	93.67	0.118	792.35	69.49	0.088
55	810.34	89.40	0.110	800.21	69.02	0.086
65	817.29	85.54	0.105	800.09	71.34	0.089
75	821.93	83.84	0.102	797.25	73.69	0.092
85	838.26	83.36	0.099	804.30	68.15	0.085
95	844.49	80.41	0.095	806.51	67.19	0.083
October 1996–December 1998						
45	739.63	87.95	0.119	760.50	66.70	0.088
55	753.21	83.68	0.111	767.11	66.17	0.086
65	760.93	79.84	0.105	767.93	68.47	0.089
75	765.27	78.24	0.102	765.20	70.73	0.092
85	780.50	77.77	0.010	771.98	65.41	0.085
95	786.25	75.03	0.095	774.09	64.49	0.083
January 1999–May 2001						
45	846.56	98.98	0.117	821.91	72.09	0.088
55	863.76	94.78	0.110	830.87	71.67	0.086
65	869.59	90.85	0.104	829.94	74.00	0.089
75	874.51	89.04	0.102	826.99	76.44	0.092
85	891.86	88.54	0.099	834.31	70.69	0.085
95	898.54	85.55	0.095	836.59	69.70	0.083

(e.g., Fausti et al., 1998; Feuz, 1999; Schroeder & Graff, 1999). However, it may be explained by the longer time series considered in this study. The standard deviation and coefficient of variation estimates indicate that, as expected, revenue variability is greater with grid pricing than with live weight pricing, regardless of pen level quality. However, the difference in revenue variability becomes more pronounced with lower quality pens (45% to 65% choice).

These results shed some light on producers' incentive to price cattle on a grid. For the two lowest quality pen levels considered here, it is likely than many producers would not view the increase in revenue (as little as $2.74 per head) as sufficient to offset the additional management/transaction costs and risks associated with grid pricing. Still, it is significant that even lower quality cattle can, under favorable market conditions, receive a premium under grid pricing. For higher quality pens of cattle (>65% choice) the premium for pricing cattle on a grid can be quite significant (over $15 per head). For all of the pens, producer attitude toward risk would be an important factor to consider in evaluating the grid pricing risk/reward trade-off.

Splitting the data at the end of 1998 (an arbitrarily selected point that roughly divides the data in half) raises some interesting questions regarding temporal changes in grid/premium discounts. For the period October 1996–December 1998, only the pens above 75% choice receive a premium, with grid pricing revenue exceeding live weight pricing revenue. On the other hand, the January 1999–May 2001 results reveal grid pricing as dominating live pricing for all pens. Further, the temporal revenue variability is greater under the grid system than with live weight pricing. Taking the 65% choice pen as an example, the difference in grid revenue per head between the earlier and later time periods is over $100 per head. The difference in live revenue is about $60 per head. Finally, grid pricing seems to have become a more attractive option over time. As previously noted, grid pricing dominates live pricing (in terms of revenue per head) for all pens of cattle in the later time period. Moreover, the coefficient of variation estimates do not change appreciably between the two time periods.

The uncertainty that sellers face in their marketing decision is further complicated by the fact that the assessment of the average quality of a pen of cattle is fairly subjective. A cattle feeder will not know with certainty what percentage of cattle in a pen will grade choice or higher until the cattle are slaughtered. In addition, the presence of "out" cattle (i.e., dark cutters, bullocks or stags, or hardboned cattle) in the pen will not be discovered until the cattle are slaughtered. Discounts on these cattle are quite severe; the presence of only a small percentage of "out" cattle can result in grid pricing revenues falling well short of expectations.

The select discount sensitivity analysis reveals that both revenue levels (Table 6) and revenue variability (Table 7) are impacted by changes in the discount level. As the select discount increases (in absolute value, from range 1 to 4), grid pricing becomes a more attractive marketing option for each pen (in terms of revenue level). This result may seem counterintuitive. An increase in the select discount represents an increase in the penalty received by lower quality cattle. Particularly for pens of below average quality (e.g., the 45% pen), it would seem that an increasing select discount would favor live pricing as the most advantageous marketing strategy. However, select discount levels are positively correlated with base price levels; as the discount levels increase so do the base price levels. (Likewise,

Table 6
Revenue per head (pen average) at different levels of select discount: October 1996–May 2001

Pens (% ≥ CH)	>−4.33			Select discount ranges ($/cwt)								
	Grid	Live	G–L	−$4.33 to −$7.84			−$7.84 to −11.35			<−$11.35		
				Grid	Live	G–L	Grid	Live	G–L	Grid	Live	G–L
45	755.79	768.69	(12.90)	798.17	799.43	(1.26)	789.99	787.59	2.40	841.14	811.27	29.87
55	766.82	776.31	(9.9)	811.91	807.36	4.55	806.45	795.40	11.05	861.78	819.30	42.48
65	771.43	776.20	(4.77)	817.76	807.24	10.52	814.20	795.28	18.92	871.92	819.19	52.73
75	772.76	773.44	(0.68)	820.91	804.37	16.54	820.19	792.46	27.73	880.52	816.28	64.24
85	784.83	780.29	4.54	835.90	811.49	24.41	837.68	799.48	38.20	901.93	823.51	78.42
95	786.59	782.42	4.17	840.70	813.71	26.99	845.11	801.66	43.45	913.56	825.76	87.80
Total no. of observations		37			86			83			35	
Average select discount		−3.03			−6.05			−9.49			−13.66	
Average base price		101.99			108.96			109.85			118.70	
Average live price		64.98			67.58			66.58			68.58	

Table 7
Coefficient of variation on grid pricing revenue per head (pen average) at different levels of select discount: October 1996–May 2001

Pens (% ≥ CH)	>−4.33	Select discount ranges ($/cwt)		
		−$4.33 to $7.84	−$7.84 to $11.35	<−$11.35
45	0.111	0.113	0.121	0.129
55	0.104	0.106	0.113	0.120
65	0.099	0.101	0.107	0.113
75	0.097	0.099	0.104	0.109
85	0.095	0.097	0.101	0.105
95	0.095	0.094	0.096	0.096
Total no. of observations	37	86	83	35

average live prices also increase with discount levels, although less dramatically.) The decrease in revenue attributable to a higher select discount (in absolute value) is more than offset by the increase in revenue due to the higher base price.

The coefficients of variation presented in Table 7 show that variability of grid pricing revenue increases with the select discount level for all but the highest quality pen (95% choice). Moreover, the impact of the select discount level on revenue variability becomes more dramatic as pen quality decreases. These results are broadly consistent with Fausti and Qasmi (1999), who report that the choice/select spread (i.e., the difference between the price of carcasses grading USDA choice and those grading USDA select) is the primary factor influencing the price variability between grid and average pricing.

5. Summary and conclusions

The analysis presented in this study provides additional insight into possible obstacles preventing more widespread adoption of grid pricing. This study allowed for comparisons to be made between live weight and grid pricing in terms of revenue levels. Over the total time period considered (October 1996–May 2001), revenue from grid pricing dominated live weight pricing for all pens of cattle, regardless of their quality consistency. This result was clearly influenced by market conditions, as illustrated by the findings when the time series data were divided into two periods. In earlier years, live weight pricing dominated for pens of cattle with inferior quality.

Variations in pen quality become more of an issue with revenue variability. Overall, the potential revenue from grid pricing is highly variable. The variance reported in this study reflects grid and base price variance over time and pen quality variations. Revenue variability with grid pricing also increases with the select discount level, across each pen. The impact of the select discount level on revenue variability becomes more dramatic as pen quality decreases. In reality, the seller's subjective assessment of average quality within a pen makes grid pricing results highly uncertain. Clearly, all of the results are dependent on the simulation methods, the underlying parameters (FACTS data), and the grid data. Therefore, the numerical results do not say anything definitive as to when grid pricing will lead to higher and more stable revenues as compared to live weight pricing. For example, a grid with higher premiums for high yielding cattle (yield grades 1 or 2) could potentially result in greater premiums being paid on pens of cattle with a relatively low percentage of choice carcasses. Despite these limitations, the following result is valid: choosing the wrong marketing method, or incorrectly estimating the quality of cattle, can lead to significant losses in revenue. It is likely that some downside revenue risk surely hinders the adoption of grid pricing. For example, USDA data indicates that for the first 6 months of 2001, the percentage of cattle grading choice or better averaged 55% (LMIC). Results of this study indicate that under most market conditions, marketing cattle of this quality on a grid would result in only a marginal increase in returns (if any) while exposing the seller to increased risk.

The optimal marketing choice must also consider an individual seller's risk aversion level. In many cases, highly risk averse sellers may not receive returns high enough under grid pricing to compensate them for the additional risk. Errors in the seller's judgment of a pen of cattle's quality can have a significant impact on grid pricing returns while having little or no impact on returns to live pricing. Moreover, although comparing revenue rather than profits is appropriate in the context of this study (since the only decision being analyzed is the selection of a marketing method for a given pen of cattle), it is not appropriate for analyzing long-run marketing decisions. The decision to engage in a given pricing strategy over the long run—which here may be defined as multiple feeding periods—may lead to management changes (e.g., cattle types and feeding programs) that will result in a different cost structure (Feuz, 1999). Further, additional transactions costs associated with grid pricing and the delay in receiving payment for cattle priced on a grid will also, to some extent, offset the potentially higher returns offered by grid pricing. From a feedlot manager's perspective, it is much simpler to sell all cattle at a single price than to make a decision on how to price each individual pen of cattle in the feedlot.

An examination of the kind of changes that would make grid pricing a more attractive alternative is beyond the scope of this paper; however, a few key points should be mentioned. First, grid pricing seems to have become a more attractive option in the last few years. Whether this is due to a conscious effort on the part of packers to change grids or simply to market conditions affecting live and boxed beef cut-out prices is not clear. Current grids still seem to consist primarily of discounts rather than premiums (i.e., downside risk). Some effort to actually reward superior quality rather than simply penalizing inferior quality could encourage greater use of grid pricing. Second, technological advances could make grid pricing less uncertain, and thus, more attractive. For example, a more objective means of estimating quality grade prior to slaughter could remove a great deal of the variability associated with grid pricing. Innovations in the use of ultrasound seem promising (Ferguson, 2001). Improved animal identification technology that would allow animals to be marketed individually rather than in pen-sized groups would also alleviate some of this variability. Finally, future research needs to assess the potential benefits of vertical integration in the industry with respect to grid pricing. Some type of coordination between producers and packers could perhaps alleviate some of the uncertainty currently associated with base prices and grid premiums and discounts. The ultimate impact of this type of coordination on grid pricing adoption and, in turn, on the rest of the industry could be tremendous.

Notes

1. In 1996 (the most recently reported year), 47.3% of all cattle (steers, heifers, cows and bulls) were purchased on a carcass basis, which includes grid pricing as well as grade, weight, yield, and other methods (GIPSA, 1996, p. 24). Value-based pricing has been steadily increasing, however.
2. The *variability* associated with a given outcome can be quantified (i.e., a distribution can be established) whereas *uncertainty* cannot be quantified.
3. The subjectivity of the grading system itself is also often cited as an obstacle to the adoption of grid pricing; an analysis of that problem is beyond the scope of this paper.
4. Base price sources include the average price of cattle purchased by the plant, highest reported price for a specific market, live cattle futures prices, carcass weight, live weight (plant average), and wholesale boxed beef prices (Schroeder et al., 1998).
5. A 4% "pencil shrink" was assumed in the calculation of per head revenue on a live basis. The term shrink refers to the amount by which the weight of cattle decreases during transport. Pencil shrink refers to an assumed rather than actual weight reduction that is used in determining the pay weight (i.e., the weight that the seller will actually be paid for) of cattle.

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