

NCCC-134

APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

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Suggested citation format:

Feuz, D. M. 1994. “Terminal Markets for Fat Cattle: Are They ‘Lemons’ Markets?” Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [<http://www.farmdoc.uiuc.edu/nccc134>].

Terminal Markets for Fat Cattle: Are They "Lemons" Markets?

Dillon M. Feuz*

Introduction

The United States cattle industry has undergone significant structural changes over the last couple of decades. Several authors have examined these changes and discussed the implications for price discovery, price reporting, and pricing methods (Bailey et al., 1993; Barkema and Drabenstott, 1990; Purcell, 1991; and Ward, 1987). Their general findings were 1) that the cattle industry has become more concentrated, particularly at the packer and feeder levels, than was previously expected; 2) that the industry is becoming more vertically integrated; and 3) that with the present level of concentration and vertical integration price reporting and pricing efficiency are a major concern.

Ward discussed the major slaughter cattle pricing methods of 1) live weight, 2) carcass or dressed weight, and 3) dressed weight and grade or grade and yield pricing. The information available with each of these pricing methods varies and the risk to buyer and seller also varies. From the buyer's (meat packer's) perspective, the grade and yield marketing method is the full information method. The price paid to the seller is based on the actual carcass weight and the USDA Quality and Yield Grades of that carcass. If cattle are marketed on a dressed weight basis, the carcass weight is known with certainty, but buyers must estimate the expected quality and yield grades. There is a risk of incorrectly estimating the quality and yield grades. When cattle are marketed on a live weight basis, the buyer must estimate the dressing percent and the quality and yield grades. There is not only the risk of incorrectly estimating the quality of the cattle, but also of paying for more or less carcass weight than actually exists.

Ward argued that a buyer's risk increased going from grade and yield to dressed to live weight pricing and that buyers offset that risk by offering a lower price in the live and dressed weight markets. While the risk to the buyer increases going from grade and yield to dressed to live weight marketing, Caughlin correctly points out that the risk to the seller decreases¹. With live weight marketing, the seller knows with certainty at the time of sale the total revenue from any pen of cattle. However, with dressed weight or grade and yield marketing, the price is known at the time of sale but the dressing percent or carcass weight is not known for dressed weight marketing, and carcass weight, quality and yield grades are not known for grade and yield marketing.

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¹ This assumes that a seller's risk is defined in terms of variance of revenue from the expected revenue. If a seller's risk was defined as the risk of not getting paid for the quality of animal, then a seller's risk would also be greatest with live weight marketing.

In a recent study, Feuz, Wagner and Fausti found that average revenue per head was \$19.50 lower for live weight and \$2.55 lower for dressed weight marketing when compared to grade and yield marketing. They concluded that this was the risk premium for the lack of information in the live and dressed weight markets. They used a terminal market price for the live weight market and used a direct market price for the dressed weight and the grade and yield pricing methods. In subsequent research, using a direct market price for the live weight price rather than the terminal market price, they found a revenue difference of only \$6.22 between live weight and grade and yield pricing (Feuz, Fausti, and Wagner, 1994).

Does average quality difference between animals sold through terminals versus direct sales account for some or all of this revenue differential? Do sellers have an asymmetric information advantage over buyers and sell their better quality animals grade and yield and their poorer quality animals on a live weight basis through the terminal markets? If the answer to these questions is yes, then are the terminal markets for fat cattle becoming "lemons" markets? The objective of this paper is to try to answer some of these questions by investigating prices for fat cattle at terminal markets compared to prices for fat cattle sold directly.

Relevant Theory

The basis for this paper is Akerlof's seminal contribution to the economics of information when there exists a degree of quality uncertainty. Using the U.S. automobile market as an example, he showed that if quality was uncertain and if sellers had asymmetric information on quality, then a "lemons" market would develop and in the extreme case market failure would result. The argument is that new cars are either good quality or poor quality (lemons) and that the buyer doesn't know the quality. The buyer does know that the probability of a good car is q and the probability of a lemon is $(1-q)$. However, a short time after owning the new car a new probability can be assigned as to whether or not the car is a lemon.

In the market for this used car, the seller has an asymmetric information advantage over the buyer. However, both good used cars and lemons still must sell at the same price, because the buyer can not tell the difference. This used price must be lower than a new price or owners of lemons would immediately sell their used cars and purchase a new one at a higher probability q of being a good car. The owners of a good used cars are now locked in to keeping the cars because they cannot sell them for their true value, or even the expected value of a new car. In this manner, the bad cars have driven the good used cars out of the market. Akerlof points out that in the continuous case the bad drive the not-so-bad which drive the medium which drive the good out of the market to the extent that no market exists.

The analogy can be extended to the U.S. slaughter cattle market and particularly to the terminal markets. Fat cattle are either good quality with probability q or poor quality with probability $(1-q)$. Quality will be defined as a USDA Choice or higher, Yield Grade 1-3, 550-950 lb carcass. This is the par bid used by one of the major meat packers (Spencer, 1994). Various discounts are applied to animals that don't meet, or are not expected to meet, this standard. As was previously stated in this article, all of this quality information is uncertain for live weight sales and dressed weight sales eliminates only the carcass weight uncertainty.

If buyers were unable to distinguish between good quality and poor quality cattle then, from Akerlof's argument, the market price would be that for the poor quality animals (this is another point of Akerlof's article: the seller pays for the lack of information). However, cattle buyers maintain that they can visually determine, on a live weight basis, most (but not all) of the quality differences. If this is correct, the price for higher quality cattle still will be lower in the uncertain cases (live and dressed markets) when compared to the certain case (grade and yield market) if buyers are even slightly risk averse.²

Therefore, if sellers have any asymmetric information advantage, based on prior knowledge of the cattle and observed feedlot performance, it would be rational economically to market those animals that were expected to be higher quality on a grade and yield basis. Those animals that were expected to be poor quality should be marketed on a live weight basis where it is possible the buyer will offer more than the true value because of the uncertain quality information.

Unlike the used car business, where negotiations occur on an infrequent basis between a specific buyer and seller, negotiations on the sale of cattle may be conducted on a weekly basis between the same buyer and seller. This changes the negotiating environment. If a seller misrepresents one lot of cattle to a buyer and sells poor quality animals on a live weight basis at a higher than justified price, the buyer will discover this following the slaughter process. The buyer likely will remember this the following week and may not return to the feedlot or may adjust the bid offered downward.

If cattle feeders believe their cattle are of inferior quality, rather than selling the cattle direct to the packer buyer, they may sell through a terminal auction. At the terminal auction there often will be one or two middlemen who may purchase and sort cattle. Typically, these middlemen purchase cattle on a live weight basis at the terminals and then sell direct to the packer on a grade and yield basis. In this manner, the packer is paying only what the cattle are worth, in terms of quality, and the middleman is accepting the risk of estimating quality correctly in return for a chance to make a profit.

Empirical Data

Do the actual markets and market participants behave according to the preceding theoretical discussion? There have been several studies done to determine what percent of cattle are marketed under each pricing method. These results are summarized in Table 1.

There have been a number of reasons given for the apparent differences in pricing method between the southern plains and the corn belt feeding regions. Among the reasons given for the corn belt feeders to be more likely to sell on a dressed weight or grade and yield basis are: smaller feedlots with less bargaining power with the major packers; more mud to cause

²A confidential view of a summary of one of the major meat packers buying records, would tend to confirm this assumption. Ratti and Ullah have also derived this result in their analysis of uncertain factor markets.

Table 1. Percent of Fed Cattle Marketed Under Various Pricing Alternatives.

Source	Year of Study	Live Weight	Dressed Weight	Grade & Yield	Packer Contract
Ward, 1987	1979				
Southern Plains		98%	1%		
Western Corn Belt		82%	18%		
Caughlin, 1988	1986				
Texas & Kansas				9%	
Nebraska & Iowa				52%	
Schroeder, 1989	1987				
Kansas Feedlots		88%	2%	1%	9%
Feuz, 1994	1993				
IA, MN, NE & SD		13%	57%	30%	

greater problems in estimating dressing percent; higher quality cattle on average; and tradition. The scope of this study is on a part of the corn belt comprising the states of Iowa, Minnesota, Nebraska and South Dakota. Figure 1 contains a map depicting the general market area.

There are three terminal markets operating in the heart of this area and two others on the fringe of the area. The USDA Market News Service reports prices for all of the terminals and also reports a direct price quote for Nebraska and a direct quote for Iowa/So. Minnesota. The original intent of the research reported here was to compare prices at Omaha, Nebraska; Sioux City, Iowa; and Sioux Falls, South Dakota with the two direct price series. It was hoped that over time, as volume at the terminals decreased and they became more susceptible to a "lemons" market phenomenon, some of this change would be reflected in relative price changes between the markets. However, the direct series only go back four years, precluding this type of analysis.

The average weekly market price for Choice, Yield Grade 2-4, 1100-1300 pound steers at the terminals and for 65-80% Choice steers in the direct markets are presented in Table 2. The only price that is significantly different from the others is the price at Sioux Falls, SD. That price is significantly lower.

There are some problems with this price comparison. The first problem is that both the direct market quotes and the terminal market quotes are representative of higher quality cattle, and it is not surprising that the prices are not significantly different. What this data set does not reveal is what percent of fat cattle going through the terminal meet the Choice, Yield Grade 2-4, category versus what percent are in an inferior grade. It also would be beneficial to know

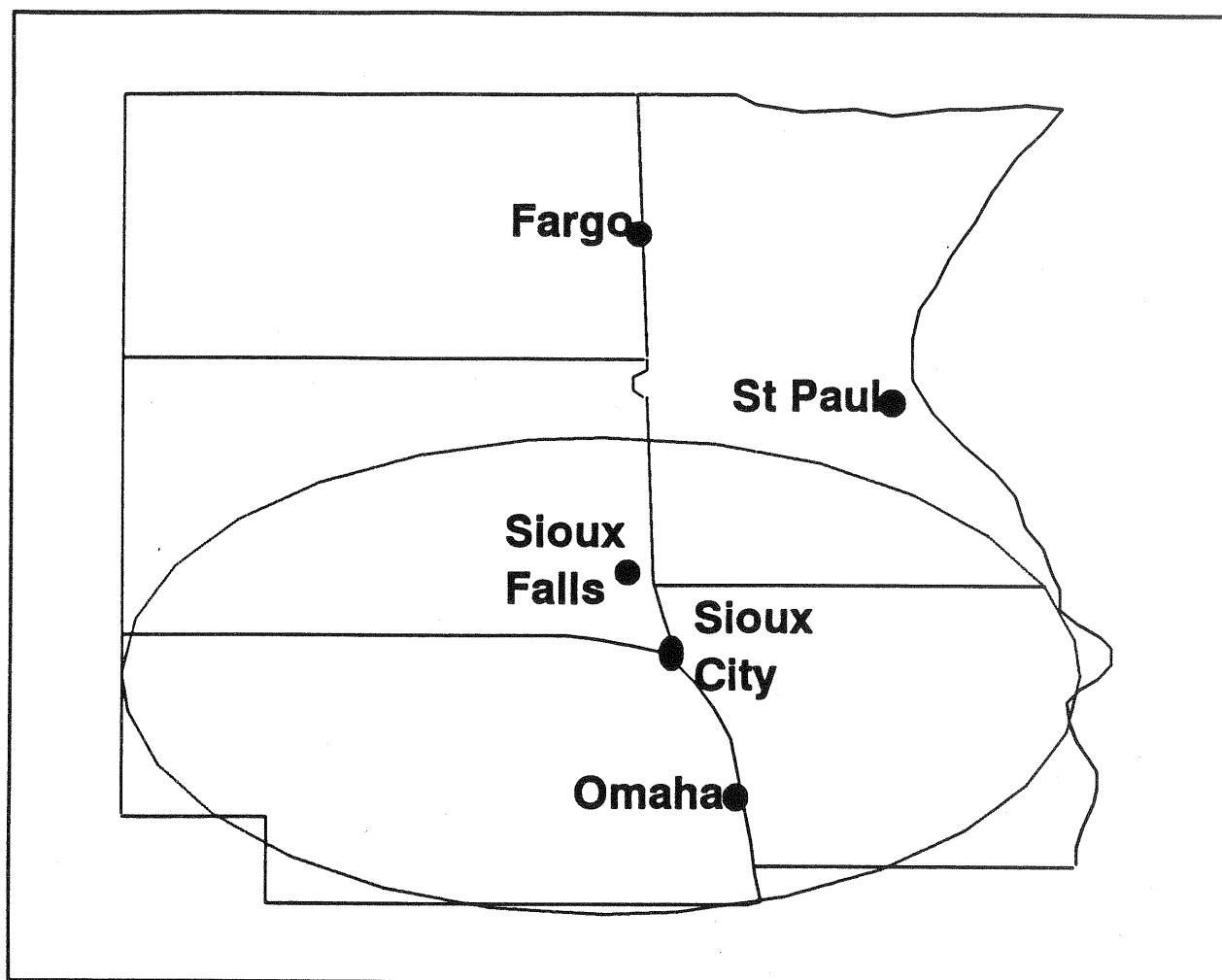


Figure 1. General Market Area for This Study.

Table 2. Weekly Average Prices and Annual Sales Volume from 1990-93.

Market	Weekly Average Price	Annual Volume	
		Head/Year (1000)	Percent of Market Area
Nebraska Direct	\$76.00	4,336	65%
So. Minn./Iowa Direct	75.35	1,752	26%
Omaha, Nebraska	75.76	116	2%
Sioux City, Iowa	75.78	114	2%
Sioux Falls, South Dakota	74.87**	370	5%

Note: Double asterisk denotes significant difference at the .01 level.

Source: USDA, Agricultural Marketing Service, Livestock and Seed Division, Market News.

the percentage of yield grade 4 animals in this category. Another problem is that the terminals usually only report prices on the first three or four days of the week and the direct price is quoted five days a week. Therefore, weekly averages are not based on the same number of days. If prices are not constant throughout the week, one or more of the averages could be biased. A third issue, and perhaps one of greatest concern in this type of analysis, is the fact that terminal price quotes may have some direct price sales included in the weighted average price. Jim Robb of the Livestock Marketing Information Center, has stated that the USDA Market Reporter for Omaha would include direct sales around Omaha in his price quotes. Likewise, reporters from Sioux City and Sioux Falls would include direct market sales in their areas as part of their terminal price quotes. From a pricing accuracy point of view, this is probably a good phenomena. However, in trying to compare the markets, this renders the data set practically useless.

Perhaps of greater interest or concern from a pricing efficiency perspective than the prices displayed in Table 2, is the annual volume through each market. These volume figures represent all fat cattle sold through each of the markets. Given that the terminal markets probably are open at least 200 days per year, the volume through Omaha, Nebraska and Sioux City, Iowa averages only about 500 head per day. That 500 head may be a mixture of steers and heifers, Choice or Select quality grade, beef or dairy breeds, and several different weight categories. Are one or two pens of cattle establishing a price that is quoted across many market news services? Bill Meyers, the USDA Market Reporter at Omaha, suggested that the Omaha price is no longer representative of the market and that researchers should be building price data bases using the Nebraska Direct or the Five State Area Direct market price rather than the Omaha price for fat cattle.

Asymmetric Information

The USDA price data set was of little or no use in determining if the terminal markets are in fact "lemons" markets. According to the theoretical discussion, for the terminals to become "lemons" markets, sellers would have to have an asymmetrical information advantage concerning cattle quality. That issue is discussed in this section.

South Dakota State University has conducted a retained ownership demonstration project for the last three years (Wagner et al. 1991, 1992, & 1993). Producers send five head lots of steer calves to a commercial feedlot to be fed out to a slaughter weight. Initial data obtained on the steer calves at feedlot arrival includes initial weight, hip height, and back fat measured by ultrasound. Producers also provided data on age at placement, number of calves creep fed, number of calves vaccinated prior to feedlot arrival, and number of calves weaned at least a week prior to feedlot arrival. Average daily gain, cost of gain, and the number of days on feed all were recorded. This would be asymmetric information that a cattle seller would have prior to choosing the slaughter cattle pricing method.

The steer calves were sold on a grade and yield basis and detailed carcass information was collected. Revenue per head was calculated for each pen of cattle sold. Expected revenue per head also was calculated had the steers been sold on a live weight or dressed weight basis. This expected revenue was obtained by using the average market price for similar quality cattle

sold on a live or dressed weight basis. Analyses was then undertaken to determine which factors were of greatest significance in explaining the most profitable marketing method for each pen of cattle. The two factors of greatest importance were the dressing percent (carcass weight/live weight) and the USDA quality grade or the degree of marbling.

Both cattle buyers and sellers claim they can estimate these factors fairly accurately by visual inspection. The intent here is not to dispute or substantiate that claim. However, regression analysis was used to regress the potential asymmetric information the seller has on the steers against dressing percent and marbling. Those results are displayed in Table 3.

While some of this prior information is statistically significant in explaining dressing percent and marbling variability, the practical significance probably is very limited. The adjusted r^2 was only 11.55 for dressing percent and 15.99 for marbling score. Based on this analysis, it would not appear that the sellers have much, if any, asymmetric information advantage over the buyers.

In a study conducted by Marshall and Wagner, calves from the same cow herd were placed in a consistent feeding program over a five year period. They showed a certain degree of consistency in performance with respect to average daily gain and percentage of calves having sufficient marbling to grade choice. Would this information be asymmetric information for the sellers? Very few cattle producers ever follow their cattle through the slaughter process and obtain carcass information on them. This may be changing with the interest in value based marketing and/or strategic alliances between cow-calf producers, feedlots and meat packers. However, even if the cattle feeder has this carcass information, if the same packer is purchasing the cattle, then the packer buyer also would have this information. In fact, the packer most likely has this information on many producers and may in fact have an asymmetric information advantage over the seller.

Conclusions and Implications

The intent of this paper was to analyze fat cattle prices at the terminal markets of Omaha, Nebraska, Sioux City, Iowa and Sioux Falls, South Dakota and compare them to the direct prices for Nebraska and Iowa/So. Minn. It was hypothesized that over time, as direct sales have become the dominant marketing method and as terminal slaughter cattle volumes have decreased, the terminal markets may now in fact be "lemons" markets, ie. markets for poorer quality cattle. This was based on the assumption that if cattle sellers possessed asymmetric information on cattle quality, they would sell their better quality cattle direct to the packer buyer and sell their poorer quality cattle through the terminal markets.

Several data sources were searched out, many knowledgeable cattle marketing individuals were consulted, and past research was reviewed to try and substantiate the proposed hypothesis. However, it is the opinion of this author, that the data are simply not available to answer the question directly. Still, there were some important findings that came out of this research endeavor.

Table 3. Results of Predicting Dressing Percent and Marbling Using the Asymmetric Information Possessed by Cattle Sellers.

Variable	Dressing Percent Parameter	Marbling Parameter
Intercept	53.764** (2.758)	3.182** (0.834)
Initial Weight	0.004* (0.002)	0.000 (0.001)
Initial Height	-0.028 (0.055)	-0.023 (0.017)
Initial Back Fat	-2.727 (1.765)	1.640** (0.534)
Age at Placement	0.008* (0.004)	0.010** (0.001)
Previously Vaccinated	-0.036 (0.197)	0.042 (0.060)
Creep Fed	-0.029 (0.100)	-0.056 (0.030)
Pre-Weaned	-0.286 (0.154)	-0.096* (0.047)
Average Daily Gain	-0.063 (0.273)	0.205* (0.083)
Days on Feed	0.031** (0.005)	0.004** (0.001)
Total Cost of Gain	0.038 (0.028)	-0.019* (0.008)
Adjusted R ²	11.55	15.99

Note: The standard Errors are in parentheses. Single asterisk and double asterisk denote significance at the .05 and .01 level, respectively.

One such finding was the relatively small volume of slaughter cattle actually going through the terminal markets. Given the small slaughter cattle volumes, and the number of weight groups and quality categories reported, the terminal markets are very thin markets. And yet, these are the markets that are routinely reported over many news outlets and used in most research analyses. In their recent review of empirical agricultural commodity price analysis, Tomek and Myers listed a need for renewed interest in data quality as the first requirement for improved empirical analyses. It may be time to look for a price series, other than the Omaha Price, for fat cattle price analyses.

In spite of the above statement, there was no statistical differences found between the weekly average prices at Omaha, Nebraska, Sioux City, Iowa, Nebraska Direct and Iowa/So. Minn Direct for the period of 1990-1993. The weekly slaughter steer prices at Sioux Falls, South Dakota were determined to be statistically lower than the other market prices.

A three year data set on a retained ownership demonstration program was used to determine if cattle sellers possessed an asymmetric information advantage over cattle buyers. Data on weight, height, back fat, age and previous management history of steer calves entered into a feeding program were used in conjunction with data on average daily gain, days on feed, and total cost of gain to predict dressing percent and marbling, two important quality variables. Only 11.55 and 15.99 percent of the variation in these two variables could be explained using this data. This would suggest that prior information is of limited value in determining the optimal selling method, ie. sellers do not have an asymmetric information advantage.

In conclusion, it is suggested that the terminal markets for fat cattle are not "lemons" markets as described by Akerlof. However, given the small volume going through the terminal markets, they may in fact, as one of my colleagues suggested, be truly terminal, ie. dead, markets.

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