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## FACTORS AFFECTING QUALITY GRADE DISCOUNTS FOR FED CATTLE

Robert Hogan, Jr.<br>Texas AgriLife Extension, District 6 Center<br>Texas A\&M University<br>Fort Stockton, TX 79735<br>Phone: 432-336-8585<br>Fax:<br>Email: rhogan@ag.tamu.edu<br>Jared G. Carlberg<br>Department of Agribusiness and Agricultural Economics<br>University of Manitoba<br>Winnipeg, MB, Canada R3T 2N2<br>Phone: 204-474-9827<br>Fax: 204-261-7251<br>Email: jared carlberg@umanitoba.ca<br>Clement E. Ward<br>Department of Agricultural Economics<br>Oklahoma State University<br>Stillwater, OK 74078<br>Phone: 405-744-9821<br>Fax: 405-744-9835<br>Email: clement.ward@okstate.edu<br>Derrell S. Peel<br>Department of Agricultural Economics<br>Oklahoma State University<br>Stillwater, OK 74078<br>Phone: 405-744-9816<br>Fax: 405-744-9835<br>Email: derrell.peel@okstate.edu

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## Factors Affecting Quality Grade Discounts for Fed Cattle


#### Abstract

Prices for Choice and Select grade fed cattle are derived from wholesale and retail beef markets. Choice-Select price discounts are a key component of fed cattle pricing, whether packers purchase fed cattle on a live weight, dressed weight, or grid. This study identifies supply, demand, and other factors affecting the Choice-Select discount series using an adaptive expectations model. It is found that the lagged value of the discount as well as the percentage grading Choice exert statistically significant influences on the discount, while neither the boxed beef price nor seasonality affect the discount.


## Keywords

cattle, Choice-Select discount , marketing, prices, quality

## Factors Affecting Quality Grade Discounts for Fed Cattle INTRODUCTION

Thomsen and Foote (1952) defined price discovery as the process of buyers and sellers arriving at transaction prices for a given quality and quantity of product at a given time and place. For fed cattle, meatpacker buyers traditionally visited cattle feedlots, visually inspected a pen or cattle, and buyer and seller negotiated a sale price. Prior to the 1990s, most sales were on a live weight basis. Some fed cattle were purchased on a dressed weight basis (referred to as "in the beef") or on a grade and yield basis. Grid pricing replaced grade and yield pricing in the early 1990s as the beef industry attempted to move toward value based marketing. Years earlier, economists argued the need for improved pricing accuracy in livestock (Stout and Thomas, 1970).

Pricing cattle on a live weight, dressed weight, or grid carries risk and potential reward implications for both the buyer and seller. With live weight pricing, each animal in the pen receives the same live-weight price. Similarly, with dressed weight pricing, each animal in the pen receives the same dressed-weight price. With these methods, higher quality animals are underpriced relative to true value and lower quality animals are overprices relative to true value. Thus, neither method rates high in terms of pricing accuracy and depends in large part on the accuracy of a buyer estimating carcass characteristics based on visual inspection of live animals. However, with grid pricing, each animal receives an individual price consisting of a base dressed-weight price plus premiums and discounts associated with each animal's quality grade and yield grade carcass characteristics. Pricing accuracy is greatly enhanced because of an increased dependence on more complete information.

Packer buyers estimate the carcass characteristics such as quality grade, yield grade, live weight, and dressing percentage for a pen of fed cattle based on visual inspection when procuring cattle on a live weight basis. Thus, buyers assume the risk of any errors in estimating carcass attributes. To compensate for estimation errors, i.e., incomplete information, packers could be expected to bid lower than if carcass characteristics were known with certainty. Similarly, when purchasing fed cattle on a dressed weight basis, packer buyers visually assess the cattle and estimate the same carcass characteristics except for the actual weight of the carcass, and thus the actual dressing percentage also. Thus, they know and pay on the basis of the dressed weight, in effect transferring the weight and dressing percentage risk to the cattle owner. With the buyer assuming slightly less risk, economic theory would suggest the buyer could pay a commensurately higher price compared with purchasing cattle on a live weight basis. Grid pricing carries this risk transfer a step further. With grid pricing, each animal is priced individually based on its actual carcass attributes. This effectively transfers carcass characteristic risk from the buyer to the cattle owner. And with less risk, the buyer can theoretically pay a higher price.

This risk-return process in pricing methods is clearly identified as the theory of factor price disparity by Fausti and Feuz (1995). Considerable empirical research has provided validation evidence of the theory (Feuz, Fausti, and Wagner, 1993; Feuz, Fausti, and Wagner; 1995; Schroeder and Graff; 2000; Anderson and Zeuli, 2001; Fausti and Qasmi, 2002).

Fed cattle prices are derived from wholesale meat and byproducts markets, in turn from retail products markets. A major differentiation at retail for beef is the USDA (U.S. Department of Agriculture) official quality grade, particularly Prime, Choice, and Select.

However at retail, consumers often have only a decision to buy either Choice or some nonmarked grade, usually Select. The limited quantity of Prime beef is marketed through more upscale restaurants and food service outlets. Price differences at the retail level between Choice and Select beef are sent upstream to the wholesale beef level and subsequently to the fed cattle level. Empirical research consistently and clearly demonstrates the importance of Choice vs. Select qualities of fed cattle and commensurate price differences (Feuz, 1999; Schroeder and Graff, 2000; Anderson and Zeuli, 2001; Fausti and Qasmi, 2002; Whitley, 2002; McDonald and Schroeder, 2003; Johnson and Ward, 2005, 2006).

Given its importance, there is little research on the behavior of or factors affecting the Choice vs. Select price difference. Information from the Livestock Marketing Information Center (LMIC) identifies data available for estimating a weekly carcass discount model, reports on one model estimation, and asserts that more research is needed (LMIC, 1999a, 1999b). This article reports on an historical analysis of the Choice-Select price difference and key factors affecting variability in the price difference over time.

## THEORY

The Choice-Select (C-S) discount can be defined as the expectation formed regarding the difference between the composite Choice cutout value and the composite Select cutout value. The use of adaptive expectations was introduced by Nerlove (1958) as part of his broader work with distributed lag models. In an adaptive expectations model, economic agents are hypothesized to revise their expectations based upon previous experiences. In other words, what they believe to be "normal" is updated based on past expectations errors. This approach is considered to be idea for modeling the C-S discount given that expectations are important in beef marketing decisions based upon the discount.

Several factors are expected to influence the C-S discount. As noted above, updated beliefs about what is likely to occur based upon previous forecast errors play a pivotal role in adaptive expectations models. Thus, past values of the dependent variable are believed to affect its current values; accordingly the single-period lagged C-S discount is included as a regressor. Given that both supply-and-demand-side factors for both Choice and Select beef also have the potential to impact the discount (McCully 2010), it is appropriate to include the percentage grading Choice as an explanatory variable. It is expected that the greater this percentage, the lower will be the value of the discount given the higher quantity of Choice beef available.

The boxed beef price is also expected to affect the magnitude of the discount. For example, an increase of the price of boxed beef should induce producers to sell sooner than they otherwise might, and at a lower price. Such a strategy would shorten the length of the finishing phase and, as a result, increase the percent of Select cattle in the kill. In turn, this could be expected to cause the discount to widen. Lastly, it is generally agreed by cattle industry observers that the demand for Choice beef increases during the so-called "grilling season", extending from about the start of May until the end of September. If the demand for Choice beef increases, ceteris paribus, the discount should become larger as a result.

## PROCEDURE \& DATA

Based upon the discussion in the previous section, equation (1) shows the model estimated for the C-S discount.

$$
\begin{equation*}
P_{t}^{C-S}=\beta_{0}+\beta_{1} P_{t-1}^{C-S}+\beta_{2} C h \%_{t}+\beta_{4} P_{t}^{B B}+\beta_{5} \text { GRILL }_{t}+e_{t}, \tag{1}
\end{equation*}
$$

where, $P_{t}^{C-S}$ is the value of the C-S discount in time period $t$ and $P_{t-1}^{C-S}$ is its lagged value, $C h \%_{t}$ is the percent grading Choice in time period $\mathrm{t}, P_{t}^{B B}$ is the boxed beef price in time
period $t$, and GRILL $_{t}$ is an indicator variable that takes on a value of 1 for observations during the grilling season and a value of zero otherwise. All data (514 observations on each variable) were provided by the Livestock Marketing Information Center and run from January $7^{\text {th }}, 2002$ through November $14^{\text {th }}, 2011$.

The model was originally estimated using the REG procedure in SAS version 9.3. A battery of specification tests was undertaken. Tests on residuals rejected the null hypothesis of normality, but histograms of the residuals revealed bell shaped distributions that only deviated from normal shape in the tails of the distribution. A Q-Q plot confirmed this result; as such the residuals were judged to be sufficiently normal. A joint conditional means test (McGuirk, Driscoll, and Alwang) was performed on the residuals; a p-value of 0.0001 implied rejection of the null hypothesis. A joint conditional variance (JCV) test for heteroskedasticity yielded a p-value of 0.2632 , implying the null hypothesis of homoskedastic residuals should not be rejected. Autocorrelation function $(\mathrm{ACF})$ and partial autocorrelation function (PACF) graphs were constructed to examine the discount series for autocorrelation and revealed that autocorrelation may exist. Accordingly, the model was re-estimated using the AUTOREG procedure, which eliminated the autocorrelation. An $R^{2}$ of 0.9629 was obtained.

USDA Choice is the benchmark quality grade and the Choice-Select discount is a key focus in grid pricing. Data for this study were obtained from the Livestock Marketing Information Center (LMIC). Premium and discount data used in the models came from from the USDA report "National Carcass Premiums and Discounts for Slaughter, Steers and Heifers". The data series ( 514 observations on each variable) represents the time period from January $7^{\text {th }}, 2002$ through November $14^{\text {th }}, 2011$. The discount series used in
this research was not calculated as price of Choice minus price of Select; instead, the reported average discount series is used for Choice-Select discount. Prior research by the authors has shown that the reported average is an acceptable proxy for the calculated series.

## RESULTS

Results from the estimation of equation (1) are shown in Table 1. The lagged value of the dependent variable exerts a positive and statistically significant effect on the C-S discount. As expected, a greater percentage of beef being graded as Choice results in a narrowing of the discount as the relative value of Choice beef declines. Somewhat surprisingly, no evidence of a statistical impact of the "grilling season" upon the C-S discount was discovered. The price of boxed beef was also determined to have no impact on the discount.

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Table 1. Regression coefficients, adaptive expectations model for C-S discount

|  | Standard |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| Variable | Coefficient | Error | t-ratio | p-value |
| Intercept | $32.2880^{*}$ | 0.23807127 | 135.623399 | $<0.0001$ |
| $P_{t-1}^{C-S}$ | $0.7969^{*}$ | 0.02898733 | 27.4913251 | $<0.0001$ |
| $C h \%_{t}$ | $-0.8429^{*}$ | 0.15654206 | -5.384716 | $<0.0001$ |
| $P_{t}^{B B}$ | 0.1595 | 0.17058642 | 0.93517014 | 0.350828374 |
| GRILL $_{t}$ | -0.0152 | 46.1613217 | -0.0003293 | 0.999737611 |

Note: an asterisk denotes statistical significance at the $\alpha=0.05$ level

