Title:
EXAMINING THE FED CATTLE CHOICE-SELECT DISCOUNT

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None

Abstract:
The choice-select discount in fed cattle pricing grids is a significant factor in determining the net grid price. Cursory analysis of data since 1997 evidences a structural change approximately when USDA-AMS mandatory price reporting began. This is important for producers/feeders deciding when to feed and market fed cattle.

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EXAMINING THE FED CATTLE CHOICE-SELECT DISCOUNT

Selected Paper to be presented at the annual meeting of the Southern Agricultural Economics Association, Little Rock, AR, February 8, 2005

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Abstract

The choice-select discount element of fed cattle pricing grids is a significant force in pricing fed cattle. This discount bears on effective sales price whether cattle are sold on live price, dressed, or grid price. The choice-select discount series will be examined in this paper to determine statistical parameters of the series. Cursory analysis of this data reveals a "discontinuity" in the data that may coincide with the beginning of mandatory price reporting (MPR). After econometric analysis, it is shown this structural change is equal to $0.62 per cwt greater Choice-Select price discount after Mandatory Price Reporting (MPR) is enacted. Results show a partial adjustment model with two lags best describes this discount component. In addition, seasonality is evident in the quality grade discount model.

Introduction

Fed cattle are traditionally sold when the feedlot marketing manager (i.e. producers of fed cattle) and packer (purchasers of fed cattle) meet, possibly view the cattle, and negotiate a live weight price per pound for the entire group of cattle. This system implies both buyers and sellers are expert cattlemen and estimate the quality grade of the cattle with their hide on. The buyer is expected to provide a fair appraisal of the pen's quality distribution by means of a short visual inspection. Several research studies indicate higher (lower) quality cattle within a pen or group are not marketed at a premium (discount) price to represent their respective higher (lower) quality (Feuz; Ward and Lee). Often the packer buyer offers the same price for several pens of cattle with differing qualities, each of which could have different owners. The entire group is then marketed at an average live weight price.

Grid pricing of cattle, from the economic sense of pricing efficiency, is a superior method of marketing fed cattle (Feuz; Ward and Lee). The incentive (disincentive)

mechanism embodied in a grid pricing system is a function of the grid's discount and premium structure. The general economic incentive structure embodied in packer grids has been pointed to as an obstacle preventing many slaughter cattle producers from selecting grid pricing as a marketing channel. In a grid pricing scheme, each animal is priced separately based on that animal's own carcass characteristics.

Quality grades have been established describing particular carcass qualities of beef animals. The grades that are relevant for fed cattle are Prime, Choice, Select, and Standard. Historically, Prime grade receives a price premium to Choice and that premium has been fairly constant over time (Ward, Feuz, and Schroeder). Choice is the benchmark grade. The Choice-Select discount is a focal point for the market and has been volatile over time (Figure 1). Both Select and Standard grades receive a price discount to the benchmark Choice grade. The Select-Standard discount appears to be an almost linear combination of the Choice-Select discount. The Choice-Select and Select-Standard price discounts represent price discounts to the Choice benchmark.

The Choice-Select carcass discount is clearly very important to the net grid price as noted and confirmed in several studies (Feuz; Ward and Lee; Schroeder, and Graff; Anderson and Zeuli; Fausti and Qasmi; Whitley; McDonald and Schroeder). However, little research has attempted to explain the behavior of the discount series. Preliminary work (LMIC a and b) identifies data available for estimating a weekly carcass discount model, reports on one model estimation, and asserts that more research is needed.

This paper will examine historical data of the Choice-Select price discount to increase understanding of the economic forces at work in that market as this discount is important to producers and packers involved in grid pricing fed cattle on a daily basis.

Conceptual Framework and Hypotheses

Premiums and discounts related to quality grades have their origin in consumer demand since quality grades are intended to relate to eating quality and consumer satisfaction. Most grids consist of a base price with specified premiums and discounts for carcasses above and below the base or standard quality specification; the base quality grade is Choice. Packer grids may identify additional premiums for carcasses meeting specifications such as a branded marketing plan (i.e. Certified Angus Beef). Likewise packers may specify discounts for hide damage, injection site blemishes, condemnations, dark cutters, hard bones, lightweight and heavyweight carcasses, and other "out" or unmarketable carcass. Thus using premiums (positive price attributes) and discounts (negative price attributes), a price grid is constructed that defines departures from a benchmark carcass due to quality grade.

Cursory analysis of the historical carcass discount series suggests some hypotheses.

- First, fundamental change appears in the data series.
- Second, it appears MPR may have affected the carcass discount series. This series was from USDA's "National Carcass Premiums and Discounts for Slaughter, Steers and Heifers" report. The weekly data series used encompasses the introduction of MPR, April 3, 2001. Visual inspection of data suggests differences in variability pre vs. post-MPR.
- Third, seasonality exists in the quality discount.

Analysis and Procedure

Data for this study were obtained from the Livestock Marketing Information Center, Lakewood, CO (LMIC) (Table 1). Premium and discount data used in the models were collected from the USDA report "National Carcass Premiums and Discounts for Slaughter, Steers and Heifers". The weekly data series used begins February 17, 1997 and ends December 27, 2004. Summary statistics for the data are found in Table 2. 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. Note the discount series is recorded by LMIC as negative numbers.

It should be noted that mandatory price reporting (MPR) by packers as required by Agricultural Market Service (AMS) began April 3, 2001. The method of reporting data changed at that time. Upon visual inspection the quality series data in Figure 1, there seems to be a difference between the time period before and after MPR commenced.

A Student's-t and F-test were used to determine if the Choice-Select series has the same means and variances respectively both before and after MPR. These statistical tests were conducted with Simetar© (Richardson). Tests confirmed that the pre-MPR Choice-Select discount mean was significantly smaller (i.e., lower) than the post-MPR mean. Additionally, the pre-MPR Choice-Select discount variance was significantly smaller than the post-MPR Choice-Select discount variance (Table 3).

There is reason to believe this change in reporting regimes may have created a structural change in the Choice-Select discount series; thus a Chow test was performed on the data. The test was modeled as

$$P_{Ch\text{-}Sel} = f(dMPR), \quad (1)$$

where $P_{Ch\text{-}Sel}$ is the Choice-Select discount and *dMPR* is a zero-one dummy variable measuring structural shift at the point of MPR. This initial econometric procedure was performed in Proc Reg using SAS statistical software version 8.2 (SAS Institute).

Two assumptions under which a Chow test is valid are: (1) the error terms have common variances across both sample regimes and (2) autocorrelation is not present among residuals. Thus a test for both autocorrelation and heteroscedasticity using joint conditional means (JCM) and joint conditional variances (JCV) (McGuirk, Driscoll, and Alwang) was performed on residuals of the model. P-values of <0.0001 were recorded for both JCM and JCV. This implies the null hypotheses of these joint tests should be rejected. Further inspection led to rejection of the null hypotheses for both no autocorrelation and dynamic homoscedasticity of the error terms. A final GARCH (1,1) specification of the Chow test was estimated in Proc Autoreg. The corrected model revealed a structural increase of the Choice-Select discount equaling $0.62 per cwt after MPR was enacted at $\alpha = 0.10$ level. In other words, the average Choice-Select discount after April 3, 2001 was $0.62 per cwt greater than the average discount before that date.

Some economic analyses assume product homogeneity, particularly in a competitive market structure, but the core of some analyses has to do with heterogeneity. Problems involving heterogeneity examine product differentiation, product quality, product grades, and product standards (Ladd and Martin). Grid pricing of fed cattle has just such a heterogeneous

nature. The price of dressed beef is made up of many factors; some of these factors have boxed beef product demand associated with them such as marbling, tenderness, and flavor.

A priori expectations of those characteristics that influence the Choice-Select discount could be seen in this general hedonic specification

$$P_{Ch\text{-}Sel} = f(q_{\%choice}, q_{\%YG4\text{-}5}, P_{BoxedBeef}, q_{Production}, \delta_s), \quad (2)$$

where $P_{ch\text{-}sel}$ is the Choice-Select discount, $q_{\%choice}$ is the percentage of Choice beef in that period's production, $q_{\%YG4\text{-}5}$ is the percentage of yield grade 4-5 in the period's production, $P_{BoxedBeef}$ is the price of wholesale boxed beef, $q_{Production}$ is the quantity of production of federally inspected steers and heifers for this period, and δ_s is a seasonal component. Biological cycles and seasonal weather patterns cause seasonal production patterns in fed cattle. Better cow-calf producers manage for fall or spring calving; this creates heavier feedlot placements two times a year. Warm weather feeding creates "sick days friendly" seasonality in fed cattle production.

It has been pointed out that hedonic models are problematic. Prior literature points out model identification can only be obtained through arbitrary functional form assumptions; hedonic models are oft times non-linear; and endogeneity are some problems mentioned (Ekeland, Heckman, and Nesheim). However in the face of products whose characteristics create heterogeneity, it is the positive or negative value of those sub-characteristics that describe the value of the more inclusive larger component. From that standpoint a hedonic model with its associated problems seems justified.

Two hedonic models were specified for the quality discount based on the above general specification of (2). The first model was a partial adjustment model with two-period lags on the dependent variable

(3) $P_{Ch\text{-}Sel(t)} = f(P_{Ch\text{-}Sel(t-1)}, P_{Ch\text{-}Sel(t-2)}, q_{\%choice}, q_{\%YG4\text{-}5}, P_{BoxedBeef}, q_{Production}, \delta_s)$,

with all variables are defined above. The second model was a reduced form of (3) and took the form

(4) $P_{Ch\text{-}Sel(t)} = f(P_{Ch\text{-}Sel(t-1)}, P_{Ch\text{-}Sel(t-2)}, q_{\%choice}, P_{BoxedBeef}, \delta_s)$.

Partial adjustment models have an intuitive appeal to economists as they imply quantities and prices adjust slowly over time to new market conditions and market information (Carlberg and Ward). This slower adjustment process is oft used as justification for including lagged dependent variables in an empirical model. It can be argued that given some exogenous shock occurring in the market, there will a price adjustment in time period t-2 and another in time period t-1, bringing about the full adjustment by time t.

These two models were estimated using OLS and a battery of statistical tests was subsequently performed on both models including stem and leaf plots, box plots, and QQ plots of both residuals and semi-studentized residuals. Further normality testing was done using Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises, and Anderson-Darling procedures. Structural change in the mean and variance equations, non-linearity in parameters, autocorrelation, static and dynamic heteroscedasticity tests were performed using JCM and JCV.

It was determined both models had error terms which showed non-normality and autocorrelation. Normality is a basic assumption of OLS and even though it was rejected it may still be achieved through asymptotic convergence appealing to the Central Limit Theorem. Analyzing results of JCV, it was determined the null hypothesis of no structural change in the variance equation and static and dynamic homoscedasticity could

not be rejected for model 3 at the 0.05 level but was rejected at that level for model 4 due to dynamic heteroscedasticity. Model 3 was then chosen over model 4 due to these heteroscedasticity issues and further discussion will be confined to model 3.

Results

Coefficient estimates for the Choice-Select model 3 are presented in Table 4. Both partial adjustment terms were significant. The positive sign on the term at time t-1 is not unexpected. The term at lag t-2 has a negative sign but having lags with alternating signs is also expected. The significance of these two terms could be seen as inertia in the quality market for different grades of beef. Quantity of percent Choice is significant and has the expected sign. Quantity of yield grade 4-5 in this period's production is not significant but has the expected sign. As the number of these lower yielding cattle increases, the number of Choice and Prime cattle in the pen increases giving a higher percent of Choice and causing the Choice-Select discount to narrow or become smaller in absolute value. The price of boxed beef is significant with the expected sign. The negative sign implies that as the price of boxed beef increases, it would be expected to see cattle sold out of feedlots with fewer days on feed, hence percent Choice would decrease and the discount would widen or become more negative.

Seasonality found suggests a greater negative impact on the Choice-Select discount during the second and third quarter (seasonality coefficients were statistically significant in April and September) than the first and fourth quarters of the year. Prior research has shown demand for both beef quality grades, Choice and Select, becomes more inelastic during the second and third quarters and these two grades are not substitutes for one another during these quarters (Lusk et al.). These are considered to be

"grilling" months. At this time of year, retailers may adjust their offerings to accommodate changes in consumer tastes and preferences. Lusk et al. further show that during the first and fourth quarter Choice and Select beef are substitutes for one another.

Summary and Conclusions

The objective of this study was to examine historical data of the Choice-Select discount for beef carcasses. Though a Chow test shows structural change in the discount series when it is modeled as in (1) with an intercept shifter only, when the series is modeled hedonically with other expected independent variables structural change is no longer significant in the model.

Results show a partial adjustment model with two lags best describes this discount component. With respect to the quality discount, partial adjustment coefficients, percent Choice, and boxed beef price describe the structure. An increase in the boxed beef price will cause feeders to market their cattle sooner to take advantage of the price.

Seasonality is evident in the quality grade discount model. Seasonality in Choice-Select finds a smaller relative discount in the first and fourth quarters of the year and larger relative discounts in the second and third quarter. These findings suggest during the second and third quarter, encompassing summer grilling months, that Choice and Select beef are not substitutes for one another. The second possible implication relates to the timing of production. Calves born during springtime calving will be weaned in the early fall, put on wheat through the following winter, and then moved to the feedlot during the first weeks of March. These cattle should be finished and ready to sell in August, September, and October. This would give buyers enough supply to be selective when making procurement bids. Thus it would be possible to sustain a greater discount

for better quality grade. In support of this conclusion, September has the greatest average seasonal quality discount.

Exogenous forces occurred in the carcass beef market with the advent of MPR on April 3, 2001. Statistical tests show quality grade discount may have changed in both mean and variance but these exogenous forces seem to have less impact on the quality discount as quantity of discount data grows.

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Table 1. Description of Data Series Used In Analysis.

Data Description[a]
National Carcass Premiums And Discounts For Slaughter, Steers And Heifers ($/Cwt.)
Commercial and Federally Inspected Cattle & Calf Slaughter (million lbs.)
USDA National Steer And Heifer Estimated Grading Percent Report (percent)
Average live weights Texas/Oklahoma Panhandle Slaughter Steers and Heifers (lbs.)

[a] All data series obtained at LMIC website.

Table 2. Summary Statistics For Variables, 2-17-1997 through 12-27-04.

Variable	Mean	Standard Deviation	Minimum	Maximum
Choice-Select discount ($P_{ch\text{-}sel}$) ($/Cwt.)	-8.5009	4.0327	-24.8700[a]	-2.0000[a]
Percent Choice ($q_{\%choice}$) (%)	0.5314	0.0240	0.4800	0.5900
Percent 4-5 ($q_{\%YG4\text{-}5}$) (%)	0.0329	0.0234	0	0.1000
Boxed beef price ($P_{BoxedBeef}$) ($/Cwt.)	119.0243	17.4560	91.6100	194.2740
Production ($q_{Production}$) (million lbs.)	255.6996	23.1529	155.1557	318.9945
Observations	411			

[a] Note: While these are in the correct order for mathematical minimums and maximums, a -$24.8700 is a wider or greater discount than -$2.0000. So while these are mathematically true, in application the reverse order is more correct.

Table 3. Summary Statistics Before and After Mandatory Price Reporting, April 3, 2001.

		Before MPR	After MPR
Choice-Select discount ($/Cwt.)			
	Mean	-7.6091	-9.5082
	Standard deviation	3.1920	4.5953
	Minimum	-14.5800	-24.8700
	Maximum	-2.0000	-3.4400
	Skewness	-0.1768	-1.3656
	Kurtosis	-0.7087	1.4770

Table 4. Model of Choice-Select Discount Coefficients and Standard Errors.

Variable	Model III
Intercept (β_0)	-3.9087**
	(1.0749)
Choice-Select discount t-1 (β_1)	1.6565**
	(0.0319)
Choice-Select discount t-2 (β_2)	-0.7470**
	(0.0308)
Percent Choice (β_3)	8.3658**
	(1.6037)
Percent YG4-5 (β_4)	1.1336
	(1.9295)
Price of boxed beef (β_5)	-0.0107**
	(0.0029)
Production (β_6)	-0.0001
	(0.0013)
January (β_8)	0.0455
	(0.1209)
February (β_9)	-0.0418
	(0.1278)
March (β_{10})	-0.0049
	(0.1194)
April (β_{11})	-0.2128*
	(0.1230)
May (β_{12})	-0.0463
	(0.1195)
June (β_{13})	0.1485
	(0.1153)
July (β_{14})	-0.0290
	(0.1133)
August (β_{15})	-0.0026
	(0.1215)
September (β_{16})	-0.2523**
	(0.1230)
October (β_{17})	-0.0381
	(0.1302)
November (β_{18})	-0.1086
	(0.1178)
AR1	0.5816**
	(0.0639)
AR2	0.1438**
	(0.0623)
R^2	0.9691

Table 4. Model of Choice-Select Discount Coefficients and Standard Errors.

Variable	Model III
AIC	918.3233
Log Likelihood	-439.1617

Note: Standard errors are given in parentheses. Single and double asterisks (* and **) denote significance at the 0.10 and 0.05 levels, respectively.

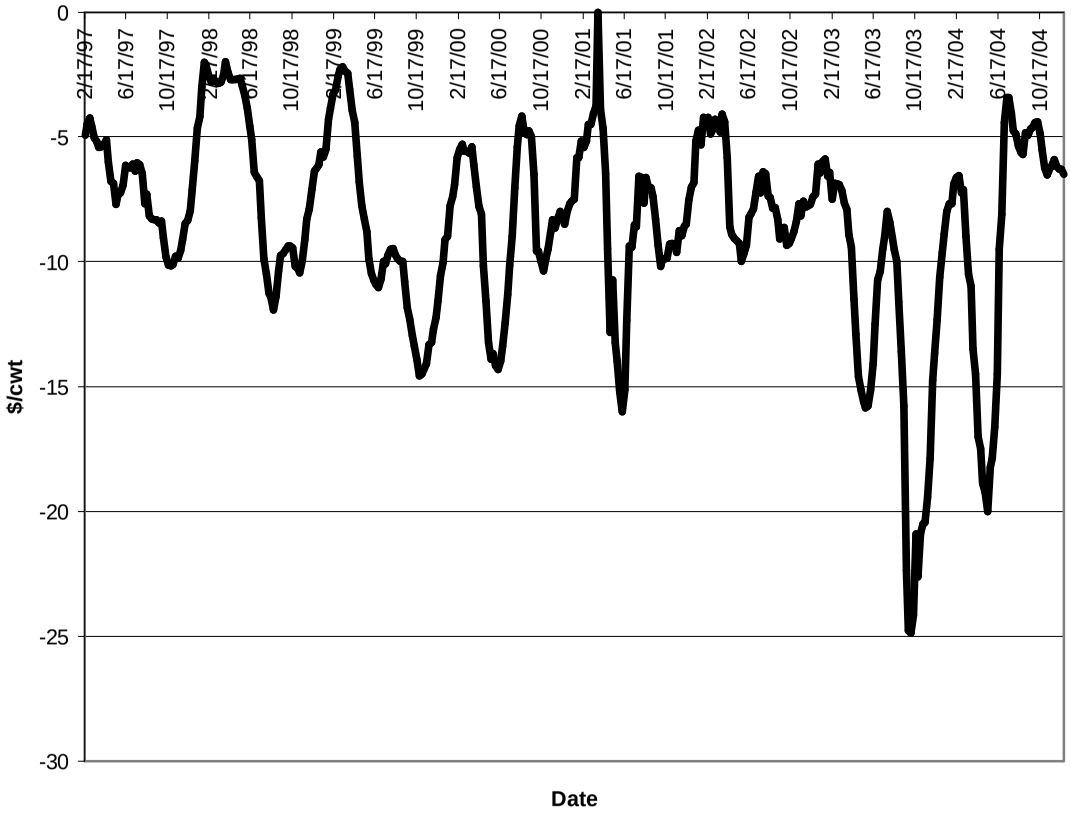

Figure 1. Weekly Reported Choice-Select Discount, 2-17-1997 through 12-27-04.

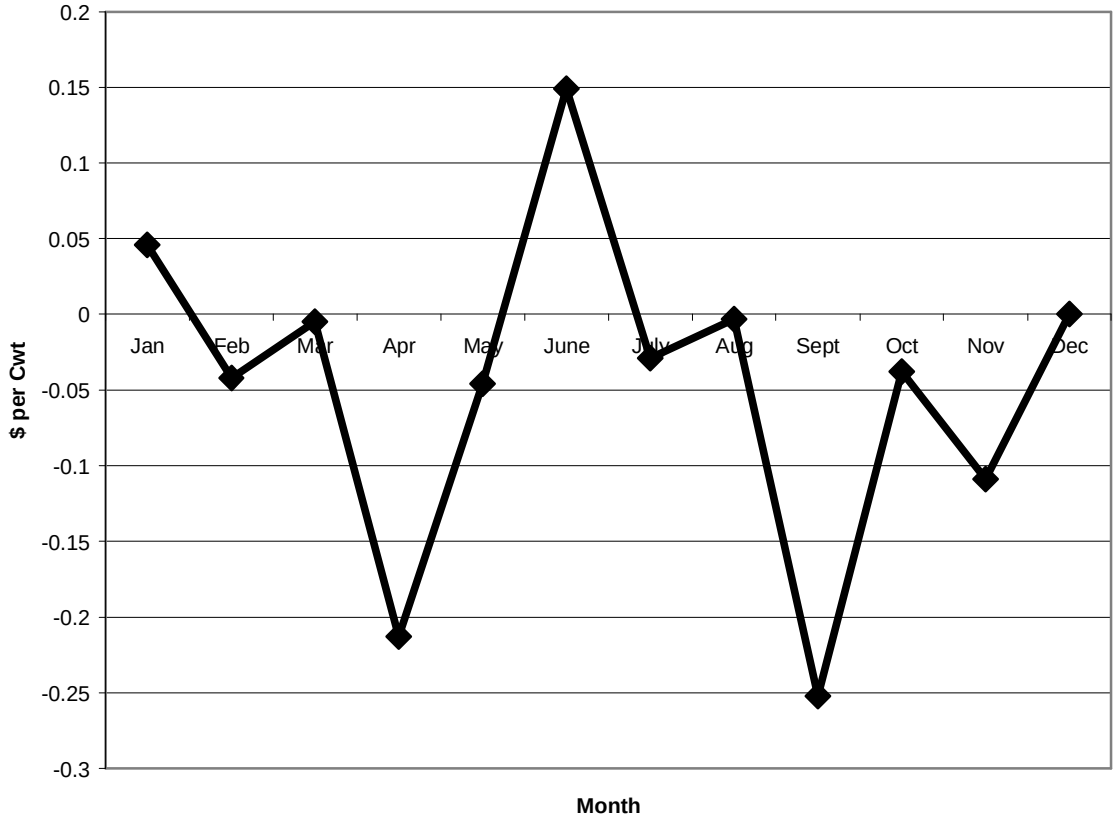

Figure 2. Choice-Select Model III Seasonality.