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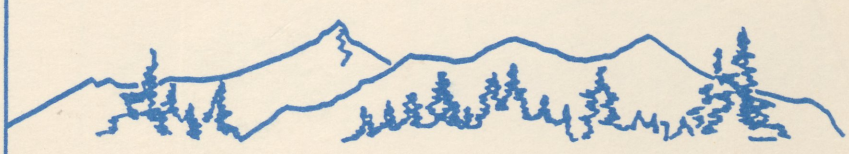

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THE IMPACT OF CASH FORWARD CONTRACTING OF FED CATTLE ON CASH PRICES

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Abstract: This research estimates that for each increase of 1,000 head of contract cattle shipments in a given month, the U.S. average cash price of fed cattle will decline by $0.03-0.06/cwt. The greatest negative impact from contracting is in Kansas, while the least negative impact is in Texas.

Introduction

A cash forward contract offers an alternative means (as compared to a futures hedge) to fix the price of fed cattle before they are ready for market. While cattle feeders are inclined to use cash contracts, they also recognize the potential negative impact of contracting on cash prices (NCA Beef Industry Concentration/Integration Task Force, p. 16; Ward and Bliss, pp. 10, 13-14). Some price-structure studies of livestock markets have concluded that the number of buyers is positively related to price (Ward, 1988, pp. 159-61). When a packer forward contracts cattle, this removes the need for the packer to buy these cattle in the cash market. However, the hypothesis that the cash price of cattle will decrease as the number of buyers decreases is disputed by some who argue that any diminished packer demand in the cash market as a result of forward contracting is offset by diminished supply in the cash market (U.S. General Accounting Office, pp. 59-60)). Therefore, price should not be impacted, either negatively or positively, as a result of increased cash contracting. Empirical evidence is required to determine whether contracting impacts cash prices.

A study by Hayenga and O'Brien reports results from a regression designed to measure the impact of contracting on cash prices. The regression results show that an increase in the percentage of total slaughter contracted in Colorado, Nebraska, and Texas is associated with a decrease in the fed cattle price in Colorado; whereas an increase in the contracting percentage in Kansas is associated with an increase in the Colorado fed cattle price. The negative coefficient for Texas and the positive coefficient for Kansas are significant. Because of the different impacts of contracting on price, the authors state that further analysis is needed before any conclusions can be drawn.

This research addresses the issue of whether contracting has a negative impact on cash prices. A price transmission equation is estimated which relates the fed cattle price to various economic variables. An additional variable is added that measures the amount of cash contracting. The results in the third section show that the estimated coefficient for the contract variable is negative, which indicates that increased contracting is associated with lower cash prices. Negative correlation coefficients were also found between the amount of contract shipments in a month and the cash price.

Impact of Contracting on Cash Prices

Whether forward contracting of fed cattle impacts cash prices is a debatable issue. Using economic reasoning, Ward (1987) shows that contracting can have a negative impact on cash prices due to reduced competition in the cash market. There are economists and cattle feeders who believe that captive supplies from contracting can be used to lower the cash market (Caughlin; Painter). By contrast, the Chicago Mercantile

Exchange and the Commodity Futures Trading Commission argue that contracting does not reduce cash price because as packers contract cattle they reduce the demand as they reduce the available supply in the market (U.S. General Accounting Office, pp. 59-60). The price impact of contracting likely differs depending on the amount of contracting. As long as the level of contracting remains low relative to total fed cattle transactions, the GAO (p. 60) does not believe that contracting impacts cash prices.

To determine the impact of contracting on cash market prices, simple correlations were calculated between cash prices and shipments of contract cattle. The cash prices are average monthly prices for the states of Kansas, Colorado, Nebraska, and Texas (U.S. Dept. of Agr., AMS). A U.S. average price was computed by weighting state prices (four states plus Iowa-So. Minnesota) by the proportion of federally inspected slaughter in each state. Cattle-Fax has reported weekly shipments of contract cattle in four states (mentioned above) since October 1988. The weekly figures were averaged for each month to obtain the average weekly contract shipments by month.[1] Averaging was used (rather than summing) to eliminate the effect of different numbers of weeks in a month. Monthly contract shipments were calculated for the 21-month period October 1988 through June 1990. Monthly figures were used because contracts call for delivery of cattle in a specified month, and thus the contract shipment figures are probably more accurate on a monthly basis.

The estimated correlation coefficients between cash prices and contract shipments are positive for the U.S. and Texas, and negative for Kansas, Colorado, and Nebraska (see original series below).

State	Original Series	First Differences
Kansas	-0.04	-0.22
Colorado	-0.33	-0.32
Nebraska	-0.15	-0.19
Texas	0.21	-0.02
U.S.	0.01	-0.18

The Colorado correlation, r=-0.33, is significant at the 0.10 level for a one-tail test.[2] Also shown above are correlations between first differences in prices and contract shipments. First differences are used to eliminate trends in the variables, and thus improve the chances that a simple correlation can measure the true association between contracting and price. The first-difference correlations are negative for the U.S. and for each state individually. The Colorado correlation, r=-0.32, is significant at the 0.10 level using a one-tail test. The correlations based on first differences show a more negative association between prices and contract shipments than the correlations based on the original series. The positive correlation between contract shipments and price for Texas using the original series is negative for the first-difference series.

Another means to determine whether contracting impacts cash prices is through the use of regression analysis. Marketing studies have estimated price transmission equations which relate the price at one level in the marketing channel to the price at another level (e.g., George and King,

p. 58; and Schultz and Marsh). For example, the price of fed cattle (dependent variable) is related to the price of wholesale beef. Other explanatory (independent) variables included in a price transmission equation are (1) cost of marketing inputs (e.g., labor, materials, etc.), and (2) quantity of product being handled by the marketing system. A variable which measures the amount of contracting can be added as an additional explanatory variable; and the estimated coefficient on the contract variable can be analyzed to determine the impact of contracting on cash prices. If contracting reduces competition in the cash market and causes the cash price to be lower, then the estimated coefficient on the contract variable should be negative. By contrast, if contracting does not reduce competition, then the estimated coefficient should be approximately zero.

A price transmission equation can be specified as follows:

$$(1) \quad PS_t = \beta_0 + \beta_1 PW_t + \beta_2 MC_t + \beta_3 Q_t + \beta_4 CS_t + u_t$$

where PS = average price of Choice 1100-1300 pound steers (Livestock, Meat, & Wool Mkt. News, U.S. Dept. of Agr., AMS);
PW = wholesale price of beef (box or carcass);
MC = marketing cost (simple average of Producer Price Index for materials, and index of meat packer wages (Employment and Earnings, U.S. Dept. of Labor));
Q = quantity of cattle slaughtered (Livestock, Meat & Wool Mkt. News, U.S. Dept. of Agriculture, AMS);
CS = contract cattle shipments (Cattle-Fax).

All the variables in eq. (1) are measured at time t. The coefficients, $\beta_0, \ldots, \beta_4$, are population coefficients, and u_t is a random (non-autocorrelated) error term with expected mean zero. Small English letters are used to represent least squares estimates of the population coefficients. The least squares coefficient b_1 is expected to be positive. The coefficient b_2 is expected to be negative because as marketing cost increases, the live animal price should decrease relative to the wholesale price. The coefficient b_3 is generally expected to be negative to reflect a higher margin associated with larger quantities handled by the marketing system (Schultz and Marsh; Ikerd; and Breimyer).

Eq. (1) was estimated using monthly data for the period October 1988 through June 1990. The estimation period was determined by the availability of contract shipments data. As explained above, contract cattle shipments have only been reported since October 1988 (Cattle-Fax). Eq. (1) was estimated for individual states (Kansas, Colorado, Nebraska, and Texas) and the U.S. The U.S. results are shown in Table 1. Separate equations were estimated using two series of wholesale prices--box beef cutout value for Choice #2-3 550-700 pound beef carcasses; and Choice #3, 600-800 pound steer carcasses. Because of the potential problem of correlation between PW (an endogenous variable in a meat sector model) and the error term (u) in eq. (1), an instrumental variable was used for PW. A two-step procedure was used where (1) the instrumental variable was developed from a regression of PW on exogenous variables such as beef production, income, and marketing costs; and (2) the set of predicted values of wholesale prices, $\widehat{PW}$, was used as the instrumental variable for

PW in eq. (1). The fact that $\widehat{PW}$ is uncorrelated with the disturbance term in eq. (1) guarantees that the least squares estimates are consistent.

The estimated coefficients, b_1, b_2, and b_3 are consistent with a priori expectations (Table 1). The estimated coefficient for PW is positive, and for MC is negative. The estimated coefficient for Q is negative, which indicates that as slaughter increases (in 1,000's of head) the fed steer price decreases relative to the wholesale price. That is, a higher margin (PW-PS) is associated with larger quantities being handled by the marketing system. This is consistent with earlier studies of meat pricing (Schultz and Marsh; Ikerd; and Breimyer).

The purpose for including a contract variable in eq. (1) was to test rival conjectures regarding the impact of contracting on cash prices. The null hypothesis tested is that contracting does not affect cash prices--i.e., H_0: $\beta_4=0$ in eq. (1). The alternative hypothesis is that contracting has a negative impact on price--i.e., H_a: $\beta_4<0$. A one-tail test is used because there is no reason to expect that contracting can increase cash prices.

The estimated b_4 values for contract shipments (-0.03 to -0.06) are all negative for the U.S. regression (Table 1). Three of the estimated coefficients are significant at the 0.05 level, and one is significant at the 0.10 level. The estimated coefficients indicate that for each increase of 1,000 head of contract cattle shipped in a given month, the U.S. average cash price declines by $0.03-0.06 per cwt., ceteris paribus. These figures are relevant for contracting levels in the sample period range--i.e., 64-251 thousand head per month in the four states, which is 90 percent of the U.S. total (Ward and Bliss, p. 18). A change of 3-6 cents per cwt. per 1,000 head seems small, but in fact can be sizeable if contract levels change by several thousand contracts, as has been happening in recent experience. An increase of 10,000 head of contract cattle shipped in a month (7.9 percent of average monthly shipments in four states) will cause an estimated decrease of $0.30-0.60 per cwt. in fed cattle prices. This is $3.33 to $6.66 per head for a 1,100 pound steer.

The above estimates are based on data for a period when there was overcapacity in the packing industry and relatively tight supplies of cattle (NCA Beef Industry Concentration/Integration Task Force, p. 15). In such a situation, a packer has limited influence on price because the kill capacity (or demand) is greater than the available supply of cattle. When supplies increase (as they will sometime in the future), the bargaining advantage may tilt toward the packer more than the feeder. This may make it easier for the packer to use captive supplies against the feeder.

The estimated impact of contracting on individual state prices is shown in Table 2. The estimates are based on ordinary least squares with actual box and carcass prices used for the wholesale price. The estimated coefficients are consistent with a priori expectations, except for the positive coefficient for the marketing cost variable in the Nebraska equation with carcass price. The coefficients for contract cattle shipments are negative in all equations, and are slightly larger when the carcass price is used for the wholesale price. The coefficients are significant at the 0.05 level for Kansas and Colorado. The estimated coefficients indicate that fed cattle prices will decrease by $0.15-

0.17/cwt. in Kansas and $0.07-0.09/cwt. in Colorado when contract cattle shipments increase by 1,000 head per month in a state. The smallest impact from contracting is in Texas where the estimated decrease in the fed cattle price is $0.01-0.04/cwt. for a 1,000 head increase in Texas monthly contract cattle shipments.

The results in Table 2 show that contracting has the least negative impact in Texas, notwithstanding the fact that Texas accounts for the highest percent (40) of contracts for the four states. Over the period October 1988 through June 1990, an average of 51,000 head of contract cattle were shipped per month in Texas (Cattle-Fax). If the monthly contract shipments were to increase by 10,000 head (or approximately 20 percent), the Texas price of fed cattle would decline an estimated 10-40 cents per cwt., or $1.10 to $4.40 per head. By contrast, in Kansas if monthly contract cattle shipments increased by 10,000 head (or 30 percent), the Kansas fed cattle price would decline an estimated $1.50 to $1.70 per cwt., or $16.50 to $18.70 per head. Kansas contracts account for 27 percent of the four-state total contracts.

Eq. (1) was also estimated for the four states using an instrumental variable for wholesale price. The estimated coefficients, b_1, b_2, and b_3 are similar to the estimates obtained when using the actual wholesale price. The estimated coefficients for the contract shipments variable (b_4) are shown below for the instrumental variable regression.

State	Box Price	Carcass Price
Kansas	-0.17	-0.18
Colorado	-0.18	-0.23
Nebraska	-0.10	-0.18
Texas	-0.01	-0.03

The coefficient estimates for Kansas and Colorado for both wholesale price series are negative and significant at the 0.05 level. Compared to using the actual wholesale price (Table 2), the estimated coefficients are more negative when an instrumental variable is used.

Summary and Conclusions

Fed cattle contracting appears to have a negative impact on cash prices. It is estimated that for each increase of 1,000 head of contract cattle shipments in a given month, the U.S. average cash price of fed cattle will decline by $0.03-0.06/cwt. The negative impact of contracting varies by states. The greatest negative impact is in Kansas where a 1,000 head increase in monthly contract shipments is associated with a $0.15-0.17/cwt. decrease in the Kansas price. The least negative impact is in Texas where a 1,000 head increase in monthly contract shipments is associated with a $0.01-0.04/cwt. decrease in the Texas price.

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Footnotes

[1]Friday was used as the decision day to determine whether a week was included in a given month. If the Friday of a given week was (not) in the month, the week was included in the (following) month. Friday was chosen as the decision day because cash contract data are reported for week ending Friday (Cattle-Fax).

[2]A one-tail test was used because it was felt that contracting either has no impact on prices, or a negative impact on prices. Thus, significant deviations from zero are expected to occur only in the negative direction.

Table 1. Estimated Coefficients for U.S. Price Transmission Equations for Fed Steers, Using Monthly Data for 1988-11 through 1990-06.

Wholesale Price / Dep. Var.	Explanatory Variables					Statistics	
	Intrcpt	Whl. Price	Mrkt. Cost Index[a]	Fed. Insp. Slg.	Contract Shipments[b]	R^2	DW[c]
Using Box Price:							
U.S. Price	71.60 (3.93)[d]	0.59 (8.85)	-0.50 (-3.19)	-0.02 (-1.69)	-0.03 (-1.73)[e]	0.94	1.59
U.S. Price with Instr. Var. for Whl. Price	93.20 (2.97)	0.49 (4.04)	-0.57 (-2.04)	-0.02 (-1.13)	-0.04 (-1.48)	0.81	1.47
Using Carcass Price:							
U.S. Price	16.54 (2.45)	0.66 (33.49)	0.14 (1.95)	-0.04 (-7.60)	-0.04 (-3.46)	0.98	2.04
U.S. Price with Instr. Var. for Whl. Price	72.08 (2.36)	0.58 (4.83)	-0.40 (-1.48)	-0.03 (-1.40)	-0.06 (-2.08)	0.82	1.71

[a]Simple average of the Producer Price Index for intermediate materials (U.S. Dept. of Commerce) and meat packer wage index (U.S. Dept. of Labor).

[b]Number of contract cattle shipped during the month in 1,000's of head (Cattle-Fax).

[c]Durbin-Watson statistic. The equations were corrected for first-order autocorrelation. The DW statistics for the corrected equations show that autocorrelation is not a serious problem.

[d]t-value for testing the null hypothesis that the coefficient is zero.

[e]Critical t-values for a one-tail hypothesis test with 15 degress of freedom are -1.34 and -1.75 for the 0.10 and 0.05 levels of significance, respectively.

Table 2. Estimated Coefficients for State Price Transmission Equations for Fed Steers, Using Monthly Data for 1988-10 through 1990-06.

Wholesale Price / Dep. Var.	Explanatory Variables					Statistics	
	Intrcpt	Whl. Price	Mrkt. Cost Index[a]	State Fed. Insp. Slg.	Contract Shipments[b]	R^2	DW[c]
Using Box Price:							
Kansas Price	65.85 (3.99)[d]	0.63 (10.55)	-0.52 (-3.66)	-0.07 (-2.56)	-0.17 (-3.10)[e]	0.95	1.80
Colorado Price	74.93 (3.70)	0.55 (7.16)	-0.55 (-3.34)	-0.15 (-2.12)	-0.09 (-1.55)	0.93	1.72
Nebraska Price	42.86 (2.41)	0.66 (10.20)	-0.35 (-2.19)	-0.08 (-2.04)	-0.03 (-0.55)[f]	0.95	1.70
Texas Price	76.17 (3.69)	0.57 (8.16)	-0.59 (-3.43)	-0.06 (-1.50)	-0.01 (-0.35)	0.91	1.74
Using Carcass Price:							
Kansas Price	59.97 (3.21)	0.63 (8.99)	-0.43 (-2.93)	-0.05 (-2.20)	-0.15 (-2.98)	0.95	1.86
Colorado Price	58.77 (2.94)	0.57 (7.69)	-0.39 (-2.52)	-0.12 (-1.93)	-0.07 (-1.38)	0.94	2.14
Nebraska Price	-10.65 (-0.82)	0.72 (19.51)	0.17 (1.36)	-0.10 (-2.97)	-0.06 (-1.00)	0.97	2.13
Texas Price	39.47 (2.63)	0.64 (13.07)	-0.22 (-1.71)	-0.10 (-3.41)	-0.04 (-1.15)	0.93	2.03

Note: Footnotes a-e in this table are the same as footnotes a-e in Table 1.

[f]Critical t-values for a one-tail hypothesis test with 14 degrees of freedom are -1.34 and -1.76 for the 0.10 and 0.05 significance levels, respectively. The regressions for Nebraska included n=20 observations.