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Asymmetric Pricing in Live Cattle Futures

by

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ASYMMETRIC PRICING IN LIVE CATTLE FUTURES

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Research has found lags in the adjustment of cash price for live cattle following a futures price change (Oellerman and Farris, 1985). However, past studies have always assumed price responses are symmetric. Some cattle producers have charged that selling futures causes cash prices to fall too quickly. They also charge that buying futures does not allow cash price to rise as fast as selling futures makes it fall. Reports from groups such as the National Cattlemen's Association (1982) have called for a complete ban on cattle futures trading. A number of Congressional Committees' Staff Reports (1980a, 1980b, 1981) have questioned the performance of the cattle market. The objective of this study is to determine if the magnitude and also the speed of transmission of price changes between live cattle futures and cash is different for futures price increases than futures price decreases.

Some hold that short sellers simply trigger more short selling, which in turn causes downward biased prices (Helmuth). But for "psychological" reasons, buying futures fails to drive up cash prices and in the same manner it drives them down. Brorsen et al. have argued that lags between cash and futures markets can imply information flows are not instantaneous, resulting in short-run disequilibrium. Schroeder and Hayenga; Marsh and Brester; and Boyd and Brorsen (1985) have also found lags in the cattle markets. One other reason for this disequilibrium in the cattle market may be due to asymmetric price behavior. A given price increase may impact another price differently than would a price decrease. Bailey and Brorsen (1989) found that some spatial cattle price increases were reacted to faster than price decreases.

However, the cattle cash and futures market has not been tested for asymmetric pricing, another test of short-run disequilibrium. According to commodity fund manager, Jack Alban, "A rising market is the mirror image of a declining market in the financial sectors. But not so in commodities, which decline at a much greater rate than they rise." This implies futures price asymmetry, and futures to cash price asymmetry may also be possible. This study tests whether the size and speed of cash price changes for live cattle are different in responding to futures price increases compared to futures price decreases.

Data and Methodology

Live cattle cash and futures daily prices are used from 1966 to 1986.[1] Futures prices are daily closing prices from the CME. Cash prices are average daily cash prices of 1,100

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[1]Since the Omaha cash market is usually most active only the first three days of each week, some researchers such as Oellerman and Farris (1985) omit Thursday and Friday. However, all days of the week are used in this study since the objective is to test for asymmetry during light and heavy cash volume days.

lb. to 1,300 lb. choice steers in Omaha. The Omaha market is used since it is a major mark for slaughter cattle. As well, it serves as a delivery point for the live cattle futures contrac

Similar daily corn cash and futures data are also used for comparison purposes and a from 1978 to 1986. Prices starting in 1978 are chosen to avoid the structural change believe to take place in grain markets from the early to mid 1970s. Futures prices are daily closin prices from the CBT and cash prices are for #2 yellow corn delivered in Chicago. A contract months are traded for both live cattle and corn futures. This creates a continuo price series, with the rollover approximately three weeks before expiration of the contra month. All prices are from Dunn and Hargitt Commodity Bank, Lafayette, Indiana.

The asymmetric model used here for cattle prices is a new approach to studying cas and futures prices. The model is similar to that of Boyd and Brorsen (1988), used to stud pork farm to wholesale price asymmetry, and Bailey and Brorsen (1989) used to study spatia price asymmetry for cattle.[2] The sum of daily cash price changes are the dependent variabl The sum of the daily positive futures price changes, and the sum of the daily negative pric changes are the two independent variables. The model can be estimated using a polynomia distributed lag model similar to Ward. This model has the advantage that it can approximat the declining impact of more distant prices, and it also reduces the number of parameters:

$$\sum_{t=1}^{T}\Delta C_t = a_o + a(L)\sum_{t=1}^{T}\Delta POSF_t + b(L)\sum_{t=1}^{T}\Delta NEGF_t \qquad (1)$$

where a_o is the intercept, a(L) and b(L) are polynomial lags, and T is the current time period.

If the price change is positive during the period, then $\sum_{t=1}^{T}\Delta POSF_t$ will increase by the amount of the change, and $\sum_{t=1}^{T}\Delta NEGF_t$ will retain its previous value. If the price change is negative during the period, then $\sum_{t=1}^{T}\Delta POSF_t$ will retain its previous value and $\sum_{t=1}^{T}\Delta NEGF_t$ will decrease (or increase in the absolute sense by the amount of the change since it is negative) by the amount of the change.

When estimated using the above data, equation (1) showed severe autocorrelation for both cattle and corn. Studies by Kinnucan and Forker, and also Boyd and Brorsen (1988), also showed high autocorrelation. For this reason, a first difference model is considered:[3]

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[2]Theoretical reasons for asymmetry are not based the spatial pricing theory of Greenhut, Norman and Hung, nor the market integration ideas of Ravallion, though they may share some common ideas.

[3]The intercept term may not be necessary for theoretical reasons, but it is included here as a precaution to avoid biasing the estimates in case the intercept is not truly zero.

$$\Delta C_t = a_o + a(L)\Delta POSF_t + b(L)\Delta NEGF_t \tag{2}$$

A second degree polynomial distributed lag function (Pindyck and Rubinfeld) is used to estimate (2). Oellerman and Farris have found lags between live cattle cash and futures prices showing that futures prices generally lead cash prices. They used a one day futures to cash lag, but pointed out that a "single day multivariate process may not capture the full extent of the lagged influences" (p. 532). For this reason a five day distributed lag is used a priori, since this length should be sufficiently long to capture all declining lagged effects.[4] A zero end point restriction is used on the distributed lag, since it would be expected that futures price effects on cash price decay to zero at the end of the lag. This zero end point restriction used with a six day lag gives an effective lag length of five days, before dropping to zero on the sixth day.

Two hypotheses relating to price asymmetry are tested. The first is that the total impact of futures price increases and futures price decreases on cash is the same. This is tested by determining statistically whether the sum of the positive coefficients from the lagged polynomials are equal to the corresponding sum of the negative coefficients. The second hypothesis is that the speed of adjustment for futures price increases is the same as the speed of adjustment for futures price decreases. This is tested by determining statistically if each individual coefficient for distributed lag positive changes is equal to its corresponding negative change coefficient. The asymmetry statistical tests are performed using the standard likelihood ratio F-test, which uses the sum of squared errors.

The same asymmetry procedure as above is also used for corn, a storable commodity, for purposes of comparison. This will determine the extent to which cattle prices behave the same or differently in relation to a storable commodity.

Results

OLS estimates of Equation (2) are shown for live cattle in Table 1. Results show that the first null hypothesis, that the sum of coefficients being equal, was not rejected. This implies that the size of the impacts of cash price changes resulting from futures price increases and decreases is the same, or is symmetric. However, results show that the second null hypothesis, that the speed of futures price increases and decreases on cash price changes is the same, was rejected. This second result implies asymmetry.

The major reason for this asymmetric result is that C_0^+=.1224, while C_0^-=.1907 is much larger, from Table 1.[5] These linear coefficient parts of the lag are statistically different at the five percent level. Because the futures price decreases portion C_0^- is statistically larger than the increases portion C_0^+, this shows decreases have a faster speed of adjustment than increases.

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[4]The same lag length and type are also used for corn so that asymmetric tests for both cattle and corn follow consistent methods.

[5]C_0^- sign is expected to be positive as shown, because it has negative values and becomes more negative as cash price falls, giving a positive sign. Also, no direct economic interpretation can be derived from nonlinear terms C_1^+, C_2^+, C_1^-, C_2^-. Instead, the lag weights of the coefficients must be examined, shown in Table 3.

In other words, the current cash price gets pushed down quickly when past futures prices fa but the cash price is slower to come up when the past futures prices rise.

The distributed lag weights for cattle in Table 3 also show this. The negative weig have larger weights in more current periods than do the positive weights. The negati weights also decline much faster than the positive weights.

These results show that claims which hold that when futures prices drop they cau the cash price to fall too quickly, may not be totally unfounded. However, any disequilibriu is short-run in nature, and less than a week, so its effect on cash cattle prices may be qui limited.

One explanation for this asymmetric short-run disequilibrium may be that bearis (downward price) information hits the futures market faster than bullish (upward pric information. It is then also passed on to the cash market faster than bullish information. information hits the market quickly in large doses as Black has argued, it may simply be th bearish doses arrive faster than bullish doses. Does the cattle futures market, as the gener public is sometimes accused of, respond quicker to bad news than good news? The mark adage "buy on rumor, sell on fact," may imply that cattle futures news that is bullish tend to be uncertain so arrives slower with slower price increases. But bearish news may tend t be certain so arrives faster and with faster price decreases.

Corn asymmetry tests are shown in Table 2 for comparison purposes with cattle Neither hypotheses of symmetry could be rejected. This indicates that both the size and spee of corn futures price increases and decreases on corn cash price changes were symmetric. Th corn market does not appear to respond quicker to bearish information like the cattle marke For corn, the speed of adjustment measured by the linear part of the lag, shows futures pric increases C_0^+=.6002 and futures price decreases C_0^-=.5583, to be almost the same. Th hypothesis that these coefficients are different could not be rejected, in contrast to cattle. A well, the distributed lag weight patterns for corn in Table 3 are almost identical for bot positive and negative weights. This also supports the symmetry between the speed of future price increases and decreases for corn in contrast to cattle.

This difference between cattle and corn price behavior is not totally inconsistent wit Helmuth and others. They have argued that the cattle markets price behavior is different tha for other markets. However, direct comparisons between the two markets examined her should be viewed with caution for a number of reasons: (1) the cattle data here is 1966-8 and the corn data is 1978-86, which represents two different time periods; (2) Brorsen Oellerman and Farris (1989) found some evidence of structural change in cattle markets, whic was not addressed here; (3) other questions concerning the distributed lag functional form selected, number of lags selected, and also the implications of including thin cash volume day for cattle, may affect results.

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[6]Seasonality tests found no seasonality in neither the cattle nor the corn equation.

Conclusion

Results showed that cattle futures price increases had the same size of impact on cash price changes as did futures price decreases. However, the speed of the impact was faster for cattle price decreases than increases, indicating asymmetry and possible short-run disequilibrium. Cash and futures prices for corn, used for comparison with cattle, showed no price asymmetry for size or speed of adjustment, in contrast to cattle prices. The cattle price asymmetry may result because downside price information for cattle hits the futures market faster than upside price information, and is then passed on faster to the cash market than the upside information.

More research is needed to test the asymmetric hypothesis over more nonstorable and storable commodities, and across different groups such as financials and metals, in order to establish more solid and conclusive results. Also, the role of asymmetry tests should also be examined in relation to other market performance tests. Finally, the theory and methodology behind asymmetry should be more fully developed.

Table 1. Asymmetric Model Results for Distributed Lag Futures on Cash Impact for Li Cattle Daily Prices, 1960-86[a]

Independent Variables		Coefficients
Intercept		.0029
		(.24)
Polynomial Lags[b]		
C_0^+	Futures Price Increases	.1224*
		(7.78)
C_1^+		.0249*
		(1.96)
C_2^+		-.0084*
		(-4.15)
C_0^-	Futures Price Decreases	.1907*
		(12.50)
C_1^-		-.0567*
		(-4.48)
C_2^-		.0051*
		(2.54)
Equal Sum of Coefficients F[c]		.0002
Identical Coefficients F[d,e]		7.74*
Equation F		142.36*
R^2		.14
Durbin-Watson		2.13

[a]Asterisks denote significance at the 5 percent level, t-values are in parentheses.

[b]These are the coefficients for the second degree polynomial lag, sixth period restricted to zero, where pluses denote positive changes and minuses negative changes for futures prices. Dependent variable is cash price changes.

[c]F test of null hypothesis that $C_0^+ + C_1^+ + C_2^+ = C_0^- + C_1^- + C_2^-$. This was accepted, indicating equal sizes of impacts.

[d]F test of null hypothesis that $C_0^+ = C_0^-$, $C_1^+ = C_1^-$, $C_2^+ = C_2^-$ as a group. This was rejected, indicating different speeds of impacts.

[e]Null hypothesis that $C_0^+ = C_0^-$ was also rejected.

$C_0^+ = \Delta POSF_t + ... + \Delta POSF_{t-6}$.

$C_0^- = \Delta NEGF_t + ... + \Delta NEGF_{t-6}$.

Table 2. Asymmetric Model Results for Distributed Lag Futures on Cash Impact for Daily Corn Prices, 1978-86[a]

Independent Variables		Coefficients
Intercept		-.1378 (-.9178)
Polynomial Lags[b]		
C_0^+	Futures Price Increases	.6002* (20.76)
C_1^+		-.3805* (-16.30)
C_2^+		.0500* (13.42)
C_0^-	Futures Price Decreases	.5583* (19.83)
C_1^-		-.3371* (-14.61)
C_2^-		.0420* (11.34)
Equal Sum of Coefficients F[c]		.06
Identical Coefficients F[d,e]		.62
Equation F		214.69*
R^2		.43
Durbin-Watson		2.11

[a]Asterisks denote significance at the 5 percent level, t-values are in parentheses.

[b]These are the coefficients for the second degree polynomial lag, sixth period restricted to zero, where pluses denote positive changes and minuses negative changes for futures prices. Dependent variable is cash price changes.

[c]F test of null hypothesis that $C_0^+ + C_1^+ + C_2^+ = C_0^- + C_1^- + C_2^-$. This was accepted, indicating equal sizes of impacts.

[d]F test of null hypothesis that $C_0^+ = C_0^-$, $C_1^+ = C_1^-$, $C_2^+ = C_2^-$ as a group. This was accepted, indicating the same speed of impacts.

[e]Null hypothesis that $C_0^+ = C_0^-$ was also accepted.

Table 3. Asymmetric Model Distributed Lag Weights for Daily Positive and Negative Li
Cattle and Corn Price Changes[a]

Market	Period of Data	Days Lagged	Positive Weights	Negative Weights
Live Cattle: Futures to Cash	1966-86	0	.1224	.1907
		1	.1291	.1483
		2	.1253	.1101
		3	.1104	.0762
		4	.0846	.0465
		5	.0478	.0211
Corn Futures to Cash	1978-86	0	.6002	.5583
		1	.2863	.2635
		2	.0689	.0582
		3	-.0683[b]	-.0707
		4	-.1256	-.1234
		5	-.1028	-.0998

[a] These weights are calculated from the coefficients reported in Tables 1 and 2. The formula used is $W_i = C_0 + C_1 i + C_2 i^2$, where W_i is the weight for lag i, and i is the days lagged for futures to cash. All weights are significant at the 5 percent level using a t-test.

[b] The negative weights after two days may indicate that a two day lag would have been sufficient. Weights quickly decline, and may be forced to become negative because lag length may be too long.

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