Impact of Cash Settlement on the Effectiveness of Price Discovery Processes in Feeder Cattle

by

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Cash settlement was introduced for the September 1986 feeder cattle contract on the Chicago Mercantile Exchange (CME). There were expectations that moving to cash settlement would enhance the performance of the contract via improved basis performance and/or more effective contributions to the price discovery process. Since the introduction of cash settlement there have been numerous research efforts examining its impact on price relationships in feeder cattle (Elam; Schroeder and Mintert; Kenyon). The majority of this work has focused on the cash-futures price relationship or the basis relationship. The objective has been to determine whether moving to cash settlement has reduced basis variability, therefore improving basis predictability and the performance of hedges for feeder cattle.

Other studies have examined the possibility of extending cash settlement to the CME live cattle futures contract (Kahl, Hudson and Ward, and Paul). Cash settlement has been considered for the live cattle contract because of the potential to improve hedging performance and solve problems encountered in delivery of cattle.

Cash settlement represents an institutional change in the feeder cattle contract that has implications beyond the manner in which the contract is settled. Institutional changes can be expected to affect the economic function and performance of markets. Futures markets have traditionally been considered to perform two primary roles. The first is to be a market for risk transfer. The second, equally as important, is to be a forum for price discovery. This paper seeks to determine the impact of cash settlement on the price discovery process in feeder cattle markets. The examination of price discovery entails determining which market is the dominant information registering center, the futures market or the cash market. Part of the price discovery process in the futures market is the providing of a source of information on expected future supply and demand conditions. A study of the impacts of cash settlement on price discovery therefore implies an examination of the price discovery relationship between nearby contracts and distant contracts.

The structure of this paper is as follows. First a parsimonious review of the literature on cash settlement and price discovery is presented. In this literature review the institutional changes implied by cash settlement are discussed. Following the literature review, trends in the composition of traders participating in the feeder cattle futures market are presented. The results of an analysis of the behavior of price variables for feeder cattle contracts and cash markets prior to and following cash settlement are then presented. Granger Causality tests are employed to determine whether the time-related dimensions of the cash and futures markets have changed since the introduction of cash settlement.

REVIEW OF LITERATURE

The use of cash settlement as a method of settling futures contracts is a relatively new concept. Though there have been some variations of the cash settlement procedure employed, this method of settlement did not become widely accepted until the introduction

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of futures contracts for stock indexes and Eurodollar loans. Paul suggested that because of the variation in grades and geographic dispersion of production and markets, it has been difficult to develop an accurate cash price or index for an agricultural commodity. The need for a cash price index that accurately represents the economic value of the underlying commodity is fundamental to the success of cash settling a futures contract. Regulatory experience with cash settlement and the development of a reliable price index for feeder cattle by the Cattle Marketing Information Services Inc. (Cattle Fax) provided the environment to cash settle the feeder cattle futures contract.

Cash settlement of futures contracts is desirable when there is a high cost associated with physical delivery of the commodity. Garbade and Silber point out that high delivery costs impair the ability of futures and cash prices to converge at contract maturity. In examining potential impacts of cash settlement for the feeder cattle contract, Cohen and Gorham contend that the greater the incremental cost of delivery the wider the range of price within which no profitable arbitrage opportunities will arise. The lack of arbitrage opportunities implies reduced convergence of futures and cash price which in turn results in a less predictable basis pattern. Jones notes that cash settlement is more desirable when there is a low deliverable supply of the commodity and there are high transaction costs associated with delivery.

The supply of feeder cattle is adequate and thus there are no major problems of a limited deliverable supply in total. However, supply problems were apparent in that the cattle could be delivered at locations the holders of short positions selected. This implies the possibility of tight **deliverable supplies** at certain locations and the delivery of cattle to locations unsuitable to the longs. Cohen and Gorham point to this factor as one reason for high delivery costs with feeder cattle. In addition, they suggested that delivery costs were elevated by grading and sorting fees, and by uncertainty about how the cattle would grade. These factors contributed to the problems of convergence for cash and futures price and limited the usefulness of the feeder cattle futures contract to hedgers.

The price index used for cash settling the Feeder Cattle futures contract is the United States Feeder Steer Price Index (USFSP) produced by Cattle Fax. The index is composed of auction and direct sale prices for 600 to 800 pound feeder steers in 27 states during a seven day period. The index is calculated daily and represents approximately 60 percent of the sales of feeder steers in this weight class. The change to the index implies a significant change in the contract specification in a number of ways. The weight classification has been expanded to encompass animals from 600 to 800 pounds from the previous limits of 575 to 700 pounds. The delivery locations previously were eleven markets. The delivery price is now essentially a weighted average price from 27 states. Grading standards were also changed. Previously, 80 percent of the animals had to grade Choice and 20 percent could grade Good. Now the price index represents animals which grade between 60 and 80 percent Choice. With physical delivery procedures, Jones points out that price tends to reflect the lowest possible deliverable grade of the commodity. The price index for feeder cattle thus represents a broadening in weight, grade, and location of the "deliverable" animal. Cash settlement for the Feeder Cattle futures contracts, therefore, is in reality a shift to a new contract.

Cash settlement was, as noted, to provide a more stable basis pattern resulting in a improved hedging instrument for feeder cattle. This gain was to come at the expense of blocking use of the feeder cattle futures contract as a means of merchandising feeder cattle. Elam examined the expected impact of cash settlement on hedging risk by simulating what the hedging risk would be with cash settlement, for Arkansas feeder cattle prices between 1977 and 1986. This analysis, conducted prior to the implementation of cash settlement, indicated that the hedging risk for 600-700 pound steers would be reduced in the order of 66 percent by shifting to the cash settled contract.

Schroeder and Mintert conducted a similar analysis to that of Elam. They examined four cash markets and the period analyzed included 15 months when cash settlement was in use. Schroeder and Mintert's conclusions tend to confirm Elam's findings, though reductions in hedging risk were more moderate. Kenyon examined how cash settlement affected the

vel and variability of basis for Virginia feeder cattle during the Fall of 1986 and 1987. enyon's analysis was conducted on prices for individual sale lots of cattle. His results uggested that basis variablity was reduced for heifers with cash settlement, but no re- uction was confirmed for steers.

Vorking points out that it is naive to think of the risk transfer function of futures markets simply a procedure of matching one risk with an opposing one. In the development of framework for understanding hedging, Working presents hedging as a multipurpose con- ept. It becomes clear from this framework that the hedger is an integral part of the price iscovery process. Just as speculators bring information to the market concerning expec- tions for price changes, the hedger takes action in the futures market based on their as- ssment of the commodity's economic value and the expectation for price to change. The tures market provides an efficient institution for individuals, as Working suggests, to ex- cise their price-forming function more freely than they otherwise could. Purcell and udson define price discovery as the process of generating a market-clearing price by fo- sing in on a price in a particular market for a certain period. Given that futures contracts ade with more than one maturity date, prices in the futures market are therefore being merated for more than one market at any particular point in time.

review of the literature on analysis of the price discovery in livestock markets indicates lat the dominant technique employed has been Granger causality tests. The essence of le term Granger causality is that variable X causes variable Y, with respect to a given in- rmation set including X and Y, if current values of Y can be better predicted using past lues of X than by not doing so. It is in this context that price discovery processes for restock markets have been examined.

breen and Shonkwiler analyzed slaughter cattle prices, feeder cattle prices, and feed costs. hey found that slaughter and feeder cattle price were determined simultaneously and that ed cost leads both animal categories. Oellermann and Farris analyzed live cattle prices r the Omaha cash market and the futures market for three subperiods between 1966 and 82. Their results suggested the futures market is the center of price discovery for live ttle. Hudson and Purcell employed Granger causality tests in examining the price dis- very process for live cattle futures and cash markets and the carcass beef market. Their sults indicated that while futures markets are important to the price discovery process, ere was significant evidence of interaction between cash and futures markets during the y. In an analysis of weekly data for 1973 through 1984 of live cattle prices in the futures arket and for terminal and direct cash markets, Koontz, Hudson and Garcia found that e futures market was the dominant force in the price discovery process. Their analysis ghlighted evidence of the futures market increasing in importance as the source of price scovery in recent years.

ellermann, Brorsen, and Farris have analyzed the price discovery process for feeder cattle. eir analysis was conducted on data for the futures market and Oklahoma City cash arket during the period 1979 to 1986, broken into two sub-periods: 1979-82 and 1983-86. e authors employed Granger causality tests and a dynamic regression testing scheme for vestigating the price leadership relation for futures and cash prices. The results of both ms of analysis indicated that futures prices lead cash prices for feeder cattle. This anal- s was conducted prior to the implementation of cash settlement. There was evidence strength of the price leadership role of the futures market weakened during the second period.

e industrial organization literature has made use of the Granger causality and price cor- ation analysis for examining the extent of markets. Stigler and Sherwin made extensive of price correlation analysis to examine market definitions for products and commod- s separated by space and time. Cartwright, Kamerchen, and Haung extended this thod of defining markets using price correlation with Granger causality tests. They ex- ined markets separated by space. Granger causality tests were used because they provide ability to extend the analysis beyond the static level. These industrial organization ap- ations suggested that price correlation analysis and Granger causality testing is appro-

priate for examining whether institutional changes in (futures) markets has an impact on the market definition.

DATA

The analysis of impacts of cash settlement on feeder cattle markets has been conducted prior to and following the introduction of cash settlement of the Feeder Cattle futures contract. The introduction of cash settlement came with the September 1986 futures contract. Thus, the anterior period analyzed is from 1983 through to the introduction of cash settlement in 1986. The postier period analyzed data from the introduction of cash settlement to 1990. A conscious effort was made to structure the prior/after analysis on data sets of approximately equal sizes. The analysis of trends in trader composition is based on data from the Commodity Futures Trading Commission (CFTC) Commitment of Traders In The Commodity Futures, monthly reports. Analysis of price relations in futures markets is based on data acquired from Technical Tools of Los Alto California. This data set includes daily price quotations, volume, open interest, and a cash price series for Oklahoma City feeder steers.

ANALYSIS AND RESULTS

Trends In Composition of Trade

The analysis of the composition of trade is premised upon cash settlement representing a new contract because of the specification changes. Therefore, we can expect that those making use of this new contract will be comprised of a different mix than those who previously used the market. Little data is available on the purpose for which the futures market is used by market participants. The CFTC monthly report on positions held by all large traders (traders with more than 50 contracts) is the extent of public information available. These reports classify traders as either speculators or commercial (hedgers) users. They do not provide information on maturity month in which positions are held. Total long and short positions held by non-reporting traders and total open interest are also reported by the CFTC. For the analysis of composition of traders this data set was broken down into a 44-month period prior to cash settlement (January 1983 through August 1986) and a 42-month period after cash settlement (September 1986 through February 1990).

In Table 1 the mean levels of positions held by the various categories of traders are reported before and after cash settlement. It is obvious that since the introduction of cash settlement there has been a significant growth in open interest, with the greatest rates of growth having taken place in the reporting speculative positions. Focusing on rates of growth masks the growth in absolute numbers with the largest increases in the short non-reporting positions and the long non-reporting positions. These two categories represent positions held for either speculative or hedging purposes. Of the categories where the purpose of the positions is identified, the greatest increase in absolute positions took place in long reporting hedgers, followed by short reporting hedgers.

Examination of changes in the mean level of positions held does not specifically address the question of how the composition of traders has changed. In Table 2, the positions held as a percent of open interest are presented for each of the above categories before and after cash settlement. The data in this table indicates that, relative to open interest, the composition of trade has shifted to greater participation by reporting speculators and spreaders. The strong growth in mean level of long reporting speculative positions is seen in the 2.54 percent increase in open interest held in this category. Reporting speculative positions held still represents a relatively smaller percentage of total positions held than do the reporting hedge positions, however.

Table 1. Mean Level of Open Positions Prior to and Following Cash Settlement in CME Feeder Cattle Futures Market

Category	1983.1 - 1986.8	1986.9 - 1990.2	Percent Change
LRS	1032	2536	+ 145
SRS	812	1551	+ 91
SRSP	230	478	+ 8
LRSP	230	478	+ 8
LRH	3440	5164	+ 50
SRH	2607	3524	+ 35
LNR	4300	6245	+ 45
SNR	5352	8877	+ 65
OI	9002	14430	+ 60

KEY TO VARIABLES

- LRS = long reporting speculative positions,
- SRS = short reporting speculative positions,
- SRSP = short reporting spread positions,
- LRSP = long reporting spread positions,
- LRH = long reporting commercial (hedge) positions,
- SRH = short reporting commercial (hedge) positions,
- LNR = long non-reporting positions,
- SNR = short non-reporting positions, and
- OI = open interest.

Correlation coefficients were estimated for the composition of trader data set. Table 3 presents the correlation coefficients for the period prior to cash settlement and Table 4 presents the post cash settlement relationships. A simple linear trend variable (LT) was added to the data set. The LT variable was added to provide further indication of what patterns developed in the level and relative composition of traders in the futures market.

Table 4. Correlation Coefficient, Composition of Traders Data: 1986.9 to 1990.2

	LT	LRS	SRS	LRH	SRH	LNR	SNR	PLRS	PSRS	PLRH	PSRH
LRS	.08*	1.00									
SRS	.21*	.32	1.00								
LRH	-.13*	.48	.75	1.00							
SRH	-.46	.61	.30	.69	1.00						
LNR	-.06*	.37	.56	.41	.43	1.00					
SNR	-.07*	.79	.65	.76	.57	.72	1.00				
PLRS	.27	.87	.04*	.11*	.26	.06*	.49	1.00			
PSRS	.42	0.00*	.88	.43	-.07*	.29	.27	-.14*	1.00		
PLRH	-.17*	-.02*	.46	.76	.40	-.11*	.21*	-.30	.36	1.00	
PSRH	-.67	-.06*	-.32	.07*	.62	-.15*	-.27	-.19	-.43	.27	1.00

*Not significant at .10 level. Variable definitions same as Tables 1 & 2.

Table 2. Composition of Open Positions as a Percent of Total Prior to and Following Cash Settlement In Feeder Cattle Futures Market

Category	1983.1 - 1986.8	1986.9 - 1990.2	Percent Change
PLRS	5.86	8.40	+ 2.54
PSRS	4.81	5.20	+ .39
PSRSP	1.23	1.66	+ .43
PLRSP	1.23	1.66	+ .43
PLRH	18.62	17.45	-1.17
PSRH	14.05	12.25	-1.80
PLNR	24.30	22.48	-1.82
PSNR	29.90	30.90	+ 1.00
TOTAL	100.00	100.00	0.00

KEY TO VARIABLES

- PLRS = LRS/(2 x OI)
- PSRS = SRS/(2 x OI)
- PSRSP = SRSP/(2 x OI)
- PLRSP = LRSP/(2 x OI)
- PLRH = LRH/(2 x OI)
- PSRH = SRH/(2 x OI)
- PLNR = LNR/(2 x OI)
- PSNR = SNR/(2 x OI)

The linear trend variable provides an indication that there was a sustained trend in the position categories. The LRS category exhibited both a large growth rate and a large relative increase since the adoption of cash settlement. The correlation analysis fails to support that this was a sustained trend. Fisher's z-transformation procedure (as defined by Steel and Torrie) was employed to test the homogeneity of specific correlation coefficients between the two periods. This test confirmed that no significant trend was apparent for either absolute level or relative level of large reporting speculative positions. The homogeneity test did indicate that for the other position categories, with the exception of long non-reporting positions, there was a significant shift in trends after cash settlement.

With the advent of cash settlement, both hedging and speculative activity have apparently increased. As has been noted, it is only for the reporting positions that information is available on the purpose for which traders are making use of the futures market. Working has documented the need for hedging activity to make a contract successful. Yet, it is important that the demand for hedging services be met. The increase in magnitude of correlation coefficients for LRS-SRH and SRS-LRH indicates that when demand for hedging services increase, the supply of speculative services increases as well. The test of homogeneity for the correlations coefficient for these relationships confirmed a statistically significant change occurred at the .05 level.

PRICE BEHAVIOR CHANGES ASSOCIATED WITH CASH SETTLEMENT

Empirical evidence suggests that hedging risk has been modified since the implementation of cash settlement for the feeder cattle futures contract. This research, though sparse at present, indicates that the risk transfer function of the this market has been enhanced.

	LT	LRS	SRS	LRH	SRH	LNR	SNR	PLRS	PSRS	PLRH	PSRH
LRS	-.07*	1.00									
SRS	-.62	-.11	1.00								
LRH	.50	-.20*	-.26	1.00							
SRH	.54	.02*	-.25	.68	1.00						
LNR	.06*	.33	.21*	.08*	.54	1.00					
SNR	.34	.50	-.36	.59	.39	.43	1.00				
PLRS	.2*	.85	-.10*	-.55	-.34	-.05*	.06*	1.00			
PSRS	-.66	-.21*	.91	-.49	-.49	-.08*	-.62	0.00	1.00		
PLRH	.43	-.46	-.24*	.90	.40	-.29	.33	-.64	-.35	1.00	
PSRH	.44	-.18*	-.26	.48	.91	.36	.04*	-.39	-.42	.30	1.00

Table 3. Correlation Coefficients, Composition of Traders Data: 1983.1 to 1986.8

*Not significant at .10 level. Variable definitions same as Tables 1 & 2.

Evidence discussed above notes that that the mix of traders has changed since the adoption of the cash settlement mechanism. It is therefore pertinent to examine whether the price discovery function of the feeder cattle market has been affected by the introduction of cash settlement.

Feeder cattle are a nonstorable commodity. The producer possesses limited ability to advance or delay the placement of cattle on feed. The CME offers feeder cattle futures contracts for eight separate contract maturity months per year. The concept of futures prices providing inventory management information, as they do for storable commodities, is not applicable for these markets. There should be no expectation that prices in feeder cattle contracts of different maturity month will reflect a carrying charge for the commodity. The prices of feeder cattle futures contracts represent an evaluation of the expected supply and demand conditions for the contract's maturity date. It is not necessary that this be an accurate forecast, but it is implied that this price forecast is the best expectation of the actual price for the maturity date.

To evaluate the behavior of prices for contracts of different maturity dates, two data sets composed of a nearby and distant contract price series were constructed. The first was a March-October series (March the nearby and October the distant), and the second an October-March series (October the nearby and March the distant). Each data set contained the following variables: nearby and distant open, high, low, and close prices; volume and open interest; total feeder cattle futures volume and open interest; and an Oklahoma City cash price series for 600-700 pound feeder steers, all on a daily basis. The March-October series contains observations for approximately four months prior to maturity, while the October-March series contains observations for approximately five months. They differ in length because the distant March contract attracts trading interest earlier than does the distant October contract. The two contract maturity months were selected for analysis because they are sufficiently separate to represent different markets in a temporal context.

The mean values and variances were compiled for selected variables for the two series of nearby and distant contracts on a before and after cash settlement basis. These values are displayed in Table 5, along with t-tests on the homogeneity of the means at the .05 level of significance. The spread variable based on the nearby closing price minus the distant closing price increased in magnitude after cash settlement for the March-October series, but the variance of this variable decreased by more than half. The spread for the October-March series, in contrast, decreased in absolute value and the variance remained stable.

Table 5. Mean and Variance of Select Nearby-Distant Price, Volume, and Open Interest Relationships Before and After Cash Settlement in Feeder Cattle Futures

| Variable | Before C.S. | | After C.S. | | t-Test |
	Mean	Variance	Mean	Variance	
March-October					
Spread	$2.83	4.04	$3.45	1.87	*
Rel-NB-Vol	.45	.039	.34	.014	*
Rel-DIS-Vol	.021	.0006	.017	.0003	
Rel-NB-OI	.37	.0217	.32	.0088	*
Rel-DIS-OI	.037	.0011	.028	.0004	*
October-March					
Spread	-$3.30	1.68	-$1.07	1.67	*
Rel-NB-Vol	.325	.030	.273	.012	*
Rel-DIS-Vol	.045	.0061	.065	.0036	*
Rel-NB-OI	.327	.0217	.264	.0064	*
Rel-DIS-OI	.060	.0069	.093	.0055	*

*Indicates means are significantly different at .05 level.

The other variables in Table 5 relate the nearby and distant contract volume and open interest to the total volume and open interest in feeder cattle contracts. **For all the relative variables, there was a decrease in variance after cash settlement.** In both the nearby and distant series, the volume and open interest for the nearby contract relative to total volume and open interest decreased. It should be pointed out that, for both series, there is an additional contract trading with a maturity in front of the "nearby" contract for a portion of the period analyzed. In the October-March series the March contract is relatively more important in terms of volume and open interest after cash settlement. These results indicate that **since the introduction of cash settlement, the feeder cattle futures market has experienced a shift in price spreads and relative trade relationships, and these relationships have become more stable.**

To expand on this notion of increased stability in the behavior of the spread between the nearby and distant contracts, correlation analysis was conducted on price variables. This provides a method to examine the static relationships between price variables. The price variable relationships analyzed were the closing price of the nearby and distant contracts, the closing prices with the Oklahoma cash price series, the first difference of the closing prices for the nearby and distant contracts, and the daily price ranges for the nearby and distant contracts. These relationships were again analyzed in a before and after cash settlement context. The results for the March-October series are presented in Table 6 while the results for the October-March series are presented in Table 7.

Fisher's z-transformation statistics and test of homogeneity of correlation coefficient were calculated for specific relationships. For both series, the closing prices of the nearby and distant contracts are much more highly correlated since the advent of cash settlement. The tests were analyzed at a .05 level and indicated that, with the exception of the Nearby-Distant daily price range for the October-March series, the correlations coefficients were significantly different. This is also true for the futures contracts closing price with the Oklahoma City cash price series. The daily change in prices of the futures contracts as

Table 6. Correlation Coefficient For Select Feeder Cattle Futures Price Relations, Before and After Cash Settlement, March-October Series

	BEFORE CASH SETTLEMENT						
	MarP	OctP	OKcash	MarDif	OctDif	MarRang	OctRang
MarP	1.00						
OctP	.56	1.00					
OKcash	.74	.68	1.00				
MarDif	.10*	-.07*	-.12	1.00			
OctDif	.10*	.05	-.06*	.66	1.00		
MarRang	-.17	-.11	.09*	.03*	-.04*	1.00	
OctRang	-.04*	.24	.14	-.11*	-.03*	.36	1.00

	AFTER CASH SETTLEMENT						
	MarP	OctP	OKcash	MarDif	OctDif	MarRang	OctRang
MarP	1.00						
OctP	.99	1.00					
OKcash	.98	.97	1.00				
MarDif	-.01*	-.03*	-.08*	1.00			
OctDif	0.00	0.00	-.06*	.84	1.00		
MarRang	.10	.08*	.12	.16	.13	1.00	
OctRang	.18	.14	.19	.02*	-.01*	.61	1.00

*Not statistically significant at .10 level.

measured by the first difference variables (Octdif and Mardif) also were much more highly correlated after cash settlement.

This analysis of price expectations for temporally separate markets suggests that **in the period following the introduction of cash settlement, the price expections for the two futures contracts at any point in time have become significantly more highly correlated.** The futures market is discovering price for the nearby and distant market periods simultaneously and at essentially the same level. The futures price for each contract maturity month **should** represent the analysis of supply and demand for those temporally separate markets. Yet, this analysis suggests that the discovered prices have been in tandem since the implementation of cash settlement.

The analysis of static price behavior for feeder cattle futures contracts with the correlation analysis, provided evidence of a shift in price behavior in the post-cash settlement sample. A preliminary analysis, using a Granger causality testing scheme as defined previously, was conducted on the first differences of the closing prices for the nearby and distant for the March-October and October-March series. The causality test was constructed using the form suggested by Geweke. The specification is as follows:

$$Y(t) = (a_{10}) + (\sum_{j=1}^{p})(a_{1j})(Y_{(t-j)}) + (e_{it}) \quad (1)$$

$$Y(t) = (a_{20}) + (\sum_{j=1}^{p})(a_{2j})(Y_{(t-j)}) + (B_{2k})(X_{(t-k)}) + (e_{2t}) \quad (2)$$

Table 7. Correlation Coefficients For Select Feeder Cattle Futures Price Relations, Before and After Cash Settlement, October-March Series

	MarP	OctP	OKcash	MarDif	OctDif	MarRang	OctRang
BEFORE CASH SETTLEMENT							
OctP	1.00						
MarP	.90	1.00					
OKcash	.66	.44	1.00				
OctDif	.10	.12	-.09*	1.00			
Mardif	.04*	.12	-.11	.73	1.00		
OctRang	-.40	-.33	-.29	.05*	.04*	1.00	
MarRang	-.46	-.24	-.47	.06*	.12	.64	1.00
AFTER CASH SETTLEMENT							
OctP	1.00						
MarP	.99	1.00					
OKcash	.98	.97	1.00				
OctDif	.03*	.03*	.01*	1.00			
Mardif	.03*	.04*	0.00	.85	1.00		
OctRang	.10	.14	.09	.06*	.05*	1.00	
MarRang	.34	.34	.31	.04*	.08*	.60	1.00

*Not statistically significant at .10 level.

The null hypothesis that $(B_{2k}) = 0$ is carried out using F-tests for the equality between the two regressions. Contemporaneous causality may be examined by allowing $K = 0$ in equation 2.

The appropriate lag length for the models was selected using Akaike's Information Criteria. The modesl were estimated for the before and after cash settlement samples. For the March-October series during the before cash settlement period, these preliminary results indicated a causal flow from the nearby contract to the distant contract. These results were not found on the post-cash settlement period. Strong contemporaneous flows were identified for both the nearby to distant flow and the distrant to nearby flow in the pre- and post-cash settlement samples for the March-october series. The contemporaneous relationship was much stronger for the post-cash settlement sample. Similar results were identified for the October-March series.

This strong increase in contemporaneous flows for nearby/distant series, using the Granger causality testing scheme, reaffirms the results found in static correlational analysis. The F-tests in post-cash settlement samples for the contemporaneous causality tests, were 2.5 to 5 times what they were in the pre-cash settlement sample. These results indicate that the link between price discovered for these temporally separate markets increased in the post-cash settlement sample.

The difference between the daily closing price and an average of the final five trading days of the futures contracts at intervals of eight, six, four, and two months prior to maturity were calculated. This was done to provide an indication of whether or not the futures market was accurately anticipating the final price. Though the futures price does not have to be a perfectly accurate predictor to provide an effective hedging mechanism, it does represent what the expected price will be. Price relationships and price spreads between

futures should register seasonal or other time-related impacts. In Table 8 the mean and coefficients of variation for these differences are presented.

The hypothesis that the mean forecast differences were equal to zero were tested for each period with t-tests at the .05 level. These tests rejected the hypothesis for all differences with the exception of the mean differences for eight, six, and four months prior to maturity for the March contract before cash settlement. It thus appears that the futures market were providing reliable forecasts prior to cash settlement for the March contract. **It is apparent that the absolute values of the mean differences has increased the farther away from maturity since the adoption of cash settlement.** The coefficients of variation also suggest that these differences are more stable in the latter sample. Taken together, **these factors provide additional evidence that the price discovery process is breaking down the farther the period is away from maturity since cash settlement was instituted. The market is not providing a unique and differentiated price discovery process for the distant feeder cattle futures.**

Summary and Conclusions

The approach taken in this research has been to analyze phenomena in the feeder cattle market prior to and following the initiation of the cash settlement process for the feeder cattle futures contracts. It is important to view the results reported as quantifying trends that are apparent in two sample periods of approximately equal duration. This is important because in this analysis, there has been no attempt to empirically test a causal link between cash settlement and phenomena observed. It is equally important to consider that the switch to cash settlement and the use of the USFSP index represented a major institutional change in the structure of the feeder cattle futures contracts.

In reviewing the literature on the impact of cash settlement on basis behavior, the results suggest a reduction in hedging risk. The implication is that by eliminating delivery costs, opportunities for arbitrage activity that force futures-cash convergence at maturity has been increased. This result is consistent with the expectations that Cohen and Gorham reported on for cash settlement. In analysis of the composition of trade, average total open interest increase as did all categories of trader positions as defined by the CFTC. In the post-cash settlement period, there was an increase in hedging and speculative activity. The growth in relative positions took place in the reporting speculative categories and the short, non-reporting categories. The increase in short, non-reporting positions would be consistent with small producers finding the post-cash settlement futures contract a more attractive hedging instrument. This conclusion is very tentative because of the inability to precisely define what purpose non-reporting positions are being held.

The analysis of price behavior for pre- and post-cash settlement samples indicate that the effectiveness of the price discovery process for temporally separate markets has diminished in post-cash settlement samples. The static analysis estimating correlation coefficients and the Granger causality testing scheme, point to this result. The analysis of the difference between expected maturity prices and actual maturity prices indicated that the price searching process diminishes the farther away from maturity a contract is, since cash settlement.

Since the adoption of the cash settlement procedure for feeder cattle futures contracts, the relationship between price expectations for temporally separate markets has changed. The implication from the analysis reported is that these price expectations are not representative of markets that are separated by time. Future research needs to address the price discovery relationship between feeder cattle futures markets and the USFSP index. In addition, it would be pertinent for researchers to conduct analysis on price expectations provided by the futures market, by expert analysis, and by econometric forecasting techniques and evaluate their relative performance prior to and following cash settlement.

Table 8. Means and Coefficients of Variation for Daily Closing Price Minus the Average Closing Price of Final Five Trading Days

	8 Months	6 Months	4 Months	2 Months
MARCH CONTRACT				
1983-86				
MEAN	-.51	-.53	.71	2.35
C.V.	-1038	-917	748	160
1987-89				
MEAN	-5.88	-2.56	-4.50	-1.81
C.V.	-73	-132	-112	-230
OCTOBER CONTRACT				
1983-85				
MEAN	4.21	2.15	1.13	-.74
C.V.	75	116	165	256
1986-88				
MEAN	-4.63	-6.33	-5.60	1.03
C.V.	-102	-24	-38	179

Further research in these areas could provide additional, relevant information on the advisability of adopting cash settlement procedures for agricultural commodity futures contracts.

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