NCCC-134
APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

Feeder Cattle Cash Settlement: Impacts on Basis Variability in Selected U.S. Markets

by

Donald R. Rich, Raymond M. Leuthold,

and Michael A. Hudson

Suggested citation format:

Rich, D. R., R. M. Leuthold and M. A. Hudson. 1990. "Feeder Cattle Cash Settlement: Impacts on Basis Variability in Selected U.S. Markets." Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [http://www.farmdoc.uiuc.edu/nccc134].

FEEDER CATTLE CASH SETTLEMENT: IMPACTS ON BASIS VARIABILITY IN SELECTED U.S. MARKETS

Donald R. Rich, Raymond M. Leuthold and
Michael A. Hudson*

Introduction

One of the primary economic functions of the futures market is to provide a mechanism by which producers can transfer cash price risk to others. By hedging, market participants seek to exchange cash price risk for a more stable basis risk. From 1980-86 excessive basis risk is believed to have reduced the effectiveness of the feeder cattle contract as a hedging mechanism (Kenyon, 1988).

Open interest for feeder cattle futures peaked in 1979 at 25,000 average month-end open positions. However, from 1979 to 1984 the contract experienced over a fifty percent reduction in average open positions. According to the Chicago Mercantile Exchange (CME), under physical delivery, contract performance was hindered because cash and futures prices did not appropriately converge at contract expiration (CME, 1985A).

The lack of a tight cash-futures price convergence at final settlement time has been attributed to uncertainty for long traders and high delivery costs confronted by shorts. Uncertainty for longs originated from the risk of being delivered upon at one of eleven possible delivery points and/or receiving an undesirable type of feeder. Short traders incurred high transaction and delivery costs with making delivery. Cohen and Gorham (1985) estimated that delivery costs could run as high as $1.00 per hundredweight for shorts owning cattle, and $2.00 to $3.00 per hundredweight for shorts having to purchase the cattle. These problems are believed to have: (1) augmented volatility in the cash-futures price relationships resulting in unpredictable basis movements for hedgers, and (2) restricted the basis from closing to theoretical levels (CME, 1985B).

The CME initiated a mandatory cash settlement system for the feeder cattle contract in September 1986. The move from physical delivery to cash settlement was designed to:

> (1) eliminate the uncertainties and disputes associated with the grading of CME feeder deliveries; (2) eliminate the risk of a long receiving delivery at an inconvenient delivery location and/or receiving an undesirable type of feeder; (3) eliminate the costs incurred in making or taking delivery on the contract; (4) eliminate the need for periodic contract amendments regarding discounts for non-par grades, weights, and locations...; and (5) reduce the basis variability for users of the contract (CME, 1985A, p.9).

---

* Graduate Research Assistant, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, and Professor, Department of Agricultural Economics, University of Illinois at Urbana-Champaign, and Associate Professor, Bruce F. Failing, Sr. Chair of Personal Enterprise, Department of Agricultural Economics, Cornell University, respectively.

n, cash settlement was expected to improve contract performance by ng hedging risk during the expiration months.[1]

Evidence exists that the influence of the settlement change on maturity risk may differ across space, sex, and between weight groups while still ng basis variability. Kenyon (1988) found, in an investigation of the for Virginia cattle producers, that the introduction of cash settlement ncreased mean basis levels and reduced basis variability, especially for heifers. Elam (1988) developed a simulation model to measure the estimated change in hedging risk due to cash settlement for Arkansas. He found hedging risk decreased with cash settlement, especially for heavier weight feeders and for heifers. Finally, Schroeder and Mintert (1988) used data from four cash markets and found results similar to Elam's (1988).

The objective of this study is to build upon these previous works by comprehensively examining basis risk. Basis risk (hedging risk) is analyzed for two years pre and two years post cash settlement. The analysis is conducted for 600 - 700 pound heifers and steers across 27 selected U.S. markets, located in 20 different states (see table 1).[2] Using weekly data from twenty-seven markets, basis variability for contracts with expiration months from January 1984 to August 1986 (BEFORE) is compared with variability for contracts from September 1986 through May 1988 (AFTER). Variability is studied for the delivery months, then more specifically within the final trading week of each expiration month. Three markets also are analyzed with daily delivery month data to gain greater insight into short-run basis variability. Finally, to analyze basis variability in more detail relative to sex and location, and to isolate cash settlement's impact on feeder cattle basis, regression models are estimated using monthly data.

Empirical Models

Variance Models

Hedging risk is defined here as the sample variance of the basis. Basis is calculated as the cash price minus the futures price. Thus, basis risk is estimated as:

$$\frac{\Sigma_i^n (X_i - \bar{X})^2}{n - 1} = \text{VARIANCE} \qquad (1)$$

where i equals 1 to n, n equals the number of observations in each time period (i.e., either BEFORE or AFTER), X_i denotes the difference between the cash and futures price (basis) for the i^{th} observation, and $\bar{X}$ represents the mean basis for the time period in question (BEFORE or AFTER). Based on this general notation, equation 1 can be used to explain the procedure employed for tests of monthly, weekly, and daily basis variability.

First, using weekly cash market data, basis variability is analyzed for the entire expiration month for each of the twenty-seven markets.[3] Variability was calculated only for the weeks in which prices were reported. Hence, n in equation 1 varied slightly from market to market; if there were no missing prices, n equaled 92 BEFORE and 67 AFTER. Assuming cash settlement

had the desired impact, the AFTER variances were hypothesized to be smaller than the BEFORE variances.

Next, basis variability was examined for the final week of trading within each expiration month for each of the twenty-seven markets. Under physical delivery (BEFORE), contracts expired on the 20th of each delivery month. Following the change in specifications (AFTER), contracts ceased trading on the last Thursday of the contract month. Based on this, X_i in equation 1 denotes the basis for the final week of trading. There were 21 contracts which expired during the BEFORE time period, and 15 during the AFTER time period (i.e., n=21 for BEFORE and n=15 for AFTER). Here again, hedging risk was hypothesized to be less for cash settled contracts than physically delivered contracts.

To analyze short-run variability in more detail and to determine the effects of averaging prices across time, daily basis volatility tests were conducted. Daily cash prices for 600 - 700 pound feeders could be obtained only for steers from three markets: Oklahoma City, OK; Amarillo, TX; and Dodge City, KS. For each of these markets, basis variability is calculated within each delivery month up to the final day of trading.[4] Since none of the markets was active every day of each delivery month due to market thinness, variability was only calculated for the days when prices were reported. Using equation 1, X_i signifies the basis for a particular day, and n represents the number of days in each time period for which prices were reported. For Kansas City, n equals 171 BEFORE and 134 AFTER; n equals 102 BEFORE and 85 AFTER for Amarillo, and n equals 58 BEFORE and 66 AFTER for Dodge City. It is assumed that some volatility is lost by averaging prices across time; consequently, the reduction in daily basis variability is expected to be greater than in the weekly or monthly analysis.

All of the weekly cash market and future prices were obtained from the CME Research Department. The daily cash market data for Oklahoma City, Amarillo, and Dodge City were obtained from the annual *Chicago Mercantile Exchange Yearbook*, 1984-1988.

Regression Model

For the monthly, weekly, and daily basis variability tests above it is implicitly assumed that any differences between the two time periods could be attributed solely to the introduction of cash settlement. To isolate the impact of cash settlements on basis variability and to gain greater insight into basis risk across space and between sex, a regression model was developed and estimated.

Using ordinary least squares, the following model for delivery month variance (i.e., the results presented in Table 2 and discussed below), is estimated:

$$VAR = f(SEX, CS, L_4)$$

where:

VAR = Delivery month basis variability. Variability is calculated as the sample variance of the basis (see equation 1). Basis is calculated as the cash price minus the futures price.

SEX = 0 if heifer, 1 if steer.

CS = Cash settlement, 0 if before cash settlement (September 1986), 1 if after.

L_i = A discrete variable for location. The sample size consists of 27 cash market terminals. L1 represents the first market, L2 the second and so on up to L27 as shown in Table II. 0 for all other markets. Market L27 is used as a base in the analysis.

There were a total of 106 observations; one pre and one post cash settlement for each sex for each of the twenty-seven markets.[5] Assuming cash settlement has lessened uncertainty and eliminated delivery costs, cash settlement is hypothesized to have a negative sign; monthly basis variability should be lower under cash settlement. The dummy variable for sex is expected to have a positive sign -- Kenyon (1988) and Elam (1988) both found a greater reduction in basis volatility for heifers than steers since the introduction of cash settlement. The dummy variables for geographic location measure whether basis risk differs among markets.

Results

Table 2 presents the BEFORE and AFTER variances during the delivery month by sex, for each of the 27 markets analyzed. As expected, the variance of the basis generally decreased following the initiation of cash settlement. For 47 of the 53 comparisons, basis variability declined with the initiation of cash-settled contracts. That is, hedging risk appears to have been reduced in 89 percent of the cases. For the 47 observations in which volatility declined, 36 of those were found to be significant at the 95 percent confidence level; and, of these 36 significant observations, 22 were heifers. This finding is similar to Elam's (1988) and Kenyon's (1988) findings. However, as Kenyon (1988) argued, this may be a result of other economic variables (e.g., increased demand for breeding stock) and not just the influence of cash settlement influence. Sex differences are analyzed in more detail with the regression model presented below.

Also interesting from these results is the geographic location of the observations in which the variance increased. Four of the six markets in which basis variability increased are located in California. Of these, only the heifer and steer observations for the Shasta California Auctions were significantly different from zero. This may imply that the physical characteristics of California feeders are quite different from other feeders, or that California feeder cattle are subjected to economic influences quite unique to that state.

The above results suggest that overall cash settlement has improved the performance of the feeder cattle contract. Furthermore, it may be inferred

from the enhanced basis stability that the settlement prices are accurately reflecting cash market values.

Table 3 presents the results of the delivery week variance tests. Conceptually, it would seem if basis variability has responded to cash settlement as expected, not only the delivery month variance but also the delivery week variance should be reduced. Interestingly, however, these empirical findings are not as strong or supportive of this hypothesis as those just presented.

Weekly basis variability declined in 44 of the 53 observations; for 24 of the 44 observations the change in variance was significantly different from zero at the 95 percent confidence level.[6] Analogous to the monthly results, of those observations that are statistically significant, more are for heifers (16) than for steers (8). Again this suggests that cash settlement has influenced heifer basis differently than steer basis. These results suggest, once again, that basis stability has improved since the initiation of cash settlement. Although the results of these first two tests support cash settlement, some intriguing differences still exist between their results. For instance, for some of the observations basis variability increased during the delivery months and decreased during the delivery weeks, and for other observations the opposite occurred. This may indicate that different economic forces influence the basis during the weeks prior to delivery than those forces at work during the expiration week.

Table 4 presents BEFORE and AFTER daily basis variability levels during the delivery months for the steers from each of the three markets. Some interesting differences can be observed between the cumulative monthly data (Table 2) and the daily data within each delivery month (Table 4). For instance, only steers at Oklahoma City were statistically significant using monthly data, versus all three markets being significant at the 99 percent confidence level using daily data. Furthermore, when using monthly data the steers at Amarillo revealed only a slight reduction in basis variability following the introduction of cash settlement. Using daily data, the variance of the basis has <u>increased</u> at Amarillo since the start of cash settlement.

From the evidence presented for these three markets, it is clear that averaging prices across time can misrepresent the actual conditions hedgers face on a given day and perhaps distort assessments of the impacts of cash settlement. However, it may be misleading to attempt to draw any additional conclusions based solely on outcome from these three markets. Except for Amarillo steers where the results are somewhat conflicting, the maturity basis variability tests using monthly, weekly, and daily data in general show that hedging risk has decreased for most of the feeder cattle industry since the cash settlement system was introduced.

Table 5 presents the regression results for models of delivery month basis variability as a function of cash settlement, sex, and geographic location. The Durbin-Watson statistic for the model suggests no first order autocorrelation and the R-square reveals that a fairly high proportion of the variation in basis risk is explained by this model. The sign of the cash settlement coefficient is negative and statistically significant. That is, the introduction of cash settlement has reduced basis risk.

Sex has a positive sign, but is not significant in this model. Although the previous research has suggested that reduction in basis variability after cash settlement seems to favor heifers, the evidence presented here suggests the reduction in variability is not statistically linked to sex differences.

Geographic location dummy variables provide mixed results as 16 signs are negative and 10 signs are positive. Six location dummies are significant: Virginia Auctions, Oklahoma Auctions, Amarillo Auctions, Colorado Auctions, McKinley-Winter Terminal, and Shasta Auctions. All of these markets, with the exception of Virginia Auctions, are located in highly concentrated areas of feeder cattle production. This may imply a correlation between market volume and basis variability levels. It is not clear to what to attribute the Virginia market discrepancy.

Summary

Feeder cattle cash-futures price spreads were investigated from 1984-1988 for 27 selected U.S. markets to ascertain the impact of cash settlement on basis variability. The results of the monthly, weekly, and daily analyses suggest that cash settlement has had a major influence on the feeder cattle industry -- basis variability has in general been reduced by the cash settlement system.

The findings suggest that cash settlement is working as expected during delivery periods. With the elimination of delivery costs and the uncertainties of making and/or taking delivery, contract performance has improved with the change in liquidation procedures as measured by the reduction in basis variability. In addition, the evidence of enhanced stability of delivery week basis suggests that cash settlement has improved the convergence (or at least the steadiness of convergence) of cash and futures prices at contract expiration. Moreover, it may be inferred from the enhanced contract performance that the settlement prices are more accurately depicting cash market values. Most importantly, the reduction of basis variability found in most of the 27 markets analyzed implies that cash settlement has reduced hedging risk for most of the feeder cattle industry. The only notable exceptions are California markets.

Table 1

Feeder Cattle Cash Markets Included in Sample

Cash Market	Location
Alabama Auctions	Montgomery, AL
Amarillo Auctions	Amarillo, TX
Arkansas Auctions	Little Rock, AR
Clovis Auctions	Clovis, NM
Colorado Auctions	Greeley, CO
Georgia Auctions	Thomasville, GA
Illinois Direct	Springfield, IL
Iowa Auctions	Des Moines, IA
Iowa - S. Minnesota Direct	Des Moines, IA
Kansas City Terminal	Kansas City, MO
Kentucky Direct	Louisville, KY
Lexington Auctions	Lexington, KY
Louisville Auctions	Louisville, KY
McKinley-Winter Terminal	Dodge City, KS
N. San Joaquin Direct	Stockton, CA
Oklahoma City Auctions	Oklahoma City, OK
S. St. Joseph Terminal	S. St. Joseph, MO
S. St. Paul Terminal	S. St. Paul, MN
Shasta Auctions	Shasta, CA
Sioux City Terminal	Sioux City, IA
Sioux Falls Terminal	Sioux Falls, SD
South Carolina Auctions	Columbia, SC
Springfield Auctions	Springfield, MO
Tennessee Auctions	Nashville, TN
Virginia Auctions	Richmond, VA
Washington-Oregon Direct	Moses Lake, WA
West Fargo Terminal	West Fargo, ND

Table 2

Delivery Month Basis Variability Results Pre and Post Cash Settlement for 600 - 700 Pound Feeder Cattle from 1/84 to 5/88

Location	Heifers		Steers	
	Before C.S.[a]	After C.S.	Before C.S.	After C.S.
Iowa-S. Minnesota Direct	5.55	3.46[1]	3.62	5.18
Kansas City Terminal	7.15	3.01[2]	7.33	4.43[1]
Kentucky Direct	10.58	3.25[2]	6.92	3.63[2]
Lexington Auctions	10.67	4.10[2]	6.95	5.05
Louisville Auctions	12.26	3.50[2]	6.61	3.81[1]
S. Carolina Auctions	14.33	6.09[2]	6.68	8.24
S. St. Paul Terminal	7.92	3.18[2]	8.22	3.09[2]
Sioux City Terminal	7.11	2.21[2]	5.02	4.20
Sioux Falls Terminal	5.14	2.10[2]	5.19	2.84[2]
Tennessee Auctions	9.01	4.19[2]	6.30	4.71
Virginia Auctions	6.95	6.71[2]	15.11	13.0
Wash-Oregon Direct	6.67	5.44	8.73	4.96[1]
Oklahoma City Auctions	3.02	1.35[2]	3.16	2.05[1]
Amarillo Auctions	3.89	1.97[2]	2.40	2.22
Colorado Auctions	3.28	0.89[2]	4.76	2.02[2]
McKinley-Winter Term.	2.99	2.25	2.49	2.45
Alabama Auctions	7.25	3.42[2]	4.96	3.54
Arkansas Auctions	5.51	2.79[2]	4.18	1.88[2]

Table 2 Continued

L19. Clovis Auctions	5.09	2.59[2]	4.06	3.74
L20. West Fargo Terminal	5.27	1.57[2]	4.72	2.82[1]
L21. Georgia Auctions	NA	NA	7.44	4.61[1]
L22. Illinois Direct	8.89	3.75[2]	9.17	6.04[1]
L23. Iowa Auctions	6.77	2.77[2]	5.37	2.20[2]
L24. Shasta Auctions	4.68	7.97[<1>]	6.30	19.0[<2>]
L25. Springfield Auctions	7.31	1.98[2]	6.79	5.34
L26. S. St. Joseph Terminal	6.17	1.61[2]	7.15	2.90[2]
L27. N. San Joaquin Direct	5.33	5.41	5.51	7.21

NA signifies the cash prices were not reported.

[a]C.S. = Cash Settlement.

[1]Variance decreased after cash settlement and was significant at the 95 percent confidence level.

[2]Variance decreased after cash settlement and was significant at the 99 percent confidence level.

[<1>]Variance increased after cash settlement and was significant at the 95 percent confidence level.

[<2>]Variance increased after cash settlement and was significant at the 99 percent confidence level.

Table 3

Delivery Week Basis Variability Results Pre and Post Cash Settlement for 600 - 700 Pound Feeder Cattle from 1/84 to 5/88

Location	Heifers		Steers	
	Before C.S.[a]	After C.S.	Before C.S.	After C.S.
L1. Iowa-S. Minnesota Direct	7.64	3.31	4.20	6.78
L2. Kansas City Terminal	8.60	2.58[1]	8.47	4.83
L3. Kentucky Direct	14.06	4.71[1]	10.86	3.81[1]
L4. Lexington Auctions	15.57	6.05[1]	10.10	6.71
L5. Louisville Auctions	17.14	2.53[2]	11.38	3.21[2]
L6. S. Carolina Auctions	18.36	4.83[2]	11.39	3.72[1]
L7. S. St. Paul Terminal	11.16	3.54[1]	10.67	5.40
L8. Sioux City Terminal	6.34	1.71[2]	4.90	4.28
L9. Sioux Falls Terminal	5.18	4.21	5.00	5.03
L10. Tennessee Auctions	12.81	4.83[1]	9.41	10.28
L11. Virginia Auctions	23.33	5.78[2]	18.39	10.33
L12. Wash-Oregon Direct	10.25	7.44	9.37	8.11
L13. Oklahoma City Auctions	3.84	1.87	3.50	1.69
L14. Amarillo Auctions	4.61	2.69	2.81	3.05
L15. Colorado Auctions	4.20	1.01[2]	5.52	2.25[1]
L16. McKinley-Winter Term.	3.93	3.63	2.26	3.94
L17. Alabama Auctions	9.52	3.96[1]	6.37	1.95[1]
L18. Arkansas Auctions	8.68	3.81	6.22	3.90

Table 3 Continued

L19. Clovis Auctions	1.84	1.37	3.30	3.79
L20. West Fargo Terminal	7.22	1.26[2]	4.46	3.72
L21. Georgia Auctions	NA	NA	11.24	4.91
L22. Illinois Direct	12.73	4.06[1]	13.06	5.52
L23. Iowa Auctions	9.40	3.41[1]	8.25	2.67[1]
L24. Shasta Auctions	6.85	9.41	5.53	9.58
L25. Springfield Auctions	9.07	2.44[2]	9.20	2.91[1]
L26. S. St. Joseph Terminal	7.61	1.77[2]	8.40	2.73[1]
L27. N. San Joaquin Direct	7.94	3.97	6.88	7.75

NA signifies the cash prices were not reported.

[a]C.S. = Cash Settlement.

[1]Variance decreased after cash settlement and was significant at the 95 percent confidence level.

[2]Variance decreased after cash settlement and was significant at the 99 percent confidence level.

Table 4

Daily Basis Variability Results Pre and Post Cash Settlement for 600 - 700 Pound Feeder Steers for the Delivery Months from 1/84 to 5/88

Location	Feeder Steers Before C.S.[a]	Feeder Steers After C.S.
Oklahoma City Auctions	5.85	1.53[1]
Amarillo Auctions	1.64	3.57[<1>]
McKinley-Winter Terminal (Dodge City, KS)	4.30	3.52[1]

NOTE: Daily basis variability was calculated during the delivery months up to the final day of trading.

[a]C.S. = Cash Settlement

[1]Variance decreased after cash settlement and was significant at the 99 percent confidence level.

[<1>]Variance increased after cash settlement and was significant at the 99 percent confidence level.

Table 5

Results of Regressing Monthly Feeder Cattle Basis on Independent Variables, 1984-1988

Variable Name	Estimated Coefficient	Standard Error
Cash Settlement (equals 1 if C.S.[a])	-2.54[2]	0.43
Sex (equals 1 if steer)	0.14	0.42
L1) Iowa-S. Minn. Direct	-1.41	1.55
L2) Kansas City Terminal	-0.39	1.55
L3) Kentucky Direct	0.22	1.55
L4) Lexington Auctions	0.93	1.55
L5) Louisville Auctions	0.68	1.55
L6) S. Carolina Auctions	2.97	1.55
L7) S. St. Paul Terminal	-0.26	1.55
L8) Sioux City Terminal	-1.22	1.55
L9) Sioux Falls Terminal	-2.04	1.55
L10) Tennessee Auctions	0.20	1.55
L11) Virginia Auctions	7.08[2]	1.55
L12) Wash-Oregon Direct	0.58	1.55
L13) Oklahoma City Auctions	-3.47[1]	1.55
L14) Amarillo Auctions	-3.25[1]	1.55
L15) Colorado Auctions	-3.13[1]	1.55
L16) McKinley-Winter Terminal	-3.12[1]	1.55
L17) Alabama Auctions	-1.07	1.55
L18) Arkansas Auctions	-2.27	1.55
L19) Clovis Auctions	-1.99	1.55
L20) West Fargo Terminal	-2.27	1.55
L21) Georgia Auctions	0.09	0.04
L22) Illinois Direct	1.09	1.55
L23) Iowa Auctions	-1.58	1.55
L24) Shasta Auctions	3.62[1]	1.55
L25) Springfield Auctions	-0.51	1.55
L26) S. St. Joseph Terminal	-1.41	1.55
Constant	7.21[2]	1.13

R-square = .67 Adj. R-square = .55 Durbin-Watson = 1.82

[a]C.S. = Cash Settlement

[1]Significantly different from zero at the 95 percent confidence level (2-sided test).

[2]Significantly different from zero at the 99 percent confidence level (2-sided test).

ENDNOTES

[1]Paul (1985, 1987), Kahl, Hudson, Ward (1989), and others point out that for cash settlement to be effective, the settlement price must be free of exploitations and accurately depict cash market prices. To improve pricing accuracy, the settlement price must be determined by cash market demand and supply conditions, representing current cash market commodity value. This lessens arbitrage opportunities, and chances for misrepresentation.

[2]Only 600 - 700 pound cattle are analyzed because "the majority feeder cattle hedges are placed... [for] animals weighing more than 600 pounds" (Elam, 1988, p. 51). Also, price data for this range are more consistent and more readily available.

[3]There are eight trading months for the feeder cattle futures contract: January, March, April, May, August, September, October, and November.

[4]As noted before, the final trading day changed with the change in settlement procedures.

[5]The 106 observations (rather than 108) result from only steer prices being reported for Georgia Auctions, Thomasville, GA.

[6]None of the 9 observations in which basis variability increased following the change in settlement procedures were significant at the 95 percent confidence level.

REFERENCES

Chicago Mercantile Exchange (1985A): "Submission of Amendments, No. 85-88, to the CME Feeder Cattle Contract," Submitted to the CFTC. Chicago: Chicago Mercantile Exchange, pp. 1-24.

Chicago Mercantile Exchange (1985B): *Cash Settlement for Feeder Cattle Futures*, Chicago: Chicago Mercantile Exchange.

Cohen, L., and M. Gorham (1985): "The Projected Impact of Cash-Settled Commodity Contracts on Cash/Futures Price Relationships," *Proceedings of Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, Chicago, pp. 313-335.

Elam, E. (1988): "Estimated Hedging Risk with Cash Settlement Feeder Cattle Futures," *Western Journal of Agricultural Economics*, 13:1:45-52.

Kahl, K., M. A. Hudson, and C.E. Ward (1989): "Cash Settlement Issues for Live Cattle Futures Contracts," *Journal of Futures Markets*, 9:3:237-248.

Kenyon, D. (1988): "Impact of Cash Settlement on Virginia Fall Feeder Cattle Basis." Paper presented at the annual meeting of the American Agricultural Economics Association, Knoxville, Tennessee.

Paul, A. B. (1985): "The Role of Cash Settlement in Futures Contract Specification," in *Futures Markets: Regulatory Issues*, Anne E. Peck, Ed., American Enterprise Institute for Public Policy Research, Washington, D.C., pp. 271-328.

Paul, A. B. (1987): "Pricing Implications of Alternative Delivery Mechanisms for Futures Contracts," in *Key Issues in Livestock Pricing: A Perspective for the 1990s*, Wayne Purcell and John Rowsell, Eds. Research Institute on Livestock Pricing, Blacksburg, VA, pp. 55-94.

Schroeder, T. C., and J. Mintert (1988): "Hedging Feeder Steers and Heifers in the Cash-Settled Feeder Cattle Futures Contract." *Western Journal of Agricultural Economics*. 13:2:316-326.