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Impact of Cash Settlement on Virginia Fall Feeder Cattle Basis

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Cash settlement (CS) for feeder cattle futures began with the September 1986 contract. The Chicago Mercantile Exchange (CME) instituted cash settlement for basically three reasons. First, physical deliveries under the old system averaged approximately 25 percent of average month-end open positions during 1978 to 1985 (Paul). Second, because of multiple delivery points, longs never knew where delivery would take place, hence discouraging long speculation and/or hedging. And third, local basis relationships for feeder cattle were volatile reducing hedger interest. These conditions lead to over a fifty percent drop in average month-end open positions in feeder cattle futures from 1978-79 to 1984-85. Hence, the CME introduced cash settlement as a means of eliminating physical deliveries, increasing long participation by hedgers and speculators, and increasing hedge participation by reducing basis variation.

The change to CS means every hedger must recompute their local basis. This is particularly important in Virginia where Forward Pricing Incorporated (FPI) is offering fixed price and minimum price forward cash contracts to feeder cattle producers. This study was conducted to determine the impact of CS on the basis for feeder cattle in Virginia.

This paper addresses two specific issues. First, what is the average basis change under CS? And second, is basis more stable under CS? These questions are addressed using three different methods. First, the basis mean and standard deviation for fall 1984 and 1985 without CS are compared to the fall of 1986 and 1987 with CS. The fall is used because it provides two years of data.[1] Second, the impact of CS on basis is analyzed using a 0-1 dummy variable in a regression model explaining basis as a function of weight, frame size, muscle score, breed and futures contract month. And third, based on the estimated basis model, the standard deviation of basis errors before and after cash settlement are compared. Before discussing this analysis, the impact of CS on the Oklahoma City basis will be presented as a benchmark for comparison.

Oklahoma City Basis

The CFTC has analyzed the basis for Oklahoma City feeder steers for contract months during the period September 1986 through May 1987. Oklahoma City was a par delivery point under physical delivery. Under cash settlement, it is only one market from 27 states used to calculate the U.S. Feeder Steer Price (USFSP). The CFTC found that September, October, and November 1986 CS basis in Oklahoma City averaged $3.30 per cwt. compared to a year earlier physical delivery basis of -$1.61, or an improvement in

[1] Spring results comparing 1986 and 1987 are similar but space limitations prevent their presentation and discussion.

basis of $4.91 a cwt. when compared to the same months a year earlier. During January, March, April, and May 1987, the cash prices averaged $3.26 stronger relative to futures during the same months in 1986. For the seven months analyzed, the average increase in basis was $3.96 a cwt.

One of the reasons for changing to cash settlement was to reduce basis volatility for hedgers. For the first seven months under cash settlement at Oklahoma City, the monthly basis averages ranged from $2.85 to $4.14 per cwt, for a range of $1.29. Under physical delivery the previous year, the monthly average basis for Oklahoma City ranged from -$2.46 to $3.02 per cwt, or a range of $5.47 between September 1985 and May 1986. The CFTC concludes that basis variability has been reduced in Oklahoma City and "...that it is likely that basis volatility for feeder cattle declined in most other cash markets at the same time." However, given the great diversity among feeder cattle markets, the CFTC suggested that further research on local basis changes as a result of CS be studied.

Virginia Basis

The average and standard deviation of feeder cattle basis for the fall of 1985 and 1986 under physical delivery and the fall of 1986 and 1987 under cash settlement are given for steers and heifers in Tables 1 and 2 respectively. These data are based on cash prices in Virginia graded feeder cattle sales on various days between August 15 and November 14. Each cash price is for a specific lot of cattle numbering from 6 to 198 head. Basis is calculated relative to September futures from August 15 to September 14, October futures from September 15 to October 14, and November futures from October 15 to November 14. The number of lots (observations) by breed, frame size, and muscle score are reported in Tables 1 and 2.

Basis Data. The average improvement in basis under CS was $6.87 per cwt. for steers. During the fall of 1984 and 1985, the average steer cash price was $59.04, the average futures price was $65.03, and the average basis was -$5.99 per cwt. In the fall of 1986 and 1987, the average cash price was $68.90, the average futures price was $68.02, and the average basis was $0.88 per cwt. Between these two periods, cash prices increased $9.86 while futures prices increased $3.00, resulting in a $6.86 improvement in the basis for fall feeder steers in Virginia as a result of cash settlement.

The average basis improvement for heifers was $7.80 per cwt. between the falls of 1984/1985 and 1986/87. The average heifer cash price in 1984/85 was $49.86 per cwt. and the average futures price was $64.75. In 1986/87, the average cash price was $60.43 and the average futures price was $67.52. Thus the large improvement in basis was mostly the result of increased cash prices relative to futures prices.

Table 1. Virginia Fall Feeder Steer Basis by Breed, Frame, and Muscle Score Before and After Cash Settlement.[a]

Breed	Frame	Muscle Score	Basis 1984-85 Obs.	1984-85 Mean	1984-85 Std.[c]	Basis 1986-87 Obs.	1986-87 Mean	1986-87 Std.	Change[d] Mean	Change[d] Std.
				$/cwt.			$/cwt.		----$/cwt.----	
Hereford	Large	1	4	-7.92	3.40	--	--	--	--	--
	LM[b]	1	133	-7.64	3.48	74	-1.03	4.38	+6.61	+0.90
		2	105	-10.02	3.52	35	-4.15	3.51	+5.87	-0.01
	Medium	1	65	-7.09	3.67	21	1.41	4.26	+8.50	+0.59
		2	14	-8.04	2.81	17	-4.29	3.26	+3.75	+.45
	Small	1	65	-10.28	3.83	38	-4.59	3.09	+5.69	-0.74
Angus	Large	1	15	-6.45	3.91	25	1.58	3.93	+8.03	+0.02
		2	4	-9.74	2.25	--	--	--	--	--
	LM	1	248	-3.57	4.44	228	3.45	5.21	+7.02	+0.77
		2	221	-6.68	4.10	129	-0.05	5.17	+6.63	+1.07
	Medium	1	114	-3.02	4.43	87	5.09	4.65	+8.11	+0.22
		2	33	-6.81	3.96	52	-0.78	4.26	+6.03	+0.30
	Small	1	259	-7.88	3.57	178	-1.31	3.70	+6.57	+0.13
Angus/ Hereford	Large	1	17	-6.90	2.36	5	4.26	6.35	11.16	+3.99
		2	4	-8.83	3.26	--	--	--	--	--
	LM	1	154	-2.95	4.64	55	4.14	5.79	+7.09	+1.15
		2	146	-6.47	4.12	31	-0.34	6.76	+6.13	+2.64
	Medium	1	91	-2.45	3.88	19	4.92	5.06	+7.37	+1.18
		2	21	-6.38	4.65	7	1.39	3.58	+7.77	-1.07
	Small	1	139	-6.87	3.16	35	0.29	4.42	+7.16	+1.26
Charlais	Large	1	43	-5.21	4.77	45	1.24	4.70	+6.25	-0.07
	LM	1	149	-4.78	4.33	109	1.62	5.13	+6.60	+0.80
		2	102	-7.42	3.68	57	-2.63	4.57	+4.79	+0.89
	Medium	1	68	-3.27	4.24	50	4.21	5.30	+7.68	+1.06
		2	17	-6.82	3.29	27	-1.17	5.24	+5.65	+1.95
	Small	1	9	-7.60	3.74	9	0.39	3.99	+7.99	+0.25
All	All	All	2240	-5.99	4.53	1333	0.88	5.41	+6.87	+0.88

a. Eight markets included are Dublin, Galax, Harrisonburg, Lynchburg, Marshall, Narrows, Roanoke, and Wytheville. Fall includes August 15 to November 14.
b. Combined sale of Large and Medium frame size.
c. Standard deviation.
d. Change from 1984-85 to 1986-87.

Table 2. Virginia Fall Feeder Heifer Basis by Breed, Frame, and Muscle Score Before and After Cash Settlement.[a]

Breed	Frame	Muscle Score	Basis 1984-85 Obs.	1984-85 Mean	1984-85 Std.[c]	Basis 1986-87 Obs.	1986-87 Mean	1986-87 Std.	Change[d] Mean	Change[d] Std.
				$/cwt.				$/cwt.	----$/cwt.----	
Hereford	Large	1	1	-11.90	--	--	--	--	--	--
		2	3	-13.29	3.75	--	--	--	--	--
	LM[b]	1	55	-14.37	4.83	20	-8.29	2.66	+6.08	-2.17
		2	28	-18.03	4.57	13	-10.36	4.34	+7.67	-0.23
	Medium	1	24	-17.52	4.94	6	-8.21	6.83	+9.31	+1.89
		2	4	-15.98	2.17	2	-9.77	9.37	+8.18	+7.20
	Small	1	31	-18.88	4.58	10	-12.95	4.76	+5.93	+0.18
Angus	Large	1	3	-15.33	3.27	9	-4.83	3.91	+10.50	+0.64
		2	4	-11.59	1.41	--	--	--	--	--
	LM	1	108	-12.46	3.75	101	-5.29	3.25	+7.17	-0.50
		2	86	-17.53	4.75	61	-8.56	4.68	+8.97	-0.07
	Medium	1	43	-13.77	4.04	38	-5.82	3.90	+7.95	-0.14
		2	10	-13.00	3.65	23	-8.96	2.78	+4.04	-0.87
	Small	1	97	-19.44	4.98	91	-12.24	4.16	+7.20	-0.82
Angus/ Hereford	Large	1	4	-17.26	4.11	2	-5.92	0.28	+11.34	-3.83
		2	3	-11.05	2.10	--	--	--	--	--
	LM	1	75	-10.51	3.82	35	-3.66	3.36	+6.85	-0.46
		2	64	-16.82	4.96	23	-6.39	3.80	+10.43	-1.16
	Medium	1	45	-12.61	4.16	12	-2.83	4.77	+9.78	+0.61
		2	6	-11.72	1.93	2	-1.40	4.60	+10.32	+2.67
	Small	1	68	-17.60	4.95	18	-9.63	3.94	+7.97	-1.01
Charlais	Large	1	18	-11.37	3.79	24	-4.32	4.18	+7.05	+0.39
		2	2	-14.67	1.34	--	--	--	--	--
	LM	1	77	-10.75	3.73	53	-4.06	3.43	+6.69	-0.30
		2	28	-15.49	4.23	28	-7.20	3.63	+8.29	-0.60
	Medium	1	26	-12.55	3.42	23	-3.06	3.66	+9.49	+0.24
		2	5	-10.63	2.29	11	-5.69	4.03	+4.94	+1.74
	Small	1	6	-18.01	3.45	5	-6.70	5.03	+11.31	+1.58
All	All	All	924	-14.89	5.28	610	-7.09	4.85	+7.80	-0.43

a. Eight markets included are Dublin, Galax, Harrisonburg, Lynchburg, Marshall, Narrows, Roanoke, and Wytheville. Fall includes August 15 to November 14.
b. Combined sale of Large and Medium frame size.
c. Standard deviation.
d. Change from 1984-85 to 1986-87.

Part of the larger improvement in heifer (+ $7.80) versus steer (+ $6.87) basis under CS comes from a narrowing of the cash heifer-steer price differential. In 1984/85, the heifer discount relative to steers was $9.18 cwt., but in 1986/87 the discount was $8.48, a $0.70 a cwt. increase in heifers relative to steers. The cash differential improvement for heifers is related to the increased demand for breeding stock in 1986 and 1987 as fed and feeder cattle prices continuee to increase compared to 1984 and 1985.

The evidence on basis volatility before and after CS is mixed. The standard deviation of basis increased $0.88 per cwt. for steers but decreased $0.43 per cwt. for heifers. Since the number of observations for steers is twice that of heifers, the weighted average change in the standard deviation of basis is positive indicating basis volatility has increased slightly in Virginia with the introduction of cash settlement.

Regression Analysis. Basis models for fall feeder steers and heifers were estimated using OLS on basis information from August 15, 1980 to November 14, 1987. Basis was estimated as a function of weight, breed, frame, muscle score, and futures contract month. All the variables except weight are 0-1 dummy variables. The impact of cash settlement was estimated using a 0-1 intercept shifter (1980-85 = 0, 1986 & 1987 = 1). Other details related to modeling Virginia feeder cattle basis can be found in Ernst, Kenyon, Purcell and Bainbridge. The results of estimating these models are in Table 3.

Two models were estimated. The BEFORE models are based on data from 1980-85 when feeder cattle futures could be settled with physical delivery. The AFTER models are based on data from 1980-87 with the addition of a cash settlement (CASHSETL) variable for 1986 and 1987. All the variables in the before regressions have the anticipated sign, and are statistically significant with the exception of the large and medium frame variable, the Charlais breed variable in the heifer equation and the September future variable in the steer equation. These equations explain 40 and 50 percent respectively of heifer and steer feeder cattle basis variation. Some estimated coefficients for heifers and steers vary substantially in magnitude. Weight is less important in determining basis for heifers than steers. For example, a 600 pound heifer reduces the basis by $1.80 (600 x -.003), while a 600 pound steer reduces the basis by $12.60 (600 x -.021). A number 2 muscle score, compared to a number 1 muscle score reduces basis by approximately $4.50 a cwt. (-$4.27 for steers and -$4.75 for heifers). Large and large and medium combined frame size reduce basis about $1.00 each for steers but are not significant in determining heifer basis. Small frame size reduces heifer basis by -$6.21 cwt. and steer basis by -$5.23 cwt. Hereford cattle are discounted about -$3.75 for both heifers and steers. Angus heifers are discounted by about -$1.40 and Angus steers are discounted by -$0.50 relative to Angus-Hereford crosses. Charlais steers are discounted about -$0.50 cwt. Using October futures as a base, the heifer basis is stronger in September and substantially weaker in November. The steer basis is unchanged in September but is about -$1.50 weaker in November.

Table 3. Virginia Fall Feeder Cattle Basis Equations by Sex Before and After Cash Settlement, 1980-1987.

PAR = Angus/Hereford crossbreed, USDA No. 1 Muscle Thickness, USDA Medium Frame Size, October CME Feeder Cattle Futures

	HEIFERS		STEERS	
	BEFORE[a]	AFTER[b]	BEFORE	AFTER
INTERCEPT	-9.132 (-19.67)[c]	-7.751 (-18.92)	13.207 (50.96)	13.885 (58.91)
WEIGHT	-0.003 (-3.35)	-0.005 (-7.56)	-0.021 (-59.54)	-0.023 (-69.01)
CASHSETL	n.a. n.a.	8.035 (44.10)	n.a. n.a.	5.686 (53.25)
MUSCLE2	-4.748 (-21.5)	-4.385 (-23.29)	-4.269 (-36.69)	-4.302 (-42.16)
FRAMELG	-0.085 (-0.24)	-0.038 (-0.12)	-1.046 (-5.35)	-1.104 (-6.15)
FRAMELM	-0.237 (-1.17)	-0.364 (-2.03)	-1.004 (-8.43)	-0.971 (-9.22)
FRAMESM	-6.210 (-27.5)	-6.503 (-31.68)	-5.227 (-41.27)	-5.397 (-46.16)
HEREFORD	-3.702 (-16.28)	-3.689 (-17.35)	-3.825 (-30.57)	-3.830 (-32.40)
ANGUS	-1.418 (-7.58)	-1.469 (-8.62)	-0.568 (-5.34)	-0.492 (-4.94)
CHARLAIS	0.012 (0.05)	0.017 (0.078)	-0.449 (-3.35)	-0.729 (-5.91)
SEPFUT	1.724 (7.23)	1.917 (8.64)	0.185 (1.42)	0.136 (1.12)
NOVMBFUT	-2.357 (-13.71)	-2.32 (-15.40)	-1.476 (-16.16)	-1.363 (-16.42)
Observations	2868	3478	7141	8474
R^2	.400	.546	.507	.597
$\sqrt{MSE}$	4.035	3.968	3.544	3.52
F value	189.9	378.8	732.9	1137.2
Average				
Basis	-14.61	-13.29	-5.07	-4.13
Weight	525.1	524.8	642.7	642.0
Number	18.3	18.2	22.4	22.4

a. Before is observations from August 15, 1980 to November 14, 1985.
b. After is observations from August 15, 1980 to November 14, 1987.
c. t-value.

A 0-1 dummy variable was added to these models to measure the impact of cash settlement (CASHSETL). The CASHSETL variable was very significant in both the heifer and steer equations. The estimated impact of cash settlement on heifers was $8.04 per cwt. and on steers was $5.69 per cwt. Adding the cash settlement variable improved the models ability to explain basis significantly, increasing R^2 for heifers from .40 to .55, and for steers from .51 to .60. In addition, the estimated parameters in the before and after models have very similar coefficients, indicating that cash settlement only changed the intercept and not the price relationships between breeds, frame size, and muscle score.

The regression estimates of the impact of cash settlement are slightly different than the raw "basis data" estimates. The main difference is that the equations take into account weight and futures contract delivery month while the basis data aggregates do not. For steers, the basis data estimate of the CS impact was $6.87, while the regression estimate of CS impact was $5.69. For heifers, the basis data estimate of CS impact was $7.80, while the regression estimate of CS impact was $8.04 a cwt. Since the regression models take into account more variables that affect basis for a specific lot of cattle, the regression estimates of the impact of CS are more reliable. However, as explained earlier, the CS estimate for heifers if probably biased upward by rising prices during 1986 and 1987, hence increasing the demand for breeding stock and narrowing the heifer-steer price differential. The current model cannot separate the impact of CS and increased breeding stock demand for heifers. Hence, the impact of cash settlement on steers more appropriately measures the true impact on cash settlement on feeder cattle basis.

The root mean square error of the before and after models are almost identical indicating that cash settlement may not have affected the variability of basis. Of course, this comparison includes six years before CS and only two years with CS settlement.

Basis Variability. To more carefully analyze the impact of CS on basis variability, a third analysis was conducted. The before CS regression models were used to predict basis for all the feeder cattle lots sold in 1984 and 1985. These estimates were compared to the actual basis and the basis errors computed. The standard deviation and minimum and maximum of basis error were computed. This same procedure was used for the after regression models and the basis errors under CS in 1986 and 1987 were computed. A comparison of these estimates are given in Table 4.

Table 4 indicates that basis variability for steers was unaffected by CS, but that basis variability for heifers was reduced by approximately 50 cents a cwt. These results are almost identical to those obtained for heifers in the raw "basis data" analysis. However, the steer results are significantly different than the "basis data" analysis which indicated the standard deviation of basis increased 88 cents per cwt. (Table 1). However, the analysis in Table 1 does not consider weight and futures delivery month for each lot while the

Table 4. Standard Deviation of Basis Error Before and After Cash Settlement.

	Number of Observations	Basis Error		
		Standard Deviation	Minimum Value	Maximum Value
			$/cwt.	
Steers				
Before[a]	2240	3.34	-13.90	13.73
After[b]	1333	3.38	-24.34	11.62
Heifers				
Before	924	4.05	-14.59	11.63
After	610	3.58	-15.83	+ 12.30

a. Before is 1984 and 1985.
b. After is 1986 and 1987.

regression does. Since weight is such an important variable for steers, the regression analysis of basis variability is more reliable than the "basis data" analysis. This analysis indicates that Virginia basis variability with cash settlement is similar to or slightly less than with physical delivery.

Conclusions

The CFTC study of Oklahoma City steer feeder cattle basis under cash settlement for the delivery months of September, October, November, January, March, April, and May of 1986 and 1987 indicates that the average basis increased $3.96 per cwt. compared to the same seven months in the previous year under physical delivery. Comparing those seven monthly averages, the CFTC concluded that basis variability had been reduced in Oklahoma City by moving to cash settlement. The analysis of this paper indicates that the change to CS improved the Virginia basis for feeder steers in the fall of 1986 and 1987 by $5.86 a cwt. compared to 1984 and 1985. The movement to CS does not appear to have affected basis variability for feeder steers. Analysis of the impact of cash settlement on Virginia heifer basis indicates a $8.04 improvement and a 50 cent a cwt. reduction in the standard deviation of basis errors generated from a basis regression model. The larger improvement in heifer basis under CS relative to steers is largely attributed to rising feeder cattle prices during 1986 and 1987, hence increasing the demand for heifers for breeding purposes. A longer time period covering rising and falling prices will be needed to evaluate the true impact of CS on heifer basis.

The introduction of cash settlement for feeder cattle futures did not affect the cash price relationships between breeds, frame size, muscle score, and futures delivery months. Hence, these estimated differentials can be used by Forward Pricing Inc. to determine fixed and minimum price cash contracts for feeder cattle. On the other hand, the movement to cash settlement did not substantially reduce the variability in Virginia basis, an occurrence that would have reduced the risk exposure of feeder cattle hedgers and FPI.

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