FUNDAMENTAL AND TECHNICAL FACTORS AFFECTING THE CATTLE-HOG PRICE SPREAD

by

John D. Williams

John D. Williams is a junior majoring in agricultural economics at Southern Illinois University at Carbondale

Paper presented at SAEA annual meeting, Blacksburg, Va., Aug. 6-9, 1978.

In the general sense, the term spread refers to the difference between two sets of prices. In a restricted sense it may refer to the difference in the price of two contract months of one or more commodities.

In spread trading it should be noted that one need not be as concerned with the direction of price as he is with the difference between the two prices. A trader should only enter a spread when he is confident that the spread is abnormal and that it will return to a normal position in the future.

Statement of the Problem. Before a person knows whether the spread is abnormal, he must first know how the spread has acted in the past and what it will be in the future. With this information he can then trade the spread with some degree of confidence.

Probably the most common spread is the intercommodity spread which involves taking equal but opposite positions in two different commodities at the same time.

For example, a trader knows that on March 30 February cattle trade on the average $3.20 higher than July hogs. He also knows that this spread is usually lowest around June 30 where it trades between 40 to 50 cents. On March 31 the trader notices that the February/July spread is $3.18. He is quite confident that it will narrow to the 40 to 50 cents range by June 30 so he acts by selling February cattle and buying July hogs. As June 30 approaches the trader realizes that the spread has narrowed to

60 cents and he decides to liquidate his positions. He simply buys February cattle and sells July hogs realizing a gross profit of $2.58 per cwt.[1]

In order for a spreader to be successful, he must have a knowledge of the fundamental factors that affect cattle prices and hog prices and, hence, the spread. He must also know if there is a seasonal pattern of the spread. That is, are there certain times during the year when the spread is unusually low or unusually high?

Objectives of the Study. The general objective of this study was to develop information to facilitate the spreading of cattle and hogs. The specific objectives were:

1. To describe the difference in price between cattle and hogs from 1950 to 1976.
2. To explain the variation in the spread from 1950 to 1976.
3. To determine if there is seasonality in the various cattle-hog spreads during the previous ten years.

METHODOLOGY

The data for the description of the annual price spread were taken from various government publications (1, 2, 3, 4). Cattle prices represent choice live steers sold out of first hands at Omaha. Hog prices represent slaughter barrows and gilts at Omaha. The spread was calculated by simply subtracting hog prices from cattle prices for each year.

---

[1] To have an equal position in a cattle-hog spread, three cattle contracts and four hog contracts must be traded simultaneously resulting in 1200 hundredweights.

An attempt was made to explain the variation in the spread over 1950 to 1976. The following multiple regression model was used:

$$SP = a + b_1X_1 + b_2X_2 + b_3X_3$$

where: SP = Annual cattle price minus annual hog price deflated by the consumer price index; 1967 = 100.

X_1 = Per capita pork consumption

X_2 = Per capita beef consumption

X_3 = Per capita disposable personal income deflated by the consumer price index; 1967 = 100.

The data for the analysis of the intercommodity seasonal spreads were gathered from two sources (5 and 6). These data consisted of the closing prices on or the last trading day prior to the 15th and 31st of each month. The spreads were computed for a ten-year period from July, 1968, through March, 1978, by subtracting the price of hogs from the price of cattle. Since there are six cattle contracts and seven hog contract months, there are 42 distinct intercommodity spreads. A bi-monthly, ten-year average was computed for each of the 42 spreads. The minimum and maximum point of the seasonal spreads and the dates they occurred were calculated. An average profit was figured by subtracting the minimum average spread from the maximum average spread. Thus, we assume that the spread was initiated at the minimum or maximum point and that the spread positions were liquidated at the following minimum or maximum point.

For example, the minimum point of the seasonal spread for October cattle and October hogs occurred on September 30 at a value of $2.80 and the maximum value occurred on October 31 at a value of $7.78. To execute this spread, October cattle were sold and October hogs were bought on October 31. On September 30 of the next year the position was reversed

and October cattle were bought and October hogs were sold resulting in a profit of $4.98 per cwt.

Only the six cattle and seven hog contracts that were nearest to expiration were used in the study. Thus, it is not possible to compute the spread between two different years.

If the minimum or maximum point occurred on a day such that the spread could not be initiated or liquidated, the first trading period prior to the minimum or maximum point was used to calculate the probability of success. For example, the minimum and maximum point of the February/July spread occurred on June 30 and November 30 respectively. However, it is not possible to initiate this spread on either June 30 or November 30 and then carry it through and liquidate it on the following date because by spreading on June 30 the spread would involve July hogs of the current year and February cattle of the next year and as July approached the July hog contract would expire and the spread would be automatically liquidated. By the same token, if the spread was initiated on November 30, it would involve February cattle and July hogs of the same year but as February approached the February contract would expire and again the spread would be automatically liquidated. To solve this, as was mentioned earlier, the first possible trading period prior to the minimum or maximum point was used. In the previous example, the spread was initiated on November 30 and liquidated on February 15. This may not result in the largest average profit but it was the only feasible way to perform the spread properly.

After computing the minimum and maximum point and the average profit for each spread, each individual year was considered from 1968 through 1978 in order to determine the probability of success of a given spread.

It should be noted that certain spreads were computed for less than ten years because the contract had not begun trading on the date of the minimum or maximum point.

FINDINGS

A Description of Annual Average Cattle Hog Spreads. The trend from 1950 to 1976 has been towards a narrowing of the spread. Although there was a great deal of variability, steers were higher priced than hogs during 25 of the 27 years. (Table 1).

The spread was greatest in 1951 at $14.71. This may be due to the fact that beef production was well below pork production causing cattle to be high priced relative to hogs. It declined to $1.20 in 1953 when beef production pulled from a slump and exceeded pork production. The spread increased only moderately in 1954 as pork production fell 130 million pounds and beef production increased 440 million pounds. The spread increased drastically over the next five years as pork production increased nearly 2.2 billion pounds while beef production increased a modest 617 million pounds. It peaked in 1959 at $12.40. Over the next seven years beef production increased an astounding 6.15 billion pounds while pork production declined 654 million pounds. As should be expected, the spread reached a low this year (1966) of $2.44. The spread peaked again in 1971 at $14.18. This may be attributed to the high increase in pork production relative to beef production. Pork production reached its highest level of the 27 year period during 1971 at 14.79 billion pounds. The spread continued to decrease over the next four years where in 1975 the price of hogs averaged $3.32 more than the price of steers. Again in

1976 hogs were higher priced than steers by $3.49. This is due largely to the increased in beef production with a concurrent decrease in pork production.

The average length of time between a major peak and a major low in the spread for the 27 year period is 5 years. This might suggest that the next major peak may occur in 1981.

Regression Findings. The following regression equation was obtained:

$$SP = -29.577 + .72677X_1 - .22734X_2 + .00473X_3$$

$$(6.86)^* \quad (-2.85)^* \quad (1.52)$$

t-values shown in parentheses

* significant at the .05 level

$R^2 = .85$

where: SP = Annual cattle price minus annual hog price deflated by the consumer price index; 1967 = 100.

X_1 = Per capita pork consumption

X_2 = Per capita beef consumption

X_3 = Per capita disposable personal income deflated by the consumer price index; 1967 = 100.

Since the per capita consumption of hogs and beef is heavily influenced by the availability of hogs and beef for any given year, it was hypothesized that as the per capita consumption of hogs increased that the cattle-hog

TABLE I. Omaha Annual Average Steer and Hog Prices and the Spread Between the Two, and U.S. Annual Beef and Pork Production, 1950-1976

Year	Steer Prices ($/cwt)	Beef Production (mil. lbs)	Hog Prices ($/cwt)	Pork Production (mil. lbs)	Spread (Steer Prices Minus Hog Prices $/cwt)
1950	28.88	9534	18.11	10714	10.77
1951	34.92	8837	20.21	11481	14.71
1952	32.37	9650	17.71	11527	14.66
1953	22.77	12407	21.57	10006	1.20
1954	23.45	12963	21.77	9870	1.68
1955	22.16	13569	14.72	10990	7.44
1956	20.99	14462	14.56	11200	6.43
1957	22.61	14202	18.16	10424	4.45
1958	26.39	13330	20.03	10454	6.36
1959	26.93	13580	14.53	11993	12.40
1960	25.18	14753	15.88	11607	9.30
1961	23.78	15327	17.07	11408	6.71
1962	26.45	15324	16.75	11827	9.70
1963	23.21	16456	15.36	12427	7.85
1964	22.21	18456	15.24	12513	6.97
1965	25.12	18727	20.99	11141	4.13
1966	25.69	19726	23.25	11339	2.44
1967	25.27	20219	19.17	12581	6.10
1968	26.83	20880	19.01	13064	7.82
1969	29.66	21148	23.55	12955	6.11
1970	29.33	21685	21.75	13438	7.58
1971	32.42	21902	18.24	14792	14.18
1972	35.83	22413	26.36	13626	9.47
1973	44.54	21277	39.83	12751	4.71
1974	41.89	23138	34.65	13805	7.24
1975	44.61	23976	47.93	11503	- 3.32
1976	39.11	25969	42.60	12415	- 3.49

Source: U.S.D.A., Livestock and Meat Statistics, Statistical Bulletin No. 522

spread would also increase and that as the per capita consumption of beef increased, the cattle-hog spread would decrease. The signs of the regression coefficients were consistent with the stated hypotheses and were significant. It was also hypothesized that as per capita income increased, the spread would tend to increase. The sign of the regression coefficient was in agreement with the stated hypothesis, but was not statistically significant. The coefficient of determination (R^2) was .85.

Analysis of seasonality of cattle-hog spreads. Analyses of the 42 spreads are shown in Table II. The table contains the value of the minimum and maximum spread, the dates they occurred, the average profit, the number of observations used to calculate the spread and the number and percentage of years that the spread was profitable. As an example Table II indicates that by selling February cattle and buying February hogs on March 15 and then liquidating those positions the following February 15, an average profit of $3.80 per hundredweight was received 71 percent of the time.

CONCLUSION AND SUMMARY

From 1950 to 1976 the cattle-hog price spread narrowed. Steers were higher priced than hogs 25 of the 27 years. Only in 1975 and 1976 were hogs higher priced than steers. The cattle-hog spread was shown to be statistically dependent on the availability of the two commodities. The spread was also shown to be dependent on disposable personal income although this relationship was not statistically significant.

The analysis of the 42 intercommodity spreads showed that there was a seasonal pattern to each spread. The average profit for the spreads

ranged from 7 cents to 583 cents per hundredweight. The probability of success was equal to or greater than 50 percent but less than 75 percent for 32 of the 42 spreads. Five of the spreads had a probability of success greater than or equal to 75 percent.

TABLE II. Minimum and Maximum Average Spread, Number of Observations, Average Potential Profit Per Spread and the Number and Percentage of Years that the Spread was Profitable

Spread	Minimum Average Spread and the Number of Observations			Maximum Average Spread and the Number of Observations			Average Profit	Number and Percent of Years Profitable	
	Value	Date	Number	Value	Date	Number	($/cwt)	Number	%
Feb/Feb	2.35	2/15	10	6.15	3/15°	7	3.80	5	71
Feb/Apr	4.67	9/30°	9	5.01*	2/15	10	.34	4	44
Feb/Jun	3.31	2/15*	10	4.45	11/30°	10	1.14	5	50
Feb/Jul	2.82	2/15*	10	4.07	11/30°	10	1.25	5	50
Feb/Aug	4.08	2/15*	10	5.28	11/30°	8	1.20	5	62.5
Feb/Oct	3.23	10/15	10	8.78	3/31°	10	5.55	6	60
Feb/Dec	2.87	12/15	10	6.33	3/15°	8	3.46	6	75
Apr/Feb	2.28	2/15*	10	6.38	5/31°	7	4.10	6	85
Apr/Apr	4.66	9/30	9	7.68	5/15°	5	3.02	3	60
Apr/Jun	3.94	4/15*	9	4.40	10/31°	10	.46	4	44
Apr/Jul	3.31	4/15*	9	3.87	8/31°	8	.56	5	62.5
Apr/Aug	4.33	4/15*	9	5.19	10/31°	8	.86	4	50
Apr/Oct	3.39	9/30	10	6.91	4/30°	7	3.52	4	57
Apr/Dec	2.84	12/15	10	6.77	4/30°*	7	3.93	5	71
Jun/Feb	3.25	2/15	10	3.76	6/30°*	7	.51	3	43
Jun/Apr	4.80	6/30°	6	6.97	4/15*	9	2.17	4	66
Jun/Jun	2.58	6/30°	5	5.02	5/31	9	2.44	3	60
Jun/Jul	4.07	6/15	9	4.48	11/30°	10	.41	4	44
Jun/Aug	5.79	6/15	9	5.86	10/31°	8	.07	4	50
Jun/Oct	6.39	10/31°	6	8.22	5/31	9	1.83	4	66
Jun/Dec	3.47	12/15	10	5.05	8/30°	9	1.58	6	66

Table II (continued)

Spread	Minimum Average Spread and the Number of Observations			Maximum Average Spread and the Number of Observations			Average Profit	Number and Percent of Years Profitable	
	Value	Date	Number	Value	Date	Number	($/cwt)	Number	%
Aug/Feb	5.75	8/15*	9	6.56	5/31°	8	.81	5	62.5
Aug/Apr	5.01	9/30°	9	6.46	4/15*	9	1.45	5	55.5
Aug/Jun	4.22	6/30°*	6	5.19	8/15	8	.97	3	50
Aug/Jul	1.38	7/15	10	4.48	8/31°	8	3.10	6	75
Aug/Aug	2.45	7/15	10	5.80	9/31°	8	3.35	5	62.5
Aug/Oct	6.00	8/15*	9	9.13	3/31°	10	3.13	4	44
Aug/Dec	5.77	8/15*	9	7.03	5/31°	9	1.26	5	55
Oct/Feb	2.32	8/31	9	5.84	3/15°	8	3.52	5	62.5
Oct/Apr	5.61	4/15*	9	7.09	10/31°	9	1.48	5	55.5
Oct/Jun	1.52	6/15	8	5.54	10/31°	9	4.02	4	50
Oct/Jul	.48	7/15*	10	5.34	10/31°	7	4,86	5	71
Oct/Aug	1.26	8/15	10	6.71	10/31°	7	5.45	6	85
Oct/Oct	2.80	9/30	10	8.63	3/31°	10	5.83	7	70
Oct/Dec	2.54	9/30	10	6.43	3/15°	9	3.89	5	55
Dec/Feb	3.00	9/30	9	5.97	3/15°	8	2.97	4	50
Dec/Apr	4.34	9/15°	9	5.07	12/15*	10	,73	5	55,5
Dec/Jun	3.02	6/30°*	6	4.37	10/31	10	1.35	4	66
Dec/Jul	.46	7/15	10	4.48	12/31°	7	4.02	5	71
Dec/Aug	1.27	8/15	10	5.43	12/31°	7	4,16	5	71
Dec/Oct	3.31	10/15	10	8.62	3/31°	10	5.31	6	60
Dec/Dec	2.30	12/15	10	6.37	12/31°	5	4.07	4	80

*Spread initiated or liquidated at a date other than the minimum or maximum point.

°Spread initiated on this date.

SOURCES

1. United States Department of Agricultural, Livestock and Meat Statistics, Statistical Bulletin Number 522, pp. 225, 252, 206.

2. United States Department of Agriculture, Livestock and Meat Situation, Statistical Bulletin Number 214, April, 1977, pp. 10, 17.

3. United States Department of Agriculture, Livestock and Meat Statistics, Statistical Bulletin Number 522; supplement, pp. 111, 123.

4. Department of Commerce, Statistical Abstract, United States Government Printing Office, 1963, 1976.

5. Chicago Merchantile Exchange, Yearbook, 1968-1976.

6. Commodity Page, The Wall Street Journal, various issues.