An Empirical Analysis of the Alleged Manipulation Attempt and Forced Liquidation of the July 1989 Soybean Futures Contract

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INTRODUCTION

On July 11, 1989, the Board of Directors of the Chicago Board of Trade (CBOT) with the approval of the Commodity Futures Trading Commission (CFTC) issued a controversial emergency order forcing large traders to drastically reduce their soybean futures positions. In particular, the emergency order stated that ". . . any person or entity . . . who owns or controls a gross long or gross short position for any purpose whatsoever

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in excess of three million bushels in the July 1989 soybean futures contract traded on the Exchange must reduce said position . . . by at least 20% per trading day . . ." (Division of Trading and Markets, CFTC, Appendix 1). No individual trading firms were mentioned in the public statement. However, documents released later by the CBOT and CFTC indicate that the order was aimed at preventing an attempted manipulation of the July contract by the Italian grain merchant Ferruzzi Finanziaria S.p.A. (Bailey; Division of Trading and Markets, CFTC).

The CBOT alleges that Ferruzzi attempted a classic squeeze.[1] By July 10, 1989, Ferruzzi had amassed large long positions that totaled approximately 53% of the open interest in the July futures contract and 85% of the registered warehouse receipts (Division of Trading and Markets, CFTC, Appendix 2). After Ferruzzi failed to heed the CBOT's repeated warnings to reduce its long positions in the July contract, the CBOT issued the emergency liquidation order on July 11. In a series of articles after the order was given, the *Wall Street Journal* reported that many traders were angered by the CBOT action. Some traders thought the CBOT emergency order caused a decline in soybean prices and that the action would hurt the Exchange's credibility.

The purpose of this research is two-fold: (1) to determine whether publicly available data support the existence of this alleged manipulation attempt and (2) to determine if the resulting disciplinary actions taken by the CBOT had significant impacts on the soybean market. Empirical analyses are conducted to address both issues.[2] The positions of the largest long futures trader and price data are analyzed to see if the period of the alleged manipulation attempt and disciplinary actions is significantly different from other periods. Event study analyses are conducted to see if significant abnormal returns can be attributed to the events that took place. Volume and open interest data are analyzed to see if significant differences are apparent after the liquidation order was issued.

Concentration and spreads during the period of the alleged manipulation were different from historical norms. Regression results indicate that concentration, measured as the largest long position relative to open

[1]Adopting McDermott's (1979) definition, a classic "squeeze" may occur if one trader holds a large percentage of the long open interest in a particular contract while concurrently owning much of the deliverable supply. As the contract matures, the shorts have two ways to fulfill the obligations of their futures contracts. They can offset their futures contracts or deliver the commodity. However, because the dominant long wants to take advantage of his monopolistic position, he is willing to sell in the futures or the cash markets only at artificially high prices. In either case, the shorts are forced to pay a premium to the dominant trader. The premium that the long trader can receive is limited by the costs that the shorts must pay to deliver to satisfy their contracts [Paul (1976); Pirrong (1993)].

[2]Other alleged or actual manipulations have been analyzed. For example, see Bailey and Ng (1991); Barnhill and Powell (1981); and Fama and French (1988).

interest, put upward pressure on the expiring futures contract price relative to the distant futures during 1982–1989. Using the regression coefficient and mean values of the variables, the July futures price is estimated to be approximately 2¢ per bushel higher relative to the November price because of the increased concentration during the period of the alleged manipulation.

Significant abnormal futures price and spread reactions to the events surrounding the alleged manipulation and liquidation order are detected. In addition, the liquidation order had dramatic, although short lived, effects on soybean open interest. Open interest declined immediately after the order, but rebounded soon thereafter. No significant effect on volume is found.

The remainder of the article is organized as follows. First it describes the data used in the analysis. Concentration and spreads are analyzed, followed by the impacts of the alleged manipulation attempt and liquidation order on trader returns and the impacts of the liquidation order on market participation. The summary and conclusions are given in the last section.

DATA

In this analysis, concentration is defined as the position of the largest long trader relative to either open interest or deliverable supply. Large positions relative to open interest provide information concerning market liquidity, and large positions relative to deliverable supply measure potential problems shorts may have in making delivery [Peck and Williams (1991)]. Daily position data represent the largest long several days prior to, and through the end of trading in each delivery month from 1982 to 1990. Thus, only approximately 15 to 20 position data are available per delivery month. The position data are taken from reports that large traders (those with positions of 500,000 bushels or more) must submit to the CFTC. The position data represent the largest long position during the expiration month which is not necessarily held by the same trader from day to day. The denominator of the concentration variable is either open interest in the expiring contract (reported daily) or deliverable supply (reported weekly at the CBOT designated delivery points, i.e., Chicago and Toledo).[3]

[3]The concentration measure using deliverable supply (like the price/earnings ratio in finance) has a numerator that changes more frequently than the denominator. Deliverable supplies that are not held by the largest position holder would be a more appropriate divisor than total deliverable supplies. However, even though Ferruzzi was reported to hold large quantities of the deliverable supply during the period of the alleged manipulation, actual data for this variable are not available.

Spreads and futures returns are calculated using daily soybean settlement futures prices over the period, 1970–1990. However, some analyses use subsets of this time period because of the limited availability of the position data. The analysis of futures returns uses daily data on the Commodity Research Bureau (CRB) futures price index, an unweighted geometric average of 27 nonfinancial futures prices, including soybeans. The nearby 90-day T-bill futures price converted to an annualized bond equivalent yield is used as the risk-free interest rate. All futures price, spread, and yield series are taken from the nearest maturing contract and strung together through time.[4]

Descriptive statistics for all variables are given in Table I. The means of the two concentration measures indicate that, on average, the top long soybean trader had positions that are 236% of the deliverable supply and 25.6% of the open interest in the delivery month. These results are comparable to the findings of Peck and Williams (1991). Dickey–Fuller tests for unit roots indicate that for the spread, both concentration variables, volume, open interest, and deliverable supply, the null hypothesis of a unit root or nonstationarity is rejected. For the futures price and the T-bill yield, the null is not rejected.

ANALYSIS OF CONCENTRATION

As mentioned above, concentration is measured as the largest long position in the expiring contract divided by either open interest in the expiring contract or by deliverable supply. The top long position divided by open interest during 1982–1989 is shown in Figure 1. The largest concentration, based on this measure, occurred in 1983, 1987, and 1989. On average, the top long controlled almost 70% of the total open interest in the contract in September 1983 and about 60% in May 1989. This is quite substantial considering that the figures represent averages for the few days before and all days during the delivery month.[5]

T-tests are conducted to determine whether concentration was significantly different in July 1989 than in other years. The test is conducted for the July contract during 1982–1989 using all available observations

[4]The data sources are as follows: Soybean futures prices and open interest are from the Center for the Study of Futures Markets at Columbia University; CRB index and 90-day T-bill futures prices are from Technical Tools, Inc.; large soybean trader position data are from the CFTC; deliverable supply data are from the CBOT Statistical Annuals and the CFTC.

[5]Measures of concentration using open interest as the divisor are expected to be large close to contract expiration. As a contract nears expiration, open interest (the divisor) typically decreases as most traders offset their positions or participate in delivery and few traders initiate new positions. (Delivery occurs throughout the delivery month for the soybean contract.) As a result, the remaining traders with outstanding positions have larger and larger percentages of total open interest.

TABLE I

Descriptive and Unit Root Statistics for Soybean Spreads, Concentration, the Futures Price, the T-Bill Yield, Volume, Open Interest, and Deliverable Supply

	$\frac{F_t^{T+n} - F_t^T}{F_t^T}$	*TLD*	*TLO*	F_{t-1}^{T+n}	r_t	*VOL*	*OI*	*DS*
Mean	4.95	2.36	.256	633.72	8.20	191,298	456,440	13,908
St. Dev.	28.67	9.97	.193	116.22	2.06	85,861	124,157	10,767
Min	−167.9	.007	.026	468.25	5.04	28,655	253,500	48
Max	49.45	118.4	1.0	1,022	15.11	645,930	903,185	43,249
Nobs	2,036	900	900	2,036	2,036	2,036	2,036	509
Dickey Fuller $\tau\mu$	−4.31[a]	−5.61[a]	−3.68[a]	−.521	−2.13	−4.32[a]	−3.19[b]	−2.87[b]

Notes: F_t^{T+n} is the settlement price in cents per bushel of the contract maturing immediately after the nearby contract.
F_t^T is the settlement price in cents per bushel of the nearby contract.
F_{t-1}^{T+n} is the one day lag of F_t^{T+n}.
TLD is the top long position in the expiring futures contract month divided by deliverable supply.
TLO is the top long position in the expiring futures contract month divided by open interest.
r_t is the bond equivalent yield implied by the nearby T-Bill futures contract quoted at time t.
VOL is the total volume in all contract months measured in thousands of bushels.
OI is total open interest in all contract months measured in thousands of bushels.
DS is deliverable supply, observed weekly, at the two delivery points, Chicago and Toledo, measured in thousands of bushels.
[a] Indicates 1% level of significance.
[b] Indicates 5% level of significance.
Significance levels for the augmented Dickey–Fuller tests are taken from Fuller (1976).

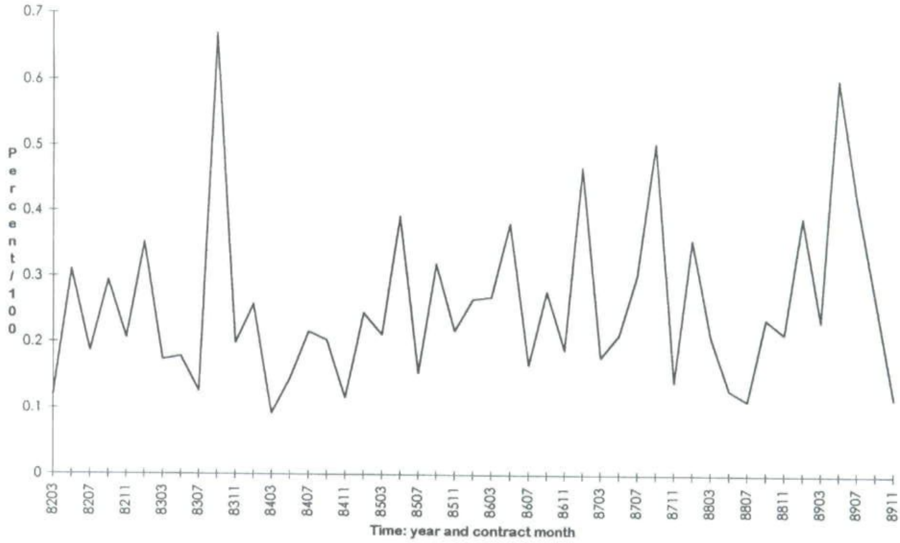

FIGURE 1
Relative concentration in the soybean futures market (ratio of top long/open interest: 1982–1989).

TABLE II

Tests of the Null Hypothesis That the Mean of Concentration in July in a Given Year is Less Than or Equal to the Mean of Concentration in Remaining Years

Year	*Mean of July TLO in That Year*	*Mean of July TLO in Remaining*	*t-Statistic*	*Mean of July TLD in That Year*	*Mean of July TLD in Remaining*	*t-Statistic*
1982	.118	.164	−1.10	.632	1.184	−4.75
1983	.087	.168	−3.97	.199	1.239	−9.76
1984	.144	.161	−.45	.703	1.187	−4.09
1985	.157	.159	−.14	2.818	.832	10.06[a]
1986	.084	.171	−5.30	1.818	1.014	6.55[a]
1987	.210	.152	1.47	.466	1.214	−5.99
1988	.078	.169	−4.50	.165	1.243	−9.94
1989	.383	.127	8.71[a]	1.627	1.051	5.05[a]

Notes: H_o: Concentration in a given year ≤ concentration in remaining years.
H_a: Concentration in a given year > concentration in remaining years.
TLO is the top long position in the expiring futures contract month divided by open interest.
TLD is the top long position in the expiring futures contract month divided by deliverable supply.
[a] Indicates 1% level of significance.
[b] Indicates 5% level of significance.

prior to the 12th day of each delivery month. Data after the 11th day of each month are not used in this analysis, given that the liquidation order (which probably affected concentration) was issued after the market closed on July 11, 1989. Thus, this test addresses the question of whether concentration was abnormally large prior to the CBOT's order.

The null hypothesis is that the mean of concentration in a given contract and year is *less* than or equal to the mean of concentration in the remaining years.[6] The null hypothesis is rejected for both measures of concentration in 1989 (Table II). Thus, the top long position relative to open interest or relative to deliverable supply was significantly larger in July 1989 than in other years. However, for one of the concentration measures, (i.e., top long divided by deliverable supply), two other years had significantly large amounts of long concentration also.[7]

ANALYSIS OF SPREADS

In this article, spreads (i.e., differences between prices of different futures contracts) are analyzed instead of prices themselves. Although manipulation might be expected to affect price levels, prices can change for many reasons that are not related to manipulation or concentration. Of course, spreads can also change for reasons unrelated to manipulation or concentration. However, spreads are unaffected by changes in factors that have the same effect on both futures prices. Thus, an analysis of spreads which automatically adjusts for changes in factors that affect both prices, makes the actual impacts of manipulation and concentration more detectable. Spread analyses have often been used as evidence in court cases of alleged manipulation [Edwards and Edwards (1984); Johnson (1981)].

In a classic squeeze, the prices of *all* old crop year contracts may be artificially high. In that case, spreads using just old crop year contract months may not be distorted even though prices of each individual contract month are. Therefore, initially the November–July spread (i.e., November futures price minus July futures price) is analyzed. The November

[6]The *t*-test is constructed in this manner because the power of a statistical test resides in rejecting the null hypothesis. If the null hypothesis (as given in the text) is rejected, then concentration in that particular year is significantly larger than concentration in the other years (i.e., the alternative hypothesis is accepted). Instead, the null hypothesis could have been stated as the mean of concentration in a given year is *greater* than or equal to the mean concentration in all other years. However, a rejection of this null can never imply that concentration in a particular year is significantly larger than concentration in the other years. The statistical result can only fail to reject the null hypothesis that concentration is greater than or equal to concentration in the other years. Thus, the null hypothesis as given in the text leads to a stronger test.

[7]Similar results are obtained if concentration is measured as the difference between the top long position and the top short position divided by either open interest or deliverable supply. Those results are available from the authors upon request.

FIGURE 2

November–July soybean spreads May 1–July 20: 1985–1990.

contract, the first new crop year contract, consistently has large volume and open interest and would be extremely difficult to manipulate. A visual inspection of the November–July spreads during May, June, and July of the years 1985–1990 shows variation in the spreads from year to year (Fig. 2). However, the spread in 1989 is more negative (i.e., smaller numerically) than in the other years, indicating that the July futures price in 1989 was higher relative to the November futures price than in the other years.

Spreads across crop years are often negative in the late summer and early fall because soybean stocks are usually smallest before harvest (Hieronymus; CBOT).[8] Such spreads tend to be even more negative (with the price of the nearby contract higher relative to the price of the deferred contract) if the previous crop size was small and/or if a long manipulation is taking place.

One-tailed t-tests are conducted to see if the inter crop year spread in 1989 was significantly different from other years. The null hypothesis is that the mean of the November–July spread in May through July 11 in each year is *greater* than or equal to the mean spread in all other years.[9]

[8]As explained by Hieronymus and the CBOT, the cash price for a storable commodity that is produced once a year (e.g., soybeans) is expected to be lowest at harvest, increase through the marketing year because of carrying charges, and decrease again at the next harvest. As a result, the price of a distant futures contract for such a commodity tends to exceed the price of a nearby futures contract, if both are in the same crop year. That is, the price of the July soybean contract exceeds the price of the March soybean contract in a normal market. However, the price of the first new crop contract is generally less than the price of the last old crop contract. That is, the price of the November soybean contract tends to be less than the price of the previous July contract.

[9]The null hypothesis is formulated in this manner to make the statistical test more powerful, as explained in footnote 6 for the analysis of concentration.

This test is conducted for each year over the period, 1970–1990 (Table III). The null hypothesis is rejected for 1989, implying that the spread in 1989 is significantly less than the spread in other years.[10] However, several other rejections are present. In particular, the test statistics for 1973, 1977–1978, and 1984 are all significant. Thus, the November–July spread is found to be different in 1989, but significant differences are found in several other years as well.

Use of a Cost-of-Carry Model

The above analysis indicates that the November–July spread in 1989 was significantly less than the spread in other years. However, this finding could occur for many reasons other than a manipulation attempt. Further analysis is conducted to see if the 1989 spread differed, after adjusting for changes in other relevant variables. Any significant differences obtained from this analysis would offer more powerful evidence that an unusual occurrence took place in 1989. Of course, these results cannot be used to prove that a manipulation attempt occurred.

This analysis uses a larger data set than used for the earlier tests. Instead of analyzing just the November–July spreads, all nearby spreads are analyzed. The spread is defined as the price of the futures contract that matures just beyond the nearby contract minus the price of the nearby contract.

Following Fama and French (1987), Brennan (1991) and Bailey and Ng (1991), an equilibrium cost-of-carry model is used to determine whether the spread in 1989 is significantly different after adjusting for changes in other relevant variables. In the cost-of-carry model, the spread is a function of the risk-free interest rate, storage costs of holding the commodity over time and the convenience yield. Consider the following spread relationship between two futures contracts for different maturities:

$$F_t^{T+n} - F_t^T = F_t^T r_t^{T,T+n} + W^{T,T+n} - y^{T,T+n} \tag{1}$$

where F_t^{T+n} is the futures price quoted at time t, for delivery at time $T + n$, similarly for F_t^T, $r_t^{T,T+n}$ is the risk-free interest rate quoted at time t on a loan beginning at time T, and maturing in time $T + n$. W is the present value of all physical storage costs quoted as dollars per bushel to be incurred during the period $(T + n) - T$, and y is the convenience yield

[10] Given that the mean spreads are negative, the spread in 1989 is a larger number in absolute value but a smaller number on the number line than the mean spread in all other years.

TABLE III

Tests of the Null Hypothesis That the Mean of the November–July Spread in a Given Year is Greater Than or Equal to the Mean of the November–July Spread in Remaining Years

Year	*Mean in That Year*	*Mean in Remaining Years*	*t-Statistic*
1970	−7.44	−33.78	8.73
1971	−7.74	−33.74	8.72
1972	−29.68	−32.68	.99
1973	−368.71	−16.19	−22.71[a]
1974	−8.16	−33.77	8.45
1975	−12.83	−33.54	6.93
1976	13.67	−34.78	16.33
1977	−147.61	−26.94	−10.62[a]
1978	−68.86	−30.69	−10.12[a]
1979	−9.21	−33.72	7.12
1980	30.59	−35.74	22.65
1981	26.20	−35.46	18.78
1982	9.84	−34.60	14.95
1983	21.65	−35.23	19.24
1984	−79.34	−30.16	−7.03[a]
1985	−1.36	−34.12	10.30
1986	−21.37	−33.10	3.66
1987	9.05	−34.60	13.67
1988	3.40	−34.32	9.55
1989	−62.24	−31.02	−6.98[a]
1990	17.66	−35.08	17.53

Data consist of the November–July spread from 1970 through 1990 with daily observations from May through July eleventh of each year. The same analysis is conducted using observations from June through July, resulting in rejections of the null hypothesis for the same years as it is rejected here. The rejection pattern is almost the same using observations from January through July and only July.

H_o: Spread in a year ≥ Spread in remaining years.

H_a: Spread in a year < Spread in remaining years.

[a] Indicates 1% level of significance.

[b] Indicates 5% level of significance.

from holding the commodity during the period. Dividing eq. (1) by F_t^T gives

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = r_t^{T,T+n} + \frac{W^{T,T+n} - y^{T,T+n}}{F_t^T} \tag{2}$$

The interest rate represents the opportunity cost of storage. This opportunity cost and physical costs of storage are positively related to the spread. The convenience yield is derived from the benefits that accrue from holding the commodity and depends, to a large extent, on the availability of supplies. When supplies are plentiful, the convenience yield is likely to be low relative to the interest rate and the cost of storage, implying that the spread is positive. During periods of low supply, the convenience yield should dominate the relationship as it is bid up by users of the commodity who will not part with their holdings. In this latter case, the spread will be negative. Additionally, because supplies of storable commodities that are produced once a year have a seasonal pattern, storage costs and the convenience yield would also have a seasonal pattern as Fama and French (1987) and Bailey and Ng (1991) recognize.

Interest rate data are readily available for model estimation, but data on physical storage costs are not. In addition, the convenience yield is unobservable. Therefore, proxies for storage costs and convenience yield are used. Variables such as current stocks, expected production, and expected consumption could serve as proxies. However, daily or weekly data on these variables do not exist. Given that the current price incorporates the effects of all of these variables, price is used as a proxy for convenience yield, following Brennan (1991) and Bailey and Ng (1991). In particular, the lagged futures price of the distant contract, F_{t-1}^{T+n}, is used. The use of the distant contract price, instead of the nearby, eliminates problems that any manipulation would have on the nearby price. The lag of the price is used to eliminate problems of simultaneity. Contract month dummy variables are included as additional proxies for these variables following Fama and French (1987). A dummy variable is also included to differentiate bad weather (i.e., drought) years, when harvests are small, from other years. Finally, a dummy variable is added to differentiate the period of the alleged manipulation (i.e., May 1 through July 11, 1989).

The empirical model used is

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta r_t + \zeta F_{t-1}^{T+n} + \theta \text{Drought} + \eta \text{DUM} + \sum_{i=1}^{6} \delta_i \text{MD}_i + u_t \tag{3}$$

where F^T is the nearby futures price and F^{T+n} is the price of the next nearest maturing contract. For example, in January, the spread represents the difference between the March futures price and the January futures price, divided by the January futures price. The interest rate variable, r, is the bond equivalent yield implied by the nearby T-bill futures contract price.[11] Drought is a dummy variable that is 1 for drought years and 0

[11]The T-bill and soybean futures contracts have predominantly different expiration months. T-bill futures contracts mature in March, June, September, and December. Soybean futures contracts mature in January, March, May, July, August, September, and November. These differences may cause a small interest rate bias in the results.

otherwise.[12] DUM is a dummy variable that is 1 for the period May 1 through July 11, 1989 and 0 otherwise. MD_i is a vector of seasonal dummy variables that are 1 in contract month i and 0 otherwise.

As indicated earlier, unit root tests reject the null hypothesis that the relative spread is nonstationary. However, the null hypothesis is not rejected for the T-bill yield and the futures price. Therefore, to ensure the statistical integrity of the results, the model is estimated in both levels and first differences. White's heteroskedastic covariance matrix is used to correct for nonconstant variance and significant lags of the dependent variable are added to correct for autocorrelation.

Equation (3) is estimated using daily data from 1982–1990 (Table IV). The level regressions have high explanatory power, primarily because of the lagged dependent variables added to the model. The coefficients have the anticipated signs, except the coefficient on the lagged futures price is positive (although insignificant). However, only the coefficients for the interest rate and the dummy variable are significantly different from zero. The negative coefficient for the dummy variable, significant at the 1% level, indicates that the spread in May through July, 1989 was significantly less than at other times, even after adjusting for changes in relevant variables. Thus, during the period of the alleged manipulation attempt, the July futures price was higher relative to the deferred contract price than in other periods. The results using first differences show that the drought dummy variable and the dummy for the alleged manipulation period are the only variables with coefficients significantly different from zero. The 1989 dummy variable was significantly negative at the 10% significance level, indicating that in May through July 1989 the change in the spread was significantly more negative than in other periods.

Estimating the Effects of Concentration Using a Cost-of-Carry Model

The spread in 1989 may be different because of increased concentration. To test this hypothesis and to estimate the effects of concentration on

[12]Drought periods are defined to be crop years (i.e., September through August) 1983–1984 and 1988–1989. That is, the dummy variable is 1 from September 1983 through August 1984 and from September 1988 through August 1989 and 0 otherwise. Soybean yields in those years were much less than in the other years. Of course, the effects of droughts are anticipated before the crop year begins. To account for the effects of an anticipated drought, several regressions are estimated also using an alternative specification of the drought dummy variable. In those cases, the dummy variable was 1 from July 1983 through August 1984 and from July 1988 through August 1989. The same general empirical results are obtained regardless of the particular specification of this dummy variable. However, the levels of significance are marginally lower when the anticipated dummy variable is used.

TABLE IV

Regression of the Relative Spread on the Far Price, T-Bill Yield, a Dummy Variable for the Drought, a Dummy Variable for the Alleged Manipulation Period, and a Vector of Seasonal Dummy Variables: 1982–1989

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta r_t + \zeta F_{t-1}^{T+n} + \theta \text{Drought} + \eta \text{DUM} + \sum_{i=1}^{6} \delta_i \text{MD}_i + u_t$$

Variable	*Regression in Levels*	*Regression in Changes*
α	−2.58	−0.19
	(−1.55)	(−1.35)
r_t	17.62	−1.07
	(2.42)[b]	(−1.22)
F_{t-1}^{T+n}	0.004	−0.008
	(1.24)	(−0.34)
Drought	−1.23	0.85
	(−1.53)	(2.15)[b]
DUM	−5.15	−2.57
	(−3.09)[a]	(−1.74)[c]
Adjusted R^2	0.956	0.0198
Lags	2	2
NOBS	1900	1881

Notes: t-statistics are in parentheses.
Coefficients are multiplied by 1000.
The estimation period is from 1982 through 1989.
α: Regression intercept.
r_t: the bond equivalent yield implied by the nearby T-Bill futures contract quoted at time t.
F_{t-1}^{T+n}: the one day lag of F_t^{T+n}, the settlement price in cents per bushel of the contract maturing immediately after the nearby contract.
Drought: Dummy variable adjusting for drought period.
DUM: Dummy variable equal to one for the period of the alleged manipulation, May 1 through July 11 of 1989.
MD is a vector of six contract month dummy variables.
Lags: Number of lags of the spread included in the regression.
NOBS: Number of observations in the regression.
[a]Indicates 1% level of significance.
[b]Indicates 5% level of significance.
[c]Indicates 10% level of significance.

the spread, the model in eq. (3) is modified by deleting the dummy variable for the period of the alleged manipulation attempt and adding a concentration variable to obtain

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta r_t + \zeta F_{t-1}^{T+n} + \theta \text{Drought} + \psi \text{Con}_{t-1} + \sum_{i=1}^{6} \delta_i \text{MD}_i + u_t \tag{4}$$

Con is the measure of concentration, defined as the top long position divided by either open interest or deliverable supply, and all other variables are as defined above. As mentioned earlier, tests for unit roots indicate that the hypothesis of nonstationarity is rejected for both concentration variables. Therefore, the test statistics for this variable are valid.[13] However, as before, the model is estimated in both levels and first differences. Again, White's heteroskedastic covariance matrix is used to correct for nonconstant variance and significant lags of the dependent variable are added to correct for autocorrelation.

Under the null hypothesis that no trader exercises monopoly power, the concentration of the largest trader(s) should have no effect on spreads implying the coefficient should be zero. Under the alternative hypothesis that monopoly power is present in the soybean futures market, the coefficient on concentration should be negative. (An increase in long concentration that bids the nearby price up relative to the distant price, causes the spread to decrease, i.e., become a smaller numerical number.) As indicated earlier, concentration measured relative to open interest provides information about current market liquidity, while concentration relative to deliverable supply provides information about potential corners or squeezes.

Equation (4) is estimated using daily data from 1982–1989 (Table V). To avoid contamination of the general results by the Ferruzzi incident, a wide window of time around that period, April 28 through August 4 of 1989, is deleted. As explained later, significant events concerning the alleged manipulation attempt occurred during this period. Results using both deliverable supply and open interest as the divisor for the concentration variable are reported. In both level regressions, the coefficient for the lagged futures price is significantly positive.[14] The concentration variable using deliverable supply as the divisor is not significant, regardless of whether the regressions are estimated in levels or first differences.[15] Thus, the results provide no evidence that corners or squeezes are wide spread in delivery months.

[13]The results of a model in which the spread is regressed on the concentration measures alone produce the same inferences for this variable as those for the full model in eq. (4).

[14]If the lagged futures price is measuring convenience yield, a negative coefficient would be expected. Recall that the lagged futures price is added as a proxy for convenience yield, following Brennan (1991). In general, convenience yield would be higher when prices are high (because stocks are low). Thus, a higher futures price would be associated with higher convenience yield and a smaller spread implying that the coefficient on the futures price would be negative. However, the estimated coefficient is positive.

[15]Peck and Williams (1991) found concentration relative to deliverable supply to be significant. The different implication could be caused by the limited number of observations they used (approximately one per delivery month), the different measures of the numerator of the concentration variable (they used net long positions), the fact that other variables based on the theory of the cost-of-carry are included in the regressions reported here, and/or the fact that corrections for statistical problems (of heteroskedasticity and autocorrelation) are made here.

TABLE V

Regression of the Relative Spread on the Far Price, T-Bill Yield, a Dummy Variable for Drought, Concentration, and a Vector of Seasonal Dummy Variables: 1982–1989

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta r_t + \zeta F_{t-1}^{T+n} + \theta \text{Drought} + \psi \text{Con}_{t-1} + \sum_{i=1}^{6} \delta_l \text{MD}_i + u_t$$

	Regressions in Levels		*Regressions in Changes*	
Variable	*Deliverable Supply*	*Open Interest*	*Deliverable Supply*	*Open Interest*
α	−7.88	−6.26	−0.62	−0.41
	(−2.23)[b]	(−1.94)[c]	(−1.28)	(−0.95)
r_t	8.25	9.28	−2.29	−2.35
	(0.55)	(0.61)	(−0.95)	(−0.99)
F_{t-1}^{T+n}	0.01	0.014	0.03	0.03
	(1.97)[b]	(2.08)[b]	(0.90)	(0.82)
Drought	−3.12	−3.15	0.26	0.21
	(−2.16)[b]	(−2.19)[b]	(0.39)	(0.33)
Con_{t-1}	0.01	−6.19	−0.01	−4.55
	(0.17)	(−4.03)[a]	(−0.30)	(−1.69)[c]
Adjusted R^2	0.919	0.921	0.064	0.067
Lags	2	2	2	2
NOBS	733	760	720	745

Notes: *t*-statistics are in parentheses.
Coefficients have been multiplied by 1000.
Deliverable Supply indicates that the concentration measure is calculated relative to deliverable supply.
Open Interest/ indicates the concentration measure is calculated relative to open interest in the expiring contract.
α: Regression intercept.
F_{t-1}^{T+n}: the one day lag of F_t^{T+n}, the settlement price in cents per bushel of the contract maturing immediately after the nearby contract.
r_t: the bond equivalent yield implied by the nearby *T*-Bill futures contract quoted at time *t*.
CON_{t-1}: One period lag of the concentration of futures positions as the top long position divided by either deliverable supply or open interest.
Drought: Dummy variable adjusting for drought period.
MD is a vector of six contract month dummy variables.
Lags: Number of lags of spread included in the regression.
NOBS: Number of observations in the regression.
[a]Indicates 1% level of significance.
[b]Indicates 5% level of significance.
[c]Indicates 10% level of significance.

When open interest is the divisor, a significant negative relationship is found between the spread and concentration, regardless of whether the regressions are estimated in levels or first differences. The hypothesis that concentration did not affect price relationships in the soybean futures market is rejected when concentration is measured relative to open interest. Thus, the results are consistent with limited liquidity in the delivery months of the soybean futures contracts during the 1982–1989 period. In other words, the evidence supports the hypothesis that large traders can influence the prices of expiring soybean futures contracts.

The effect that the increased concentration had on spreads during the period of the alleged manipulation attempt can be estimated using the coefficients on the concentration variables from the level regressions in Table V. The coefficient for the measure of concentration using open interest estimated over the 1982–1989 period excluding the alleged manipulation period is −.00619. Multiplying this coefficient by the mean concentration of .224 gives the average effect of concentration on the relative spread over 1982–1989. If this product is then multiplied by the average nearby futures price over this period (the divisor in the relative spread) of 627.66¢ per bushel, one obtains an estimate of the average effect of concentration on the simple spread, i.e., August minus July, in cents per bushel.

For the entire period, concentration has been associated with a change in the spread of −.8703¢ per bushel for the measure of concentration using open interest. The same coefficient and average nearby futures price are used to calculate the effect during the alleged manipulation period. During the delivery period for May and July of 1989, the mean concentration level was .5428 and the estimated change in spreads due to increased concentration was −2.1089¢ per bushel. Although the change may not seem large, it represents $105.45 per spread of one contract in each futures contract month (because each contract represents 5000 bushels and the spreads are quoted in cents per bushel).

Estimating the Effects of Concentration Using a Supply of Storage Model

The effect of concentration on spreads can be estimated using an alternative model specification. Following the supply of storage theory [Williams (1986); Working (1949)], the relative spread is modeled as a function of deliverable supply, deliverable supply squared, and concentration.[16] Again, contract month and drought dummy variables are included to obtain

[16]The supply of storage theory actually addresses the nonlinear relationship between the spread and stocks. The relative spread is used as the dependent variable here to be consistent with the earlier regressions presented. However, the general empirical results are similar regardless of whether the spread or the relative spread is the dependent variable. The general results are also similar regardless of whether a cubic term is included (i.e., deliverable supply cubed). The general implications are also similar if weekly data, rather than daily data, are used in the estimation of eq. (5). In that case, no evidence of heteroskedasticity is found and only one lag of the dependent variable corrects for autocorrelation. The estimated coefficient of the concentration variable relative to open interest is −.0091 and the estimated change in the spread associated with concentration during the period of the alleged manipulation attempt is −3.1003 cents per bushel. Both results are similar to those presented in the text.

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta \mathrm{DS}_t + \gamma(\mathrm{DS}_t)^2 + \psi \mathrm{Con}_{t-1} + \theta \mathrm{Drought} + \sum_{i=1}^{6} \delta_i \mathrm{MD}_i + u_t \qquad (5)$$

where DS_t is deliverable supply at time t, and all other variables are as defined above. Unit root tests indicate that for the spread, both concentration variables, and deliverable supply, the null hypothesis of a unit root or nonstationarity is rejected. Thus, only level regressions are estimated. Again, White's heteroskedastic covariance matrix is used to correct for nonconstant variance and significant lags of the dependent variable are added to correct for autocorrelation.

Equation (5) is estimated using daily data from 1982–1989 (Table VI). Both regressions have high explanatory power, primarily because of the lagged dependent variables. The deliverable supply variables are not significant in either case. Again, the concentration variable is insignificant when deliverable supply is used as the divisor, but significantly negative when open interest is the divisor. Thus, the implications regarding the effects of concentration are the same for this supply of storage model as for the earlier cost-of-carry model.

The coefficient for concentration using open interest is $-.00623$, similar to the coefficient $-.00619$ obtained earlier. Using the same estimating procedures as before, concentration is associated with a change in the spread of $-.8759$¢ per bushel for the entire period and -2.1225¢ per bushel for the period of the alleged manipulation attempt. Thus, the estimated changes in the spread associated with concentration are similar using either of the above two models.

IMPACT ON TRADER RETURNS

The purpose of this section is to determine the price impacts, if any, of the alleged manipulation attempt and the resulting disciplinary action taken by the CBOT. Two alternative pricing models are used to conduct an event study.[17] The first is the cost-of-carry model of the spread used above and used by Bailey and Ng (1991) to examine default premiums during the 1980 silver price manipulation. The second model is a variant of the Capital Asset Pricing Model and follows work by Dusak (1973), Draper (1984) and others who model futures returns as a function of a

[17]The event study approach applied to one firm or one futures series follows work by Ruback (1982); Hill and Schneeweis (1983); Draper (1984); Chen and Merville (1986); and Bailey and Ng (1991).

TABLE VI

Regressions of the Spread as a Nonlinear Function of Deliverable Supply, Concentration, Drought Periods, and a Vector of Seasonal Dummy Variables: 1982–1989

$$\frac{F_t^{T+n} - F_t^T}{F_t^T} = \alpha + \beta \mathrm{DS}_t + \gamma(\mathrm{DS}_t)^2 + \psi\ \mathrm{Con}_{t-1} + \theta\ \mathrm{Drought} + \sum_{i=1}^{6} \delta_i \mathrm{MD}_i + u_t$$

	Concentration Measure	
Variable	*Deliverable Supply*	*Open Interest*
α	−0.86	1.14
	(−1.34)	(1.62)
DS_t	.980	.992
	(1.00)	(1.05)
$(\mathrm{DS}_t)^2$	−.033	−.0199
	(−0.18)	(−0.11)
Con_{t-1}	.0023	−6.23
	(0.09)	(−3.89)[a]
Drought	−1.47	−1.50
	(−1.58)	(−1.62)
Adjusted R^2	.918	.919
Lags	2	2
NOBS	733	733

Notes: *t*-statistics are in parentheses.
Coefficients have been multiplied by 1000.
F_t^{T+n} is the settlement price in cents per bushel of the contract maturing immediately after the nearby contract.
F_{t-1}^{T+n}: the one day lag of F_t^{T+n}
Deliverable Supply indicates that the concentration measure is calculated relative to deliverable supply.
Open Interest indicates that the concentration measure is calculated relative to open interest in the expiring contract.
α: Regression intercept.
DS_t is deliverable supply divided by 10,000, measured weekly, at the two delivery points, Chicago and Toledo.
CON_{t-1}: One period lag of the concentration of futures positions measured as the top long position divided by either deliverable supply or open interest.
Drought: Dummy variable adjusting for drought period.
MD is a vector of six contract month dummy variables.
Lags: Number of lags of spread included in the regression.
NOBS: Number of observations in the regression.
[a]Indicates 1% level of significance.

market index. Here, futures returns are a function of the return on a commodity futures market index, i.e.,

$$\mathrm{SR}_t = \alpha + \beta\,\mathrm{CRB}_t + e_t \tag{6}$$

SR is the log price-relative of daily soybean futures settlement prices and CRB is a similar return for the CRB index. The data set consists of soybean and CRB futures prices from the nearest maturing contract, strung together over time.

Both eqs. (4) and (6) are estimated using daily data over the period May 1, 1986 through April 30, 1989.[18] The residuals or abnormal returns for the period May 1, 1989 through August 25, 1989 are then examined as the event period. The statistical significance of the abnormal returns or prediction errors is obtained using the t-statistic $t = e_t/\sigma_e$ [from either eq. (4) or (6)]. Following Pindyck and Rubinfeld (1991) and Brown and Warner (1985), the standard deviation of the prediction error, σ_e, is defined as the square root of $\sigma_e^2 = \sigma^2[1+(1/n) + (\mathrm{crb}_t - CRB)^2/(n - 1)\sigma_{\mathrm{crb}}^2]$ where σ^2 is the residual variance from the original regression model, n is the number of observations in the estimation, crb_t is the value of the index at time t, and CRB and σ_{crb}^2 are the mean and variance of the CRB series over the estimation period.

Table VII reports the abnormal returns from both the market model, eq. (6), and the cost-of-carry model in first differences, eq. (4), for selected dates.[19] The table contains dates on which significant events occurred, as obtained from the *Wall Street Journal* or from CBOT and CFTC documents. The date and description of the event as well as the excess returns and their respective t-statistics are reported. Note that when the nearby futures price falls significantly, the abnormal return is negative from the market model, but positive for the cost-of-carry model (as the spread increases).

Although a few of the excess returns are significant before the liquidation order, many are large in absolute value and significant after the liquidation order. In addition, the significant abnormal returns are not all the same sign, i.e., either all positive or all negative, because Ferruzzi was aggressively protesting the order and actually filed a lawsuit to prevent it.

Figures 3 and 4 illustrate the excess returns for the market model and the cost-of-carry model, respectively. First, notice that the volatility of the excess returns increases in both figures after the liquidation order on July 11. Excess returns are dramatically negative after the liquidation order and positive when rumors spread that Ferruzzi was fighting the liquidation order by purchasing large numbers of contracts (Fig. 3). The return is again negative when the deadline for the liquidation order is reached on July 20. The returns from the cost-of-carry model give the same general results, but in opposite sign (Fig. 4). Thus, the evidence

[18]The choice of a three-year estimation period is arbitrary. However, the sensitivity of the results is tested using alternative estimation periods of 100 days to three years. The results did not change in any meaningful sense using these different estimation periods.

[19]The results for the market model over the estimation period indicate that the market index is quite significant with a t-statistic of 24.12 and an R^2 of .426. The fit of the cost-of-carry model is similar to the first difference results reported in Table V.

TABLE VII

Market Reactions to Significant Events During the Ferruzzi Incident

Date	*Description of Occurrence*	*Market Model ABR (t-Stat)*	*Cost-of-Carry Model ABR (t-Stat)*
5-2-89	Business Conduct Committee (BCC) reminds Ferruzzi's clearing member firm that it is responsible for orderly liquidation of Ferruzzi's long position totaling 23.5 million bushels in May contracts.	−.14 (−.12)	−.23 (−.38)
5-11-89	BCC warns Ferruzzi to liquidate May soybean futures contracts. May futures prices fall as traders anticipate U.S. Department of Agriculture crop report forecasting large crop.	−.95 (−.81)	−.30 (−.50)
5-16-89	The Commodity Futures Trading Commission (CFTC) writes Ferruzzi a letter suggesting present holdings of 16.2 million bushels of May futures may constitute manipulation of prices.	−.73 (−.62)	−.36 (−.60)
5-18-89	The CFTC phones Ferruzzi and says hedging exemption is revoked. The Chicago Board of Trade (CBOT) changes initial margins in May contract from $1500 to $15,000 and maintenance margins from $1250 to $10,000.	1.22 (1.05)	.20 (.33)
6-1-89	CFTC urges Ferruzzi to liquidate July futures.	−1.84 (−1.57)	1.69 (2.81)[a]
6-5-89	All major long and short participants meet with the BCC to justify their positions in the July contract.	−.59 (−.50)	1.03 (1.71)[c]
6-13-89	CFTC urges Ferruzzi to liquidate July futures.	1.09 (.93)	.48 (.79)
6-19-89	Speculative margins for July contract are increased from $1500 to $2000. CFTC again urges Ferruzzi to liquidate July futures positions.	.42 (.36)	.93 (1.53)
6-27-89	The BCC and Office of Investigations and Audits (OIA) of the CBOT warn Ferruzzi of disciplinary actions if liquidation does not occur.	−.11 (−.09)	.47 (.78)
6-28-89	CFTC urges Ferruzzi to liquidate July futures and buy cash to close out its hedged positions.	−1.08 (−.92)	1.57 (2.59)[a]
7-5-89	The BCC warns Ferruzzi that they will be forced to liquidate July futures contracts if they do not do so voluntarily.	1.54 (1.31)	.20 (.32)
7-6-89	Ferruzzi meets with the CBOT to explain large long position	.65 (.55)	.38 (.63)
7-7-89	The BCC writes Ferruzzi to warn them that they will be forced to liquidate if they do not do so immediately.	1.38 (1.18)	−.76 (−1.25)
7-10-89	Ferruzzi responds, says it will maintain position. CFTC rules position is not bona fide hedge.	−1.12 (−.96)	−1.66 (−2.75)[a]

TABLE VII (Continued)

Market Reactions to Significant Events During the Ferruzzi Incident

Date	*Description of Occurrence*	*Market Model ABR (t-Stat)*	*Cost-of-Carry Model ABR (t-Stat)*
7-11-89	The CFTC notifies Ferruzzi and the CBOT that Ferruzzi's hedging request is denied. CBOT posts mandatory liquidation order after soybean pit's close.	−1.26 (−1.08)	.99 (1.63)
7-12-89	Prices plunge in response to CBOT's liquidation order. Ferruzzi requests temporary restraining order blocking liquidation order.	−5.35 (−4.57)[a]	3.69 (6.10)[a]
7-13-89	Prices of most soybean futures rise in response to request for temporary restraining order. Federal judge refuses to block CBOT order, decision announced after market closes.	−.14 (−.12)	1.01 (1.64)
7-14-89	Market reach to effects of judge's decision.	.59 (.50)	.70 (1.16)
7-18-89	CFTC testifies before House subcommittee during market hours, explaining reasons for the CBOT's liquidation order.	2.75 (2.35)[b]	−3.69 (−6.09)[a]
7-19-89	July shorts attempt to cover positions before liquidation deadline. Prices of August and November contracts rise as rumors of Ferruzzi's "purchasing war" spread within market.	4.38 (3.74)[a]	−3.45 (−5.61)[a]
7-20-89	Deadline for liquidation order; price of July futures plunges. After market closes, in hearing before House subcommittee, CBOT discloses that the CFTC ordered Ferruzzi to decrease July long positions only hours before CBOT issued mandatory order.	−6.15 (−5.25)[a]	4.10 (6.72)[a]
7-26-89	CBOT doubles initial margin from $1500 to $3000 and hedging from $1250 to $2500 for August contracts. National Weather Service's six to ten day outlook forecasts low rainfall which may help soybean growing conditions.	−.13 (−.11)	−.30 (−.50)
8-1-89	Ferruzzi's large sale of August futures decreases fear of squeeze.	−1.68 (−1.44)	2.53 (4.17)[a]
8-2-89	Prices fall as soybean trader indictments are expected to be announced after market's close. Ferruzzi still selling soybeans for August delivery.	−1.26 (−1.08)	.18 (.29)
8-3-89	Ferruzzi drops law suit to block CBOT order, however, threatens to sue for losses.	−4.21 (−3.60)[a]	2.68 (4.45)[a]
8-22-89	August futures expire; price falls as volume falls.	−4.49 (−3.84)[a]	4.67 (7.74)[a]

Notes: The estimated period extends from May 1, 1986 through April 30, 1989 (i.e., 785 observations). The event period is May 1, 1989 through August 25, 1989. Data series are daily.
ABR is the abnormal return, or residual.
[a]Indicates a 1% level of significance.
[b]Indicates a 5% level of significance.
[c]Indicates a 10% level of significance.

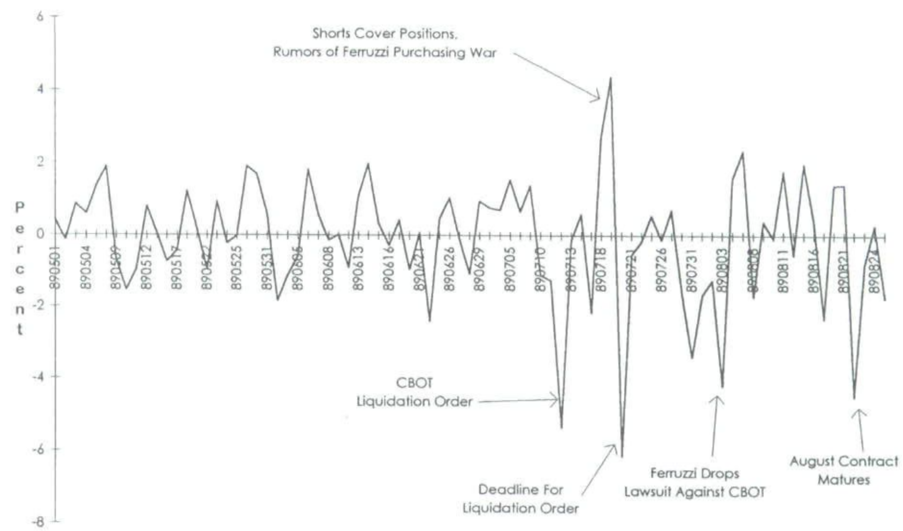

FIGURE 3
Futures price abnormal returns.

seems compelling that the liquidation order had dramatic effects on returns.

IMPACT ON MARKET PARTICIPATION

Historical open interest and volume are examined to see if significant changes in participation occurred during and after the liquidation order. A visual inspection indicates that during 1981–1990, open interest was volatile (Fig. 5). However, open interest did increase in the year following the order. Tests are conducted to see if open interest or volume changed significantly after the liquidation order was given. While one would expect open interest to decline and volume to increase immediately after the order, participation could either rise or fall after that depending on whether the action was deemed beneficial or harmful by market participants.

In general, periods in which prices are more volatile are periods in which interest in futures trading increases. That is, it is relatively easy to argue that causality runs from price change to open interest or volume rather than the reverse. As discussed above, the futures price is a unit root variable, but open interest and volume are not. Therefore, open interest and volume are modeled as a function of the absolute value of the change in price and lagged values of the dependent variable. This measure of price is stationary and serves as a proxy for price variability that influ-

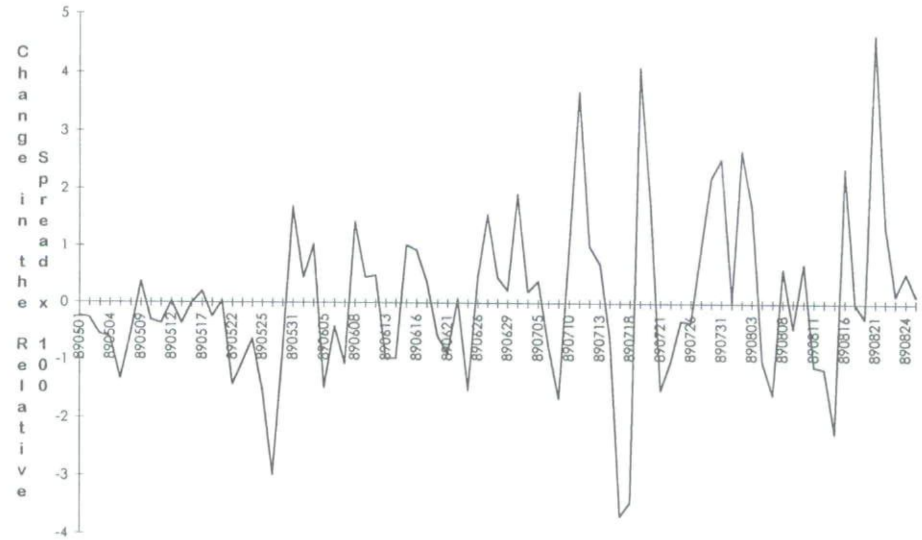

FIGURE 4
Cost of carry model abnormal return.

ences open interest and volume. The equation also contains six contract month dummy variables to account for seasonal variation and a dummy variable to measure the effects of the liquidation order.

The following regression model was estimated using daily data for 1981–1990:

$$DV_t = a + \beta \Delta P_t + \lambda \mathrm{DUM} + \sum_{i=1}^{6} \delta_i \mathrm{MD}_i + \varepsilon_t \tag{7}$$

where DV_t is the dependent variable (i.e., either total open interest or total volume) on day, t; ΔP_t is the absolute value of the change in price on day t; DUM is a dummy variable to measure the effects of the liquidation order, and MD is as defined earlier. Significant lags of the dependent variable are included to remove serial correlation. Five lags are added when the dependent variable is open interest, and ten when the dependent variable is volume.

Equation (7) is estimated using daily data for several different specifications of the liquidation order dummy variable. The dummy variable is set equal to 1 for July 12, 1989, or for July 12–14, 1989, or for July 12–20, 1989, or July 12, 1989 through the end of the sample period and 0 otherwise. The liquidation order is expected to cause open interest to decline immediately and volume to increase immediately. The periods

FIGURE 5
Total soybean open interest 1981–1990.

outlined above are chosen arbitrarily to determine the duration of the effects of the order.

The results indicate that on the day of the order, there was a significant decline in total open interest by approximately 22 million bushels or 4471 contracts (Table VIII, column 1). However, the effect of the order declines quite rapidly through time. No negative long-term effects of the order are found. In fact, open interest increased (although insignificantly) in the year or so following the order (column 4).

Volume increased immediately after the liquidation order, although the increase is not significantly different from zero. Volume declined afterwards, although no significant decreases are found. Thus, no significant long-term effects of the liquidation order are found.

If an exchange does not take appropriate precautions against manipulation, then traders transfer their business to other exchanges or other markets (e.g., forward markets) [Easterbrook (1986)]. Given that neither volume nor open interest declined significantly in the long term, there is no evidence that soybean traders took their business elsewhere after the market intervention of July 1989.

SUMMARY AND CONCLUSIONS

This article provides an empirical analysis of the alleged manipulation attempt of the July 1989 soybean futures market to see if publicly available information offers justification for the concerns of the CBOT and the CFTC. An analysis of this particular historical incident can provide

TABLE VIII

Regressions of Total Open Interest or Volume on the Absolute Value of the Change in the Cash Price, A Dummy Variable for the Effects of the Liquidation Order, and a Vector of Seasonal Dummy Variables: 1981–1990

$$\mathrm{DV}_t = \alpha + \beta \Delta P_t + \lambda \mathrm{DUM} + \sum_{i=1}^{6} \delta_i \mathrm{MD}_i + \varepsilon_t$$

	Dates for the Liquidation Dummy Variable			
	1 on July 12, 1989; 0 Otherwise	*1 from 7/12–7/14; 0 Otherwise*	*1 from 7/12–7/20; 0 Otherwise*	*1 on and after 7/12; 0 Otherwise*
	Results for Open Interest			
DUM	−22,357	−7586.35	−1682.60	455.35
(t-statistic)	(−2.99)[a]	(−1.75)[c]	(−.50)	(1.07)
Adjusted R^2	.996	.996	.996	.996
$\chi^2_{(6)}$	5.54	5.35	5.13	5.15
Serial correlation [prob]	[.48]	[.50]	[.53]	[.52]
	Results for Volume			
DUM	24,013	−5007.96	−1415.75	−99.15
(t-statistic)	(.46)	(−.16)	(−.07)	(−.03)
Adjusted R^2	.590	.590	.590	.590
$\chi^2_{(6)}$	2.09	2.08	2.08	2.08
Serial correlation [prob]	[.91]	[.91]	[.91]	[.91]

Notes: DV is the dependent variable used in the regression. The first three rows of the table use open interest as the dependent variable. The bottom three rows use volume as the dependent variable.
MD is a vector of six contract month dummy variables.
ΔP_t is the absolute value of the change in the cash prize.
DUM is the liquidation order dummy variable.
n: significant lags of the dependent variable are included to remove serial correlation.
Five lags are added when the dependent variable is open interest and ten lags are added when the dependent variable is volume.
[a]Indicates 1% level of significance.
[b]Indicates 5% level of significance.
[c]Indicates 10% level of significance.

government and exchange regulators of futures markets additional insight in analyzing future incidents in progress. Spreads and concentration are found to be significantly different in 1989 than in other years. Spreads are found to be significantly different in 1989, even after adjusting for changes in other relevant variables. Thus, this analysis provides evidence that the period of the alleged manipulation attempt was significantly different from other periods. The significant differences in variables that are detected are consistent with what would be expected if a long manipulation attempt had been underway. Using the regression coefficient from either a cost-of-carry model or a supply of storage model and mean values of the variables, the increased concentration is associated with a decrease in the spread of approximately two cents per bushel.

The largest long position relative to open interest is found to have a significant negative effect on spreads during delivery months throughout the 1980s, reflecting the illiquidity of soybean futures contracts during the delivery period. Thus, this research supports the general recommendation of brokers and trading advisors for public traders to offset their positions prior to the delivery month. However, no significant pricing effects are found from large positions relative to deliverable supply. Thus, there is evidence of market illiquidity near expiration, but no evidence of widespread market squeezes.

The analysis of abnormal market returns prior to and after the liquidation order indicates that the liquidation order had significant effects and that default premiums were present. These significant price changes associated with the CBOT's disciplinary action highlight the importance of limited use of emergency powers (i.e., the use of emergency powers only when a manipulation attempt is imminent). Finally, the examination of open interest and volume indicates that the liquidation order had a significant negative short-term impact on open interest, as expected. However, no evidence of a negative long-term impact is detected.

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