The Review of Futures Markets, Vol. 6, No. 2 , 1987

Futures Funds and Price Volatility*

B. Wade Brorsen
Assistant Professor
of Agricultural Economics
Purdue University

Scott H. Irwin
Assistant Professor
of Agricultural Economics
The Ohio State University

*This research benefited from a grant provided by the Chicago Board of Trade.

Futures funds, which pool investors' money to speculate in futures markets under the guidance of a professional trader, have become popular in recent years. Public futures funds grew from $7.2 million to $435.1 million over the period January 1975-March 1984 [Irwin and Brorsen]. Currently, public and private funds have been estimated to control $1.5 billion [Laing]. Because of this growth and fund managers' reliance on technical trading systems, concern has been expressed about the ability of futures funds to distort price movements. For example, the *Kiplinger Agricultural Letter* argued, "There's a need to determine if prices are distorted by managed accounts and computer trading pools. Is it possible such vast chunks of capital are causing the market to swing excessively . . . one direction or another?" Arnold Mergell, International Association of Seed Crushers, has argued, "What one should probably recognize is that as the volume of these funds increases further so does the risk that they will move prices more and for longer periods and introduce a new dimension of uncertainty for ordinary commercial operations." The research reported in this paper seeks to determine whether futures funds, through their reliance on trading systems, have distorted futures price movements. This is accomplished by determining the relationship between the relative size of technical trading by futures funds and the "volatility" of futures markets.

Past research on this issue has primarily consisted of questioning experts. Hearings held in April 1984 by the Joint Economic Committee of Congress produced diverse testimony. John Frazier, Frazier-Parrott Commodities, argued, 'A large proportion of the total speculative trade appears to be coming from pools or combinations of accounts which while endeavoring to be 'unique,' tend to give buying and selling signals at approximately the same time." He further argued, "Markets from time to time are being subjected to unprecedented waves of one way buying or selling followed by sharp reversals when participants try to take profits or limit losses following various indications which tend to give the same signals at the same time." In contrast, Robert Kohlmeyer, Cargill, Inc., speculated, "The effects of systems trading generally are limited to a very short time—a few minutes, an hour, perhaps a day."

Hartley, Baratz, and *Commodities* also questioned experts concerning the effect system trading had on futures prices. Some traders Hartley surveyed denied existence of the problem, some recognized it but considered it inconsequential, while others considered it "healthy." Hartley concluded, "Agreement seems to be that as a result of trend-identifying, risk-limiting systems, market run-ups are faster and price adjustments are sharper." Baratz also found divergent responses. Gordon L. Rausser, trading advisor for Creston Commodities, stated, "I would say yes, trend followers do affect prices because most systems, even though they are using different parameters, will end up with stop-losses or buy points at roughly the same level. This creates huge moves in the market that lead to instability." On the other hand, Donald Braverman, Rosenthal and Company, said, "Any impact of trend followers will be an aberration, which will be straightened out immediately by the market. . . . There may be a momentary push up or down, but price will fall to volume. . . . " In conclusion, Baratz doubted trendist traders exhibited herdlike behavior and caused significant price distortions. *Commodities* found opinions as widespread as in the previous surveys and offered no conclusion, apparently due to the lack of persuasive arguments one way or the other.

Marshall conducted the only quantitative study on this topic. He divided the 1967-1980 period into a "pretechnical" 1967-1973 period and a "posttechnical" 1974-1980 period. Marshall concluded that increased price variability and departures from randomly ordered sign changes were associated with futures traders increased reliance on technical methods of price analysis. Unfortunately, the quantitative link was quite weak, owing to Marshall's lack of an accurate measure for technical system usage. Furthermore, his model did not control for other factors that might affect variance.

This paper uses an improved measure for technical system usage. A regression framework is used that controls for other factors that might affect variance. This paper is the first to estimate the size of positions held by futures funds relative to other trading. Results from a survey of futures fund managers provide descriptive statistics that are useful in understanding how funds are operated.

The next section reviews the theoretical work that has hypothesized how the use of technical analysis would affect market prices. Results of a survey of futures fund managers are used to provide estimates of the percent of open interest controlled by futures funds. The data and methods used to test hypotheses about the effects of technical trading on futures price movements are then discussed, and results are used to draw implications about the need for regulation.

Theoretical Considerations

Working [1977a, p. 192] argued that, "We must start from a demonstrated fact that futures prices tend to be sluggish; that as a rule their price changes, other than those involved in their tiny jiggles, tend to be gradual and *not* followed by reaction." This would imply that trading using trend-following systems might be profitable. This is in contrast to the efficient market hypothesis that implies successive price movements are random and, thus, technical analysis would not be profitable [Samuelson; Fama]. Even Working [1977b, p. 205] argued that changes in prices are very nearly random.

Empirical work seems to support Working on both counts. Prices do very nearly follow a random walk, but there is sufficient sluggishness for technical analysis to be profitable [Irwin and Uhrig; Peterson and Leuthold; Irwin and Brorsen].

The tendency for markets to be in disequilibrium in the very short run has been recognized in recent theoretical work on the microstructure of markets (Black; Cohen et al.; Oldfield et al.). Murphy argued that price adjustments could not be instantaneous since no single trader possesses complete information. Grossman and Stiglitz suggested that speculative markets are constantly being subjected to information shocks and prices never fully reflect all information because of the costs of acquiring, evaluating, and adjusting to the new information.

Beja and Goldman proposed a theoretical model in which disequilibrium conditions present opportunities for "trading on the trend in prices." In their model, prices move sluggishly from one equilibrium to another due to market "imperfections." They showed that technical trading may be beneficial during disequilibrium periods because such trading may force prices to converge quicker to an equilibrium. This assumes technical traders are, on average, correct in their assessment of price trends. Beja and Goldman also showed that too much technical trading could cause changes unrelated to the fundamental (supply and demand) equilibrium even if technical traders were correct about the trend in prices. Thus, excessive trendist trading could result in oscillations that would increase the volatility of prices.

Thus, whether increased technical trading through large pools is good or bad is basically an empirical question. Theoretical models suggest technical traders may serve a legitimate function. However, the same models suggest the possibility of a need to regulate the size of technical trading relative to other trading in order to prevent oscillations.[1]

Results of the Trading Advisor Survey

The 32 largest public futures fund advisory groups were surveyed in February 1986 in order to better specify the measure of the size of the positions held by funds in each contract and investigate the similarity of the techniques used by fund advisors. The 32 advisors represented 50 percent of all advisors listed in the "Funds Review" of *Futures* in December 1985. These advisors managed slightly less than 80 percent of the public futures funds listed. Twenty-one of those surveyed responded. (A copy of the survey form can be obtained from the authors.)

The first section of the survey asked questions regarding the personal characteristics of the advisors. Those responding averaged 42 years of age, with the youngest being 29. Fund managers are highly educated. Of the 25 individuals responding (some funds are comanaged), all had attended college and only four did not have degrees. Seven had doctorates. Most of the advisors had degrees in business, engineering, physics, or mathematics.

The second section of the survey asked questions regarding the trading techniques used by the advisors. Thirteen of the 21 advisors relied totally on computer-guided technical trading systems. Only two used no objective technical analysis. The advisors used trading systems in a variety of ways. Nine used a single system while 10 used multiple systems. One advisor relied on eight different technical trading systems. Over half (11 of 19) have changed their systems during the time they have been trading, but one did note that the original system was still the same and that he had merely added systems. Those that did change systems averaged changing slightly more

[1]There may never be any need for governmental regulation. The futures markets should regulate the size of technical trading. If technical trading gets too large and prices oscillate, returns to technical trading may drop and money would be withdrawn from futures funds.

often than once every two years. Thus, some have changed systems frequently.

Six of the 19 used the same parameters across all of the commodities they traded (e.g., used a four-week channel system in all commodities). All six of these advisors and two others reported never changing their parameters once they were selected. Only four did not select their parameters by optimizing over historical data. Thus, if advisors use the same or similar systems, they may have similar parameters if they selected them in the same way. But, of those that changed their parameters, some changed them twice a year, while some did so as little as every five years. The advisors also used different amounts of historical data to select their parameters. The smallest amount of data used was two years, the most frequent was five years (five advisors) and some mentioned they used all the historical data they had available. Since the advisors select their parameters in different ways, they are quite unlikely to be trading exactly the same, but they may still trade similarly.

The third and final section of the survey examined the procedures used for allocating fund equity across futures contracts and the actual contracts traded over 1978 through 1984. Because of liquidity costs, these funds concentrated their trading in the nearby contract. The funds held 80 percent of their position in the nearby contract with most of the rest presumably in the next maturity month. The prospectuses of most funds suggest about 30 percent of the funds' equity will be invested in margins. The advisors reported averaging slightly less with 27.7 percent invested in margins. This is larger than the 19.8 percent equity invested in margins reported by Cornew. The advisors, however, do not use margins to decide how to allocate their investments across the commodities. Three simply held equal numbers of contracts in each commodity. The rest made an adjustment for volatility. Nine held positions with equal variance across commodities, thus holding larger positions in the less volatile commodities. The rest used a similar approach except they based their allocation on a trade-off between risk and reward.

Table 1 shows that most funds tended to trade the same commodities over time. The percentages are based on the survey responses of the 18 advisors who indicated they relied at least 50 percent on technical analysis. As Table 1 shows, the average number of commodities traded has remained fairly constant through time. However, there has been some dilution over time since new contracts have been added and funds continued to trade about the same number of commodities. Table 1 also shows a growth in the participation of the funds in the financial futures. Most funds trade in each of these 10 large markets. Very few funds traded in the smaller-volume markets, such as orange juice, Mexican peso, and Kansas City wheat (Table 2).

Table 1. Percent of technically traded public futures funds actively trading in the 10 commodities studied

Commodity	Year 1978	1980	1982	1984
Live cattle	100	100	81	67
Cocoa	83	100	81	72
Copper	100	100	94	83
Corn	83	88	94	89
Soybeans	100	100	94	89
Wheat (Chi)	100	100	94	83
Sugar	100	100	100	94
Deutsche marks	83	78	100	94
T-bills	0	44	81	72
T-bonds	0	67	88	78
Number of commodities traded	24.0	22.6	21.8	24.5
Number of observations	6	9	16	18

Source: Survey results

Table 2. Percent of technically traded public futures funds actively trading in commodities not studied

Commodity	Year 1978	1980	1982	1984
Coffee	0	44	63	72
Cotton	100	100	100	83
Feeder cattle	33	33	38	28
Gold (NY) - CMX	83	89	100	94
Heating oil	0	22	63	72
Live hogs	100	100	81	61
Lumber	50	44	25	44
Oats	33	11	19	11
Orange juice	33	11	19	17
Platinum	50	56	63	56
Western plywood	50	33	0	0
Pork bellies	100	78	63	61
Potatoes (Maine)	0	0	0	0
S&P 500	0	0	31	44
Silver (NY) - CMX	67	56	69	67
Soymeal	83	67	88	94
Soyoil	83	89	88	83
Wheat (KC)	0	0	13	11
British pounds	83	67	100	94
Canadian dollars	67	56	63	38
Japanese yen	67	67	94	89
Mexican pesos	0	0	6	6
Swiss francs	83	67	94	89
Ginnie Maes	17	56	69	39

Source: Survey results

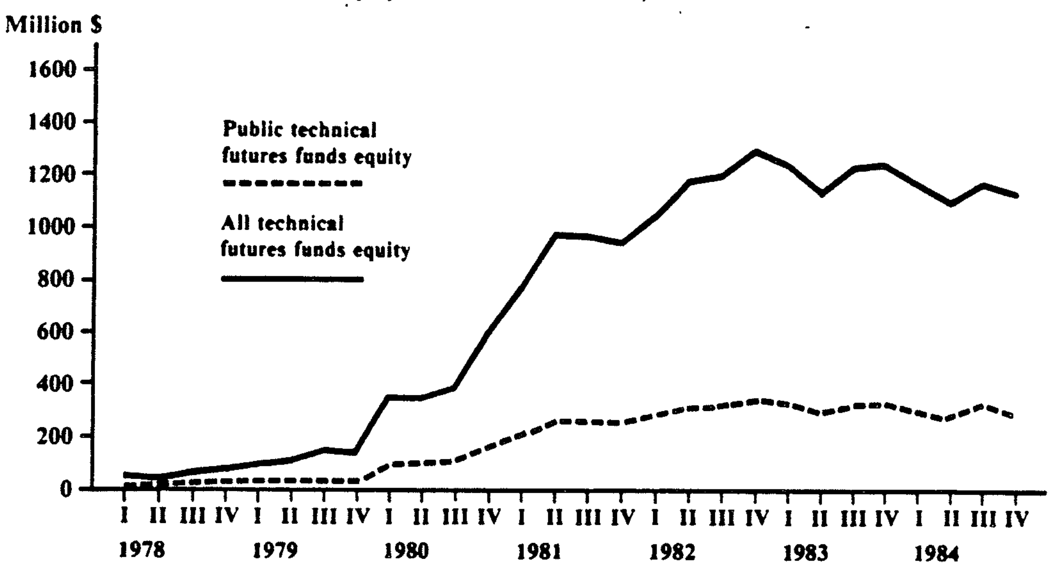
The Size of Futures Fund Trading

The starting point for estimating the positions held by futures funds in futures contracts over 1978 through 1984 was the total equity in these funds. The total equity was estimated using data from two sources. First, Irwin and Brorsen [1985] have calculated the total equity in public futures funds from 1978 through 1984. Second, the National Futures Association (NFA) has surveyed commodity pool operators and, as of September 30, 1985, estimated $1.5 billion of equity in all futures funds, public and private. The ratio of total futures fund equity from the NFA survey on September 30, 1985, to the total public futures fund equity on December 31, 1984, was assumed to be valid for the entire 1978 through 1984 period.[2] The ratio (3.71) was then applied to the public futures fund equity series to estimate a total (public and private) futures fund equity series. Finally, the proportion of technical public futures fund equity over 1978 through 1984 was assumed to apply to the estimated total equity series.

Figure 1 presents the estimated equity for technical futures funds over 1978 through 1984. The top line is the estimate for all futures, which was relatively small, under $200 million, until 1980. Estimated equity increased from $143.9 at the beginning of 1980 to $1,304.9 million at the end of 1982. Thereafter, equity declined to $1,143.5 million at the end of 1984. To better understand the potential ability of futures funds to affect price behavior, estimates of their relative importance are needed.

The equity devoted by futures funds to the nearby contract in each commodity is estimated as,

Figure 1. Equity of technical futures funds, 1978-1984



[2]The lag between the two dates could potentially introduce some bias into the calculations. However, aggregate returns were −1.6 percent and only four new funds were started during the January through September 1985 period. Thus, the ratio of total to public futures fund equity was relatively constant over the indicated period.

$$\text{Equity} = \text{Technical Fund Equity} \times \%\ \text{Nearby} \times \%\ \text{Invested} \div \text{Total Commodities Traded} \times \%\ \text{Funds Trading Commodity} \quad (1)$$

The 10 commodities considered are live cattle, cocoa, copper, corn, soybeans, Chicago wheat, sugar, Deutsche mark, 90-day U.S. Treasury bills, and long-term U.S. Treasury bonds. The fund managers reported that they did not allocate their funds based on margins, but, rather, based on volatility. Yet, it is generally accepted that exchanges also attempt to base margins on volatility. Table 3 shows quarterly average initial speculation margins for the 10 commodities. These data show that most exchanges keep margins constant over long periods of time and change them irregularly. Since changes are infrequent, some changes are quite large. This irregular movement in margins may explain why fund managers use their own measures of volatility to allocate their funds. But, the average margins over the 1978-1984 period may provide good estimates of the relative risk associated with each contract. These averages are reported in Table 4. Margins are not adjusted for inflation, since commodity prices have not experienced the same price increases that have been present in the general economy. Margins in 1978I averaged $1,325 per contract while they were $1,250 per contract in 1984IV which suggests nominal margins are appropriate. Margins as a percent of contract value are higher for the more volatile markets such as cocoa and sugar and lowest for U.S. Treasury bills. Thus, average margins appear to be an appropriate measure of relative volatility. The number of contracts held by futures funds are estimated by taking the estimated equity devoted to each commodity from Equation 1 and dividing by the average margins in Table 4.

Table 3. Average quarterly initial speculation margins for futures contracts ($/contract)

Year	Quarter	Commodity: Corn	Soybeans	Wheat	T-Bonds	Live cattle	T-Bills	D-mark	Cocoa	Sugar	Coffee
1978	I	750	2500	1000	1250	916	1113	1500	2000	1466	750
	II	750	2994	1000	1250	1200	1000	1500	2000	1200	750
	III	660	2551	1000	1250	1200	915	1913	2000	1126	750
	IV	600	2250	1000	1250	1200	800	2032	2000	1628	750
1979	I	600	2566	1000	1250	1200	800	2466	2000	1800	883
	II	600	2709	1110	1148	1200	800	2000	2000	1800	1000
	III	600	3276	1250	1000	1200	800	1630	2000	1800	1048
	IV	600	2500	1250	1896	1200	1332	1500	2000	1800	2500
1980	I	600	1811	1250	2183	1200	1500	1500	2000	3013	3933
	II	600	1500	1250	2346	1200	1500	1500	2000	5472	1898
	III	600	2087	1250	2000	1200	1500	1500	2000	7130	1215
	IV	600	2250	1250	2000	1200	1500	1500	1766	7543	1080
1981	I	600	2250	1250	2000	1200	1500	1500	1363	4761	891
	II	600	1887	1129	2000	1200	1741	1500	1180	2532	730
	III	600	1500	1000	2000	916	2000	1500	1456	1213	760
	IV	600	1500	1000	2000	900	2000	1500	1500	1809	900
1982	I	600	1500	914	2000	900	2000	1500	1500	1396	726
	II	567	1500	750	2000	900	2000	1500	1351	1101	748
	III	500	1500	750	2853	900	2201	1500	1000	1000	867
	IV	500	1500	750	3000	900	2500	1500	861	804	860
1983	I	500	1500	750	3000	900	2388	1500	1086	750	851
	II	500	1500	750	2384	900	1500	1500	1777	1052	769
	III	801	2559	750	1608	900	1500	1500	2000	1500	1100
	IV	1070	2500	750	1500	900	1500	1500	1711	1315	1186
1984	I	800	2500	750	1300	900	1461	1500	1980	937	600
	II	750	2500	750	902	900	1000	1500	1497	800	539
	III	1173	2500	750	2500	900	1000	1500	1250	715	700
	IV	1591	2059	661	2500	645	1000	1500	1250	600	700

Source: Compiled from unpublished data from the respective futures exchanges

Table 4. Average exchange margins for speculative positions, 1978–1984

Commodity	Average margin	Percent of contract value
Live cattle	$1031.4	4.0
Cocoa	1661.9	11.5
Copper	1053.4	5.5
Corn	689.8	4.7
Soybeans	2134.0	6.0
Wheat (Chi)	966.6	5.0
Sugar	2074.0	14.2
D. marks	1590.8	2.8
T-bills	1459.1	0.16
T-bonds	1870.5	2.5

Source: Compiled from unpublished data provided from the respective futures exchanges

Table 5 shows these estimates as a percent of open interest in the nearby contract for the fourth quarter of 1984. Public and private technically traded futures funds are estimated to control an average of 23 percent of total open interest. Thus, if all funds traded alike, they could control approximately one fourth of one side of the market. Public funds alone would only control an average of 7 percent of open interest. These funds control an even higher percent of speculative open interest. The estimates presented in Table 5 are only rough approximations of true relative positions of technically managed futures funds. The only comparable evidence is for a single day. Jaffe and Hobson reported the results of a survey conducted by the Commodity Futures Trading Commission concerning all open positions in interest-rate futures markets as of March 30, 1979. The survey results showed that all "commodity pools and funds" could have held 42 and 37 percent of one side of the market across all contract months in the Treasury bond and Treasury bill markets. The comparable figures using Equation 1, the 1980 percent of funds trading these commodities, and total futures fund equity for the first quarter of 1979 are 16.4 and 9.2 percent of the open interest in the nearby Treasury bond and bill contracts, respectively. Thus, Jaffe and Hobson's results suggest that futures funds may be an even larger part of the market than our estimates suggest.

Table 5. Estimates of the percent of open interest in the nearby contract held by technically traded futures funds in 1984

Commodity	Public funds only (%)	Public and private funds (%)
Live cattle	9	31
Cocoa	11	41
Copper	6	21
Corn	5	18
Soybeans	4	13
Wheat	12	41
Sugar	4	14
Deutsche marks	7	26
T-bills	6	23
T-bonds	2	6
Average	7	23

Note: These percents estimate the percent of one side of the market that funds could control if funds were all short or all long.

It should be noted that the research of Lukac et al. suggests different trading systems with parameters selected in the same manner are only on the same side of the market about 70 percent of the time and most trades are not signaled on the same day. Thus, the ability of these funds to influence prices is likely diluted since they do not always trade the same way. On the day sampled by Jaffe and Hobson, funds long and short positions were nearly equal for Treasury bonds and Treasury bills. But, in the CD GNMA contract, funds held 78 percent of the long positions and only 3 percent of the short positions. The next section explains the procedures used to test if funds are a large enough force to distort prices.

Procedure

The effect of technically traded futures funds on price volatility is tested for the 10 commodities. Price volatility is measured in two ways: (1) average daily range and (2) standard deviation.[3] A quarterly model for 1978-1984 is used and volatility is measured in percentage terms. The measure of the daily range is the quarterly average of the difference between the daily high and low prices divided by the average price level for the quarter. The standard deviation is calculated using daily log changes. In all cases, only prices for the nearby contract were used.

Two different regression models are used which correspond to the models of Anderson and Peck. Anderson included dummy variables for year and seasonality in addition to a time-to-maturity variable that is not needed here. Peck used a more heuristic approach with a measure of long-term price volatility as an independent variable. Choi and Longstaff argue that the price level should also be included. The two models considered are

$$V_i = \alpha_0 + \sum_{j=1}^{6} \alpha_j D_j \alpha_7 P_i + \alpha_8 T\text{trade} \qquad i = 1,2 \tag{2}$$

$$V_i = \gamma_0 + \gamma_1 LV + \gamma_2 P_i + \gamma_3 T\text{trade} \qquad i = 1,2 \tag{3}$$

where α and γ are parameters, V_1 = daily range and V_2 = standard deviation, D_j is a dummy variable for year, P is the price level, Ttrade is the measure of the relative size of futures trading, and LV is a measure of long-term volatility. Seasonal dummies were also included in the equations for corn, soybeans, and wheat. The variable Ttrade is millions of dollars invested in technically traded futures funds divided by open interest in the nearby contract in the quarter. This proxy is valid assuming public and private futures funds have grown proportionally and that the allocation of funds across contracts has not changed over time. The measure of long-term volatility (LV) is the range of prices within the quarter divided by the average price level within the quarter.

Regression Results

Most of the coefficients for the measure of the relative importance of technical trading are not significant. Conclusions in regard to the effects of technical trading are quite similar for the two measures of volatility, but not for the two regression models (Tables 6-9). Only one of the 20 equations shows a significant effect of technical trading with the dummy variable model, while 7 of 20 coefficients for the measure of technical trading are significant in the regressions that use the measure of long-term volatility. The yearly dummies are significant in 8 of the 20 equations. The measure of long-term variability is significant in all but the two equations for cocoa. The price level is significant about half the time, but the sign of its coefficient varies across commodities.

[3]Variance was also used as a third measure, but the results were essentially the same as for the standard deviation. Kurtosis, average price change, first-order autocorrelation, and the sum of one-day through five-day autocorrelations were also used as dependent variables, but the amount of technically traded futures funds was not significantly related to any of these measures more often than would randomly be expected.

Table 6. Estimated regression equations for quarterly average daily range of futures prices using annual dummy variables[a]

Commodity	Independent variables: Intercept	Annual dummies	Seasonal dummies	Price level	Ttrade[b]	R^2
Live cattle	.018		—	−.075	−.172	.76
	(1.57)	[1.46]		(−.51)	(−.86)	[7.67]**
Cocoa	.025**		—	−.009	−.063	.40
	(4.33)	[.64]		(−.23)	(−.31)	[1.57]
Copper	.011		—	.198	−1.047**	.77
	(1.01)	[3.25]**		(1.57)	(−2.21)	[8.12]
Corn	.003			.030	−.588	.72
	(.38)	[1.65]	[8.08]**	(1.66)	(−.74)	[3.77]**
Soybeans	−.019			.044**	.492	.73
	(−1.06)	[1.55]	[1.91]	(3.28)	(.57)	[3.87]**
Wheat	.001			.031	−.094	.63
	(.11)	[.83]	[1.35]	(1.37)	(−.30)	[2.51]**
Sugar	.028**		—	.152	.244	.59
	(5.15)	[1.54]		(.43)	(.53)	[3.46]**
Deutsche marks	.009**		—	−.007	−.062	.75
	(2.13)	[5.29]**		(−.07)	(−.67)	[7.20]
T-bills	.020*		—	−.200*	−.038	.88
	(2.02)	[8.53]**		(−1.86)	(−.62)	[17.04]**
T-bonds	.023**		—	−.236**	.271	.90
	(3.21)	[10.64]**		(−2.10)	(.78)	[20.73]**

[a] The values in brackets are F-values and those in parentheses are t-values. One asterisk denotes significance at the 10 percent level and two asterisks denote significance at the 5 percent level using a two-tailed test.

[b] Ttrade is the total equity in technically traded public futures funds ($ million) divided by average open interest in the nearby futures contract.

Table 7. Estimated regression equations for the standard deviation of futures prices using annual dummy variables[a]

Commodity	Intercept	Annual dummies	Seasonal dummies	Price level	Ttrade[b]	R^2
	Independent variables					
Live cattle	1.81		—	−12.42	−16.72	.73
	(1.69)	[1.65]		(−.89)	(−.88)	[6.26]**
Cocoa	1.96**		—	.25	−1.80	.31
	(3.42)	[.51]		(.07)	(−.09)	[1.07]
Copper	.023		—	29.47*	−64.92	.72
	(.02)	[2.32]*		(2.01)	(−1.18)	[6.18]**
Corn	.51			1.82	−58.85	.72
	(.76)	[1.31]	[9.08]**	(1.16)	(−.85)	[3.82]**
Soybeans	−2.10			4.13**	60.18	.78
	(−1.55)	[1.91]	[3.35]**	(3.91)	(.90)	[5.10]**
Wheat	.20			2.06	−8.10	.62
	(.23)	[.34]	[.81]	(1.01)	(−.29)	[2.33]*
Sugar	2.38**		—	3.58	33.07	.61
	(4.24)	[1.49]		(.10)	(.86)	[3.67]**
Deutsche mark	.26		—	13.26	−.44	.55
	(.47)	[3.26]**		(.93)	(−.04)	[2.94]**
T-bills	1.81**		—	−18.59**	−2.41	.89
	(2.44)	[9.00]**		(−2.29)	(−.52)	[19.07]
T-bonds	1.91**		—	−19.18*	17.70	.87
	(3.17)	[7.47]**		(−2.05)	(.61)	[16.54]**

[a]The values in brackets are *F*-values and those in parentheses are *t*-values. One asterisk denotes significance at the 10 percent level and two asterisks denote significance at the 5 percent level using a two-tailed test.

[b]Ttrade is the total equity in technically traded public futures funds ($ million) divided by average open interest in the nearby futures contract.

Table 8. Estimated regressions for quarterly average daily range of futures prices using a measure of long-term variability[a]

	Independent variables					
Commodity	Intercept	Quarterly range (%)	Seasonal dummies	Price level	Ttrade[b]	R^2
Live cattle	.016**	.016*	—	−.016	−.323**	.69
	(2.93)	(1.74)		(−.22)	(−4.77)	[18.07]**
Cocoa	.024**	.003	—	−.035	−.026	.33
	(7.34)	(1.33)		(−2.04)	(−.34)	[3.86]**
Copper	.0003	.027**	—	.174**	−.043	.64
	(.08)	(2.61)		(2.70)	(−.25)	[14.40]**
Corn	.004	.021**		.022**	−.387**	.67
	(1.44)	(2.41)	[3.80]**	(2.33)	(−2.14)	[7.09]**
Soybeans	−.002	.025**		.023**	−.144	.65
	(−.40)	(2.31)	[.91]	(2.72)	(.36)	[6.63]**
Wheat	.009**	.019**		.014	−.259**	.64
	(2.43)	(2.67)	[1.38]	(1.60)	(−3.21)	[6.23]**
Sugar	.013**	.032**	—	.157	.356*	.59
	(4.60)	(3.38)		(1.05)	(1.82)	[11.52]**
Deutsche mark	.007**	.025**	—	−.080**	.037	.49
	(3.41)	(2.70)		(−2.08)	(1.26)	[7.73]**
T-bills	.034**	.047**	—	−.366**	−.004	.86
	(4.75)	(7.28)		(−4.70)	(−.21)	[48.77]**
T-bonds	.010**	.071**	—	−.099**	.151	.88
	(2.68)	(8.05)		(−2.55)	(.62)	[58.07]**

[a]The values in brackets are F-values and those in parentheses are t-values. One asterisk denotes significance at the 10 percent level and two asterisks denote significance at the 5 percent level using a two-tailed test.

[b]Ttrade is the total equity in technically traded public futures funds ($ million) divided by average open interest in the nearby futures contract.

Table 9. Estimated regressions for quarterly standard deviation of futures prices using a measure of long-term variability[a]

Commodity	Independent variables: Intercept	Quarterly range (%)	Seasonal dummies	Price level	Ttrade[b]	R^2
Live cattle	1.37**	1.484	—	−3.47	−25.27**	.63
	(2.56)	(1.70)		(−.50)	(−3.83)	[13.43]**
Cocoa	2.04**	.031	—	−2.65	−.63	.20
	(6.21)	(.14)		(−1.53)	(−.08)	[2.02]
Copper	−.17	3.509**	—	14.80**	8.23	.69
	(−.41)	(3.64)		(2.35)	(.50)	[17.82]**
Corn	.29	2.028**		1.96**	−30.25*	.72
	(1.21)	(2.87)	[4.93]**	(2.52)	(−2.04)	[8.99]**
Soybeans	−.50	2.610**		2.15**	−6.85	.73
	(−1.11)	(3.07)	[.88]	(3.27)	(.59)	[9.60]**
Wheat	.64**	1.85**		1.21	−24.82**	.69
	(2.07)	(3.15)	[1.06]	(1.65)	(−3.76)	[7.84]**
Sugar	.09**	3.725**	—	18.91	26.89	.67
	(3.26)	(4.26)		(1.35)	(1.48)	[16.34]**
Deutsche marks	.40*	3.771**	—	−1.95*	.72	.47
	(1.88)	(4.09)		(−.52)	(.25)	[6.97]**
T-bills	2.98**	3.28**	—	−31.87**	−.211	.82
	(−4.60)	(5.66)		(−4.55)	(−.11)	[35.91]**
T-bonds	.96**	4.677**	—	−9.68**	20.73	.83
	(2.93)	(5.86)		(−2.74)	(.94)	[38.08]**

[a]The values in brackets are F-values and those in parentheses are t-values. One asterisk denotes significance at the 10 percent level and two asterisks denote significance at the 5 percent level using a two-tailed test.
[b]Ttrade is the total equity in technically traded public futures funds ($ million) divided by average open interest in the nearby futures contract.

The relative size of technical trading has a negative impact on volatility in all but one case (sugar) when significant. The growth of funds has been associated with a decrease in volatility for live cattle, copper, corn, and wheat. These four commodities along with soybeans have restrictive position limits while the other commodities do not. These markets may be less efficient because of the position limits and, thus, the funds help stabilize these markets. Alternatively, the position limits may prevent funds from controlling large enough positions to disrupt markets (most funds are not restricted by these limits). These results suggest that futures funds either have no effect on volatility or have a beneficial effect by reducing volatility. Thus, these results do not signal the need for regulation of futures funds.

Summary and Conclusions

This paper sought to determine if the growth of futures funds had influenced the volatility of futures prices. Theoretical models suggest that the technical trading systems upon which these funds rely can improve the efficiency of markets by speeding up price adjustments. But, too much technical trading may cause prices to oscillate and, thus, increase price volatility.

Futures fund managers were surveyed to learn more about how they use trading systems and to estimate the number of contracts that funds control.

Futures fund managers have frequently changed systems, use different numbers of systems, and select the parameters for their systems in different ways. Thus, fund managers do not trade in exactly the same way, but they still may trade similarly. Public and private technically traded futures funds were estimated to control an average of 23 percent of the open interest in 10 important futures markets. Thus, the funds are large enough to move prices if they acted in unison.

Most of the regression coefficients measuring the effect of the measure of technical trading on price volatility were not significant. The coefficients that were significant suggested that increased technical trading reduced volatility. This suggests that technical trading may have improved the performance of these markets. Technical trading may influence prices. But, these results suggest that regulating the size of technical trading would not reduce price volatility.

References

Anderson, Ronald. "Some Determinants of the Volatility of Futures Prices." *Journal of Futures Markets* 5(Fall 1985), pp. 331-48.

Baratz, Morton. "Do Trend Followers Distort Prices?" *Managed Account Reports* Issue No. 43(September 1982), pp. 9-12.

Beja, A., and M.B. Goldman. "On the Dynamic Behavior of Prices in Disequilibrium." *Journal of Finance* 34(1980), pp. 235-47.

Black, S.W. "Rational Response to Shocks in a Dynamic Model of Capital Asset Prices." *American Economic Review* 66(1976), pp. 767-79.

Choi, Jin W., and Francis A. Longstaff. "Pricing Options on Agricultural Futures: An Application of the Constant Elasticity of Variance Option Pricing Model." *Journal of Futures Markets* 5(Summer 1985), pp. 247-58.

Cohen, Kalman J., Gabriel A. Hawawini, Steven F. Maier, Robert A. Schwartz, and David K. Whitcomb. "Implications of Microstructure Theory for Empirical Research on Stock Price Behavior." *Journal of Finance* 35(1980), pp. 249-57.

Cornew, Ronald W. "Note on Initial Margin to New Asset Values: Average Values for the Commodity Pool Industry." *Journal of Futures Markets* 6(Fall 1986), pp. 495-502.

"Do Trend Followers Distort Prices?" *Commodities*, June 1983, pp. 58-59.

Fama, E.F. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Business* 25(1970), pp. 383-417.

Frazier, John H., Jr. "Statement of John H. Frazier, Jr., Chairman, Frazier-Parrott Commodities, Inc." U.S. Congress Joint Economic Committee, April 25, 1984.

Grossman, S.J., and J.E. Stiglitz. "On the Impossibility of Informationally Efficient Markets." *American Economic Review* 70(1980), pp. 393-408.

Hartley, Philippe B. "How Computer Systems Affect the Market." *Commodity Journal* (July-August 1979), pp. 9, 11.

Irwin, Scott H., and B. Wade Brorsen. "Public Futures Funds." *Journal of Futures Markets* 5(Fall 1985), pp. 463-85.

Irwin, Scott H., and J.W. Uhrig. "Do Technical Analysts Have Holes in Their Shoes?" *Review of Research in Futures Markets* 3(3)(1984), pp. 264-77.

Jaffe, Naomi L., and Ronald B. Hobson. "Survey of Interest Rate Futures Markets." Commodity Futures Trading Commission, Division of Economics and Education, December 1979.

Kiplinger Agricultural Letter Vol. 55, No. 10, May 11, 1984.

Kohlmeyer, Robert. "Improving the Efficiency of Futures Markets." Testimony before U.S. Congress Joint Economic Committee, April 25, 1984.

Laing, Jonathan R. "$200 Million Swinger." *Barron's* (February 17, 1986), pp. 8-9, 35-36, 38.

Lukac, Louis P., B. Wade Brorsen, and Scott H. Irwin. "Similarity of Computer Guided Technical Trading Systems." Center for the Study of Futures Markets Working Paper #CSFM-124, March 1986.

Marshall, John F. "The Impact of Technical Trading on Futures Prices: Some Empirical Evidence." Unpublished manuscript, St. John's University, January 1983.

Mergell, Arnold F. "Improving the Efficiency of Commodity Futures Markets." Testimony before U.S. Congress Joint Economic Committee, April 25, 1984.

Murphy, R. *Adaptive Processes in Economic Systems.* New York: Academic Press, 1965.

Oldfield, George S., Jr., Richard J. Rogalski, and Robert A. Jarrow. "An Autoregressive Jump Process for Common Stock Returns." *Journal of Financial Economics* 5(1977), pp. 389-418.

Peck, Anne E. "The Adequacy of Speculation on the Wheat, Corn, and Soybean Futures Markets." *Research in Domestic and International Agribusiness Management* 2(1981), pp. 17-29.

Peterson, P.E., and R.M. Leuthold. "Using Mechanical Trading Systems to Evaluate the Weak Form Efficiency of Futures Markets." *Southern Journal of Agricultural Economics* 14(1982), pp. 147-52.

Samuelson, P.A. "Proof that Properly Anticipated Prices Fluctuate Randomly." *Industrial Management Review* 6(1965), pp. 41-50.

Working, Holbrook A. "Price Effects of Scalping and Day Trading," In *Selected Writings of Holbrook Working*, ed. Anne E. Peck. Chicago: Chicago Board of Trade, 1977a, pp. 181-94.

———. "Tests of a Theory Concerning Floor Trading on Commodity Exchanges," In *Selected Writings of Holbrook Working*, ed. Anne E. Peck. Chicago: Chicago Board of Trade, 1977b, pp. 195-239.