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Does the Tail Wag the Dog?: Stock Index Futures

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Abstract

This paper investigates the impact of the trading of stock index futures on the underlying stocks in the cash market. The Tail Wagging the Dog Effect is evaluated by looking at the relationship between the change in futures prices and the subsequent change in the spot index. Additionally, the crises at expiration phenomena of the impact of the expiration of the futures contracts on the underlying index is evaluated.

Using intraday futures price data for the Major Market Index which were traded on the Chicago Board of Trade, during the period 23 August 1984 to 15 August 1986, a significant relationship between changes in futures prices and subsequent changes in the spot index were found; the tail does wag the dog. For the Major Market Index, the tail wagging the dog effect was particularly strong during the expiration month and week, supporting the notion of the crises at expiration.

Does the Tail Wag the Dog?: Stock Index Futures

The rise in program trading based on a comparatively narrow blue chip stock market barometer, the Major Market Index (MMI), is said to be fueling the volatile price swings in the stock market, a case of the tail wagging the dog. The MMI is a price-weighted index of 20 very actively traded stocks, 16 of which are included in the Dow Jones 30 Industrials. Because of its relatively small size, the MMI is expected to be more easily arbitragible than other stock index futures contracts. Basically program trading is taking a position (long or short) in a portfolio of stocks comprising the index and simultaneously taking an opposite position in the index futures contracts. The objective of the program trade is to create a "risk free" position which earns a return in excess of the currently available risk free return.

These so-called program trades may move both the futures and the spot market. The chain of causality may work as follows: (1) The investors believe the stock market will rise and they purchase futures contracts in expectation of higher equity values. The purchase of futures contracts is preferable because they entail no initial investment and lower transaction costs than a position in the stock market; (2) The rise in futures prices causes an imbalance between the prices of the futures and the underlying index; as this premium between the futures and the index increases, it may become more profitable to execute a program trade, and (3) The simultaneous sale of the futures and purchase of the underlying index will cause the premium between the futures and the index to shrink. Changes in other factors, such as interest rates can also have an effect on the equilibrium relationship between the index price and the futures price, thereby changing the premium or discount between the two markets. Program traders can take advantage of any change in the spread between the markets. It does not matter what causes the change in spreads, either internal factors like changes in investor expectations or external factors such as interest rate changes. All program trading does is to bring cash and futures prices together. The program trade may be an essential mechanism which insures that the futures prices and the underlying equity prices are efficiently determined.

To date most of the literature on the impact of futures trading on the cash market have focused on the changes in spot price volatility because of the initiation or cessation of futures trading.[1] A common conclusion of these studies is that the futures market has a smoothing effect on the cash market by stabilizing the spot price. The recent uproar with the "triple witching hour" and the so-called "crises at expiration" caused by the expiration of stock index futures and options, at the close on the third Friday of March, June, September, and December brings to question the smoothing influence that futures contracts have on the underlying index.[2]

If the market is efficient, prices adjust instantaneously to reflect all relevant information and knowledge of such information cannot lead to excess risk adjusted returns. The central concept in the efficient market hypothesis is the fair game model.[3] A sequence of past returns over time is a fair game if today's price reflects the then available information, making it impossible to earn excess risk adjusted returns by trading on that information. If the information set today contains all of the information known and used by the market participants in the spot market in determining the spot price, one of the components of the information set is the previous change in the price of futures contracts.[4]

The title of this article asks the question, Does the Tail Wag the Dog? The financial press and the SEC have answered this question in the affirmative.[5] This paper investigates the impact of the futures market on the spot market, the existence of the tail wagging the dog effect, by evaluating the relationship between index futures price changes and subsequent spot index price changes. In addition, we evaluate the degree to which the expiration of the futures contract affects the underlying index. The data and methodology is discussed in the next section.

Data and Methodology

This paper uses intraday spot and futures prices of the Chicago Board of Trade's Major Market Index (MMI) and the Maxi Major Market Index (MMMI) over the period August 23, 1984-August 15, 1986.

For every reported change in the index price, the closest preceding change in the futures price was identified. The index was reported at least once every minute in some cases three or four times per minute, so that a percentage change in the index at a minimum was available for each minute of trading. The index value and the closest futures price were paired and this was the data base used in the study. For contracts that have matured, the number of observations for each contract is in the thousands.

Two regressions were run for each individual contract: (1) the relationship between the change in the spot index and the change in the closest previous futures price; and (2) a dummy variable regression on the same data controlled for the expiration week or month. A discussion of the methodology is presented in Appendix A.

Results

The detailed regression results are shown in Table I and Table II in the Appendix. The exact statistical parameters are not of paramount importance, but rather the number of contracts that showed a significant relationship and the time pattern of the results. In Exhibit 1, these results are summarized.

Exhibit I Frequency and Timing of Regression Results

	Maxi Major Market Index		Major Market Index
Number of contracts studied	11		24
Number showing significance at the 10% level	7		16
Number showing significance if results were random	1		2
Number significant before December 1985/ Number of Contracts	0/4	Number significant before April 1985/ Number of Contracts	3/9
Number significant after December 1985/Number of Contracts	7/7	Number significant after April 1985/Number of Contracts	13/15

A majority of the contracts studied showed a significant relationship between the change in the futures price and the subsequent change in the index. This supports the notion that the tail is wagging the dog. This result was present for both the Maxi and the regular MMI contracts. Of interest is the fact that when each of the contracts was first traded, there existed a period of time when there was no relationship between the change in the futures price and the subsequent change in the index. For the Maxi contract this was the first four months of trading from September to December 1985. And for the MMI during the first nine months of trading, six out of nine contracts showed no relationship between futures and subsequent spot price changes. This could indicate that either arbitrage opportunities were not available during the initial trading of the contracts or program traders were unable to immediately take advantage of the opportunities if they were available.

However, after the initial start up periods, the results indicate that there exists a strong relationship between futures and subsequent index price changes in seven out of the last seven months for the Maxi and thirteen out of the last fifteen months for the MMI contracts. These results indicate that it is reasonable to answer the question posed in the title in the affirmative, the tail is wagging the dog at least in the case of the MMI and Maxi MMI.

Given the existence of the relationship between changes in futures prices and subsequent changes in the index, we hypothesize that this relationship will be strongest during the latter part of the contract life. This is so because regardless of when the arbitrageurs execute a program trade they usually close their position at expiration or just before the contract expires. Hence we hypothesize that the coefficients β_3 and β_6 of the dummy variable regression will be significantly different from zero. This will indicate that the time one month (β_3) and one week (β_6) before expiration has a different relationship for the futures and the spot than that found over the entire life of the contract. The dummy variable regression results are shown in Table II in the Appendix. These results are summarized in Exhibit 2.

Exhibit 2 Frequency and Timing of Dummy Variable Regression Results

	Last Month	Last Week
Maxi Major Market Index		
Number of times the end of contract trading was different from rest of contract trading/ Number of contracts	2/11	2/11
Major Market Index		
Number of times the end of contract trading was different from rest of contract trading/ Number of contracts	11/24	11/24
Number significant since August 85/Number of contracts	11/12	11/12

For the Maxi MMI contract, the trading during the last week or last month of the contract appears to be the same as the trading over the life of the contract. The implication of this is that any dependencies between the futures and subsequent spot price changes are spread out across the entire trading life of a contract and not clustered during the expiration of the contract. Program traders, arbitraging the Maxi MMI appear to take positions when arbitrage opportunities present themselves and they do not necessarily wait until contract expirations before unwinding their positions.

The results for the MMI contract are different. The relationship during the last month or last week of the contract is different from the relationship found over the entire life of the contract for eleven out of the twelve contracts traded between August 1985 and July 1986. The program traders seem to take positions and systematically unwind them during the latter part of the contract's life, thereby intensifying the relationship near the contract expiration.

The difference in the behavior of the arbitrageurs trading the Maxi and MMI contracts is an area for further inquiry. The traders of the Maxi appear to trade uniformly over the contract life whereas the traders of the MMI seem to all unwind their position close to expiration.

Conclusion

We have investigated the impact of changes in futures prices on subsequent changes in spot prices, i.e., the tail wagging the dog effect, and the degree to which the expiration of a futures contract affects the underlying index price. Using intraday spot and futures prices of the Major Market Index and the Maxi Major Market Index for August 23, 1984-August 15, 1986, we have found a significant relationship between changes in futures prices and subsequent changes in spot prices; the tail does wag the dog. This is especially true during the 1985-1986 period. However for the Maxi MMI contract there is no evidence that the trading during the last week or last month is different than the trading over the entire life of the contract. For the MMI contract, the significant tail wagging the dog effect is present during the expiration month or week and this is especially true during the 1985-1986 period.

Footnotes

[1]See J. Cox, "Futures Trading and Market Information," Journal of Political Economy, Vol. 84, 1976; G. Gardner, "Futures Prices in Supply Analysis," Journal of Agricultural Economics, 1976; S. Grossman, "The Existence of Futures Markets, Noisy Rational Expectations and Informational Externalities," Review of Economic Studies, Vol. 44, 1977; S. Turnovsky, "Futures Markets, Private Storage and Price Stabilization," Journal of Public Economics, Vol. 12, 1979.

[2]See J. Finnerty and H. Park, "A Note on the Tail Wagging the Dog Effect in Stock Index Futures," The Journal of Futures Markets, forthcoming, Spring, 1987.

[3]For a review of the fair game model, see E. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," Journal of Finance 39, 1970.

[4]For a theoretical discussion of the informational content of prices, see S. Grossman, "On the Efficiency of Competitive Stock Markets Where Traders Have Diverse Information," Journal of Finance 31, 1976; K. Garbade, J. Pomrenze and W. Silber, "On the Information Content of Prices," American Economic Review 69, 1979.

[5]The most recent study on the volatility and volume behavior of futures and options around their maturity dates is Hans Stoll and Robert Whaley, "Expiration Day Effects of Index Options and Futures," unpublished manuscript, Vanderbilt University, 1986.

APPENDIX A

Research Methodology

The empirically testable form of the "tail wagging the dog effect" is:

$$\ell n \frac{S_{t+1}}{S_t} = \alpha + \beta \ \ell n \frac{F(t,T)}{F(t-1,T)} + e_t , \qquad (1)$$

where S and F represent the spot and futures prices, respectively, T represents maturity of a futures contract and e_t is assumed to have expected value of zero with constant variance. In eq. (1), $\beta = 0$, if there is no relationship between changes in future prices and subsequent changes in spot prices. Alternatively, if $\beta \neq 0$, there is an empirically determined relationship between changes in futures prices and subsequent changes in spot prices.

First, we attempt to investigate the impact of futures prices on the underlying spot prices using eq. (1). The null hypothesis to be tested would be that $\beta = 0$.

Second, the basic model in eq. (1) is modified to control for the expiration week or month to evaluate any differences in the relationship based on nearness to contract expiration as:

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_1 + \beta_1 \ \ell n \frac{F(t)}{F(t-1)} + \beta_2 D_1 + \beta_3 (D_1 \cdot \ell n \frac{F(t)}{F(t-1)}) \qquad (2)$$

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_2 + \beta_4 \ \ell n \frac{F(t)}{F(t-1)} + \beta_5 D_2 + \beta_6 (D_2 \cdot \ell n \frac{F(t)}{F(t-1)}) \qquad (3)$$

where all terms are defined as before and

D_1 is a dummy variable equal to zero for all trading days prior to the last month of trading and equal to one for all trading days during the expiration month of the contract;

D_2 is a dummy variable equal to zero for all trading days prior to the last five days of trading and equal to one for the last five trading days before contract expiration.

Table I

Regression Results*

$$\ln \frac{S_{t+1}}{S_t} = \alpha + \beta \ln \frac{F(t,T)}{F(t-1,T)} + e_t$$

Maxi Major Market Index

Contract	α	β	Adjusted R^2	Pr(β=0)[a]	N[b]
Sept. 85	$3.5\ E^{-6}$ ($1.9\ E^{-6}$)	$3.1\ E^{-4}$ ($1.8\ E^{-3}$)	0.0000	86%	9188
Oct. 85	$8.2\ E^{-5}$ ($5.6\ E^{-5}$)	$2.8\ E^{-4}$ ($4.9\ E^{-3}$)	0.0023	98%	7358
Nov. 85	$3.1\ E^{-7}$ ($2.5\ E^{-6}$)	$3.4\ E^{-4}$ ($1.3\ E^{-2}$)	0.0001	98%	6815
Dec. 85	$1.2\ E^{-6}$ ($1.4\ E^{-6}$)	$1.2\ E^{-3}$ ($3.1\ E^{-3}$)	0.0000	71%	23645
Jan. 86	$-2.0\ E^{-6}$ ($2.7\ E^{-6}$)	$2.0\ E^{-2}$ ($8.5\ E^{-3}$)	0.0004	1%	13787
Feb. 86	$3.5\ E^{-6}$ ($1.5\ E^{-6}$)	$1.3\ E^{-2}$ ($3.7\ E^{-3}$)	0.0006	0.04%	17724
Mar. 86	$2.8\ E^{-6}$ ($1.5\ E^{-6}$)	$1.0\ E^{-2}$ ($2.8\ E^{-3}$)	0.0006	0.03%	21953
Apr. 86	$3.1\ E^{-6}$ ($1.7\ E^{-6}$)	$2.3\ E^{-2}$ ($4.2\ E^{-3}$)	0.0015	0.01%	18762
May 86	$1.4\ E^{-6}$ ($1.5\ E^{-6}$)	$3.1\ E^{-2}$ ($3.5\ E^{-3}$)	0.0046	0.01%	17354
Jun. 86	$1.9\ E^{-6}$ ($1.3\ E^{-6}$)	$1.1\ E^{-2}$ ($1.9\ E^{-3}$)	0.0014	0.01%	24173
Jul. 86	$-4.3\ E^{-6}$ ($1.8\ E^{-6}$)	$1.3\ E^{-2}$ ($3.9\ E^{-3}$)	0.0008	0.07%	12751

Major Market Index

Contract	α	β	Adjusted R^2	Pr(β=0)[a]	N[b]
Aug. 84	$3.2\ E^{-5}$ ($6.1\ E^{-6}$)	$-1.7\ E^{-5}$ ($3.4\ E^{-3}$)	0.0000	99%	4076

Table I (continued)

Regression Results*

$$\ell n \frac{S_{t+1}}{S_t} = \alpha + \beta \ \ell n \frac{F(t,T)}{F(t-1,T)} + e_t$$

Contract	α	β	Adjusted R^2	$Pr(\beta=0)^a$	N^b
Sept. 84	7.9 E^{-6} (4.1 E^{-6})	5.1 E^{-3} (2.1 E^{-3})	0.0008	2%	7432
Oct. 84	4.1 E^{-6} (4.6 E^{-6})	1.6 E^{-2} (3.5 E^{-3})	0.0040	.01%	5855
Nov. 84	-3.9 E^{-6} (5.1 E^{-6})	1.7 E^{-2} (4.8 E^{-3})	0.0028	.03%	4667
Dec. 84	2.1 E^{-4} (2.1 E^{-4})	6.6 E^{-2} (1.6 E^{-1})	0.0000	69%	10850
Jan. 85	7.7 E^{-6} (5.3 E^{-4})	7.7 E^{-3} (5.7 E^{-1})	0.0000	99%	6125
Feb. 85	6.5 E^{-6} (5.2 E^{-4})	1.5 E^{-2} (6.5 E^{-1})	0.0000	99%	6209
Mar. 85	1.6 E^{-6} (3.0 E^{-4})	-1.8 E^{-1} (2.6 E^{-1})	0.0000	48%	10598
Apr. 85	2.8 E^{-6} (4.1 E^{-6})	2.4 E^{-3} (2.0 E^{-3})	0.0002	22%	6291
May 85	1.7 E^{-6} (4.2 E^{-6})	3.2 E^{-2} (6.0 E^{-3})	0.0060	.01%	4833
Jun. 85	1.2 E^{-5} (1.1 E^{-5})	3.5 E^{-3} (1.1 E^{-2})	0.0000	77%	9737
Jul. 85	5.6 E^{-6} (2.7 E^{-6})	3.6 E^{-4} (5.8 E^{-5})	0.0079	.01%	4766
Aug. 85	-4.9 E^{-4} (5.1 E^{4})	-8.1 E^{-1} (6.0 E^{-1})	0.0004	18%	4466
Sept. 85	4.5 E^{-3} (2.7 E^{-6})	1.1 E^{-2} (2.1 E^{-3})	0.0045	.01%	5705

Table I (continued)

Regression Results*

$$\ell n \frac{S_{t+1}}{S_t} = \alpha + \beta \ \ell n \frac{F(t,T)}{F(t-1,T)} + e_t$$

Contract	α	β	Adjusted R^2	$Pr(\beta=0)$[a]	N[b]
Oct. 85	1.7 E^{-6} (3.8 E^{-6})	9.4 E^{-3} (4.9 E^{-3})	0.0006	5%	4348
Nov. 85	4.9 E^{-6} (5.8 E^{-6})	5.4 E^{-2} (5.9 E^{-3})	0.0001	.01%	2534
Dec. 85	2.0 E^{-6} (3.0 E^{-6})	1.9 E^{-2} (2.9 E^{-3})	0.0001	.01%	5808
Jan. 86	3.0 E^{-6} (3.5 E^{-6})	3.5 E^{-2} (5.1 E^{-3})	0.0165	.01%	2811
Feb. 86	-1.9 E^{-6} (4.3 E^{-6})	2.1 E^{-2} (3.9 E^{-3})	0.0106	.01%	2600
Mar. 86	3.9 E^{-6} (3.0 E^{-6})	1.6 E^{-3} (2.6 E^{-3})	0.0060	.01%	5852
Apr. 86	6.6 E^{-6} (3.8 E^{-6})	4.2 E^{-2} (4.6 E^{-3})	0.0177	.01%	4485
May 86	1.6 E^{-6} (3.4 E^{-6}	3.3 E^{-2} (3.4 E^{-3})	0.0247	.01%	3741
Jun. 86	-6.8 E^{-7} (2.4 E^{-6})	2.4 E^{-2} (2.3 E^{-3})	0.0159	.01%	7040
Jul. 86	-1.2 E^{-6} (3.2 E^{-6})	2.6 E^{-2} (3.8 E^{-3})	0.0115	.01%	4010

* The numbers in parentheses represent standard errors.

[a]Pr β = 0 represents the probability that $\beta = 0$.

[b]N represents the number of observations.

Table II

Dummy Variable Regression Results*

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_1 + \beta_1 \ \ell n \frac{F(t)}{F(t-1)} + \beta_2 D_1 + \beta_3 (D_1 \ \ell n \frac{F(t)}{F(t-1)})$$

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_2 + \beta_4 \ \ell n \frac{F(t)}{F(t-1)} + \beta_5 \ D_2 + \beta_6 \ (D_2 \ \ell n \frac{F(t)}{F(t-1)})$$

<u>Maxi Major Market Index</u>

Contract	β_3	Pr β_3=0[a]	β_6	Pr β_6=0[a]
Sept. 85	$-2.7\ E^{-3}$ ($1.0\ E^{-2}$)	79%	$-1.0\ E^{-2}$ ($2.3\ E^{-2}$)	64%
Oct. 85	$2.5\ E^{-3}$ ($2.5\ E^{-3}$)	35%	$1.3\ E^{-2}$ ($2.4\ E^{-2}$)	60%
Nov. 85	$2.5\ E^{-2}$ ($2.6\ E^{-2}$	34%	$1.6\ E^{-2}$ ($2.7\ E^{-2}$)	55%
Dec. 85	$6.8\ E^{-3}$ ($1.3\ E^{-2}$)	60%	$2.4\ E^{-2}$ ($2.1\ E^{-2}$)	29%
Jan. 86	$3.0\ E^{-2}$ ($2.2\ E^{-2}$)	16%	$-1.7\ E^{-2}$ ($3.2\ E^{-2}$)	59%
Feb. 86	$2.5\ E^{-2}$ ($1.2\ E^{-2}$)	3%	$3.4\ E^{-2}$ ($1.8\ E^{-2}$)	6%
Mar. 86	$7.2\ E^{-3}$ ($1.2\ E^{-2}$)	55%	$2.6\ E^{-2}$ ($2.0\ E^{-2}$)	18%
Apr. 86	$5.9\ E^{-4}$ ($1.1\ E^{-2}$)	96%	$2.2\ E^{-2}$ ($2.1\ E^{-2}$)	30%
May 86	$1.3\ E^{-3}$ ($1.2\ E^{-2}$)	91%	$-1.7\ E^{-2}$ ($1.8\ E^{-2}$)	33%
Jun. 86	$3.9\ E^{-3}$ ($9.2\ E^{-3}$)	67%	$-2.0\ E^{-2}$ ($1.7\ E^{-2}$)	24%
Jul. 86	$2.2\ E^{-2}$ ($1.2\ E^{-2}$)	8%	$5.9\ E^{-2}$ ($2.3\ E^{-2}$)	.92%

Table II (continued)

Dummy Variable Regression Results*

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_1 + \beta_1 \ \ell n \frac{F(t)}{F(t-1)} + \beta_2 D_1 + \beta_3 (D_1 \ \ell n \frac{F(t)}{F(t-1)})$$

$$\ell n \frac{S_{t+1}}{S_t} = \alpha_2 + \beta_4 \ \ell n \frac{F(t)}{F(t-1)} + \beta_5 \ D_2 + \beta_6 \ (D_2 \ \ell n \frac{F(t)}{F(t-1)})$$

Major Market Index

Contract	β_3	Pr $\beta_3=0$[a]	β_6	Pr $\beta_6=0$[a]
Aug. 84	$-3.8\ E^{-2}$ $(4.2\ E^{-2})$	33%	$2.0\ E^{-2}$ $(2.2\ E^{-2})$	36%
Sept. 84	$6.5\ E^{-3}$ $(1.1\ E^{-2})$	56%	$2.1\ E^{-2}$ $(1.8\ E^{-2})$	25%
Oct. 84	$8.8\ E^{-3}$ $(1.1\ E^{-2})$	44%	$2.8\ E^{-2}$ $(1.7\ E^{-2})$	11%
Nov. 84	$-1.2\ E^{-2}$ $(1.2\ E^{-2})$	30%	$-1.4\ E^{-2}$ $(1.5\ E^{-2})$	36%
Dec. 84	$9.4\ E^{-1}$ $(6.8\ E^{-1})$	16%	$-8.5\ E^{-2}$ (1.1)	93%
Jan. 85	$6.1\ E^{-5}$ $(1.4\ E^{-4})$	99%	$-2.6\ E^{-2}$ (2.22)	99%
Feb. 85	$-2.4\ E^{-2}$ $(1.7\ E^{-1})$	98%	$-5.6\ E^{-2}$ (2.43)	98%
Mar. 85	.2 (1.27)	87%	.18 (1.97)	92%
Apr. 85	$3.6\ E^{-3}$ $(1.3\ E^{-2})$	78%	$6.9\ E^{-3}$ $(2.1\ E^{-2})$	74%
May 85	$1.5\ E^{-2}$ $(1.3\ E^{-2})$	24%	$2.5\ E^{-2}$ $(1.9\ E^{-2})$	18%
Jun. 85	$-6.2\ E^{-2}$ $(4.3\ E^{-2})$	14%	$-2.1\ E^{-3}$ $(7.4\ E^{-2})$	97%

Table II (continued)

Dummy Variable Regression Results*

$$\ln \frac{S_{t+1}}{S_t} = \alpha_1 + \beta_1 \ln \frac{F(t)}{F(t-1)} + \beta_2 D_1 + \beta_3 (D_1 \ln \frac{F(t)}{F(t-1)})$$

$$\ln \frac{S_{t+1}}{S_t} = \alpha_2 + \beta_4 \ln \frac{F(t)}{F(t-1)} + \beta_5 D_2 + \beta_6 (D_2 \ln \frac{F(t)}{F(t-1)})$$

Contract	β_3	Pr $\beta_3=0$[a]	β_6	Pr $\beta_6=0$[a]
Jul. 85	$-1.6\ E^{-2}$ $(1.1\ E^{-2})$	24%	$-3.8\ E^{-3}$ $(1.3\ E^{-2})$	77%
Aug. 85	-2.9 (1.34)	2%	-4.12 (1.49)	.5%
Sept. 85	$8.4\ E^{-3}$ $(1.2\ E^{-2})$	48%	$-2.9\ E^{-2}$ $(2.1\ E^{-2})$	17%
Oct. 85	$1.4\ E^{-2}$ $(8.1\ E^{-3})$	.4%	$4.0\ E^{-2}$ $(1.6\ E^{-2})$	1%
Nov. 85	$2.8\ E^{-2}$ $(2.2\ E^{-3})$	.01%	$4.0\ E^{-2}$ $(1.8\ E^{-2})$	3%
Dec. 85	$2.8\ E^{-2}$ $(9.9\ E^{-3})$	.43%	$2.5\ E^{-2}$ $(1.3\ E^{-2})$	6%
Jan. 86	$3.6\ E^{-2}$ $(1.1\ E^{-2})$	.12%	$5.5\ E^{-2}$ $(1.6\ E^{-2})$	.07%
Feb. 86	$2.5\ E^{-2}$ $(9.6\ E^{-3})$	.89%	$4.2\ E^{-2}$ $(1.7\ E^{-2})$	.5%
Mar. 86	$2.3\ E^{-2}$ $(8.0\ E^{-3})$	.48%	$-6.5\ E^{-2}$ $(1.0\ E^{-3})$	.01%
Apr. 86	$2.6\ E^{-2}$ $(1.0\ E^{-2})$	1%	$3.4\ E^{-2}$ $(1.7\ E^{-3})$	.84%
May 86	$2.6\ E^{-2}$ $(1.2\ E^{-2})$	3%	$4.7\ E^{-2}$ $(1.8\ E^{-2})$	.94%

Table II (continued)

Dummy Variable Regression Results*

$$\ln \frac{S_{t+1}}{S_t} = \alpha_1 + \beta_1 \ln \frac{F(t)}{F(t-1)} + \beta_2 D_1 + \beta_3 (D_1 \ln \frac{F(t)}{F(t-1)})$$

$$\ln \frac{S_{t+1}}{S_t} = \alpha_2 + \beta_4 \ln \frac{F(t)}{F(t-1)} + \beta_5 D_2 + \beta_6 (D_2 \ln \frac{F(t)}{F(t-1)})$$

Contract	β_3	Pr β_3=0[a]	β_6	Pr β_6=0[a]
Jun. 86	3.6 E^{-2} (9.4 E^{-3})	.01%	2.1 E^{-2} (6.7 E^{-3})	.21%
Jul. 86	7.5 E^{-2} (1.2 E^{-2})	.01%	6.2 E^{-2} (2.4 E^{-2})	1%

* The numbers in parentheses represent standard errors.

[a]Pr β_i = 0 represents the probability that β_i = 0.