Day-of-the-Week Patterns in Futures Prices: Some Further Results

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Abstract

This paper describes the results of an investigation into the daily price change behavior of the NYSE composite index and its futures contracts. Although a strong nontrading period weekend effect is found in the spot market during the Friday close-to-Monday open period, evidence on the presence of a similar effect in the futures market is inconclusive. In general, there does not appear to be any relationship between changes in prices in the two markets over nontrading periods. This contrasts with the results for the close-to-close and open-to-close periods, which suggests that the spot and futures price changes during these periods are highly correlated.

Introduction

One of the most widely documented but unexplained anomalies in the stock market is the so-called weekend effect,[1] according to which measured returns for the trading day following a weekend are, unlike any other day of the week, significantly negative.[2] Recent studies by Cornell [3], Junkus [15], Dyl and

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[1]The weekend effect was identified first by Cross [5], French [10], and Gibbons and Hess [11]. Other studies investigating the effect in the spot market for common stock include Lakonishok and Levi [17], Keim and Stambaugh [16], Rogalski [25], Harris [12], and Smirlock and Starks [26].

[2]Negative Monday returns and other empirical regularities also have been identified in the markets for gold (Ball, Torous, and Tschoegl [1], Ma [19]),

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Maberly [7, 8], Maberly [20], and Maberly, Spahr, and Herbst [21] extend the investigation of this anomaly by attempting to establish whether it persists in the futures markets for stock indices as well. Unfortunately, these studies, which employ different methods for rolling over futures contracts[3] and measuring day to day price changes,[4] produce conflicting and inconclusive results. Although Cornell and Junkus find no evidence of a weekend effect in either close-to-close or, in the case of Cornell, close-to-open and open-to-close price change data, Dyl and Maberly, Maberly, and Maberly, Spahr, and Herbst report significantly negative price changes for the weekend nontrading period.[5]

The present study examines the daily price change behavior of the NYSE composite index and its futures in an effort to complement and extend the work of previous authors.[6] The futures, which are traded on the New York Futures Exchange, are similar to the S&P 500 futures. The value of each of the contracts is $500 times the level of the corresponding index, the contracts have the same trading hours (after adjusting for differences in time zones), and the minimum price fluctuations ($25) are the same. In addition, neither contract is subject to daily price limits, though a limit was imposed on the S&P 500 Futures Exchange when it was introduced.

The similarities between the two contracts notwithstanding, the underlying indices differ significantly. The S&P 500 is more representative of large firms,

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treasury bills (Gibbons and Hess [11]), and foreign exchange (Levi [18], Coats [2], McFarland, Pettit, and Sung [22]).

[3]All past authors begin by choosing the contract nearest to maturity at the time of the initial observation because near contracts typically have the largest open interest and are the most actively traded. Junkus retains the near contract until it expires, and Dyl and Maberly only switch to the next-to-near contract on the Wednesday preceding the Friday expiration date, but Cornell, Maberly, and Maberly, Spahr, and Herbst switch to the next contract at the beginning of the month of expiration.

[4]Cornell [3] and Junkus [15] utilize returns, calculated as $R_t = \ln (P_t/P_{t-1})$, while Dyl and Maberly [7] argue that studies involving futures contracts should rely upon price changes--that is $\Delta P_t = P_t - P_{t-1}$--because no investment is required.

[5]Dyl and Maberly [7] ascribe Cornell's results to errors in his data. When replicating his study with the errors corrected, they find that the close-to-open weekend price change in the futures market is negative, but not significantly different from zero.

[6]Most previous research on the daily price change behavior of stock index futures has focussed on the S&P 500 composite index or the Value Line composite index. Junkus [15] includes the NYSE composite in her study, but only considers close-to-close price changes.

and the NYSE is more representative of medium and small firms. As Harris [12] discovered using spot transactions data for the NYSE, day-of-the-week return patterns vary according to firm size, with significant differences in returns obtained over both trading and nontrading periods. Smirlock and Starks' [26] results for the Dow Jones Industrial Average suggest that these patterns may change over time.

The results of the present study indicate a statistically significant close-to-open weekend effect in the spot market, with no significant effect in the futures market.[7] In addition, an examination of the close-to-close and open-to-close price changes in the two markets reveals that on Monday the spot price change is negative and the futures price change positive in each case. The reverse is true on Friday. Further, on all days except Wednesday, the changes in the index are significantly negative during the nontrading period, with no corresponding pattern in the futures market. These results are somewhat surprising, as one would expect the price change behavior of a derivative asset such as a futures contract to be highly correlated with that of the underlying spot market. One possible explanation suggested by the results of a recent study by Harris [13] is that there is a tendency for the reported index price to be high relative to the closing price in the futures market. This conjecture is addressed in an investigation of daily changes in the futures-spot basis. Studying the basis also allows more precise information about day-of-the-week price change behavior to be obtained. This is because the variance of the changes in the basis will be much smaller than the variance of the changes in either spot or futures prices.

The paper also examines the correlations between price changes in the two markets on a day-to-day basis. From this analysis, it emerges that although the price changes for the close-to-close and open-to-close periods are highly correlated on all days, the close-to-open price changes exhibit almost no correlation. This also may be attributable to the apparent tendency for spot prices to rise at the close.

Data and Analysis of Daily Price Changes

The data, obtained directly from the New York Futures Exchange, consist of time-ordered records of the opening and closing prices of the NYSE composite index and of the futures contracts written on the index between April 1982 (when trading in the futures began) and September 1986. The level of the index at

[7]The close-to-open price changes in both markets are negative. Although the futures price change is greater in magnitude, it is not statistically significant. This is because the standard deviations of the futures price changes are much larger.

10:15 is used as its opening price, while the opening price of the futures is an average of the prices at which the first few transactions occur. In the case of the index, the price reflects the most recent prices at which individual stocks have traded, even if the most recent trade occurred on the previous day. The closing price for the index is the final version thereof, while the closing price for the futures is a weighted average of the prices at which transactions occurred during the last minute of trading. In addition, the present study attempts to abstract from the effects of holidays, as it excludes all long weekends from the sample. Thus, all of the observations used in this study are for normal one day and weekend periods.

For both the spot and futures markets three price change series were generated:

ΔP_t^c = close-to-close daily price changes and is calculated as $\Delta P_t^c = P_t^c - P_{t-1}^c$,

where

P_t^c = level of the index or its futures at the close of trading on day t;

ΔP_t^o = close-to-open daily price changes and is calculated as $\Delta P_t^o = P_t^o - P_{t-1}^c$,

where

P_t^o = level of the index or its futures when the market opens on day t; and

ΔP_t^d = open-to-close daily price changes and is calculated as $\Delta P_t^d = P_t^c - P_t^o$.

The futures price change series was calculated using near contract data to the beginning of the month of expiration and next-to-near contract data thereafter. In this respect, this paper's approach follows the switching convention first adopted by Cornell.[8] Finally, each of the three price change series also was resolved into two subperiods, April 1982 to July 1984 and July 1984 to September 1986. This was done in order to ascertain the consistency of the patterns indicated by the results and isolate the effect of any possible mispricing of the futures when the contract was introduced and trading volumes were low.[9]

[8]The tests contained in this paper also were conducted using price changes based upon the utilization of near contract data for the entire life of each futures as well as with rate of return substituted for price change in both the spot and futures series. Neither variation in the calculation of the input data had any material effect on the results obtained.

[9]Evidence of mispricing of the S&P 500 futures when first introduced has been reported by Cornell and French [4] and Figlewski [9].

The daily means, standard deviations, and associated t-statistics for each of the close-to-close price change series over the entire April 1982 to September 1986 period are summarized in Panel A of Table 1. The pattern of daily means is similar to that reported by Cornell, Dyl and Maberly, and Junkus, with the price changes for most days, including Monday, statistically insignificant in both the spot and the futures market. The only day on which a statistically significant price change is observed is Wednesday and then only in the spot market. The results are much the same for the two subperiods, except that the Wednesday spot price change is not significant in either case.

The resolution of ΔP_t^c into its components, ΔP_t^d and ΔP_t^o, yields the results reported in Panels B and C of Table 1. The trading day price changes, ΔP_t^d, are generally similar to their close-to-close counterparts. In most cases, the signs obtained for ΔP_t^d are the same as those of the corresponding close-to-close price change. Only on Friday in the spot market--and then only in Tables 1 and 1b--is the price change statistically significant.

The daily price change patterns for the nontrading period, in contrast, are different from the close-to-close patterns. In the spot market, the close-to-open price changes are negative on all days and significant (at one percent) on all days except Wednesday for the full period. Similar results also are observed for the two subperiods. On Wednesday, the price change in the first subperiod is significantly negative. In the second, it is positive, albeit insignificant.

French [10] suggests that the tendency for price changes to be significantly negative between the Friday close and the Monday open may be attributable to a tendency for firms to delay the release of unfavorable information until the weekend to provide time for investors to digest the information in a detached fashion. Moreover, this conjecture appears to be supported by a number of studies, including Patell and Wolfson [23], Penman [24], and Dyl and Maberly [8]. Another complementary explanation that may be extended to all days is that stock prices rise at the close. This behavior is exhibited by most NYSE firms and across all days, according to a recent study by Harris [13]. Harris also reports that these price increases are associated with a tendency for final trades to be at the ask rather than at the bid, possibly because they are more likely to be initiated by buyers than by sellers.

In the futures market, ΔP_t^o is negative but not significant on Monday and positive on most other days. The weekend nontrading period results in Tables 1, 1a, and 1b are similar to those obtained by Dyl and Maberly in their replication of Cornell's study of the S&P 500 and its futures. That is, the price change in the futures market has the same sign as that obtained in the spot market, but is not significantly different from zero. Dyl and Maberly obtain statistically significant negative returns when they extend the observation period utilized by Cornell. The present study, which is based on an even larger number of

observations, yields results that are closer to those obtained for Cornell's original and shorter time period.

In order to conduct a formal test of the equivalence of the weekday means in the price change behavior of the NYSE index and its futures, the following model was estimated for both the spot market and futures market time series:

$$(1)\quad \Delta P_t^i = \delta_1^i d_{1t} + \delta_2^i d_{2t} + \delta_3^i d_{3t} + \delta_4^i d_{4t} + \delta_5^i d_{5t} + \varepsilon_t^i$$

ΔP_t^i = change in price measure i (i = c, o, d) in week t; and

d_{1t} through d_{5t} = dummy variables indicating the day of the week on which the price change is observed.

Thus, for example, d_{1t} assumes a value of one if the price change occurs on a Monday and zero otherwise. The error term e_t^i is assumed to be independently and identically distributed as $N(0,\sigma_i^2)$.

The coefficient δ_j^i in equation (1) measures the mean price change for measurement interval i on day of the week j (j = 1 to 5). If the price change distributions are identical for all days, the distribution means will be equal. In addition, the F-statistic for the joint hypothesis

$$\delta_1^i = \delta_2^i = \delta_3^i = \delta_4^i = \delta_5^i$$

will not be significant.[10]

The F-statistics for both sets of price changes are reported in the final two columns of Tables 1, 1a, and 1b. Although the values obtained for the close-to-open price changes are consistently higher than those obtained for the close-to-close and open-to-close price changes, the joint hypothesis can be rejected (at one percent) only in the case of the spot market. The results indicated by the daily price change t-statistics are confirmed; although there is a significant day-of-the-week effect in the price change behavior of the NYSE index, the effect is much less pronounced in the price change patterns of the futures contracts written on the index.[11]

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[10]See Theil [27], Chapter 7.

[11]The preceding tests also were conducted using data for all months of the year but January. This was done in order to abstract from the potentially confounding turn-of-the-year effects identified by Rogalski [25] and Smirlock and Starks [26] in the spot market for common stocks. The results obtained were substantially the same as those described above and, for this reason, are not reported.

Daily Changes in the Basis

The evidence suggests that since the inception of trading in NYSE index futures, the weekend effect in the NYSE spot market has been confined to the nontrading period between the Friday close and the Monday open. In the futures market, even the weekend nontrading price changes fail to support the hypothesis that a weekend effect exists.

An examination of the close-to-close and open-to-close periods in the two markets suggests that on Monday the spot price changes are negative and the futures price changes are positive. On Friday, however, the converse is true. Although the coefficients are not statistically significant, their signs are somewhat surprising, as one would expect the changes in price of a derivative asset such as a futures contract to be highly correlated with those of the underlying spot asset. This apparent inconsistency may be associated with a tendency for the Friday closing price in the spot market to be high relative to the closing price in the futures market.

In order to obtain additional evidence on the relationship between the NYSE spot and futures prices, the daily behavior of the futures-spot basis was examined. The daily change in the basis,

$$(P^F - P^S)_t - (P^F - P^S)_{t-1},$$

is useful in this respect because it is simply the difference between the daily price changes in the futures and spot markets,

$$(P^F_t - P^F_{t-1}) - (P^S_t - P^S_{t-1}).$$

The results summarized in Tables 2, 2a, and 2b correspond to the full period and the first and second subperiods, respectively. As shown by Panel A of each table, the Friday basis change is always negative and the Monday change always positive for the close-to-close period. Except on Friday during the first subperiod, the changes are all significant at the five percent level or less. The results confirm those reported in Table 1. On Friday, the spot price change is greater than the futures price change; on Monday, the converse is true. A tendency for the Friday closing price in the spot market to be high relative to the futures price would account for both of these observations.

The open-to-close basis changes yield generally similar results. Panel B of Tables 2, 2a, and 2b shows that during the Friday trading period, the change in the spot price is greater than the change in the futures price. The opposite is true during the trading period on Monday--though in the case of the latter, the

change is not significant in the second subperiod. In addition, for both the close-to-close and open-to-close periods, the F-statistics in the final column of the table indicate that the daily basis changes are significantly different from one another.[12]

One would also expect the basis change for the weekend nontrading period to be significantly positive if the Friday closing spot price is relatively high. The results for the close-to-open period reported in Panel C of Tables 2, 2a, and 2b, however, do not support this interpretation. Apparently, the adjustment of the spot price from its relatively high level at the Friday closing is not completed until after the commencement of trading on Monday.

Day to Day Spot-Futures Price Change Correlations

Earlier, this paper reported the absence of a significant weekend effect for futures during the nontrading period despite the presence of one in the spot market. This differs from the results obtained by Dyl and Maberly and Maberly, Spahr, and Herbst for the S&P 500 and Value Line indices. More importantly, for the nontrading period, the changes in the price of the spot index are significantly negative for all days of the week except Wednesday, whereas no corresponding pattern can be detected in the futures market. What these results suggest is that the pricing relationship between the index and the futures breaks down during the nontrading period.

In order to investigate the relationships between changes in the price of the index and changes in the price of its futures, the following equation was estimated for each of the three price change intervals examined:

$$(2)\quad \Delta P^{F,i}_{j,t} = \alpha^{i}_{0,j} + \alpha^{i}_{1,j}\Delta P^{S,i}_{j,t} + \varepsilon^{i}_{j,t}$$

where

$\Delta P^{F,i}_{j,t}$ = the futures contract price measure i (i = c, o, d) on day j (j = 1 to 5) in week t; and

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[12]The F-statistics were obtained using equation (1) and substituting basis change,

$\Delta(P^{F}\text{-}P^{S})^{i}_{t}$,

for price change,

ΔP^{i}_{t}.

$\Delta P^{S,i}_{j,t}$ = the corresponding price change measure for the index.

The error term $\varepsilon^{i}_{j,t}$ is assumed to be independently and identically distributed as $N(0,\sigma^{2}_{i,j})$.

The estimates of $\alpha^{i}_{1,j}$, corresponding t-statistics, and R-squared values for equation (2) are reported in Tables 3, 3a, and 3b. Throughout the week and between observation periods, the coefficient estimates, t-statistics, and R-squared values are remarkably stable when price changes are measured from close to close or open to close. In all cases, the estimates of $\alpha^{i}_{1,j}$ are significantly different from zero at the one percent level. In addition, the R-squared values, particularly for the close-to-close time series, indicate a high degree of correlation between the price changes in the spot and futures markets.

The day-to-day pattern of coefficient estimates for the close-to-open price changes, in contrast, is far from uniform. On Monday, Wednesday, and Thursday, the relationship is positive. On Tuesday and Friday, it is negative. In addition, among those coefficients with the same signs, the magnitudes vary considerably from day to day. Except on Monday for the full period and the second subperiod, however, the t-statistics do not allow rejection of the hypothesis that the daily slope coefficients are equal to zero. Finally, the close-to-close and open-to-close price change series produce relatively high R-squared values, but the values obtained using the close-to-open series are all close to zero.[13]

The apparent absence of any link between the price changes in the spot and futures markets during the close-to-open period may be associated with the lack of arbitrage. The explanation also may involve the tendency for stock prices, recently identified by Harris, to rise at the close. As the results in Table 1, 1a, and 1b indicate, the overnight spot price change is consistently negative, as would be expected if the spot price is adjusting to a high closing price on the previous day. The futures market, in contrast, reveals no such tendency. Hence, even though spot and futures prices are likely to respond to the same fundamental factors, it is not surprising that their overnight behavior seems different.[14]

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[13]The S&P 500 index and its futures also were examined. Their price changes display the same lack of any relationship over the nontrading period. The results are available upon request.

[14]The lack of correlation between the observed price changes in the two markets also may be explained by the information and reporting lags involved in determining the price of the index (see Herbst and Maberly [14] for a discussion) or by the fact that the NYSE and NYFE close at different times--4:00 p.m. and 4:15 p.m., respectively.

Summary

This paper examines the pattern of daily price changes for the NYSE composite index and its futures contracts using data for the period April 1982 to September 1986 and for two subperiods of approximately equal length. Several observations emerged from the analysis. First, the evidence in support of a weekend effect in the futures market is far from conclusive. There is no trace of a significant weekend effect for NYSE futures regardless of which daily measurement interval is used. This contrasts sharply with results reported by Dyl and Maberly, Maberly, and Maberly, Spahr, and Herbst for the S&P 500 index.

Second, previous research indicates that the close-to-open weekend effect is a widespread phenomenon in spot markets for common stocks. The present study confirms this result. It also provides evidence, however, suggesting that if the Friday closing price in the spot market is high relative to the closing futures price, the adjustment of the spot price from its relatively high level is not completed until after the commencement of trading on Monday. Unlike previous studies, the current research finds the close-to-open spot price change to be consistently negative and significant on all days but Wednesday.

Finally, in general there does not appear to be any relationship between the changes in the level of the index and in the price of its futures during nontrading periods. The implications of the weekend effect for investor behavior suggested by French [10] thus cannot be applied to futures. Specifically, French notes that while trading rules cannot be used to profit from the weekend effect in the presence of transactions costs, it may be worthwhile to alter the timing of trades that would have been made anyway. In the case of futures, a parallel case cannot be made on the basis of the evidence reported here. The apparent lack of any relationship between the index and its futures during the nontrading period makes it impossible for index arbitrageurs to undertake offsetting spot and futures transactions without increasing basic risk.

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Table 1
Daily Price Changes
NYSE Composite Index and NYSE Composite Index Futures
April 1982 to September 1986

Statistic	Monday		Tuesday		Wednesday		Thursday		Friday		Spot	Futures
	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	F_{4,n_2}	F_{4,n_2}
Panel A: Close to Close (ΔP_t^c)												
Mean	-0.0287	0.0897	0.1011	0.0858	0.1046	0.0373	0.0894	0.0989	0.0691	-0.0425	0.980 (n_2=1075)	0.657 (n_2=1057)
Standard deviation	0.8371	1.0636	0.8377	1.1314	0.7915	1.0771	0.8424	1.1150	0.7291	0.9234		
t-statistic	-0.493	1.190	1.749	1.094	1.979[b]	0.515	1.578	1.310	1.402	-0.676		
Observations	206	199	210	208	224	221	221	218	219	216		
Panel B: Open to Close (ΔP_t^d)												
Mean	-0.0119	0.0780	0.0912	0.0138	0.0993	0.0093	0.1036	0.0836	0.1072	-0.0556	0.814 (n_2=1097)	0.671 (n_2=1106)
Standard deviation	0.8788	1.0537	0.8572	1.1321	0.7839	1.0632	0.8403	1.0354	0.7181	0.8905		
t-statistic	-0.197	1.075	1.607	0.184	1.888	0.132	1.841	1.211	2.204[b]	-0.931		
Observations	211	211	228	228	222	225	223	225	218	222		
Panel C: Close to Open (ΔP_t^o)												
Mean	-0.0352	-0.0405	-0.0191	0.0478	-0.0051	0.0150	-0.0144	0.0167	-0.0279	0.0225	6.602[a] (n_2=1062)	2.352 (n_2=1055)
Standard deviation	0.0584	0.3939	0.0342	0.2655	0.0692	0.2440	0.0263	0.2699	0.1097	0.3096		
t-statistic	-8.629[a]	-1.449	-8.111[a]	2.599[a]	-1.082	0.912	-8.113[a]	0.916	-3.712[a]	1.064		
Observations	205	199	210	208	220	220	219	218	213	215		

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 1a
Daily Price Changes
NYSE Composite Index and NYSE Composite Index Futures
April 1982 to July 1984

Statistic	Monday		Tuesday		Wednesday		Thursday		Friday		Spot	Futures
	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	F_{4,n_2}	F_{4,n_2}
Panel A: Close to Close (ΔP_t^c)												
Mean	-0.0385	0.0820	0.0659	0.0137	0.1190	0.0874	0.0233	0.0380	0.0201	-0.0776	0.672 (n_2=537)	0.469 (n_2=527)
Standard deviation	0.8244	1.0587	0.7738	1.0904	0.7861	1.1200	0.6606	0.9328	0.6584	0.8676		
t-statistic	-0.470	0.775	0.868	0.127	1.617	0.822	0.373	0.425	0.321	-0.939		
Observations	101	100	104	102	114	111	112	109	111	110		
Panel B: Open to Close (ΔP_t^d)												
Mean	0.0050	0.1268	0.0388	-0.0374	0.1264	0.0373	0.0436	0.0039	0.0465	-0.0858	0.401 (n_2=548)	0.708 (n_2=554)
Standard deviation	0.8212	1.0540	0.7905	1.0725	0.7791	1.1207	0.6541	0.8901	0.6415	0.7858		
t-statistic	0.061	1.221	0.526	-0.374	1.717	0.355	0.709	0.046	0.760	-1.161		
Observations	103	103	115	115	112	114	113	114	110	113		
Panel C: Close to Open (ΔP_t^o)												
Mean	-0.0361	-0.0380	-0.0161	0.0216	-0.0100	0.0315	-0.0151	0.0385	-0.0329	0.0119	2.843[b] (n_2=530)	1.062 (n_2=527)
Standard deviation	0.0637	0.4398	0.0181	0.2524	0.0209	0.2433	0.0320	0.2510	0.1398	0.2676		
t-statistic	-5.671[a]	-0.864	-9.029[a]	0.863	-5.058[a]	1.366	-4.989[a]	1.603	-2.444[b]	0.467		
Observations	100	100	104	102	112	111	111	109	108	110		

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 1b
Daily Price Changes
NYSE Composite Index and NYSE Composite Index Futures
July 1984 to September 1986

Statistic	Monday		Tuesday		Wednesday		Thursday		Friday		Spot	Futures
	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	F_{4,n_2}	F_{4,n_2}
Panel A: Close to Close (ΔP_t^c)												
Mean	-0.0193	0.0975	0.1357	0.1552	0.0897	-0.0132	0.1573	0.1599	0.1194	-0.0059	0.671 (n_2=533)	0.619 (n_2=525)
Standard deviation	0.8531	1.0737	0.8982	1.1705	0.8003	1.0347	0.9939	1.2729	0.7952	0.9809		
t-statistic	-0.232	0.903	1.555	1.365	1.176	-0.134	1.653	1.312	1.561	-0.062		
Observations	105	99	106	106	110	110	109	109	108	106		
Panel B: Open to Close (ΔP_t^d)												
Mean	-0.0280	0.0315	0.1446	0.0659	0.0717	-0.0194	0.1652	0.1656	0.1691	-0.0243	0.963 (n_2=544)	0.566 (n_2=547)
Standard deviation	0.9339	1.0562	0.9207	1.1922	0.7914	1.0050	0.9954	1.1640	0.7867	0.9901		
t-statistic	-0.311	0.310	1.670	0.588	0.951	-0.203	1.740	1.498	2.234[b]	-0.256		
Observations	108	108	113	113	110	111	110	111	108	109		
Panel C: Close to Open (ΔP_t^o)												
Mean	-0.0343	-0.0429	-0.0222	0.0731	0.0001	-0.0018	-0.0137	-0.0051	-0.0228	0.0335	4.594[a] (n_2=527)	2.184 (n_2=523)
Standard deviation	0.0531	0.3435	0.0446	0.2764	0.0964	0.2448	0.0190	0.2871	0.0660	0.3493		
t-statistic	-6.615[a]	-1.243	-5.121[a]	2.724[a]	0.010	-0.078	-7.506[a]	-0.184	-3.532[a]	0.984		
Observations	105	99	106	106	108	109	108	109	105	105		

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 2
Daily Changes in the Basis
NYSE Composite Index
April 1982 to September 1986

Statistic	Monday	Tuesday	Wednesday	Thursday	Friday	F_{4,n_2}
			Panel A: Close to Close $(\Delta(P^F - PS)_t^c)$			
Mean	0.1085	-0.0141	-0.0706	0.0109	-0.1068	6.245[a] (n_2=1057)
Standard deviation	0.4600	0.5152	0.4881	0.4718	0.4470	
t-statistic	3.328[a]	-0.396	-2.150[b]	0.342	-3.512[a]	
Observations	199	208	221	218	216	
			Panel B: Open to Close $(\Delta(P^F - PS)_t^d)$			
Mean	0.0900	-0.0774	-0.0910	-0.0190	-0.1645	6.423[a] (n_2=1096)
Standard deviation	0.5945	0.5801	0.5385	0.5094	0.5151	
t-statistic	2.195[b]	-2.015[b]	-2.518[b]	-0.556	-4.717[a]	
Observations	210	228	222	223	218	
			Panel C: Close to Open $(\Delta(P^F - PS)_t^o)$			
Mean	-0.0036	0.0669	0.0176	0.0327	0.0470	1.601 (n_2=1045)
Standard deviation	0.3890	0.2695	0.2524	0.2701	0.3315	
t-statistic	-0.130	3.582[a]	1.030	1.781	2.060[b]	
Observations	198	208	217	216	211	

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 2a
Daily Changes in the Basis
NYSE Composite Index
April 1982 to July 1984

Statistic	Monday	Tuesday	Wednesday	Thursday	Friday	F_{4,n_2}
			Panel A: Close to Close $(\Delta(P^F - P^S)_t^c)$			
Mean	0.1236	-0.0491	-0.0386	0.0193	-0.0847	2.654[b] (n_2=527)
Standard deviation	0.4996	0.5537	0.5200	0.5079	0.4549	
t-statistic	2.474[b]	-0.896	-0.781	0.396	-1.953	
Observations	100	102	111	109	110	
			Panel B: Open to Close $(\Delta(P^F - P^S)_t^d)$			
Mean	0.1225	-0.0762	-0.0876	-0.0335	-0.1419	3.296[b] (n_2=547)
Standard deviation	0.6617	0.5976	0.5672	0.5352	0.4540	
t-statistic	1.869	-1.367	-1.634	-0.666	-3.279[a]	
Observations	102	115	112	113	110	
			Panel C: Close to Open $(\Delta(P^F - P^S)_t^o)$			
Mean	0.0029	0.0375	0.0394	0.0541	0.0428	0.404 (n_2=520)
Standard deviation	0.4389	0.2533	0.2429	0.2512	0.3030	
t-statistic	0.066	1.493	1.692	2.237[b]	1.461	
Observations	99	102	109	108	107	

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 2b
Daily Changes in the Basis
NYSE Composite Index
July 1984 to September 1986

Statistic	Monday	Tuesday	Wednesday	Thursday	Friday	F_{4,n_2}
			Panel A: Close to Close $(\Delta(P^F - P^S)_t^C)$			
Mean	0.0933	0.0195	-0.1029	0.0026	-0.1297	4.427[a] (n_2=525)
Standard deviation	0.4183	0.4755	0.4537	0.4350	0.4396	
t-statistic	2.220[b]	0.423	-2.379[b]	0.062	-3.038[a]	
Observations	99	106	110	109	106	
			Panel B: Open to Close $(\Delta(P^F - P^S)_t^d)$			
Mean	0.0594	-0.0787	-0.0945	-0.0040	-0.1876	2.192[b] (n_2=520)
Standard deviation	0.5244	0.5644	0.5101	0.4834	0.5719	
t-statistic	1.178	-1.482	-1.942	-0.087	-3.409[a]	
Observations	108	113	110	110	108	
			Panel C: Close to Open $(\Delta(P^F - P^S)_t^o)$			
Mean	-0.0101	0.0953	-0.0043	0.0114	0.0513	4.427[a] (n_2=525)
Standard deviation	0.3338	0.2825	0.2609	0.2874	0.3599	
t-statistic	-0.301	3.473[a]	-0.170	0.412	1.455	
Observations	99	106	108	108	104	

[a] Significant at the one percent level
[b] Significant at the five percent level

Table 3
The Relationship Between the Daily Price Changes
of the NYSE Composite Index and the NYSE Composite Index Futures
April 1982 to September 1986

Variable[a]	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.
		Monday				Tuesday				Wednesday		
ΔP^c_t	1.1490	30.668[b]	0.827	199	1.2318	30.817[b]	0.822	208	1.2289	31.936[b]	0.823	221
ΔP^d_t	0.9911	21.177[b]	0.683	210	1.1431	25.982[b]	0.749	228	1.1489	25.441[b]	0.746	222
ΔP^o_t	1.1007	2.145[c]	0.023	198	-0.4035	-0.750	0.027	208	0.0927	0.388	0.001	217
		Thursday				Friday						
ΔP^c_t	1.2108	34.523[b]	0.847	218	1.1327	27.256[b]	0.776	216				
ΔP^d_t	1.1079	26.699[b]	0.763	223	1.0225	20.958[b]	0.670	218				
ΔP^o_t	0.5683	0.815	0.003	216	-0.0619	-0.318	0.0005	211				

[a] ΔP^c_t denotes close-to-close price changes; ΔP^d_t, open-to-close price changes; and ΔP^o_t, close-to-open price changes.

[b] Significant at the one percent level

[c] Significant at the five percent level

Table 3a
The Relationship Between the Daily Price Changes
of the NYSE Composite Index and the NYSE Composite Index Futures
April 1982 to July 1984

Variable[a]	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.
		Monday				Tuesday				Wednesday		
ΔP_t^c	1.1356	19.119[b]	0.789	100	1.2616	18.585[b]	0.775	102	1.2816	22.608[b]	0.824	111
ΔP_t^d	1.0023	12.493[b]	0.609	102	1.1347	16.216[b]	0.699	115	1.1953	17.876[b]	0.744	112
ΔP_t^o	0.5695	0.819	0.007	99	-0.2393	-0.173	0.0003	102	1.1523	1.041	0.010	109
		Thursday				Friday						
ΔP_t^c	1.1878	16.653[b]	0.722	109	1.1519	17.435[b]	0.738	110				
ΔP_t^d	1.0942	14.184[b]	0.644	113	1.0154	14.914[b]	0.673	110				
ΔP_t^o	0.7174	0.951	0.008	108	-0.0322	-0.171	0.0003	107				

[a] ΔP_t^c denotes close-to-close price changes; ΔP_t^d, open-to-close price changes; and ΔP_t^o, close-to-open price changes.
[b] Significant at the one percent level

Table 3b
The Relationship Between the Daily Price Changes
of the NYSE Composite Index and the NYSE Composite Index Futures
July 1984 to September 1986

Variable[a]	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.	$\hat{\alpha}^i_{1,j}$	t-statistic	R^2	Obs.
		Monday				Tuesday				Wednesday		
ΔP^c_t	1.1627	24.948	0.865	99	1.2090	25.350[b]	0.861	106	1.1750	22.649[b]	0.827	110
ΔP^d_t	0.9819	18.012[b]	0.754	108	0.1150	20.396[b]	0.789	113	1.1049	18.055[b]	0.751	110
ΔP^o_t	1.6238	2.612[c]	0.066	99	-0.3532	-0.582	0.003	106	0.0599	0.243	0.001	108
		Thursday				Friday						
ΔP^c_t	1.2244	33.698[b]	0.914	109	1.1251	21.000[b]	0.809	106				
ΔP^d_t	1.0715	23.183[b]	0.833	110	1.0321	14.631[b]	0.669	108				
ΔP^o_t	0.2226	0.151	0.0002	108	-0.5187	-1.006	0.010	104				

[a] ΔP^c_t denotes close-to-close price changes; ΔP^d_t, open-to-close price changes; and ΔP^o_t, close-to-open price changes.

[b] Significant at the one percent level

[c] Significant at the five percent level