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The Weekly Pattern in Stock Returns: Cash versus Futures: A Note

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ABSTRACT

This paper presents tests designed to determine whether the weekly pattern in stock returns continues after the introduction of futures trading on stock indexes and whether the pattern carries over to the futures market. Using data for the SP500, I find that the "Monday effect" does persist in the cash market, but there is no evidence of a similar pattern in the futures market.

AMONG THE GROWING ARRAY of market anomalies, one of the most widely documented, but least understood, is the day-of-the-week effect. Detailed research by French [2], Gibbons and Hess [3], Lakonishok and Levi [6], and Keim and Stambaugh [5] clearly shows that the mean return on Monday is less than that for the other four days and, in general, is negative. More recently, Rogalski [8] finds that for the Standard & Poor's Composite Index, henceforth SP500, and for the Dow Jones Industrial Average, the negative returns on Monday appear to be confined to the interval between Friday's close and Monday's open. However, Harris [4] shows that Rogalski's conclusion depends, in part, on the sample of stocks he selected and on the fact that Rogalski did not use transaction-by-transaction data.

While several explanations for the weekly seasonal have been suggested, all of them have been found to be inconsistent with the data. For example, Lakonishok and Levi [6] and Gibbons and Hess [3] find that the abnormal Monday returns cannot be explained by the lag between trading and settlement, Keim and Stambaugh [5] shows that measurement error does not appear to cause the seasonal, and Smirlock and Starks [9], as well and Keim and Stambaugh, find that specialist-related biases are not an adequate explanation.

In this paper I test to see whether the same seasonal pattern is present in futures prices. French [2], Keim and Stambaugh [5], and Rogalski [8] all find a weekly pattern for the SP500. Futures contracts written on the SP500 began trading on April 21, 1982. Thus one obvious, but intriguing, question is whether the seasonal observed in the cash market holds in the futures market. The most plausible hypothesis is that the relation between cash and futures prices does not depend on the day of the week, so that a seasonal in the cash market produces a seasonal in the futures market. However, there are a number of reasons why this

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conclusion might not hold. First, at a purely empirical level, Cornell [1] and Modest and Sundaresan [7] find that the basis is highly variable for stock index futures and that the relation between cash and futures prices appears to change as time passes. Second, transaction costs, particularly the costs of selling short, are much smaller in the futures market. The bid-ask spread for the most actively traded contract is typically about 0.07% and clearing costs are less than $2.00 per contract for floor traders. Finally, the volume of futures trading is very high during the opening and closing minutes, implying that reported opening and closing quotes may be more representative of true market prices.

It is also possible that the seasonal pattern in the cash market has been affected by the introduction of futures trading. A second interesting question, therefore, is whether the day-of-the-week effect continues for the SP500 after April 21, 1982.

Although definitive answers must await larger samples, the first 27 months of futures trading produces some surprising results. First, there is no evidence of "blue Monday" in the SP500 futures market. In fact, the mean return is higher on Monday than on any other day. Nonetheless, the day-of-the-week effect persists in the cash market.

I. Data and Empirical Results

The data consist of daily observations of the opening and closing price for the SP500 index and the most actively traded futures contract. Only the most actively traded contract is used because of the skewed volume of trading in the futures market. For example, on July 12, 1984 the volume of trading was as follows:

September 84 contract	55,924
December 84 contract	1,139
March 85 contract	6
June 85 contract	0

In general, the nearby contract is the most actively traded until the beginning of the delivery month, then volume quickly shifts to the next contract. Therefore, the price data used in this study are for the nearby contract, except during delivery month when the next most distant contract is used.

The sample period runs from May 3, 1982 to July 24, 1984. All holidays, and the days following holidays, are excluded from the sample. For example, if Monday is a holiday then the Friday to Tuesday return is deleted. Thus, all the data are "normal" one-day and weekend returns. There are not enough holidays in the sample to study them separately.

The results are reported in Table I. Because the market rose about 25% during the sample period, the net means, defined as the mean for each day minus the grand mean, are reported, as well as the daily means, the t-statistics, and two F-statistics. The first F-statistic is for the hypothesis that all the daily means are equal, the second is for the hypothesis that Monday's return equals the average of the other four days.

Table I

Day-of-the-Week Statistics: Spot and Futures Returns, May 3, 1982–July 24, 1984

	Mon	Tue	Wed	Thur	Fri	*F*-Statistic[a]
Observations	99	107	104	103	111	
Spot SP500: close to close						
Mean	−0.0300	0.945	0.1577	−0.0229	0.0411	0.74
t-Statistic	(−0.31)	(1.01)	(1.73)	(−0.25)	(0.44)	
Net mean	−0.0798	0.0447	0.1079	−0.0727	−0.0087	0.82
Spot SP500: close to open						
Mean	−0.1285	0.0715	0.0915	0.0176	0.0971	3.13*
t-Statistic	(−2.38)*	(1.38)	(1.82)	(0.35)	(1.90)	
Net mean	−0.1618	0.0382	0.0582	−0.0157	0.0638	11.01**
Spot SP500: open to close						
Mean	0.0986	0.0230	0.0662	−0.0405	−0.0560	0.60
t-Statistic	(1.10)	(0.27)	(0.79)	(−0.48)	(−0.66)	
Net mean	0.0821	0.0065	0.0497	−0.0570	−0.0725	1.03
SP500 futures: close to close						
Mean	0.1090	−0.0302	0.0627	0.0805	−0.0584	0.39
t-Statistic	(0.90)	(−0.26)	(0.55)	(0.71)	(−0.51)	
Net mean	0.0772	−0.0620	0.0309	0.0487	−0.0902	0.50
SP500 futures: close to open						
Mean	0.0139	0.0137	0.0608	0.0664	0.0387	0.26
t-Statistic	(0.27)	(0.28)	(1.27)	(1.38)	(0.81)	
Net mean	−0.0258	−0.0260	0.0221	0.0267	−0.0010	0.31
SP500 futures: open to close						
Mean	0.0951	−0.0440	0.0019	0.0140	−0.0971	0.38
t-Statistic	(0.80)	(−0.38)	(0.17)	(0.13)	(−0.86)	
Net mean	0.1030	−0.0361	0.0098	0.0219	−0.0892	0.92

[a] The first *F*-statistic is for the hypothesis that all the coefficients are equal in the regression $R_t = a_1D1 + a_2D2 + a_3D3 + a_4D4 + a_5D5 + u_t$, where R_t is the return on the market index and $D1$ through $D5$ are day-of-the-week dummies. The second *F*-statistic is for the hypothesis that Monday's return is equal to the average of the other four days.

*,** Denote significance at the 5% level and the 1% level, respectively.

For cash SP500 the results are similar to those reported by Rogalski [8]. In addition, Table I confirms Rogalski's contention that the Monday effect is a weekend effect which occurs between Friday's close and Monday's open. The return from Friday's close to Monday's open is significantly negative despite the overall positive return during the sample period. Furthermore, the *F*-tests reject the hypothesis that the close to open mean returns are equal across days of the week, and the hypothesis that Monday's return equals the average of the other four days. Once the market opens, however, the effect disappears and Monday has the highest return, although the difference is not statistically significant. Nonetheless, the high return when trading is open offsets the low return from

close to open so that none of the t-statistics nor the F-statistics are significant at the 5% level for the close to close data.

The futures results are strikingly different. There is no evidence of a Monday effect whatsoever. On a close to close basis, Monday's mean return is the largest of the week. During the close to open period, the mean returns are virtually indistinguishable across days of the week. In short, the behavior of the future prices is consistent with the predictions of the efficient market hypothesis.

To check the results, the sample was divided into two subperiods. The first subperiod runs from May 3, 1982 to June 30, 1983; the second runs from July 1, 1983 to July 24, 1984. This division makes it possible to see if the conclusions are sensitive to the overall market return. During the first period, the market rose 36.4 percent, while it fell 12.9 percent during the second period. Nonetheless, the results for both periods are similar. A significant Monday effect is found for the cash market, but none is observed in the futures market.

In light of the different behavior of the spot and futures markets, additional information can be obtained by studying the basis, defined here as the log of the futures price minus the log of the spot price. The main benefit to be derived from using the basis is an increase in the precision of the estimates since the variance of the change in the basis is significantly less that the variance of the change in the futures price or the change in the spot price.

Results for the basis are presented in Table II. The close to close figures reveal a significant Monday effect that was not found in the cash market. This development is due to a combination of the positive futures return on Monday and the smaller standard errors. Note, however, that Monday's increase in the basis is almost totally offset by a significant decrease on Tuesday. It is also

Table II

Day-of-the-Week Statistics: Changes in the Basis ($\log(F) - \log(S)$), May 3, 1982–July 24, 1984

	Mon	Tue	Wed	Thur	Fri	F-Statistic[a]
Observations	99	107	104	103	111	
Basis change times 100: close to close						
Mean	0.1389	−0.1248	−0.0950	0.1034	−0.0096	5.09**
t-Statistic	(2.40)*	(−2.24)*	(−1.76)	(1.91)	(−1.82)	8.88**
Basis change times 100: close to open						
Mean	0.1424	−0.0578	−0.0307	0.0489	−0.0584	2.76*
t-Statistic	(2.67)*	(−1.12)	(−0.62)	(0.98)	(−0.72)	7.99**
Basis change times 100: open to close						
Mean	−0.0035	−0.669	−0.0643	0.0546	−0.0411	0.80
t-Statistic	(−0.05)	(−1.14)	(−1.13)	(0.96)	(−0.72)	0.14

[a] The first F-statistic is for the hypothesis that all the coefficients are equal in the regression $R_t = a_1D1 + a_2D2 + a_3D3 + a_4D4 + a_5D5 + u_t$, where R_t is the return on the market index and $D1$ through $D5$ are day-of-the-week dummies. The second F-statistic is for the hypothesis that Monday's return is equal to the average of the other four days.

*,** Denote significance at the 5% level and the 1% level, respectively.

interesting to note that the seasonal pattern in the basis is attributable to price moves that occur when the markets are closed. The open to close change in the basis is not significantly different from zero on any day and an F-test does not reject the hypothesis that all of the daily changes are zero. (The F-statistics referred to here are different than the F-statistic reported in Table II which tests the hypothesis that all of the daily changes are the same.) This contrasts sharply with the close to open findings where the Monday effect is significant and an F-test clearly rejects the hypothesis that all of the daily changes equal zero. Thus, the basis results provide further evidence that the Monday effect is due to the peculiar behavior of cash prices when the market is closed.

Assuming that the weekly pattern in the cash market is found to persist, but that no similar pattern emerges in the futures market, two obvious explanations are transaction costs and and measurement error. Trading costs are much lower in the futures market, and the opening and close quotes are generally based on recent transactions. Unfortunately, neither of these explanations is adequate. As French [2] notes, transaction costs may prevent direct arbitrage in the cash market, but sellers can always choose to liquidate at Friday's close, while buyers can postpone purchases until Monday's open. Similarly, Keim and Stambaugh [5] show that although nontrading will produce measurement error in the SP500 index, such measurement error does not cause the Monday effect. Thus, the fact that a weekly pattern does not exist in the futures market deepens the mystery of why such a pattern exists in the cash market.

II. Summary and Conclusions

The results reported here confirm the findings of Rogalski and others regarding the weekly pattern of returns for the SP500 index, but reveal no similar pattern for the SP500 futures. Consistent with this finding there is also a significant weekly seasonal in the basis, which tends to widen on Monday and narrow on Tuesday. A more detailed investigation revealed that the weekly pattern is primarily due to the peculiar behavior of cash prices during nontrading hours. There is no evidence that futures prices deviate from the predictions of the efficient market hypothesis.

The fact that the futures market is "efficient" makes it more difficult to explain the seasonality in cash returns. Although transaction costs are less in the futures market and although futures data more closely approximate true market prices, previous studies show that neither transaction costs nor measurement error can explain the pattern in cash prices. This is clearly a subject that should be studied further as more futures data become available.

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