FINNISH TURN-OF-THE-MONTH EFFECTS: RETURNS, VOLUME, AND IMPLIED VOLATILITY

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INTRODUCTION

A turn-of-the month (TOM) effect has been found in many markets.[1] Recently, Martikainen, Perttunen, and Ziemba (henceforth, MPZ) (1994) investigated the regularity of the TOM effect in 24 stock markets and 12 different regional indices of the world. They reported that the TOM effect exists for most countries as well as for regions. However, the TOM effect seemed not to exist in some small stock markets, such as those of Finland, Mexico, New Zealand, and Australia.

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[1]In his pioneering work, Ariel (1987) found that the returns of U.S. Stocks were larger at the TOM than in the rest of the month for the period of 1963–1981. His results have been supported by, e.g., Keim and Smirlock (1987), Linn and Lockwood (1988), Lakonishok and Smidt (1988), Cinar and Vu (1991), and Hensel, Sick, and Ziemba (1993, 1994). Recent studies have generalized the results to non-U.S. stock and stock index futures markets, e.g., Jaffe and Westerfield (1989), Barone (1990), Cadsby and Ratner (1991), and Ziemba (1989, 1991, and 1994).

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Even though the empirical findings of MPZ (1994) do not support the existence of the TOM effect in the Finnish stock market for January, 1988–January, 1990, the Finnish market participants and media have widely discussed the seasonality recently.[2] This article provides new evidence on the TOM effect in the Finnish stock and stock index derivatives markets. The purpose of this investigation is to discover why the Finnish TOM effect was not found in MPZ (1994). They claimed that this may be due to three major reasons: (i) short sample period; (ii) the small number and infrequency trading of stocks included in the index investigated; and (iii) the use of the period between the last trading day of the month (−1) and four first trading days of the month (+1 to +4) as the TOM.

This article uses a longer estimation period, a market index with greater coverage, and different definitions for the TOM days to investigate the effect in Finland. The derivatives markets are also included in the analysis. The results of this study indicate that significant TOM effects between the days −5 and +5 are found in Finnish stock and stock index futures markets.

The second contribution of this study is that analysis is extended to stock index options. The Finnish options market is very suitable for this purpose because Finnish stock index options are European options with no risk of early exercise. This makes it possible to calculate the put–call parity implied index value. There are only a few studies on the TOM effect in options markets; but recently, Cotner and Nayar (1993) reported no statistically significant difference in S&P 100 cash implied index option returns between the first half of the month and the rest of the month. The TOM effect was not directly investigated, however. The results of this study indicate that the TOM effect is evident in the Finnish stock index options markets, both in put–call parity implied index returns as well as in implicit volatilities.

Third, the TOM literature is for the first time related to the behavior of volume figures.[3] This study investigates the call and put volumes in Finnish stock index options markets to measure the level of bearishness and bullishness in the market. The results indicate that the call–put signal based on the relationship between call and put volumes is dependent on the day of the month. In the TOM, the call–put signal

[2]A major Finnish business newspaper, *Kauppalehti,* and the leading newspaper, *Helsingin Sanomat,* discussed the seasonality in their stock market commentaries on October 1, 1993, and September 28, 1993, respectively.

[3]Exceptions are the studies by Lakonishok and Maberly (1990) and Martikainen and Puttonen (1993), who investigate volume figures in connection with the day-of-the-week effect.

is significantly higher than in the rest of the month. This suggests that investors are more bullish in the TOM than on other trading days.

THE DATA

Finnish Stock Index Derivatives

This study uses cash as well as derivatives market information to investigate the Finnish TOM effects. Several studies have reported that derivatives markets anticipate the TOM effect on cash markets. This may be because derivatives markets have better transactional efficiency (lower transaction costs and less restrictive rules on short sales) than stock markets. In addition, the use of derivatives markets in empirical tests eliminates the problem of nonsynchronous trading evident in stock market indices (see e.g., Chan, 1992). Thus, it is evident that the omission of derivatives markets may in some cases bring misleading conclusions.

The Finnish Options Market (FOM) began trading in stock index options and futures on May 2, 1988. The base figure of the value-weighted FOX (Finnish Options Index) index was set at 500.0 on March 7, 1988.[4] On April 17, 1989 the index reached its all-time high, 697.7. The volume of index options has been higher than the volume of index futures. The average daily number of (nearest to expiration) futures contracts was 95 (median 60) for the period investigated. At the same time, the average number of corresponding at-the-money options (call + put) was 144 (median 88).[5]

Table I provides a description of the problems of infrequency trading in the FOX index. The FOX index consists of the 25 most actively traded shares on the Helsinki Stock Exchange (HESE). The series are checked semiannually, i.e., the composition of the index comes up for review at the beginning of February and August (Finnish Options Market, 1993). The basic principle of the FOM is that the FOX index

[4]MPZ (1994) used FTA-indices from 24 countries to make their results comparable across different stock exchanges. The FOX index analyzed here differs considerably from the FTA index. The major difference is that the FTA-index consists of only unrestricted stocks. Prior to the beginning of 1993, the unrestricted stocks were tradable by both foreign and domestic investors, while the restricted stocks were tradable only by Finnish investors. Booth, Chowdhury and Martikainen (1994) found that there are two major characteristics typical of Finnish unrestricted stocks: their volatility is very high and they are infrequently traded. The FOX index covers the Finnish market better than the FTA index, the proportion of FOX shares being typically about 70% of the total trading in the Helsinki Stock Exchange.

[5]The number of options traded is multiplied by the rough estimate of delta which for at-the-money options equals 0.50. This is done to get a better picture of the risk transfer volume of options markets relative to futures markets (whose delta, of course, equals one).

TABLE I
The Nontrading Probability of the Stocks Included in the FOX Index during the Different Time Periods

Period	*Min*	*Q1*	*Med*	*Q2*	*Max*	*Average*	*Weighted Average*
8805–8807	0.000	0.000	0.000	0.000	0.047	0.005	0.004
8808–8901	0.000	0.000	0.008	0.023	0.208	0.029	0.014
8902–8907	0.000	0.008	0.008	0.024	0.669	0.063	0.022
8908–9001	0.000	0.008	0.031	0.063	0.227	0.048	0.021
9002–9007	0.000	0.032	0.081	0.194	0.573	0.134	0.081
9008–9101	0.000	0.016	0.024	0.143	0.437	0.086	0.040
9102–9107	0.000	0.000	0.024	0.105	0.371	0.066	0.023
9108–9201	0.000	0.016	0.056	0.128	0.312	0.093	0.046
9202–9207	0.000	0.008	0.032	0.073	0.298	0.054	0.024
9208–9301	0.000	0.000	0.019	0.038	0.264	0.036	0.020
9302–9307	0.000	0.000	0.000	0.000	0.064	0.006	0.003
9308–9401	0.000	0.000	0.000	0.000	0.043	0.002	0.000

The nontrading probability is the proportion of days in which there was no trade for a specific stock during the period.
Min is the minimum of the nontrading probabilities of the 25 stocks included in the FOX index in the period.
Q1 is the lower quartile of the nontrading probabilities of the 25 stocks included in FOX index in the period.
Med is the median of the nontrading probabilities of the 25 stocks included in the FOS index in the period.
Q2 is the upper quartile of the nontrading probabilities of the 25 stocks included in the FOX index in the period.
Max is the maximum of the nontrading probabilities of the 25 stocks included in the FOX index in the period.
Average is the average of the nontrading probabilities of the 25 stocks included in the FOX index in the period.
Weighted Average is the weighted average of the nontrading probabilities of the 25 stocks included in the FOX index in the period. The weights are those used in computing the FOX index.

should be made up of the most liquid stocks in the HESE. Thus, the stock series selected are the top 25 shares in terms of median trading during the previous half of a calendar year. The nontrading probability figures in Table I indicate the proportion of days in which there was no trading in a given stock during the sample period. The lowest trading frequency in FOX stocks is observed in the period February, 1990–July, 1990, when the median of nontraded days across stocks is 8.1%. The respective mean is 13.4%. The last column of the table is the mean of the value-weighted nontrading probability of the FOX stocks when the weighting is based on the weights of the individual stocks in the FOX index. To illustrate the seriousness of the nonsynchronous trading problem in the FOX index, Chan (1992) reports much lower nontrading probabilities for the MMI index in five-minute intervals than found in Finland in daily intervals.

Data Description

The sample period investigated covers the period of May 2, 1988–October 14, 1993. Daily closing prices at 3:30 PM are used. The spot index is based on last transaction prices of individual stocks. For the futures and options markets, the average of bid and ask prices is calculated at 3:30 PM. The returns are determined as differences in logarithmic price indices, and are multiplied by 100.

The main derivatives data base used in this article is based on the nearby contracts because they have been more liquid than other contracts. A week before maturity the analysis is shifted to the next nearest contract to avoid possible expiration week effects. For both futures and options, the expiration occurs at the fourth Friday of the expiration month. To account for the financing costs (or savings) of holding a futures position (instead of the underlying stocks) and to control for the possible price jumps on rollover days, the futures price has to be adjusted. The cash equivalent futures price is calculated using the cost-of-carry model. The three-month HELIBOR (Helsinki Interbank Offered Rate) is used as the discount rate.

Finnish stock index options are European options. Since there is no risk of early exercise, it is possible to calculate the put–call parity implied index value. In addition to put–call parity implied returns, the implicit volatilities are investigated. These are iterated from the price of the at-the-money call options by using the Black76 model. Volume figures from the stock index options market are analyzed also. This is done by using the call–put signal based on the volume of call and put options as follows:

$$\text{Call} - \text{put signal} = (\text{Call volume})/(\text{Call volume} + \text{Put volume})$$

where the option volume is the total number of contracts traded in each day. The information content of the call–put signal lies in the assumption that call options are purchased by bullish investors and put options by bears. Since every trade must be balanced, a seller is needed for buyers. The seller of a call is not necessarily bearish but he is not bullish. Correspondingly, the seller of a put option is not bearish. Therefore, a large (small) call–put signal can be interpreted as bullishness (bearishness) of option traders (see, e.g., Anthony, 1988).

When evaluating the behavior of variables on different trading days, the return for each day is adjusted to the average return of the current month. Thus, for instance, the return of the last trading day of December, 1989 is adjusted to the mean return computed using the last nine days of 1989 and the first nine trading days of 1990. The aim is to highlight the daily variation in monthly figures.

EMPIRICAL RESULTS

Table II shows the average returns, implicit volatilities and call–put signals for the Finnish markets for trading days from −9 to +9. Turn-of-the-years (TOYs) are excluded from the sample eliminating the effect of the TOY regularity (see Ziemba, 1994).[6] Regarding cash market returns, the −1 day is clearly statistically significant, the *t*-value being 2.999. This result is in accordance with most of the earlier TOM studies in large markets typically reporting largest stock market returns on the last trading day of the month.

The average returns of the stock index futures market by trading day of the month show that the largest returns are observed on days −2 and −3, both of which are statistically significant. Thus, the TOM effect is evident one or two days earlier in stock index futures than in cash markets. The stock index futures market appears to anticipate the behavior of stock market. Also, this finding is similar to what has been reported in large markets, i.e., in Japan and the U.S. by Ziemba (1994) and Hensel, Sick and Ziemba (1994), respectively. It also supports the earlier findings by Puttonen (1993) indicating that Finnish stock index options markets lead cash markets by 1–2 days.

In the put–call purity implied index returns, the largest returns are observed on day-3. Similarly, the put–call signal appears to be highest on day −3, i.e., two days prior to the TOM. The implicit volatilities reflect the TOM effect very clearly. In the last trading days of the month the implicit volatilities are considerably higher than they are in the first trading days of the month.

One obvious problem in the above analysis is that diffusion exists in daily seasonalities. This is the case especially in small markets, because in these markets the returns are not independently and identically distributed over time.[7] Theobald and Price (1984) analytically discuss the implications of this phenomenon for stock market seasonalities. To avoid the problem of diffusion across days, the TOM effect is analyzed for longer intervals, i.e., the last trading week (−5 to −1), the first trading week (+1 to +5), the turn of the month (−5 to +5), the last half of the month (−9 to −1), and the first half of the month (+1 to +9) are each analyzed separately.

[6]The analysis was also replicated including TOYs. It indicated that the results reported here are not sensitive to the exclusion of TOYs. A similar analysis was performed also to control for the day-of-the-week effect. The exclusion of Mondays did not materially affect the results reported here.
[7]Martikainen and Puttonen (1993) provide an analysis of the distributions of Finnish stock, stock index futures, and put–call parity implied index returns.

TABLE II

Averages of the Investigated Variables in the Different Trading Days of the Month

	Cash		*Futures*		*Options*		*Volatility*		*Call–Put Signal*	
DOM	*Mean*	*(t)* *(p)*	*Mean*	*(t)* *(p)*	*Mean*	*(t)* *(p)*	*Mean*	*(t)* *(p)*	*Mean*	*(t)* *(p)*
−9	−0.018	(−0.140)	−0.155	(−0.708)	−0.044	(−0.197)	−0.000	(−0.025)	0.006	(0.438)
		(0.889)		(0.482)		(0.845)		(0.980)		(0.663)
−8	−0.197	(−1.057)	−0.227	(−1.244)	−0.325	(−1.688)	0.004	(0.934)	−0.002	(−0.108)
		(0.295)		(0.218)		(0.097)		(0.354)		(0.914)
−7	−0.308	(−2.097)	−0.530	(−2.692)	−0.513	(−2.382)	0.009	(2.892)	0.008	(0.550)
		(0.040)		(0.009)		(0.020)		(0.005)		(0.585)
−6	−0.146	(−0.924)	−0.143	(−0.761)	−0.150	(−0.797)	0.006	(1.494)	−0.026	(−1.622)
		(0.359)		(0.450)		(0.429)		(0.141)		(0.110)
−5	0.262	(1.619)	0.343	(1.365)	0.250	(1.025)	0.007	(2.549)	−0.006	(−0.388)
		(0.111)		(0.178)		(0.310)		(0.013)		(0.699)
−4	0.058	(0.386)	−0.016	(−0.091)	0.021	(0.115)	0.014	(4.861)	0.005	(0.309)
		(0.701)		(0.928)		(0.909)		(0.000)		(0.758)
−3	0.176	(1.339)	0.381	(2.005)	0.539	(2.710)	0.009	(3.630)	0.038	(2.482)
		(0.186)		(0.049)		(0.009)		(0.001)		(0.016)
−2	0.166	(1.537)	0.311	(2.003)	0.228	(1.388)	0.007	(2.737)	−0.007	(−0.342)
		(0.130)		(0.049)		(0.170)		(0.008)		(0.734)
−1	0.367	(2.999)	0.008	(0.060)	−0.003	(−0.024)	0.007	(2.780)	0.010	(0.677)
		(0.004)		(0.952)		(0.981)		(0.007)		(0.501)
+1	−0.127	(−1.193)	−0.221	(−1.288)	−0.180	(−0.991)	0.000	(0.002)	0.025	(1.664)
		(0.238)		(0.203)		(0.326)		(0.998)		(0.101)
+2	−0.073	(−0.446)	0.140	(0.713)	0.091	(0.500)	−0.005	(−2.160)	0.005	(0.295)
		(0.657)		(0.479)		(0.619)		(0.035)		(0.769)
+3	0.114	(0.828)	0.112	(0.676)	0.003	(0.016)	−0.001	(−0.564)	0.015	(0.949)
		(0.411)		(0.502)		(0.987)		(0.575)		(0.347)
+4	0.057	(0.471)	0.118	(0.791)	0.204	(1.459)	−0.003	(−1.407)	0.012	(0.734)
		(0.639)		(0.432)		(0.150)		(0.165)		(0.466)
+5	0.033	(0.223)	0.008	(0.048)	0.027	(0.155)	−0.008	(−2.463)	0.009	(0.740)
		(0.825)		(0.962)		(0.877)		(0.017)		(0.462)
+6	0.041	(0.250)	0.104	(0.499)	0.047	(0.228)	−0.009	(−2.582)	0.006	(0.402)
		(0.804)		(0.620)		(0.821)		(0.012)		(0.689)
+7	−0.203	(−1.592)	−0.147	(−0.864)	−0.212	(−1.236)	−0.013	(−3.742)	−0.007	(−0.471)
		(0.117)		(0.391)		(0.222)		(0.000)		(0.640)
+8	−0.091	(−0.547)	0.031	(0.203)	0.091	(0.595)	−0.009	(−2.457)	−0.034	(−2.003)
		(0.587)		(0.840)		(0.554)		(0.017)		(0.050)
+9	−0.020	(−0.180)	−0.250	(−1.540)	−0.217	(−1.395)	−0.010	(−2.462)	−0.057	(−3.992)
		(0.858)		(0.129)		(0.168)		(0.017)		(0.000)

Cash is the average mean-adjusted daily stock market return based on the FOX index.
Futures is the average mean-adjusted daily return of the nearby FOX futures contract.
Options is the average mean-adjusted daily put–call parity implied return based on the option contracts on the FOX index.
Volatility is the average mean-adjusted implicit volatility of the option contracts on the FOX index.
Call–Put Signal is the average mean-adjusted relative proportion of the call-option contracts of all option contracts on the FOX index.
The averages are computed over the whole research period.
The adjustments are made using the mean values of the variables computed over the one-month period surrounding the corresponding turn-of-the-month.
t-values are for the hypothesis that the average does not differ from zero.
p-values are the significance levels of the (two-tailed) t-test.
Turn-of-the-years are excluded from the analysis.

Table III

Averages of the Investigated Variables during the Different Periods of the Month

	Period				
	−9 to −1	*+1 to +9*	*−5 to −1*	*+1 to +5*	*−5 to +5*
Cash	0.040	−0.030	0.206	0.001	0.103
(*t*)	(0.814)	(−0.646)	(3.382)	(0.011)	(2.389)
(*p*)	(0.416)	(0.519)	(0.001)	(0.991)	(0.017)
Futures	−0.003	−0.011	0.205	0.031	0.118
(*t*)	(−0.049)	(−0.196)	(2.472)	(0.410)	(2.095)
(*p*)	(0.961)	(0.845)	(0.014)	(0.682)	(0.037)
Options	0.000	−0.016	0.207	0.029	0.118
(*t*)	(0.006)	(−0.280)	(2.475)	(0.381)	(2.089)
(*p*)	(0.995)	(0.779)	(0.014)	(0.703)	(0.037)
Volatility	0.007	−0.006	0.009	−0.003	0.003
(*t*)	(6.329)	(−6.207)	(7.467)	(−3.015)	(3.081)
(*p*)	(0.000)	(0.000)	(0.000)	(0.003)	(0.002)
Call−Put Signal	0.003	−0.003	0.008	0.013	0.011
(*t*)	(0.559)	(−0.541)	(1.142)	(1.959)	(2.175)
(*p*)	(0.576)	(0.589)	(0.255)	(0.051)	(0.030)

Cash is the average mean-adjusted daily stock market return based on the FOX index.
Futures is the average mean-adjusted daily return of the nearby FOX futures contract.
Options is the average mean-adjusted daily put−call parity implied return based on the option contracts on the FOX index.
Volatility is the average mean-adjusted implicit volatility of the option contracts on the FOX index.
Call−Put Signal is the average mean-adjusted relative proportion of the call-option contracts of all option contracts on the FOX index.
The averages are computed over the whole research period.
The adjustments are made using the mean values of the variables computed over the one-month period surrounding the corresponding turn-of-the-month
t-values are for the hypothesis that the average does not differ from zero.
p-values are the significance levels of the (two-tailed) *t*-test.
Turn-of-the-years are excluded from the analysis.

The results in Table III show that the TOM from −5 to +5 is significant for all of the five variables investigated. This can be seen from the significant *t*-values for testing the null hypothesis that the values of the variables do not differ from the average values of the variables across all trading days. The comparison of the figures of the last and first trading weeks of the month shows that the Finnish TOM effect seems to be evident especially in the last trading days of the month. The *t*-values for the rest-of-the-month figures are typically insignificant, except for the implicit volatilities for which the day-of-the-month effect seems to be especially clear, as shown in Table II.

The results of this study therefore suggest that significant TOM effects are found in the Finnish stock index futures, options, and cash markets. Significantly larger returns in stock index futures and cash markets are reported at the TOM than during the rest of the month. This is in accordance with previous findings for large markets. However, the result is different from that reported in MPZ (1994) in the Finnish cash markets. As suggested by MPZ (1994), the nonexistence of the Finnish TOM effect in their study may be because of the short estimation period and infrequency trading in the component stocks of the stock market index investigated. Moreover, a clear TOM effect is observed in the put–call parity implied index options returns, as well as in the implicit volatilities in the options markets. In addition, the call–put signal based on the volume of call and put options suggests that investors are more bullish in the TOM than in the rest of the month.

Discussions with market participants reveal that the TOM effect in Finland is often explained by the expiration of stock index derivatives. Since the derivatives expire on the fourth Friday of the expiration month, there might be some pressure on stock and stock index derivatives prices at the end of the expiration month. To investigate whether this is the case, the above analysis is replicated separately for expiration month (February, April, June, August, October, December) and nonexpiration months (January, March, May, July, September, November). The results indicate that the TOM is statistically significant in nonexpiration months, indicating that explanation appears to be not valid for the Finnish TOM effect.

Another explanation offered by market participants (see, e.g., *Kauppalehti,* October 1, 1993) is that the Finnish TOM seasonality is due to mutual funds' activities at the TOM designed to influence the market values of their portfolios. Finnish mutual funds typically publish their financial statements on a quarterly basis at the end of March, June, September, and December. To investigate the potential effect of this phenomenon on the TOM seasonality, the above analysis is performed separately for the four "disclosure months" and the eight other months. TOM seasonality is observed in "nondisclosure" months, indicating that the mutual fund explanation appears to be not valid also.[8]

[8]Ogden (1990) claims that the U.S. TOM effect is due to the fact that the U.S. economy has substantial payments to private investors, such as salaries and debt interest on the last trading day of the month. For instance, most of the corporate and municipal debt is payable on the first or last days of the month. Penman (1987) suggests that bad news such as that relating to earnings announcements is delayed and announced late in the month, while good news is released promptly at the beginning of the month. Ziemba (1994) reviews the TOM effect literature as well as other studies related to stock market seasonalities.

CONCLUSIONS

This article reports significant turn-of-the-month effects in the Finnish stock index futures, options, and cash markets. The effects are observed in returns and implicit volatilities as well as in call–put signals based on call and put volumes of index options. Especially strong effects are found in the last trading week of the month. The effects seem not to be sensitive to the turn-of-the-year or day-of-the-week seasonalities. Neither could the effects be explained by the expiration of stock index derivatives or the behavior of mutual funds.

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