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Day of the week effects: new evidence from an emerging stock market

ERCAN BALABAN

Institute of Economic and Social Sciences, Bilkent University, Bilkent 06533 Ankara, Turkey

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The primary objective is to investigate day of the week effects in an emerging stock market of a developing country, namely Turkey. Empirical results verify that although day of the week effects are present in Istanbul Securities Exchange Composite Index (ISECI) return data for the period January 1988 to August 1994, these effects change in direction and magnitude through time.

I. INTRODUCTION

It has been well documented in finance literature that any predictable pattern in asset returns may be exploitable and therefore judged as evidence against semi-strong efficiency of asset markets. One statistically significant pattern in stock market returns stems from seasonality. As such, seasonal effects in securities markets have attracted much interest among both academics and practitioners. Numerous researchers have studied seasonal anomalies in developed financial markets. However, it seems more difficult to find empirical studies with special reference to daily seasonality in emerging stock markets in international literature. Although there has been an increasing trend in studies using daily data, many researchers have employed lower-frequency data. A nonexhaustive list of studies concerning daily anomalies in developed stock markets includes Cross (1973), French (1980), Lakanishok and Levi (1982), Gibbons and Hess (1981), Keim and Stambaugh (1984), Jaffe and Westerfield (1985), Smirlock and Starks (1986), Abraham and Ikenberry (1994), and Agrawal and Tandon (1994). The primary aim of this paper is to present new evidence for daily anomalies from an emerging stock market of a developing country, namely Turkey.

Previous studies have reported that common stock returns, on average, are abnormally low on Mondays and abnormally high on Fridays. The above cited references, except Jaffe and Westerfield (1985) and Agrawal and Tandon (1994), provide empirical evidence from the USA. Jaffe and Westerfield (1985) find similar results in Japanese, Canadian and Australian stock markets as well as in the USA. Agrawal and Tandon (1994) provide international evidence from stock markets in 18 countries in support of the day of the week effects. However, to my knowledge, the reported day of the week effects remain a puzzle to be solved given market efficiency.[1]

Emerging stock markets have recently been of great importance to the worldwide investment community. In addition, there has been an increase in empirical studies concerning emerging markets thanks to the reliable and continuous data provided by the International Finance Corporation (IFC).[2] Unfortunately, the IFC's data set is, in general, aggregate in nature. This may prevent researchers from focusing on comparative studies using high frequency data from emerging markets. However, it is feasible to provide individual country evidence to extend the results of Agrawal and Tandon (1994). In addition, this paper provides both contrary and complementary evidence for the day of the week effects in the Turkish stock market reported by Erbil (1993) and summarized in Aydoğan (1994).

[1]In my opinion, the absence or existence of evidence for daily anomalies alone should not be considered as conclusive for market efficiency or inefficiency.

[2]See, for example, Claessens and Gooptu (1993), and Errunza (1994) among others.

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II. DATA AND METHODOLOGY

Daily observations of the Istanbul Securities Exchange Composite Index (ISECI) are employed to investigate the day of the week effects in the Turkish stock market. ISECI is an equally weighted index using closing prices and published by the Istanbul Securities Exchange (ISE). Daily index numbers provided by the Capital Market Board ranges between 4 January 1988 and 5 August 1994. Unconditional logarithmic returns that amount to 1646 observations are calculated as follows:

$$R_t = \log\ (I_t / I_{t-1}) \tag{1}$$

where I_t and R_t refer to ISECI number and return to the ISECI on day t, respectively. Returns for each day of the week are separately calculated for each year as well as for the whole period. A two-sample analysis for equality of mean returns across years is employed for comparison. Variance ratios are also reported.

A sign analysis is performed to detect weekend effect, if any, in ISECI return data. Following Abraham and Ikenberry (1994), percentages of sign of Monday return in week w conditional on the sign of Friday return in week w–1 are calculated for each year and for the whole period.

The following regression for the whole period is run to test whether there is any statistically significant difference among index returns on different days of the week:

$$R_t = B_1 D_{1t} + B_2 D_{2t} + B_3 D_{3t} + B_4 D_{4t} + B_5 D_{5t} + u_t \tag{2}$$

where $D_{1t} = 1$ if day t is a Monday and 0 otherwise; $D_{2t} = 1$ if t is a Tuesday and 0 otherwise; and so on. The OLS coefficients B_1 to B_5 are the mean returns for Monday through Friday, respectively. The stochastic disturbance term is indicated by u_t. The hypothesis to be tested is:

$$B_1 = B_2 = B_3 = B_4 = B_5 \tag{3}$$

The same regression is repeated for each individual year and for two sub-periods, 1988–91 and 1992–94, to detect whether the day of the week effect, if any, is stable through different periods.

III. EMPIRICAL RESULTS

Table 1 provides summary statistics for daily index returns through different time periods. The reported significance levels are due to one-sample analysis. The first order autocorrelation coefficients are positive and significant for the whole period and for each year except 1993. The coefficient of variation, CV, is a measure of return obtained per unit of risk. It is useful to compare risk-return trade-off across days as well as years.

For the period 1988–94, the lowest and negative average return, although not significant, is observed on Tuesday. Average returns are all negative on Tuesdays for each year except 1989. The highest average return, significant at 1%, is on Friday for the same period. In addition, it is more than two times greater than the average return if all days are included. Friday is the only day for which average returns are all positive for individual periods. The highest volatility is observed on Monday for each year as well as for the whole period. Friday has the lowest volatility for the period 1988–94. Highest return and lowest volatility observations on Fridays are followed by the second highest and lowest corresponding observations on Wednesdays (significant at 5%). These findings are consistent with those of Agrawal and Tandon (1994) who report lowest and negative returns on Tuesdays in 12 countries among which 8 are significant, and large and significantly positive returns on Fridays and on Wednesdays in 17 and 13 countries, respectively. In addition, they find that variance of stock returns is highest on Mondays and lowest on Fridays in all countries.

The findings of this paper in some cases conflict with those of Erbil (1993) who employ the same data using percentage returns for the period 1988–91. Aydoğan (1994), in his reference to Erbil (1993), notes that highest and lowest average returns are on Fridays and Thursdays, respectively. Monday has the highest standard deviation. In addition, lowest volatility is observed on Thursday. Although it is not reported in Table 1, for the period investigated by Erbil (1993) this study finds that the Friday return is large and positive (significant at 5%). Besides, the lowest standard deviation is observed on Friday.

The results of tests for equality of mean returns across years are provided in Table 2. In 16 of 28 cases, the null of equality of mean returns cannot be rejected. Although some pairs of years are reported to have equal means, they differ in variance ratios. For example, mean returns in 1990 and 1992 cannot be rejected to differ but year 1990 is almost 2.5 times more volatile than 1992. Similarly, volatility in 1992 is only one-quarter of that in 1994. This finding is significant to investigate risk-return trade-off in financial markets.

Table 3 is for sign analysis. Abraham and Ikenberry (1994) find that when Friday's return is negative, Monday's return is negative nearly 80% of the time. When Friday's return is positive, Monday's return is positive nearly 56% of the time. For the period 1988–94, positive Friday returns are followed by a positive and a negative return on Mondays 32.5% and 21.9% of the time, respectively. For the negative Friday returns, percentages for positive and negative Monday returns are 18.6 and 27, respectively. Thus, there is a positive relation between signs of Friday return and of subsequent Monday return. This result is even stronger for all individual years except 1992 and 1994.

The results of regressions with binary dummy variables for days are presented in Table 4. For the whole period, positive and statistically significant coefficients (nearly 0.0015 and 0.0019, respectively) are reported for Wednesday and Friday. This leads to higher returns on these days compared to the others. Although it is not significant, the coefficient for Tuesday is negative. These results are consistent with those presented in Table 1. In the case of separate regressions for each year, the results are mixed in terms of sign and magnitude. Note that (significant) negative coefficients for Tuesday and Wednesday in 1988 turn out to be positive in 1989. No significant coefficients are found for 1990

Table 1. *Logarithmic returns on ISECI by day of week*

	1988	1989	1990	1991	1992	1993	1994	1988–94
Monday								
No. Obs.[a]	50	51	48	48	51	50	29	327
Average[b]	0.047	0.242	0.163	0.097	–0.300*	0.390*	–0.117	0.086
SD[b]	1.299	1.496	1.801	1.879	1.196	1.531	2.304	1.643
CV[c]	0.036	0.162	0.091	0.051	–0.251	0.255	–0.051	0.052
% (+)[d]	42.0	62.7	58.3	45.8	39.2	64.0	48.3	51.7
Tuesday								
No. Obs.	49	52	50	48	51	50	29	329
Average	–0.326**	0.479**	–0.054	–0.119	–0.154	0.100	–0.260	–0.030
SD	1.069	1.295	1.631	1.491	0.901	0.969	1.653	1.318
CV	–0.305	0.370	–0.033	–0.080	–0.171	0.104	–0.157	–0.023
% (+)	32.7	69.2	44.0	43.8	47.1	52.0	44.8	48.0
Wednesday								
No. Obs.	50	51	50	50	50	49	31	331
Average	–0.270*	0.438**	0.185	0.036	0.193	0.391**	0.113	0.153**
SD	0.994	1.360	1.384	1.108	0.781	1.064	1.968	1.253
CV	–0.271	0.322	0.133	0.032	0.247	0.367	0.057	0.122
% (+)	38.0	60.8	46.0	48.0	54.0	59.2	58.1	51.7
Thursday								
No. Obs.	51	51	49	51	50	49	30	331
Average	–0.127	0.247*	–0.160	–0.176	0.112	0.331**	0.334	0.064
SD	0.959	1.040	1.388	1.508	1.100	0.943	1.952	1.284
CV	–0.132	0.238	–0.115	–0.117	0.101	0.350	0.171	0.050
% (+)	39.2	54.9	44.9	41.2	56.0	59.2	63.3	50.5
Friday								
No. Obs.	52	50	50	49	49	48	30	328
Average	0.136	0.103	0.203	0.430	0.089	0.266	0.013	0.186***
SD	0.820	1.031	1.347	1.358	0.685	1.113	1.659	1.157
CV	0.166	0.100	0.151	0.316	0.130	0.239	0.008	0.161
% (+)	51.9	60.0	50.0	55.1	53.1	60.4	50.0	54.6
All Days								
No. Obs	252	255	247	246	251	246	149	1646
Average	–0.105	0.303***	0.068	0.052	–0.015	0.290***	0.020	0.092***
SD	1.053	1.266	1.526	1.502	0.972	1.143	1.932	1.343
CV	–0.100	0.239	0.044	0.035	–0.016	0.254	0.010	0.068
% (+)	40.9	61.6	48.6	46.7	49.8	58.9	53.0	51.3
AC[e]	0.213***	0.344***	0.322***	0.114*	0.128*	0.077	0.417***	0.260***

Notes: [a]Number of observations; [b]average and standard deviation, SD, in percentages; [c]coefficient of variation, CV, average divided by standard deviation; [d]percentage of positive returns; [e]first order autocorrelation coefficient; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively, in two-tailed tests, based on the *t*-statistic for the difference of the mean return and first order autocorrelation coefficient from zero.

and 1994. All days are reported to be significant at least once. Also note that Friday returns differ significantly from those on the other days for the period 1988–91, a contrary result to that given by Aydoğan (1994).

IV. CONCLUSION AND FURTHER RESEARCH

Empirical results of this paper contribute to the previous research findings that daily anomalies in stock markets are an international phenomenon. The results of Agrawal and Tandon (1994) among others are extended to present evidence in support of day of the week effects from an emerging stock market of a developing country namely Turkey for the period 1988–94 as well as for different sub-periods. One interesting result also found for major developed markets is that reported daily seasonals are not constant in direction and magnitude through different time periods. This paper documents some contrary evidence to those results reviewed by Aydoğan (1994) who stresses that both parametric and non-parametric tests show that there are no statistically significant differences among daily returns on ISECI. This contradiction may stem from the data set employed or using percentage returns in

Table 2. *Two-sample analysis for equality of mean returns across years*

	1988	1989	1990	1991	1992	1993	1994
1989	–3.938***						
	(0.69)[b]						
1990	–1.471	1.882*					
	(0.48)	(0.69)					
1991	–1.352	2.023**	0.114				
	(0.49)	(0.71)	(1.03)				
1992	–0.995	3.161***	0.720	0.590			
	(1.17)	(1.70)	(2.46)	(2.39)			
1993	–4.004***	0.123	–1.827*	–1.973**	–3.199***		
	(0.85)	(1.23)	(1.78)	(1.73)	(0.72)		
1994	–0.836	1.774*	0.272	0.184	–0.239	1.741*	
	(0.30)	(0.43)	(0.62)	(0.60)	(0.25)	(0.35)	
WP[a]	–2.531**	2.742***	–0.305	–0.502	–1.367	2.515**	–0.684
	(0.58)	(0.88)	(1.36)	(1.31)	(0.49)	(0.70)	(2.33)

Notes: [a]Whole period excluding year at column; [b]variance ratio, VR, between year at column and year at row; e.g., $VR_{1988/1989}$ = $variance_{1988}/variance_{1989}$ = 0.69; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, in two-tailed tests, respectively, based on the *t*-statistic for equality of mean returns across years. The top number is calculated *t*-value.

Table 3. *Analysis of sign of Monday return conditional on the sign of the preceding Friday return*

(Sign of R^F_{w-1} / Sign of R^M_w)*

	(+/+)	(–/–)	(–/+)	(+/–)
1988	27.5	33.3	15.7	23.5
1989	43.8	18.8	20.8	16.6
1990	29.8	23.4	27.7	19.1
1991	32.6	30.4	17.4	19.6
1992	24.5	32.6	14.3	28.6
1993	45.7	21.7	15.2	17.4
1994	16.7	29.2	20.8	33.3
1988–94	32.5	27.0	18.6	21.9

*Percentage of sign of Friday return in week *w*–1 versus sign of Monday return in week *w* at each column for each year.

Erbil (1993). With reference to the former, this paper employs a data set at least 65% larger than that of Erbil (1993) in addition to an analysis of sub-periods missing in Erbil (1993). Moreover, even for the period investigated by Erbil (1993), this paper reports significant day of the week effects. Although it is not reported to save space, using percentage returns do not change any results of significance presented here.

Further research studies can and should be constructed to investigate whether reported daily anomalies are valid for individual shares and also to search for possible sources of these anomalies in an emerging market. Another fruitful area of research can be testing whether a trading strategy based on daily seasonals are profitable out of transactions costs. Finally, it is important for potential researchers to check the validity of the conflicting results presented in this paper and in Erbil (1993).

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Table 4. *Test for equality of mean return on ISECI across days of the week (B_i * 10^{-4})*

$$R_t = B_1D_{1t} + B_2D_{2t} + B_3D_{3t} + B_4D_{4t} + B_5D_{5t} + u_t$$

	B_1	B_2	B_3	B_4	B_5	R^2-ADJ.[a]	F-value	p-value
1988	4.66	–32.6**	–26.97*	–12.67	13.61	2.24	1.952	0.0864
	0.314[b]	–2.176	–1.819	–0.863	0.936			
1989	24.20	47.90***	43.75**	24.73	10.27	5.06	3.505	0.0044
	1.360	2.717	2.458	1.389	0.571			
1990	16.31	–5.41	18.47	–15.98	20.29	0.00	0.547	0.7403
	0.737	–0.249	0.852	–0.729	0.935			
1991	9.67	–11.92	3.57	–17.6	42.95**	0.50	1.047	0.3907
	0.446	–0.550	0.168	–0.837	2.001			
1992	–29.95**	–15.36	18.73	11.17	8.92	2.03	1.837	0.1062
	–2.218	–1.137	1.373	0.819	0.647			
1993	38.98**	10.04	36.38**	33.05**	26.62	5.27	3.527	0.0043
	2.396	0.617	2.214	2.011	1.603			
1994	–11.71	–26.03	11.26	33.40	1.27	0.00	0.320	0.9005
	–0.323	–0.717	0.321	0.936	0.036			
1988–91	13.78	–0.33	9.88	–5.28	21.57**	0.45	1.699	0.1320
	1.425	–0.034	1.032	–0.552	2.257			
1992–94	0.63	–7.97	23.60**	24.65**	13.8	01.00	2.102	0.0634
	0.053	–0.688	2.038	2.120	1.178			
1988–94	8.55	–2.30	15.27**	6.39	18.58**	0.07	1.285	0.2750
	1.152	–0.404	2.069	0.865	2.505			

[a]Adjusted R^2, in percentages; [b]calculated *t*-value; ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, in two-tailed tests, respectively, based on the *t*-statistic for difference of coefficient B_i from zero where $i = 1, \ldots, 5$.

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