SOME EMPIRICS OF THE TURKISH STOCK MARKET

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I. INTRODUCTION

I.1. Emerging Markets

Emerging stock markets have recently been of great importance to the worldwide investment community. According to the International Finance Corporation (IFC), a subsidiary of the World Bank, all markets in developing countries are treated as emerging. The World Bank defines developing countries to have per capita GNP below 7,620 U.S. dollars in 1990 prices. Under these definitions, the Istanbul Securities Exchange (ISE) is an emerging market of a developing country namely Turkey.

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ISE has continued to operate since January 1986. Number of companies whose stocks have been traded increased from 42 in January 1986 to 176 by the end of 1994. Total market capitalization was US $ 938 million at the end of 1986. It increased to US $ 21.8 billion by the end of 1994. The highest capitalization, US $ 37.8 billion, was observed in December 1993. In 1994, total trading volume was US $ 23.2 billion. For the period 1986-94, average price-earnings (P/E) ratio was 12.4. Average dividend payout (DIV) ratio was 6.5% for the same period. Table 1 gives further descriptive details concerning the ISE.

There has been an increase in empirical and policy-oriented studies concerning emerging stock markets. A partial list of these studies includes Claessens and Gooptu (1993), Cornelius (1993), Keane (1993), Mullin (1993), Claessens and Rhee (1994), Errunza (1994), Hauser *et. al.* (1994). In addition, one can find many studies on emerging markets using individual country data. However, there is little work with special reference to the Turkish stock market in international literature.[2]

I.2. Informational Efficiency

Informational efficiency of financial markets has attracted much interest among financial scholars and practitioners. The basic assertion given by the efficient market hypothesis (EMH) developed by Fama (1970) is that stock prices fully reflect any changes in the information set of investors. After two decades, Fama (1991) reviews the voluminous theoretical and empirical work undertaken by

[2] To my knowledge, recent published research includes Muradoğlu Şengül and Önkal (1992), Özer and Yamak (1992), Balaban (1995a), Metin and Muradoğlu (1995a, b).

numerous researchers on the informational efficiency of stock markets.

Finance literature presents three different forms of informational efficiency in stock market: *weak-form, semi-strong form,* and *strong form.* All three forms of efficiency under the EMH depend on information sets of investors. Weak-form efficiency basically asserts that one cannot use past price changes to achieve abnormal profits out of transactions costs. Stock prices *do* follow a random walk. As such, past prices have nothing to do with future prices. Semi-strong form efficiency enhances information set to include all publicly available information. Under this form, *all publicly available information* is quickly incorporated to stock prices to prevent investors trading on this piece of information from extra profits in a stock market. According to strong-form efficiency, stock prices reflect *all information* whether publicly available or not. Strong-form efficiency *implies* semi-strong form efficiency *implies* weak-form efficiency. However, the reverse is not correct.

I.3. Seasonal Anomalies

It has been well documented in finance literature that any predictable pattern in asset returns may be exploitable and therefore judged as evidence against 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. A nonexhaustive list of studies concerning daily anomalies in developed stock markets includes Cross (1973), French (1980), Gibbons and Hess (1981), Lakanishok

and Levi (1982), Keim and Stambaugh (1984), Jaffe and Westerfield (1985), Smirlock and Starks (1986), Abraham and Ikenberry (1994), and Agrawal and Tandon (1994).

Previous studies have reported that common stock returns, on average, are abnormally low on Mondays and abnormally high on Fridays. In addition, Fama (1965) reports that the variance of returns on Monday is 20% greater than the variances of returns on the other days for the U.S. stock market. The above cited references except Jaffe and Westerfield (1985), and Agrawal and Tandon (1994) provide empirical evidence from the U.S. Jaffe and Westerfield (1985) find similar results for Japanese, Canadian, and Australian stock markets as well as for the U.S. Agrawal and Tandon (1994) provide international evidence from stock markets in 18 countries in support of the day of the week effects.

Another calendar anomaly is turn-of-the year effect. Under this effect, stock prices decline in late December and increase in early January. Empirical evidence concerning the so-called year-end or January effect has been documented by Keim (1983), Reinganum (1983) and Roll (1983). In addition, Gültekin and Gültekin (1983) provides international evidence.

I.4. Aim of the Paper

This paper primarily aims to present some empirics of the Turkish stock market. To this end, the ISE Composite Index (ISECI) returns are employed. Weak-form efficiency of the ISE is the scope of the paper. In addition, daily and monthly seasonals are also investigated.[3] The paper is organized as follows: Section II outlines

[3] Investigation of daily anomalies in this paper is an extended version of Balaban (1995a).

data set and methodology used in the paper. Section III presents summary statistics and some empirical results of the tests. Section IV includes conclusion and further research.

II. DATA AND METHODOLOGY

This paper employs daily and weekly returns on ISECI for the period January 1988-August 1994. Monthly returns range between January 1986-December 1994. ISECI is a weighted index using closing prices of stocks and published by the ISE. All calculations are in local currency; i.e., Turkish lira. Data sources are the Capital Market Board and the Central Bank of the Republic of Turkey.

Unconditional logarithmic returns for different time intervals are calculated as follows:

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

where I_t and R_t refer to ISECI number and return to the ISECI on day or week or month t, respectively. For weekly returns, Wednesday is the base day.

Returns for each day of the week are separately calculated for each year as well as for the whole period. The following regression is first run for the whole period to test whether there is any statistically significant difference among index returns on different days of the week:

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

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 random disturbance term is indicated by u_t. The hypothesis to be tested is:

$$B_1 = B_2 = B_3 = B_4 = B_5 \quad (3)$$

The same regression is repeated for each individual year to detect whether day of the week effect, if any, is stable through different periods.

A two-sample analysis for equality of daily mean returns across years is employed for comparison. Variance ratios are also reported. The same applies to weekly mean returns.

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.

A parametric random walk test run to investigate weak-form efficiency for different periods is given by:

$$R_t = K * R_{t-1} + e_t \quad (4)$$

where K is the first-order autoregression coefficient. Random error term is e_t. The ordinary least squares (OLS) assumptions apply in all tests. Note that equation (4) is also a first-order Markov process. If K = 1, the null of index returns follow a random walk cannot be rejected. Otherwise, index returns can be thought as a first-order autoregressive model, a predictable pattern. Under random walk assumption, there is no difference between conditional returns based on a particular information set and unconditional returns.

Non-parametric tests for randomness are also performed. Two runs tests are used to determine whether an ordered sequence of the ISECI returns is random. First, the runs test above and below the median counts the number of runs that are completely above or

below the median. Values equal to the median are ignored. Second, the runs test up and down counts the number of times the sequence rises or falls. The number of rising and falling runs is one more than the number of turning points.

Weekly and monthly returns are investigated to present basic risk-return relationship in the ISE. To this end, summary statistics concerning the ISECI are reported for each year and for the whole period. Monthly returns are compared to detect month of the year effect, if any.

III. EMPIRICAL RESULTS

Summary statistics for daily index returns through different time periods are presented in *Table 2*. 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 stability that shows risk per unit of return. Standard deviation or variance is a measure of absolute risk whereas CV is a relative measure of risk. Therefore, it is useful to compare risk-return trade-off across different periods. According to CV, Friday is the most stable day whereas Tuesday is the least stable one in absolute terms. Stability, if measured by CV, widely differs not only across days of the week in a given year but also across years. This is consistent with the findings of Balaban (1995b) who reports that the ISE is highly volatile like the other emerging markets compared to the developed stock markets.

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 and

1993. 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. Friday has the lowest volatility for the period 1988-94. The highest volatility is observed on Monday for each year as well as for the whole period. Consistent with the findings of Fama (1965), the variance of Monday returns is approximately 25%, 31%, 28%, and 42% greater than the variances of Tuesday, Wednesday, Thursday, and Friday returns, respectively, for the whole period. 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 results of regressions with binary dummy variables for days are presented in *Table 3.* 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, coefficient for Tuesday is negative. These results are consistent with those presented in *Table 2*. 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 and 1994. All days are reported to be significant at least once.

The results of tests for equality of daily and weekly mean returns across years are provided in *Table 4* and *Table 10*, respectively. In 57% of daily tests and 81% of weekly tests, 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, daily mean returns in 1990 and 1992 cannot be rejected to differ but year 1990 is almost 2.5 times more volatile than 1992. In the case of weekly returns, this ratio increases to 3.2. These findings are consistent with that of Özer and Yamak (1992) who report that the volatility of stocks in the ISE increased and risk-return relationship was destroyed due to the Gulf Crisis. Similarly, daily volatility in 1992 is only one-fourth of that in 1994. For weekly returns, 1994 is five times more volatile than 1992. Increase in volatility in 1994 is not surprising because Turkey experienced a deep financial crisis in that year. The finding of dramatic increases in volatility during extraordinary periods is particularly significant to investigate risk-return trade-off in emerging financial markets. A detailed investigation of the term structure of daily volatility of the ISECI can be found in Balaban (1995c).

The effect of the direction of Friday return on the direction of the following Monday return is analyzed in *Table 5*. 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% 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, it can be speculated that 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. However, the results of this table should be interpreted with caution since no significance levels are reported.

The results of parametric random walk tests are presented in *Table 6*. In Panel A, the first order autoregression coefficient, K, is found to be different from unity as well as zero for each year and for the whole period. Note that all coefficients are positive but differ in magnitude. The highest K, approximately 0.42, is found for 1994. Almost 18% of the returns on ISECI during 1994 is explained by the previous day returns. For the whole period, the previous day returns could explain almost 7% of the following day returns with a K of 0.264. Although not reported in *Table 6*, the higher lags are also found to be statistically significant for all periods. In Panel B and Panel C, the results for weekly and monthly returns are shown. For the period 1988-94, weekly returns are positively correlated. However, for the same period, it cannot be rejected that monthly returns have a zero K. The findings of these random walk tests culminate in the rejection of weak-form efficiency of the ISE for daily and weekly data.

Non-parametric tests for randomness also reject weak-form efficiency in the ISE. According to *Table 7*, both runs tests result in rejection of randomness of daily returns. In Panel A of *Table 8*, for the period 1988-94, the null of randomness of weekly returns is rejected. However, for the period 1986-94, monthly returns follow a random walk according to the results in Panel B of *Table 8*. Note that all these results are consistent with those given by parametric tests.

The difference of weekly mean returns form zero cannot be rejected except for 1989, 1993 and for the whole period according to *Table 9*. Although volatility across years highly differs, weekly returns are less volatile compared to daily returns if risk is standardized by average return.

Summary statistics concerning monthly returns are presented in *Table 11*. Four months have merit to investigate further: January, March, April and October. For the period 1986-94, monthly returns in January are always positive except 1994. No other months have this property. In addition, January has the highest average return and the lowest CV compared to the other months and the whole period. Average March return is significantly negative. On the other hand, volatility, measured by standard deviation, is the lowest in March. April is the most unstable month according to risk per unit of return in absolute terms. October has the lowest and negative average return. A more detailed investigation of month of the year effects in the Turkish stock market can be found in Balaban (1995d).

IV. CONCLUSION AND FURTHER RESEARCH

This paper concludes that the ISE is not weak-form efficient if daily and weekly data are employed. On the other hand, monthly index returns follow a random walk. These results are of independent of test nature; i.e., both parametric or non-parametric tests give similar results. In addition, the volatility of stock market returns highly differs across periods.

The other empirical results of the paper contribute to the previous research findings that such seasonal anomalies as day and month effects are also present in the Turkish stock market. The

paper reports 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 the Turkish stock market for the period 1988-94 as well as for different sub-periods. One interesting result also founded for major developed markets is that reported daily seasonals are not constant in direction and magnitude through different time periods.

The paper also reports that risk-return relationship in the ISE differs across months. There is a positive January effect. On the other hand, March and October present a negative effect for the same period.

Further research can and should be constructed to investigate whether reported daily and monthly anomalies are valid for individual shares. Another fruitful area of research can be testing whether a trading strategy based on these seasonals is profitable out of transactions costs. For example, such an active portfolio strategy as "buy an index-representative portfolio of stocks on Tuesdays and sell it on Fridays" can be investigated whether it outperforms a passive strategy such as "buy-and-hold." A similar strategy can be applied by using month effects detected in the paper. Finally, possible sources of calendar effects should also be investigated. However, I presently remain silent to answer what causes these reported anomalies in the Turkish stock market and leave it further research.

Table 1. *Istanbul Securities Exchange (ISE): Descriptive Data*

	1986	1987	1988	1989	1990	1991	1992	1993	1994
#[a]	80	82	79	76	110	134	145	160	176

TMC[b]	938	3,125	1,128	6,756	18,737	15,564	9,922	37,824	21,785
TTV[c]	13	118	115	773	5,854	8,502	8,567	21,770	23,203
P/E[d]	3.66	13.43	6.42	6.55	23.29	13.64	10.73	15.42	18.18
P/E[e]	5.07	15.86	4.97	15.74	23.97	15.88	11.39	25.75	24.83
DIV[f]	13.14	4.92	8.41	10.80	2.55	4.74	5.79	4.17	4.32
DIV[g]	9.15	2.82	10.48	3.44	2.62	3.95	6.43	1.65	2.78

Source: ISE Monthly Bulletin, February 1995, and the author's own calculations.
[a] Number of stocks traded as of year-end; [b] total market capitalization at year-end in US $ million; [c] total trading volume in US $ million; [d] average price-earnings ratio; [e] year-end price-earnings ratio; [f] average dividend payout ratio in percentages; [g] year-end dividend payout ratio in percentages.

Table 2. *Logarithmic Returns on ISECI by Day of Week*

	1988	1989	1990	1991	1992	1993	1994	1988-94
Monday								
Average[a]	.047	.242	.163	.097	-.300 *	.390 *	-.117	.086
SD[a]	1.299	1.496	1.801	1.879	1.196	1.531	2.304	1.643
CV[b]	27.64	6.18	11.05	19.37	-3.99	3.93	-19.69	19.10
% (+)[c]	42.0	62.7	58.3	45.8	39.2	64.0	48.3	51.7
Tuesday								
Average	-.326 **	.479 **	-.054	-.119	-.154	.100	-.260	-.030
SD	1.069	1.295	1.631	1.491	.901	.969	1.653	1.318
CV	-3.28	2.70	-30.20	-12.53	-5.85	9.69	-6.36	-43.93
% (+)	32.7	69.2	44.0	43.8	47.1	52.0	44.8	48.0
Wednesday								
Average	-.270 *	.438 **	.185	.036	.193	.391 **	.113	.153 **
SD	.994	1.360	1.384	1.108	.781	1.064	1.968	1.253
CV	-3.68	3.105	7.48	30.78	40.47	2.72	17.42	8.19
% (+)	38.0	60.8	46.0	48.0	54.0	59.2	58.1	51.7
Thursday								
Average	-.127	.247 *	-.160	-.176	.112	.331 **	.334	.064
SD	.959	1.040	1.388	1.508	1.100	.943	1.952	1.284
CV	-7.55	4.21	-8.68	-8.57	9.82	2.85	5.84	20.06
% (+)	39.2	54.9	44.9	41.2	56.0	59.2	63.3	50.5
Friday								
Average	.136	.103	.203	.430 *	.089	.266	.013	.186 ***
SD	.820	1.031	1.347	1.358	.685	1.113	1.659	1.157
CV	6.03	10.00	6.64	3.16	7.70	4.18	127.62	6.22
% (+)	51.9	60.0	50.0	55.1	53.1	60.4	50.0	54.6
All Days								
Average	-.105	.303 ***	.068	.052	-.015	.290 ***	.020	.092 ***
SD	1.053	1.266	1.526	1.502	.972	1.143	1.932	1.343
CV	-10.03	4.18	22.44	28.88	-64.80	3.94	96.60	14.60
% (+)	40.9	61.6	48.6	46.7	49.8	58.9	53.0	51.3
AC[d]	.213 ***	.344 ***	.322 ***	.114 *	.128 **	.077	.417 ***	.260 ***

[a] average and standard deviation, SD, in percentages; [b] coefficient of variation, CV, standard deviation divided by average; [c] percentage of positive returns; [d] first order autocorrelation coefficient; ***, **, and * denote statistical significance at the 1 percent, 5 percent and 10 percent 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.

Table 3. *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			
1988-94	8.55	-2.30	15.27**	6.39	18.58**	0.07	1.285	0.2740
	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 percent, 5 percent, and 10 percent levels, in two-tailed tests, respectively, based on the *t*-statistic for difference of coefficient B_i from zero where i = 1,..., 5.

Table 4. Two-Sample Analysis for Equality of Daily Mean Returns Across Years

	1988	1989	1990	1991	1992	1993	1994
1989	-3.938*** (0.69)[b]						
1990	-1.471 (0.48)	1.882 * (0.69)					
1991	-1.352 (0.49)	2.023** (0.71)	0.114 (1.03)				
1992	-.995 (1.17)	3.161*** (1.70)	0.720 (2.46)	0.590 (2.39)			
1993	-4.004*** (0.85)	0.123 (1.23)	-1.827 * (1.78)	-1.973** (1.73)	-3.199*** (0.72)		
1994	-0.836 (0.30)	1.774 * (0.43)	0.272 (0.62)	0.184 (0.60)	-0.239 (0.25)	1.741 * (0.35)	
WP[a]	-2.531** (0.58)	2.742*** (0.88)	-0.305 (1.36)	-0.502 (1.31)	-1.367 (0.49)	2.515** (0.70)	-0.684 (2.33)

[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 percent, 5 percent and 10 percent levels, in two-tailed tests, respectively, based on the *t*-statistic for equality of daily mean returns across years. The top number is calculated *t*-value.

Table 5. Analysis of Sign of Monday Return Conditional on the Sign of the Preceding Friday Return

(Sign of R_{w-1}^{F} / Sign of R_{w}^{M})*				
	(+ / +)	(- / -)	(- / +)	(+ / -)
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.

Table 6. Parametric Tests for Random Walk

$R_t = K * R_{t-1} + e_t$

H_0: K = 1

	1988	1989	1990	1991	1992	1993	1994	1988-94
Panel A: Daily Returns								
K	0.221	0.380	0.324	0.116	0.128	0.132	0.417	0.264
SE[a]	0.061	0.058	0.060	0.063	0.063	0.063	0.075	0.024
R^2%[b]	3.86	9.51	10.38	1.19	1.62	0.00	17.60	6.53
Panel B: Weekly Returns								
K	0.210	0.177	0.103	0.130	0.216	0.297	0.126	0.160
SE	0.138	0.139	0.142	0.145	0.137	0.135	0.181	0.053
R^2%	0.00	0.00	0.87	1.00	4.52	0.00	1.65	0.91
Panel C: Monthly Returns								
								1986-94
K								0.159
SE								0.098
R^2%								0.00

[a] Standard error; [b] coefficient of determination.

Table 7. Non-Parametric Tests for Randomness: Daily Returns

Year	k [a]	E(k) [b]	Z-cal. [c]	p-value
1988	103 [d]	127	-2.967	0.0030
	148 [e]	167.7	-2.874	0.0041
1989	89	128.5	-4.894	<0.0001
	136	169.7	-4.944	<0.0001
1990	105	124.5	-2.422	0.0154
	142	164.3	-3.307	0.0009
1991	126	124	0.192	0.8480
	153	163.7	-1.543	0.1228
1992	102	126.5	-3.036	0.0024
	165	167	-0.226	0.8217
1993	107	124	-2.108	0.0350
	151	163.7	-1.847	0.0648
1994	58	75.5	-2.794	0.0052
	89	99	-1.857	0.0633
1988-94	690	824	-6.583	<0.0001
	985	1097	-6.522	<0.0001

[a] number of runs; [b] expected number; [c] large sample test statistic;
[d] number of runs above and below median; [e] number of runs up and down.

Table 8. Non-Parametric Tests for Randomness: Weekly and Monthly Returns

Year	k[a]	E(k)[b]	Z-cal.[c]	p-value
Panel A: Weekly Returns				
1988	21[d]	27	-1.541	0.1234
	27[e]	34.3	-2.288	0.0222
1989	21	27	-1.541	0.1234
	31	34.3	-0.949	0.3428
1990	24	26	-0.429	0.6682
	32	33	-.0171	0.8644
1991	25	26.5	-0.280	0.7793
	33	33.5	-0.056	0.9550
1992	23	27.5	-1.107	0.2681
	32	35	-0.829	0.4072
1993	20	27	-1.821	0.0687
	35	34.3	0.056	0.9555
1994	15	16.5	-0.360	0.7190
	21	20.3	0.073	0.9417
1988-94	143	171.5	-3.037	0.0024
	213	227	-1.739	0.0821
Panel B: Monthly Returns				
1986-94	47	52	-0.896	0.3705
	71	67.7	0.671	0.5020

[a] number of runs; [b] expected number; [c] large sample test statistic;
[d] number of runs above and below median; [e] number of runs up and down.

Table 9. *Summary Statistics: Weekly Returns*

	1988	1989	1990	1991	1992	1993	1994	1988-94
Average[a]	-0.51	1.42***	0.32	0.33	-0.08	1.33***	0.19	0.44**
SD[a]	2.47	3.64	3.85	3.62	2.16	2.49	5.12	3.41
CV[b]	-4.84	2.56	12.03	10.97	-27.00	1.87	26.95	7.75

[a] Average and standard deviation in percentages; [b] coefficient of variation, standard deviation divided by average.

Table 10. *Two-Sample Analysis for Equality of Weekly Mean Returns Across Years*

	1988	1989	1990	1991	1992	1993
1989	-3.130***[a] (0.46)					
1990	-1.292 (0.41)	1.462 (0.89)				
1991	-.1363 (0.47)	1.505 (1.00)	-0.010 (1.13)			
1992	-0.947 (1.31)	2.540** (2.83)	0.648 (3.18)	0.692 (2.81)		
1993	-3.748*** (0.99)	0.140 (2.14)	-1.562 (2.40)	-1.621 (2.12)	-3.067*** (0.75)	
1994	-0.831 (0.23)	1.251 (0.50)	0.126 (0.56)	0.138 (0.49)	-0.334 (0.18)	1.337 (0.23)

[a] 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 percent, 5 percent and 10 percent levels, in two-tailed tests, respectively, based on the *t*-statistic for equality of weekly mean returns across years. The top number is calculated *t*-value.

Table 11. Summary Statistics: Monthly Returns

										1986-94		
	1986	1987	1988	1989	1990	1991	1992	1993	1994	AVG	SD	CV
January		10.36	10.53	0.67	21.54	11.20	5.21	3.93	-1.23	7.78	6.79	0.87
February	7.87	8.00	-7.54	10.81	-1.52	8.31	-12.85	13.08	-12.71	1.50	9.71	6.47
March	-1.52	-2.56	-5.50	-1.93	-2.83	-5.27	4.63	-0.44	-2.74	-2.02	2.81	-1.39
April	-1.32	3.98	-5.95	5.89	0.18	-10.44	-4.37	12.43	3.01	0.38	6.48	17.05
May	1.09	16.60	-0.07	8.83	6.61	0.87	-4.84	3.05	-1.01	3.46	6.01	1.74
June	0.11	5.33	-7.17	8.53	3.06	-0.47	12.60	10.95	12.72	5.07	6.42	1.86
July	2.21	35.56	2.17	-5.49	11.49	-7.17	-1.43	-2.92	4.16	4.29	12.25	2.86
August	5.74	5.51	-6.12	9.65	-3.75	3.56	-1.10	8.86	6.53	3.21	5.27	1.64
September	2.46	-4.78	2.67	22.64	1.26	-5.82	-1.94	8.65	2.57	3.08	8.05	2.62
October	1.04	-11.69	-5.17	5.23	-4.63	-2.17	-3.81	-1.70	-3.25	-2.91	4.35	-1.50
November	2.82	5.41	0.18	-4.29	-14.71	16.95	1.68	11.68	5.39	2.79	8.55	3.06
December	2.77	-12.17	-3.56	16.76	-0.02	3.20	2.43	3.74	-1.45	1.30	7.20	5.53
AVG.[a]	2.11	4.96	-2.13	6.44	1.39	1.06	-0.32	5.94	1.00	2.28		
SD[a]	2.67	12.36	5.16	8.02	8.61	7.74	6.08	5.49	6.05	7.90		
CV[b]	1.27	2.49	-2.42	1.25	6.19	7.30	-19.00	0.92	6.05	3.47		

[a] Average and standard deviation in percentages; [b] coefficient of variation, standard deviation divided by average.

REFERENCES

Abraham, A. and Ikenberry, D. L. (1994) The Individual Investor and the Weekend Effect, *Journal of Financial and Quantitative Analysis,* **29,** 263-77.

Agrawal, A. and Tandon, K. (1994) Anomalies or Illusions? Evidence from Stock Markets in Eighteen Countries, *Journal of International Money and Finance,* **13,** 83-106.

Balaban, E. (1995a) Day of the Week Effects: New Evidence from an Emerging Stock Market, *Applied Economics Letters,* **2**, forthcoming.

------- (1995b) A Preliminary Note on the Relationship Among International Stock Markets, *Unpublished Paper,* The Central Bank of the Republic of Turkey: Research Department.

-------- (1995c) Term Structure of Volatility in the Istanbul Securities Exchange, *Unpublished Paper,* The Central Bank of the Republic of Turkey: Research Department.

------- (1995d) Month of the Year Effects: New Evidence from an Emerging Stock Market, *Unpublished Paper,* The Central Bank of the Republic of Turkey: Research Department.

Claessens, S. and Gooptu, S. (Eds.) (1993) Portfolio Investments in Developing Countries, *World Bank Discussion Papers,* **228.**

Claessens, S. and Rhee, M. W. (1994) The Effects of Barriers on Equity Investment in Developing Countries, *The World Bank Policy Research Papers,* **1263.**

Cornelius, P. K. (1993) A Note on the Informational Efficiency of Emerging Stock Markets, *Weltwirtschaftliches Archiv,* **129,** 820-8.

Cross, F. (1973) The Behaviour of Stock Prices on Friday and Monday, *Financial Analysts Journal,* **29,** 67-9.

Errunza, V. R. (1994) Emerging Markets: Some New Concepts, *Journal of Portfolio Management,* **(Spring),** 82-87.

Fama, E. F. (1965) The Behavior of Stock Market Prices, *Journal of Business,* **28,** 34-105.

------- (1970) Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance,* **25,** 383-417.

------- (1991) Efficient Capital Markets: II, *Journal of Finance,* **46,** 1575-1617.

French, K. (1980) Stock Returns and the Weekend Effect, *Journal of Financial Economics,* **8,** 55-70.

Gibbons, M. and Hess, P. (1981) Day of the Week Effects and Asset Returns, *Journal of Business,* **54,** 579-96.

Gültekin, M. and N. B. Gültekin (1983) Stock Market Seasonality: International Evidence, Journal of Financial Economics, (December), 469-81.

Hauser, S., Marcus, M., and Yaari, U. (1994) Investing in Emerging Markets: Is It Worthwhile Hedging Foreign Exchange Risk? *Journal of Portfolio Management,* **(Spring),** 76-81.

International Finance Corporation (1992) *Emerging Stock Markets Factbook.*

Jaffe, J. and Westerfield, R. (1985) The Week-End Effect in Common Stock Returns: The International Evidence, *Journal **of** Finance,* **40,** 433-54.

Keane, S. (1993) Emerging Markets - The Relevance of Efficient Market Theory, *The Chartered Association of Certified Accountants (ACCA) Technical and Research (T&R) Committee Occasional Research Papers,* **15.**

Keim, D. (1983) Size-Related Anomalies and Stock Return Seasonality: Further Empirical Evidence, *Journal of Financial Economics,* (June), 13-32.

Keim, D. and Stambaugh, R. (1984) A Further Investigation of the Weekend Effect in Stock Returns, *Journal of Finance,* **39,** 819-35.

Lakanishok, J. and Levi, M. (1982) Weekend Effects in Stock Returns: A Note, *Journal of Finance,* **37,** 883-89.

Metin, K. and G. Muradoğlu (1995a) Efficiency of the Turkish Stock Exchange with respect to Monetary Variables: A Cointegration Analysis, *European Journal of Operations Research,* forthcoming.

------- (1995b) Inflation and the Stock Market: A Cointegration Analysis, *Journal of Economics and Administrative Sciences,* forthcoming.

Mullin, J. (1993) Emerging Equity Markets in the Global Economy, *Federal Reserve Bank of New York Quarterly Review,* **18,** 54-83.

Muradoğlu Şengül, G. and Önkal, D. (1992) Türk Hisse Senedi Piyasasında Yarı-Güçlü Etkinlik, *METU Studies in Development,* **19,** 197-207.

Özer, B. and Yamak, S. (1992) The Impact of the Gulf Crisis on Risk-Return Relationship and Volatility of Stocks in Istanbul Stock Exchange, *METU Studies in Development,* **19,** 209-23.

Reinganum, M. (1983) The Anomalous Stock Market Behavior of Small Firms in January: Empirical Tests for Tax-Loss Selling Effects, *Journal of Financial Economics,* (June), 89-104.

Roll, R. (1983) The Turn-of-the Year Effect and the Return Premia of Small Firms, *Journal of Portfolio Management,* **(Winter)**, 18-28.

Smirlock, M. and Starks, L. (1986) Day-of-the-Week and Intraday Effects in Stock Returns, *Journal of Financial Economics,* **17,** 197-210.