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CONTENTS

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SIZE AND BOOK-TO-MARKET EFFECTS: EVIDENCE FROM THE ISTANBUL STOCK EXCHANGE (ISE)

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Abstract
In this paper, the existence of size and book-to-market effects in the Istanbul Stock Exchange (ISE) is investigated for the period between 1990-2002. In order to isolate the size and book-to-market effects from each other, similar to the method used by Fama-French (1993), specific portfolios are established on stocks sorted by both median size (market capitalization) and median book-to-equity values. It is concluded that if we hold annually re-established sorted portfolios during the whole 12-year period, there exist a small-size and book-to-market effect in the ISE. But if we examine good and bad years of the ISE separately, we see that the size and book-to-market effects are valid mostly in the good times. There is a great asymmetry between up and down market conditions concerning size and book-to-market effects in the ISE. It seems that all sorted portfolios are alike when the market goes down, whereas they behave very differently when the market goes up.

I. Introduction

The existence of size and book-to-market (book equity/market equity, BE/ME) effects along with other effects relating to factors that are correlated with the cross-sectional pattern of stock returns such as earnings-to-price ratio (E/P), dividend-yield ratio, leverage, trading volume, momentum etc. has been examined by a number of empirical researches. Size anomaly (small size premium), the tendency of small stocks to have higher average returns in comparison to big stocks, was shown by Banz (1981), Keim (1983), Heston et al.(1995) for the USA and other developed countries. Fama-French (1998) find evidence confirming the presence of the small-size effect in the emerging markets, as well as in developed ones. They showed that for the period of 1987-1995, in eleven out of sixteen emerging markets, small stocks had higher average returns in comparison to big stocks. The average difference between the dollar returns on the small and big stock portfolios is found as 14.89 percent for value-weight and 8.70 percent for equal-weight portfolios.

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On the other hand, some studies such as Daniel and Titman (1997), assert that the size effect is mostly a January phenomenon and the data excluding January do not confirm its existence. Another explanation of small-size premium (effect) is survival bias. Wang (2000) argues that the size effect is largely a spurious statistical inference resulting from survival bias that causes data truncation. Small stocks' returns are more volatile and small firms are more likely to go bankrupt. As a result they are more likely to drop out of the sample. Excluding poor small stocks from sample gives rise, ex post, to higher returns for small-size portfolios.

The book-to market effect, i. e., value premium, that is the stocks belonging to firms with higher BE/ME ratios (value stocks) generate higher average returns than the stocks belonging to firms with low BE/ME ratios (growth stocks), was first documented by Stattman (1980), Rosenberg et al. (1985) and Fama and French (1992, 1995). Fama and French (1998) provide evidence that value stocks outperform growth stocks in twelve of thirteen major markets and the difference between average returns on global portfolios of high and low book-to-market stocks is 7.68 percent per year for the 1975-1995 period. Arshanapalli et al. (1998) find similar results supporting the existence of small-size and value premium in their study covering 18 global stock markets. Patel (1998), Rouwenhorst et al. (1999) and Hart et al. (2001) are other studies supporting the presence of small-size and book-to-market effects in the emerging markets. Barry et al. (2002) investigate the robustness of size and book-to-market effects in 35 emerging equity markets for the period 1985-2000 and their findings also support the validity of both effects. They showed that the existence of value premium is robust to the removal of extreme returns whereas the size effect is not. Lam (2002) finds that as beta is unable to explain the average monthly returns on stocks listed in the Hong Kong Stock Exchange for the period July 1984-June 1997, size, book-to-market equity and earnings-to-price ratios seem able to capture the cross-sectional variation in returns.

There are other studies in which a reverse direction of book-to-market effect is found. For example, Claessens et al (1998) reached the reverse of Fama-French result, discovering a growth premium instead of a value premium in 10 out of 19 emerging markets sampled. Fama and French (1998) explains this contradictory finding by the difference in sample periods covered in two studies, and sensitivity of cross-section regressions used by Claessens et al. (1998) to outliers which are very common in stock returns in the emerging markets. Bossaerts and Fohlin (2000) also observed a growth premium among German stocks for the period between 1881-1913.

Controversy over the theoretical explanation of size and book-to-equity effects is far to come to an end. As some scholars follow a risk-based approach, others use non-risk–based factors to explain those pricing anomalies. Risk-based approach says that CAPM is not able to capture all the systematic risks in the market, especially, risks associated with firm characteristics. Berk (1995) explain size effect using the argument that a firm's size, market capitalization, is a proxy for its unmeasured risk not captured by CAPM and this risk is higher for small firms. Hence, small-size premium is consistent with CAPM. Fama and French (1993, 1995, 1996) argue that size and book-to-market ratio are proxies for distress. Small and/or high BE/ME firms are distressed firms, they have depressed earnings and highly uncertain future earnings. Hence, the value premium is compensation for systematic risk associated with this distress. Lakonishok et al. (1994) and Haugen (1995) explain the value premium with the hypothesis that the market undervalues distressed stocks and overvalues growth stocks. Value premium arises as a result of the correction of these pricing errors. They also say that growth stocks are more attractive than value stocks and excess interest of investors toward these stocks push up stock prices and lower the returns. Thus, according to mispricing argument, book-to-market effect catches biases in investors' expectations. Chen and Zheng (1998) support Fama-French distress hypothesis arguing that value stocks are characterized by frequent dividend cuts, high financial risk and high uncertainty about future earnings. Daniel and Titman (1997) reject distress hypothesis and argue that characteristics are the determinants of returns rather than risk (p. 30) and there is no evidence of a separate distress factor; most of the co-movement of high book-to-market stocks is not due to distressed stocks being exposed to a unique "distress factor", but rather, because stocks with similar factor sensitivities tend to become distressed at the same time.

Another explanation of book-to-market effect is the arbitrage risk. Shleifer and Vishny (1997) argue that risk associated with the volatility of arbitrage returns deters arbitrage activity and is an important reason why the BE/ME effect exists. Examining all firms on NYSE and AMEX for the period between 1976-1997, Ali et al. (2003) show that book-to-market effect is greater for stocks with higher idiosyncratic return volatility, higher transaction costs, and lower investor sophistication. These finding are said to be consistent with both market mispricing approach and Shleifer and Vishny (1997) thesis.

II. Size and Book-To-Market Effects in the Istanbul Stock Exchange (ISE)

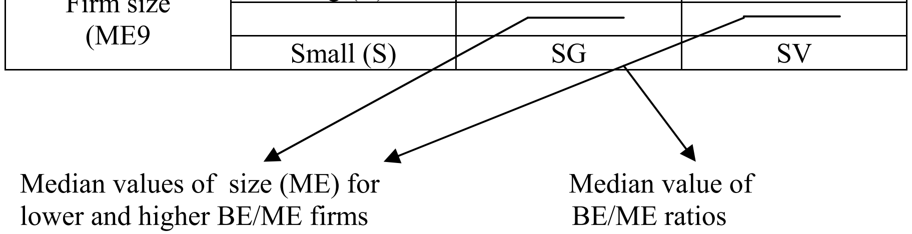
2.1. Formation of Sorted Portfolios

A traditional way to test the existence of size and book-to-market effects is to form portfolios on stocks of firms sorted by firm size, i.e., market

capitalization (market equity, ME) and book-to-market ratios (BE/ME) and check if portfolio returns vary systematically among the sorted portfolios. However, there is usually a significant negative relationship between size of the firms measured by market capitalization (ME) and book-to-market ratios (BE/ME) across firms. In other words, value stocks are usually scattered among the small stocks, and growth stocks are scattered among the big stocks. Therefore, the size and book-to-market effects are intertwined in most cases. This case is valid for the ISE firms too. Spearman's rank correlation between these two characteristics, ME and BE/ME ratios, across the ISE firms, vary between–0.40 and–0.60 from year to year in the period 1990-2000[1]. Small firms generally have high BE/ME ratios and vice versa.

In order to isolate the size and book-to-market effect from each other, a method similar to the one used by Fama and French (1993) and Davis at al (Feb. 2000) was employed. Firms were divided into four subgroups[2] at the end of each calendar year t sorting by median values of their market equity (ME) and book-to-market equity (BE/ME) ratios of the same year. The firms above and below two median values are gathered into four subgroups as shown in the following diagram. In order to divide firms (stocks) equally among four subgroups, two median values of ME are used, one for low BE/ME firms (left side of the diagram) and the other for high BE/ME firms (right side of the diagram). Then average annual dollar returns for each subgroup were calculated for the next year, year t+1. The same procedure was repeated at the end of each year. In this way, four different equal-weighted portfolios were formed:

		BE / ME Ratio	
		Low	Hig
Firm size (ME9	Big (B)	BG	BV
	Small (S)	SG	SV



[1] This correlation is smaller (-0.22 and –0.26 respectively) but still significant at 1 percent level in 2001 and 2002.
[2] Since the number of firms and stocks is not large in the ISE, the number of subgroups is kept limited.

small-growth (SG), big-growth (BG), small-value (SV) and big-value (BV). G denotes growth stocks, V value stocks, S small firms and B big firms. Thus while properties of each portfolio, i.e., being small or big stock portfolio and low or high book-to-market ratio portfolio, are maintained, stocks that enter the portfolios are changed each year.

By comparing portfolio SG with BG and SV with BV, it is possible to obtain the size effect, relatively free of book-to-market effect. On the other hand, comparison of the portfolio SG with SV and BG with BV provides information on book-to-market effect, relatively free of size effect.

2.2. The Data

Monthly data of dollar returns, including dividend payments and capital gains are available from the ISE publications for the period of 1986-2002. Since we are interested in real stock returns free of inflation, we used dollar returns. Alternatively, nominal returns could be deflated by CPI, but because of close comovement of inflation and exchange rate variations probably two approaches would lead to similar results. Since the number of traded stocks was limited in the early years, 1990-2002 period is covered in this study. Market capitalization (ME), book-to-market equity (BE/ME), and earnings-to-book equity (E/BE) ratios are also published by the ISE. All data represent year-end values. Market capitalization values of stocks in Turkish Liras are converted into USD using year-average exchange rates. Due to fact that these data mentioned above are enough to test whether size and book-to-market effects exist, the other stock ratios were not used in the study.

Since annual returns, BE/ME and E/BE ratios across the ISE firms often have very extreme outliers and results are very sensitive to these outliers, the observations which lie behind $\mp 3\sigma$ (σ: standard deviation) about mean are excluded from the sample. But the numbers of these outliers for BE/ME ratios are limited and vary between 1 and 7 from year to year. Firms with negative BE/ME ratios are also left out.

Interest rate paid to 3-month dollar time deposits by commercial banks was taken as risk-free rate. There are two reasons to justify this selection: First, after the 1994 economic crisis the government provided almost full coverage insurance guarantee to all bank deposits and the second, individual investors do not have easy access to treasury bills. Furthermore, 3-month treasury bill rate, widely used proxy for risk-free rate, did take negative values in real terms in Turkey in certain years such as 1988-90 and 2000. Number of stocks traded in the ISE National Market was 110 in 1990 and it has gradually increased in time and reached 262 in 2002. Changing from year to year, approximately 70-85 percent of these stocks are covered in this study depending on the availability of data.

2.3. Empirical Results

2.3.1. The Portfolio Analysis

Table 1 and Figure 1 depict the compound values from investing $100 in 1990 into four sorted portfolios and 3-month bank dollar deposit calculated from annual portfolio returns given in Table Appendix-1. As seen from the portfolio end-period (2002) values, a considerable increase in portfolio value is realized only in Portfolio SV, the best portfolio, while portfolios SG and BV are not far from the beginning value of $100 and Portfolio BG, the worst portfolio, lost 40 percent of its initial value. If we take only the end-period values of the portfolios into account, the annual exponential returns are calculated as 5.1 percent for Portfolio SV, 0.8 for SG, -0.1 for BV and -4.2 percent for BG. Since exponential annual returns of all four sorted portfolios and market portfolio (MP) are less than risk-free rate, all portfolio excess returns are negative.

Table 1: The Compound Values from Investing $100 in 1990 in Four Sorted Portfolios and Relative Portfolio Performance: 1990-2002

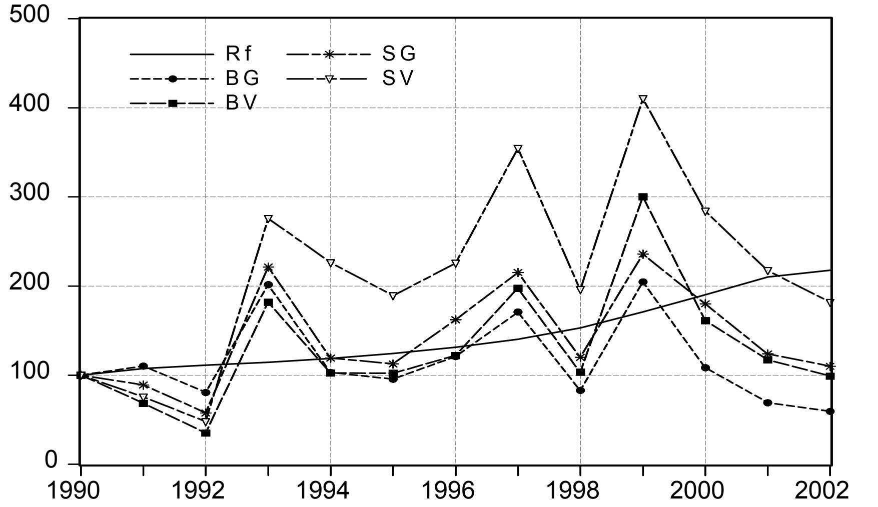
	SV	SG	BV	BG	MP	R_f**	SV/SG	BV/BG	SV/BV	SG/BG
1990	100.0	100.0	100.0	100.0	**100.0**	**100.0**	1.00	1.00	1.00	1.00
1991	75.4	88.9	68.4	110.1	**85.8**	**107.4**	0.85	0.62	1.10	0.81
1992	48.0	57.6	35.0	80.6	**54.1**	**111.2**	0.83	0.43	1.37	0.71
1993	275.7	221.4	181.8	201.5	**233.9**	**114.4**	1.25	0.90	1.52	1.10
1994	226.2	119.3	102.4	103.0	**142.0**	**118.8**	1.90	0.99	2.21	1.16
1995	189.0	112.7	102.1	95.6	**131.6**	**124.4**	1.68	1.07	1.85	1.18
1996	225.7	162.3	122.2	121.1	**167.8**	**131.3**	1.39	1.01	1.85	1.34
1997	354.5	215.3	197.4	170.9	**248.8**	**140.5**	1.65	1.16	1.80	1.26
1998	196.1	120.2	103.5	82.8	**131.9**	**153.1**	1.63	1.25	1.89	1.45
1999	410.2	235.8	300.0	204.7	**311.2**	**171.0**	1.74	1.47	1.37	1.15
2000	284.1	180.1	161.1	108.3	**195.1**	**190.2**	1.58	1.49	1.76	1.66
2001	217.3	124.0	117.2	69.1	**137.6**	**210.0**	1.75	1.70	1.85	1.79
2002	181.7	110.0	99.0	59.5	**117.8**	**217.7**	1.65	1.66	1.84	1.85
R^*_{exp}	5.1	0.8	-0.1	-4.2	**1.4**					
R^*_{trend}	9.6	4.2	6.0	-2.2	**5.4**	**6.7**				

* R_{exp}: Compound (exponential) annual portfolio returns from 1990 to 2002 calculated from the data in the related columns. R_{trend}: Annual average portfolio returns (%) calculated by trend regression applied to the data in the related columns.

** R_f , Here, shows the compound value of $100 three-month bank deposit through the period.

Since the last three years of the period 1990-2002 are bad years for the ISE, exponential annual returns which are based on only the beginning and end-period values might not be a right measure of portfolio performance. With this reasoning, alternatively, trend returns from a trend regression applied to compounded portfolio values series given in Table 1 are presented. Annual trend returns are positive for three portfolios (SV, SG and BV) and negative for one portfolio (BG). As shown in Table 2, only Portfolio SV has a positive excess return in this case.

Figure 1: The compound values of $ 100 placed into the sorted portfolios and bank dollar deposit in 1990 through time.



The compound value of Portfolio SV is greater than the value of $100 bank-deposit investment in eight out of twelve years sampled. In other words, the best portfolio, Portfolio SV outperformed risk-free investment in two-third (8/12) of the time. This ratio is 5/12, 3/12 and 4/12 for the portfolios SG, BV and BG, respectively.

Table 2 reports the annual average exponential (compound) and trend returns on sorted portfolios for the 1990-2002 period. The portfolio details are given in Table Appendix-1 at the end of the text. As seen from Table 2, if we base on exponential returns, that is, if we accept the holding period of portfolios as 12 years (1990-2002), all of four sorted portfolios have substantial negative excess returns during this period. If we base on trend returns, only the Portfolio SV has a positive excess return. As the portfolio with minimum losses has been SV, while the worst one is Portfolio BG with a negative annual excess return of –10.9 percent.

Table 2: Annual Period Averages of the Portfolio Returns and Excess Returns: 1990-2002

Portfolios	**R_{exp}**	**R_{trend}**	**$R_{exp} - R_f$**	**$R_{trend} - R_f$**
SV	5.1	9.6	-1.6	2.9
SG	0.8	4.2	-5.9	-2.5
BV	-0.1	6.0	-6.8	-0.7
BG	-4.2	-2.2	-10.9	-8.9
MP*	**1.4**	**5.4**	**-5.3**	**-1.3**
R_f	6.7			

* MP is market portfolio formed on all stocks included in four sorted portfolios.
Risk-free rate, R_f, is annual interest rate on 3-month dollar bank deposits, having a simple annual average of 6.74 and a compounded annual average of 6.70 percent for the 1990-2002 period. R_{exp}: compound (exponential) annual returns from 1990 to 2002 calculated from data given Table 2 below. R_{trend}: annual returns obtained from trend regression applied to the same data.

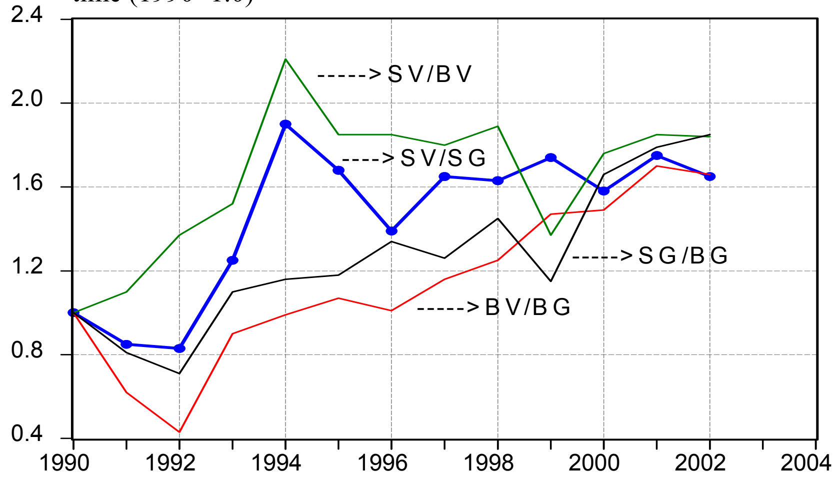
The relative performance of the sorted portfolios can be followed from last four columns of Table 1 and Figure 2. The ratio of the market value of the Portfolio SV to the market value of the Portfolio BV, SV/BV, is stable at about 1.8-1.9 level indicating a strong small-size-effect among value (high BE/ME) stocks[3]. Small value stocks outperformed big value stocks by 80-90 percent during the period covered. The SG/BG ratio is also greater than 1 from 1994 on, pointing out the existence of small-size-effect among growth (low BE/ME) stocks too. However, the small-size-effect among value stocks is stronger than among growth stocks with the exception of the last three years of the period. The ratios SV/SG and BV/BG which rose to 1.6-1.7 level

[3] A small-size effect (but without controlling book-to-market effect) in the ISE is discovered by Demir et al. (1996) for the period 1990-96.

towards the end of period, mark a value premium (book-to-market effect) among both small and big stocks[4]. Besides, the value premium is stronger and persistent for small stocks than for big stock.

Table 3 reports the paired return differences of four sorted portfolios for each individual year. Return differences SV-BV and SG-BG will show size effect keeping book-to-market effect under control. Similarly, return differences SV-SG and BV-BG will carry information about book-to-market effect isolated from size effect.

Figure 2: The relative performance of the sorted portfolios through time (1990=1.0)



From Table 3 we see that when the portfolio holding period is taken one year, the size and book-to-market effects are not systematic in ISE. Effects are statistically significant only in five out of twelve years sampled. Furthermore, these effects are mixed, i.e., have different direction.

[4] Karan (1995) and Karan (1996) discovered a value premium and earnings/price effect in the ISE in pre-95 period. Akdeniz et al (2000) conclude that stock returns vary directly with book-to-market and inversely with firm size while market beta has no effect at all in the ISE during 1992-98 period. Aydoğan and Gürsoy (2000) found a positive correlation between returns and E/P ratios and a negative correlation between returns and price-to-book ratios (that is, a value premium) from the data of 1986-99 period for 19 emerging markets including Turkey.

Table 3: Size and BE/ME Effects: Return Differences Between Sorted Portfolios in the ISE: 1991-2002

	Size effect				**BE/ME effect**			
	SV-BV	t	**SG-BG**	t	**SV-SG**	t	**BV-BG**	t
1991	7.0	0.63	-21.1	-0.97	-13.5	-0.76	-41.7	-2.40*
1992	12.3	1.70**	-8.4	-0.72	-1.2	-0.12	-22.0	-2.60*
1993	56.1	0.66	134.1	2.40*	190.9	2.12**	268.8	5.40*
1994	25.7	2.78*	2.8	0.32	28.2	2.85*	5.2	0.65
1995	-16.2	-1.39***	1.6	0.18	-10.9	-1.13	6.9	0.63
1996	-0.3	-0.02	17.3	1.34***	-24.6	-2.08**	-7.0	-0.62
1997	-4.4	-0.22	-8.4	-0.60	24.4	1.38***	20.4	1.24
1998	2.9	0.53	7.4	1.48***	-0.5	-0.08	4.0	0.84
1999	-80.9	-4.25*	-51.0	-2.71*	12.9	0.76	42.8	2.08**
2000	15.6	2.71*	23.5	2.97*	-7.1	-0.78	0.8	0.20
2001	3.7	0.62	5.1	0.90	7.6	1.30***	9.0	1.56***
2002	-0.8	-0.15	2.5	0.32	-5.0	-0.71	-1.7	-0.28

* / **/*** : Significant at 1%, 5% and 10% respectively. The years in bold are good years in the ISE.

2.3.2. Up and Down Markets: Asymmetry in the ISE

If we define the year t as a good (bad) year when the annual (December to December) dollar return on the ISE National-100 Index is positive (negative) in that year, four out of twelve years sampled are good years (1993, 1996, 1997 and 1999) and remaining eight years are bad years for the ISE. Since direction of size and book-to-market effects can be different during up and down markets, it will be useful to analyze the bad and good years separately.

Table 4 reports annual simple average portfolio returns and return differences for good and bad years separately. From the first half of the Table we see that the annual average returns (losses) and their standard deviations are very close to each other for all sorted portfolios in down years, whereas they vary substantially from portfolio to portfolio in up years.

Standard deviations of portfolio returns in up years are greater than those in down years by two to four times. There is a strong asymmetry between up and down market conditions in the ISE regarding both volatility and portfolio performance. In good years both value portfolios, SV and BV, outperformed growth portfolios, SG and BG. The average return of Portfolio SV is greater than that of SG by 44.4 percent, while the Portfolio BV earned more than Portfolio BG by 89 percent. In up years portfolio standard deviations are positively related to portfolio returns.

Table 4: Simple Annual Average of Portfolio Returns in Up and Down years in the ISE (%).

Portfolios	Average returns in down years		Average return in up years	
SV	-26.3	(34.2)*	165.1	(145.4)
SG	-26.0	(40.7)	114.3	(120.7)
BV	-32.6	(29.1)	172.5	(120.4)
BG	-27.7	(35.2)	91.3	(73.3)
MP	**-28.2**	**(36.3)**	**136.0**	**(129.1)**
Portfolio return differences:				-
SV-BV	6.3		7.4	
SG-BG	1.7		23.0	
SV-SG	-0.3	-	50.9	
BV-BG	4.9		81.3	

* Standard deviations.
Source : Table Appendix -1.

From the second half of the Table 4 it can be concluded that (i) Portfolio return differences are negligible during down years pointing out absence of size and book-to-market effects in those years in the ISE. (ii) During good years, there is a weak big-size-effect among value stocks and a stronger small-size effect among growth stocks. SV-BV and SG-BG annual average return differences are –7.4 and 23.0 percent, respectively. (iii) During good years, there is a very strong book-to-market effect among both small and big stocks, but the effect is stronger among big stocks. SV-SG and BV-BG annual average return differences are 50.9 and 81.3 percent respectively for up periods. Hence we observe a strong asymmetry from the point of view of the existence of size and book-to-market effects in the ISE between good and bad years.

Asymmetry is also seen from the correlation coefficient between portfolio returns (R_p) and portfolio $(BE/ME)_p$ ratios given in Table-Appendix 1. While the correlation is 0.052 for 32 portfolios of eight down years it is 0.712 among 16 portfolios of up years. The same asymmetry albeit not too strong is valid for the relationship between portfolio returns and portfolio earnings/equity ratios: the correlation is –0.322 for bad, –0.651 for good years. Shortly, firm characteristics are effective on returns mostly during up markets.

2.3.3. Other Characteristics of the Sorted Portfolios

Since each portfolio is reformed at year ends and we have four different portfolios, there are 12 repetitions for each portfolio and 48 portfolios (4x12) totally. Table 5 reports the period averages of some characteristics of these 48 portfolios detail of which are given in Table Appendix-1.

Table 5: Period Average of Main Characteristics of the Sorted Portfolios: 1990-2002

Portfolios	Size (ME) US$ mills.	BE/ME	R_{exp}	R_{trend}	$SD(R_p)$*	E/BE (%)
SV	16.8	0.96	5.1	9.6	71.3	13.1
SG	24.3	0.33	0.8	4.2	67.4	15.8
BV	205.0	0.55	-0.1	6.0	59.5	23.6
BG	379.7	0.18	-4.2	-2.2	47.9	31.6
MP	**157.9**	**0.35**	**1.4**	**5.4**	**67.3**	**21.2**

* Simple average of standard deviations of annual portfolio returns.
Source: Table appendix-1.

One point stirring up interest in Table 5 is the positive relationship between annual portfolio returns and their average standard deviations. Portfolios SV and BG with highest and lowest annual returns have highest and lowest standard deviations respectively. It seems that volatility is priced in ISE.

Secondly, from sixth column of Table 5, we see that the average earnings-book equity (E/BE) ratios corresponding to small (SV and SG) and big (BV and BG) stock-based portfolios differ substantially by 10-15 percentage points. Similarly, average E/BE ratios corresponding to value portfolios (SV and BV), 18.4%, is lower, albeit not too much, than that of growth portfolios (BV and BG), 23.7%. This findings supports distress hypothesis of Fama-French (1995) and Lakonishok et. al. (1994). Small and high book-to-equity firms which are weak firms with respect to earnings should provide higher returns in the stock market as a compensation for distress created by these low earnings.

III. Conclusion

In this paper, the question of whether size and book-to-market effects exist in the Istanbul Stock Exchange during post-1990 period is investigated. For this purpose, four different portfolios were formed in every year sorting stocks by median values of firm size and book-to-equity ratios. These four portfolios, SV, SG, BV and BG, are re-established each year-end and using one year lag, average rate of return is calculated for the next year for each portfolio. The following conclusions are deserved to bring into attention:

Firstly, comparing the compound values of $100 investment placed on each portfolio in 1990 over time, it is concluded that there is a small-size effect (small-size premium) and book-to-market effect (value premium) in the period 1990-2002 in the ISE. Portfolios based on relatively small stocks (SV, SG) outperformed portfolios based on relatively big stocks (BV, BG). Similarly, value portfolios (SV, BV) outperformed growth portfolios (SG, BG). Second, if we examine individual years separately, that is if portfolio holding period is taken one year, not 12 years, we see that the small-size and book-to-equity effects are valid only in 4-5 years out of 12 years sampled. Moreover, a big-size premium and growth premium are observed in two years, showing that size and book-to-market effects have not the same direction all the time in the ISE, taking the opposite direction in some years.

Third, there is a great asymmetry between up and down market conditions concerning size and book-to-equity effects in the ISE. In down years, average annual returns (losses) of four sorted portfolios are very close to each other, hence there is no sign of any size or book-to-market effect, whereas in up years, average portfolio differences are very large, marking the presence of a strong value premium, a more moderate small-size premium among growth stocks and a weak big-size effect among value stocks. Firm characteristics such as size (ME), book-to-market ratio and earnings-to-equity ratio are effective variables in explaining cross-section of stock returns mostly in up years. This relationship disappears during down years. Similarly, while volatility of returns are relatively small and close to each other for portfolios in bad years, it is too high and vary considerably from portfolio to portfolio in good years. This means that all stocks are alike when the market goes down, but they behave very differently depending on their own firm characteristics when the market goes up. Shortly, firm-specific characteristics and idiosyncratic risks become more important during good times.

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Appendix

Table -1: Sorted Portfolios Formed on Size and Book-to-Market ratios in the Istanbul Stock Exchange (ISE): 1990-2002

Years	Portfolios	ME_{t-1} (mills. $)	$(BE/ME)_{t-1}$	$R_{p,t}$	$\sigma(R_{p,t})$	$(E/BE)_{t-1}$	n
1991	SV	12.4	1.19	-24.6	34.9	1.7	17
	SG	24.8	0.40	-11.1	66.2	22.7	20
	BV	356.6	0.56	-31.6	33.3	22.8	20
	BG	487.6	0.24	10.1	69.8	21.0	19
	MP	**225.0**	**0.43**	**-14.2**	**55.5**	**17.6**	**76**
1992	SV	13.0	1.21	-36. 4	27.6	-0.4	23
	SG	15.1	0.43	-35.2	42.5	1.9	21
	BV	214.8	0.70	-48.8	22.1	22.6	24
	BG	221.7	0.25	-26.8	34.8	30.2	23
	MP	**119.5**	**0.46**	**-36.9**	**32.8**	**13.9**	**91**
1993	SV	9.4	1.72	475.0	353.9	7.7	25
	SG	10.9	0.73	284.1	269.9	10.6	24
	BV	130.3	1.25	418.9	239	22.6	25
	BG	128.0	0.39	150.0	69.9	34.7	25
	MP	**70.3**	**0.75**	**332.5**	**281.2**	**19.0**	**99**
1994	SV	35.9	0.39	-18.0	40.4	15.1	28
	SG	53.3	0.19	-46.1	34.2	33.2	29
	BV	398.7	0.33	-43.7	26.6	24.2	27
	BG	390.7	0.15	-48.9	32.8	44.1	29
	MP	**218.1**	**0.22**	**-39.3**	**35.7**	**29.4**	**113**
1995	SV	32.5	0.45	-16.4	43.3	17.7	32
	SG	47.4	0.16	-5.5	34.3	28.2	33
	BV	245.4	0.28	-0.3	49.6	21.7	32
	BG	523.7	0.11	-7.1	36.9	40.4	32
	MP	**211.0**	**0.19**	**-7.3**	**41.3**	**27.0**	**129**
1996	SV	15.6	0.75	19.4	41.1	25.6	36
	SG	23.6	0.25	44.0	58.1	47.7	37
	BV	140.3	0.45	19.7	44.8	34.7	37
	BG	227.5	0.18	26.7	52.3	50.9	36
	MP	**101.5**	**0.31**	**27.5**	**50.1**	**39.7**	**146**
1997	SV	15.9	0.67	57.1	92.3	23.0	43
	SG	26.8	0.23	32.7	66.8	34.2	41
	BV	165.2	0.40	61.5	87.8	32.4	42
	BG	281.3	0.13	41.1	60.8	51.2	42
	MP	**122.2**	**0.25**	**48.2**	**78.4**	**35.1**	**168**
1998	SV	19.4	0.52	-44.7	29.2	21.3	50
	SG	27.0	0.17	-44.2	28.3	35.9	53
	BV	189.6	0.28	-47.6	26	29.5	53
	BG	454.3	0.09	-51.6	21.7	49.0	50
	MP	**170.7**	**0.18**	**-47.0**	**26.4**	**33.9**	**206**

Table -1: Sorted Portfolios Formed on Size and Book-to-Market ratios in the Istanbul Stock Exchange (ISE): 1990-2002 (Continue)

1999	SV	8.9	1.50	109.1	94.1	29.8	58
	SG	11.6	0.43	96.2	88	22.5	56
	BV	75.9	0.68	190.0	110	25.5	58
	BG	222.8	0.20	147.2	110.1	46.8	56
	MP	**79.2**	**0.42**	**135.9**	**106.9**	**31.1**	**228**
2000	SV	19.2	0.68	-30.7	36.9	9.9	55
	SG	25.8	0.21	-23.6	55.6	-5.1	51
	BV	277.9	0.32	-46.3	22.4	17.3	57
	BG	937.2	0.10	-47.1	19.3	15.8	56
	MP	**322.8**	**0.21**	**-37.3**	**37**	**9.8**	**219**
2001	SV	8.8	1.43	-23.5	32.9	17.6	54
	SG	15.5	0.35	-31.2	26.9	-5.3	52
	BV	132.8	0.71	-27.2	29.7	16.6	56
	BG	389.6	0.18	-36.2	30.7	21.8	54
	MP	**137.8**	**0.38**	**-29.5**	**30.3**	**12.9**	**216**
2002	SV	10.5	0.98	-16.4	28.5	-12.2	45
	SG	10.0	0.38	-11.3	37.7	-37.1	42
	BV	132.9	0.68	-15.6	22.8	13.2	47
	BG	292.3	0.17	-13.8	35.8	-27.0	49
	MP	**117.3**	**0.36**	**-14.3**	**31.5**	**-15.4**	**183**

Notes: ME: Market Equity (market capitalization), a proxy for firm size. Mid-year exchange rate is used to convert TL values into USD BE/ME: Book Equity/Market Equity (book-to-market ratio). E/BE: Earnings/Book Equity. R_p: Annual average portfolio return. $\sigma(R_{p,})$: Standard deviation of portfolio return. n : Number of stocks included in the portfolio.

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PERSISTENCE IN EMERGING MARKET STOCK RETURNS: EMPIRICAL EVIDENCE FROM SIX STOCK MARKETS

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Abstract
This paper examines the persistence in stock return series based on the stock price index for six countries. The order of fractional differencing is estimated using approximate maximum likelihood method. Persistence of each series is evaluated using the time required for a given percentage of the effect of a shock to dissipate. We find that stock return series show no significant persistence. Eighty percent of the effect of the shock on the value of the series disappears after two periods. The evidence provided by this paper shows that these series are antipersistent processes and have low persistency.

I. Introduction

The efficient market with random walk stock prices requires that the arrival of new information should be promptly arbitraged away. Dependence between distance observations of a price series must decrease very quickly for the arbitrage pricing to be necessary and sufficient condition. The stock prices in an efficient market should be determined by a martingale process where each price change is not affected by its predecessor and has not revealed a memory or dependency. The arbitrage price changes do not follow the martingale process that identifies the efficient market if the persistent dependence is present. Hence, long-term dependence is present in returns on condition that the financial markets are efficient. Lo and MacKinlay (1988) and Poterba and Summer (1998) report positive autocorrelation for stock returns in the short-run and negative autocorrelation in the long-run in spite of the implication of random walk hypothesis. Negative autocorrelation suggests that mean reversion indicates the presence of long-term dependence in stock prices. On the other hand, positive autocorrelation means that stock prices are not mean-reverting processes which implies that a unit shock has a permanent effect on the value of stock prices. As a consequence, as long as there is a long-term

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dependence in the stock returns or the null hypothesis that stock returns are serially uncorrelated is not rejected, the level of stock prices is unpredictable.

A great deal of researches has examined the issue of persistence in stock returns following the implications of long memory for the theory and practice of financial economics. Greene and Fielitz (1977) estimate long memory in daily stock returns series by applying "the rescaled-range (R/S) method". However, the result of this study is opposed by Lo (1991) with his "modified R/S method". Using the exact maximum likelihood estimation, Crato (1994) finds no evidence for the stock returns series of the G-7 countries. Cheung and Lai (1995) report similar evidence for the several international stock returns using both the modified R/S methods and the Geweke and Porter-Hudak log-periodogram method. Barkoulas and Baum (1996) and Hiemstra and Jones (1997) examine individual U.S. stocks. Both of these articles find evidence of statistically significant long memory only for a few stocks. Barkoulas et al. (2000) examine weekly returns in the Greek stock market during the 1980s and found clear evidence of significant long memory. On the other side, Panas (2001) examines the daily returns of 13 Greek stocks and finds statistically significant long memory in most of the series. Sadique and Silvapulle (2001) report the long memory in several international stock returns. The evidence of this paper does not support the efficient market hypothesis. Similarly, Wright (2001) examines a number of emerging markets where long memory is more often found than in developed markets. Henry (2002) investigates the long-range dependence in a sample of nine international stock index returns. The evidence of this study provides the long memory in four of them.

The aim of this paper is to analyze the persistence in six emerging markets stock returns, namely Argentina, Greece, Israel, Korea, Mexico and Turkey by means of fractional integration analysis. Since fractional models offer better approximation for the low-frequency dynamics than standard time series models, the stock return series will be modeled by a class of generalized univariate processes, which is called autoregressive fractionally integrated moving average (ARFIMA) processes. Using these processes, stock return series are shown to be mean reverting even though they exhibit significant persistence in the short run. The ARFIMA model for each series is estimated using the reduced form of Whittle approximate maximum likelihood (WML) method. The results obtained suggest that stock return series of the countries being analyzed, except Israel, possess the long memory property and show low persistency but stock market return of Israel is stationary series.

The structure of the paper is as follows. Section II describes the fractional statistical analysis. Section III contains the data and empirical results. The final section presents the conclusions.

II. Methodology

The concept of fractional integration was suggested by Granger and Joyeux (1980) and Hosking (1981). Many researches have been done concerning long memory in economic and financial time series. Fractional integration processes belong to long memory due to their ability to reveal significant dependence between distant observations in time. In the frequency domain, assume that y_t is weakly stationary process and its spectral density function, $f(\lambda)$, at frequency $\lambda \in (-\pi,\pi]$ satisfying

$$\gamma_j = E[(y_t - E(y_t))(y_{t+j} - E(y_t))] = \int_{-\pi}^{\pi} f(\lambda)\cos(j\lambda)d\lambda, \quad j = 0, \pm 1, \pm 2, \ldots \quad (1)$$

where γ_j are the autocovariance of y_t. Spectral density function of y_t satisfy

$$f(\lambda) \sim c_1 \lambda^{-2d} \quad \text{as } \lambda \to 0^+ \quad \text{for } 0 < c_1 < \infty \quad (2)$$

and autocovariances follow

$$\gamma_j \sim c_2 j^{2d-1} \quad \text{as } j \to \infty \quad \text{for } |c_2| < \infty \quad (3)$$

where the symbol ~ means that the ratio of the left hand side and right hand side tends to 1, as $j \to \infty$ in (3) , and as $\lambda \to 0^+$ in (2). For $d \in (-0.5,0.5)$, y_t follows a long memory process (Brockwell and Davis, 1991; Robinson, 1995a,b).

The autoregressive fractionally integrated moving average model with integrated of order d can be expressed as ARFIMA(p,d,q). The ARFIMA (p,d,q) is

$$\phi(L)(1-L)^d y_t = \theta(L)\varepsilon_t, \quad t = 1, 2, \ldots \quad (4)$$

where d denotes the fractional differencing parameter, all roots of $\phi(L)$ and $\theta(L)$, polynomials in the lag operator L with degrees p and q respectively, lie outside the unit circle and ε_t is white noise sequence. The long memory parameter d is not restricted to integer values. For any real number $d > -1$, the fractional differencing term $(1-L)^d$ can be expressed as an infinite moving average (MA(∞)) process using the binomial expansion

$$(1-L)^d = 1 - dL + \frac{d(d-1)}{2!}L^2 - \frac{d(d-1)(d-2)}{3!}L^3 + \ldots, \quad (5)$$

When $p = q = 0$ in equation (4), the process ε_t could be a stationary and invertible ARMA sequence, when its autocovariance decay exponentially. However, they could decay much slower than exponentially. When $d = p = q = 0$ in (4), y_t is "weakly autocorrelated". If $d = 0$ in (4), y_t follows an ARMA(p,q) representation. For $d \in (-0.5,0)$, y_t is called antipersistent or intermediate memory and hence $\sum_{j=-\infty}^{\infty} |\gamma_j| < \infty$. When $d \le -0.5$, y_t is covariance stationary but not invertible. If $d \in (0,0.5)$, y_t is covariance stationary, but its lag-j autocovariance γ_j decreases very slowly, like the power law j^{2d-1} as $j \to \infty$ as in (3). If $d \in (0.5,1)$, y_t is covariance nonstationary and displays strong persistence, but it is still mean-revert process, any shock on the value of y_t will disappear in the long run. If $d \ge 1$, y_t is both covariance nonstationary and not mean-revert process, with the effect of shocks persisting forever (Granger and Joyeux, 1980; Hosking, 1981; Baillie, 1996).

2.1. Measuring Persistence in Long Memory Models

The persistency of a shock on the value of y_t depends on whether $d < 1$ or $d \ge 1$. The effect of any shock on the fractionally integrated process with $d < 1$ slowly dies out. An impulse response function measures the effect of a unit shock at time t on y_{t+k}; moreover, impulse responses of a stationary process are the coefficients of its MA(∞) representation. The infinite moving average representation for y_t is

$$y_t = (1-L)^{-d}\phi(L)^{-1}\theta(L)\varepsilon_t = A(L)\varepsilon_t, \quad t = 1, 2, \ldots \quad (6)$$

where $A(L) = (1-L)^{-d}\phi(L)^{-1}\theta(L) = 1 + a_1 L + a_2 L^2 + \cdots$, the impulse responses are given by the coefficients a_k of $A(L)$. The moving average coefficients $\{\theta_1, \theta_2, \theta_3, \ldots\}$ are called the impulse responses. The impact of a unit innovation at time t on the value of y_t at $t+j$ is equals to ($C_\infty = 1+\theta_1+\theta_2+\theta_3+\cdots\theta_j$). As $j \to \infty$, $C_\infty = A(1)$. That is the measure of the long run impact of the innovation (Campbell and Mankiw, 1987). Cheung and Lai (1993) show that for the fractionally integrated process with $d < 1$, $C_\infty = 0$ implying no long-run impact of the innovation on the value of y_t. For $d \ge 1$, $C_\infty \ne 0$. This means that y_t process is not mean reverting since an innovation has permanent effect on the value of y_t. When the $d < 1$, the y_t process is mean-reverting.

2.2. Estimation Method for Long Memory Models

In this paper, it is aimed to evaluate the persistence in emerging market using the impulse response functions of the estimated ARFIMA models. In order to obtain impulse responses firstly it is needed to estimate the parameters of the models. In the literature, there are two well-known parametric methods that are the exact maximum likelihood (EML) method (Sowell 1992) and the WML method (Fox and Taqqu 1986; Whittle 1951). In this study, only the WML method is used. The WML estimates are obtained by maximizing an approximation of the likelihood function of the ARFIMA model in equation (4) in the frequency domain. In this method, the parameter vector $\theta = (\alpha_1, \ldots, \alpha_p, d, \beta_1, \ldots, \beta_q)$ is estimated by maximizing the approximate log likelihood function (Hauser 1999).

$$\log L_W(\theta, \sigma_u^2) = -\sum_{j=1}^{m} \log f(\lambda_j \mid \theta, \sigma_u^2) - \frac{1}{2\pi} \sum_{j=1}^{m} \frac{I(\lambda_j)}{f(\lambda_j \mid \theta, \sigma_u^2)} \quad (7)$$

with respect to the parameter vector θ, where $I(\lambda_j) = T^{-1} \left| \sum_{t=1}^{T} (y_t - \bar{y}) e^{it\lambda_j} \right|^2$ is the periodogram defined at the jth Fourier frequency, $\lambda_j = 2\pi j/T$, $j = 1,\ldots,m$, $m = [(T-1)/2]$, $[\cdot]$ is the integer part. The reduced form of L_W with respect to the error variance σ_u^2 is

$$\log L_W^*(\theta) = m \log(2\pi) - m \log\left(m^{-1} \sum_{j=1}^{m} (I(\lambda_j)/g(\lambda_j)) \right) - \sum \log g(\lambda_j) - m \quad (8)$$

with $\sigma_u^2 = \sigma_u^{2*} = m^{-1} \sum_{j=1}^{m} \left(I(\lambda_j)/g(\lambda_j) \right)$ where

$f(\lambda_j) = \sigma_u^2 g(\lambda)/(2\pi)$ with $g(\lambda) = g(\lambda \mid \theta)$. On the assumption that the order (p,q) of the ARFIMA model is known as a priori, the model parameters are estimated by maximizing the likelihood function in equation (8). The result estimates are consistent and asymptotically normal (Brockwell and Davis, 1991; Hauser, 1999).

III. Empirical Analysis

3.1. Data

The data set used in this paper consists of weekly stock return series of countries; namely, Argentina, Greece, Israel, Korea, Mexico and Turkey and are taken from Datastream databases. The six stock markets selected are a part of the International Financial Corporation's *Emerging Market Database* (IFC-EMDB) classification. The selection is made based on the fact that these markets have had similar experience in terms of market volatility, market volume and financial crises. The sample period spans 10/10/1988 to 24/03/2003 for a total of 755 weekly observations. The data from 1988 onward is chosen for the Turkish Stock Market since the market came into existence in 1986 and did not have substantial transaction or number of listed companies in the early 90's. Stock return series used in this study is calculated as: $y_t = 100 \cdot \ln(p_t/p_{t-1})$ where y_t is logarithmic return in period t and p_t is the price at the end of week t.

3.2. Empirical Results

Before analyzing the impulse-response analysis of stock returns of the six emerging markets, we estimate different ARFIMA(p,d,q) models in which both p and q are less than or equal to three for each series taken into consideration. The estimation results of different ARFIMA(p,d,q) models are shown in Table 2. For each of the sixteen resulting models, several tests are performed on the residuals to assure that they are white noise. In particular, tests for normality, heteroscedasticity and autocorrelation are conducted. On those models, after conducted the diagnostic tests on the residuals, different criteria are used to determine the best possible specification. For the identification of the best ARFIMA models, Schwartz information criterion (SIC) is performed and is shown in Table 1.

In Table 2, the best ARFIMA model of each series according to the minimum SIC is reported, which shows that the SIC selects an ARFIMA(3,0.224,3) for Argentina, an ARFIMA(0,0.120,1) for Greece, an ARFIMA(1,0.016,1) for Israel, an ARFIMA(1,0.073,2) for Korea, an ARFIMA(1,0.091,0) for Mexico and an ARFIMA(0,0.057,0) for Turkey. The results are sensitive to the specific model selected. The estimated fractional differencing parameter of each series exhibits fractional dynamics with long-memory features in these stock markets. They range from 0.016 to 0.224 for the series under the study. The estimated values of d are significantly different from zero at the 5% level for Argentina, Greece, Mexico and Turkey, at the 20% for Korea in the models chosen by the SIC. All estimates of d for these countries are significantly positive. This indicates that fractional integration may be a useful way of thinking about the serial correlation properties of these returns. This is especially true in the light of the fact that the unit root tests such as, the Dickey-Fuller and Phillips-Perron, tend to have low power against fractional alternatives such as GPH and Lo's modified *R*/S. However, the estimate of *d* is not significantly different from zero at the 5%, 10% and 20% for Israel. There is thus some evidence for positive long memory for Argentina, Greece, Korea, Mexico, and Turkey. Therefore, stock market returns series for Argentina, Greece, Korea, Mexico, and Turkey are not *I*(0) processes that show a rapid exponential decay in their impulse response. The series are clearly covariance stationary and exhibit long-memory behavior. However, stock market return of Israel is stationary process.

When compared to the estimated value of *d* of these market returns, Argentina has the largest *d* estimate, indicating that it has the strongest long memory component. For Greece, Korea, Mexico and Turkey, the estimates of *d* lie between 0.057 and 0.12. This shows that these markets have the lowest long memory component than Argentina.

Table 1: Model Selection Criteria of ARFIMA(*p*,*d*,*q*) Models for Stock Return Series

	SIC for ARFIMA(*p*,*d*,*q*) Models					
ARFIMA(*p*,*d*,*q*) Models	Argentina	Greece	Israel	Korea	Mexico	Turkey
(0,d,0)	-654.02	-626.93	-624.81	-624.37	-624.21	**-627.99**
(0,*d*,1)	-661.33	**-627.57**	-626.05	-626.85	-625.47	-626.56
(0,*d*,2)	-660.84	-625.19	-625.21	-624.28	-623.96	-627.15
(0,*d*,3)	-675.30	-622.75	-625.00	-621.71	-621.53	-626.97
(1,*d*,0)	-663.66	-627.30	-626.81	-626.75	**-626.07**	-626.92
(1,*d*,1)	-668.45	-625.15	**-627.62**	-624.28	-625.10	-624.99
(1,*d*,2)	-666.84	-623.02	-625.04	**-627.64**	-621.47	-626.98
(1,*d*,3)	-673.29	-620.50	-623.39	-625.23	-619.25	-625.08
(2,*d*,0)	-664.38	-625.28	-625.84	-624.26	-624.25	-627.10
(2,*d*,1)	-666.35	-623.12	-625.04	-621.70	-621.71	-626.48
(2,*d*,2)	-666.18	-620.22	-623.27	-625.18	-619.97	-625.37
(2,*d*,3)	-663.33	-618.20	-620.79	-622.74	-618.08	-623.20
(3,*d*,0)	-674.84	-622.84	-625.24	-621.82	-621.90	-627.32
(3,*d*,1)	-673.47	-620.55	-623.58	-619.52	-619.49	-624.78
(3,*d*,2)	-677.29	-618.12	-620.97	-622.82	-617.98	-622.89
(3,*d*,3)	**-680.02**	-615.48	-620.88	-622.09	-618.50	-621.46

Notes: Table reports the estimates of ARFIMA(*p*,*d*,*q*) models selected by the Schwarz information criterion (SIC). SIC equals to -2 ln *L*+ (log *n*)(*p*+*q*+2), for $p,q \leq 3$, where *L* is the Whittle likelihood function as given in Hauser (1999). The estimation of mean and residual variance are added as well as the penalty of two in addition to *p*+*q* in the SIC. All ARFIMA models are estimated using the reduced form of Whittle frequency domain approximate maximum likelihood method.

Table 2: Parameter Estimates of Best ARFIMA(*p*,*d*,*q*) Models for Stock Return Series

Countries	log-lik	*d*	α_1	α_2	α_3	β_1	β_2	β_3	SIC
Argentina	351.60	0.224 (0.048)	-0.084 (0.168)	-0.826 (0.049)	-0.369 (0.158)	0.089 (0.203)	-0.917 (0.050)	-0.149 (0.197)	**-680.02**
Greece	318.94	0.120 (0.050)	-	-	-	0.116 (0.064)	-	-	**-627.57**
Israel	320.25	0.016 (0.034)	-0.716 (0.185)	-	-	-0.635 (0.211)	-	-	**-627.62**
Korea	321.55	0.073 (0.051)	-0.990 (0.015)	-	-	-0.858 (0.065)	0.119 (0.064)	-	**-627.64**
Mexico	318.19	0.091 (0.041)	-0.124 (0.052)	-	-	-	-	-	**-626.07**
Turkey	317.86	0.057 (0.028)	-	-	-	-	-		**-627.99**

Notes: The estimates given in the Table are for the models that have the minimum SIC. The values in parenthesis are s.e. of parameter. Standard errors -in parentheses- are calculated under the asymptotic formula in Robinson (1994) and Beran (1995).

As an alternative confirmation of mean reversion of the emerging stock market returns, the impulse responses implied by the models obtained in the previous estimates are analyzed. Figure 1 displays the plots of the impulse responses for the selected model in each stock market returns when they are shocked by one standard deviation, while Table 3 contains its numerical values. Impulse responses show that these series are antipersistent series and have low persistency. For all the series analyzed in this study, the effect of the shock on the value of the series disappears 80 percent after two periods. The quick movement of effect of the shocks through 0 shows that series are antipersistent processes.

Figure 1: Impulse Responses

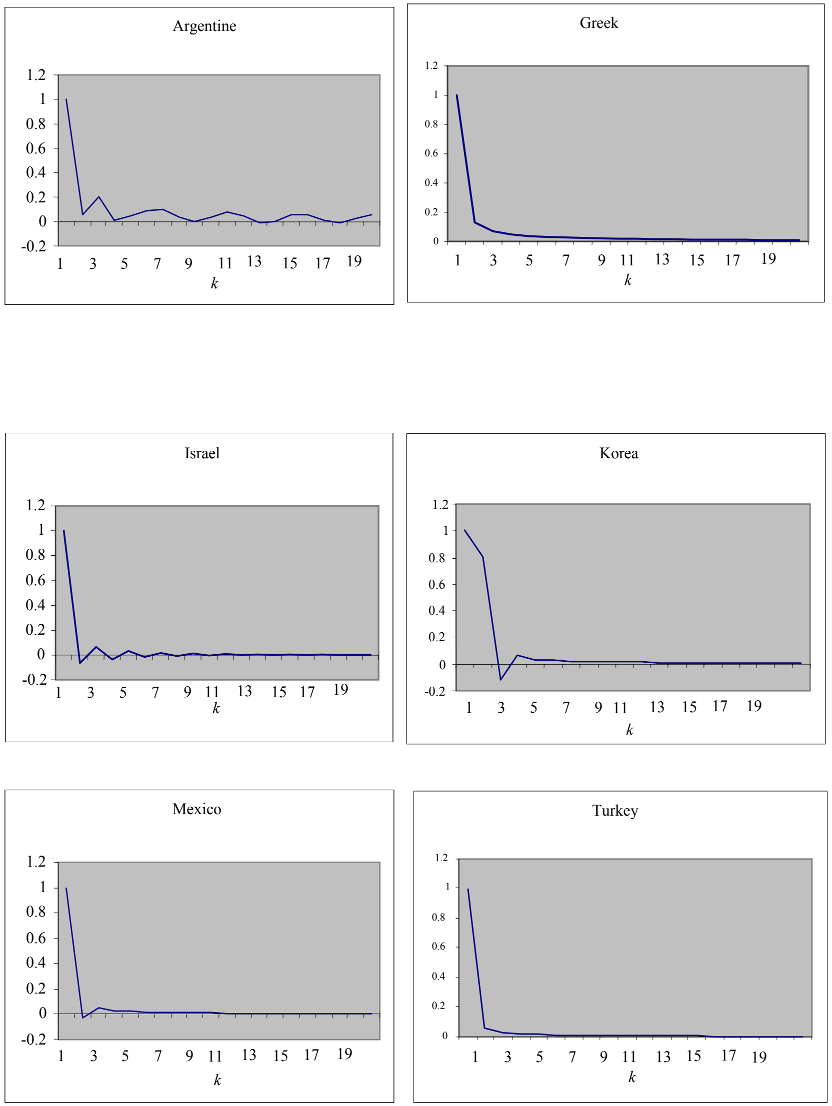

Table 3: Impulse Responses

Steps (k)	Argentina	Greece	Israel	Korea	Mexico	Turkey
1	1	1	1	1	1	1
2	0.051	0.129	-0.065	0.807	-0.033	0.057
3	0.203868	0.06828	0.064828	-0.11727	0.053732	0.030124
4	0.015584	0.048093	-0.03579	0.06652	0.027937	0.020655
5	0.04343	0.037468	0.033215	0.031102	0.023273	0.015786
6	0.08378	0.030855	-0.01786	0.027698	0.01899	0.012809
7	0.095686	0.02632	0.017653	0.022942	0.016207	0.010796
8	0.030603	0.023005	-0.00851	0.019849	0.014142	0.009341
9	-0.00336	0.020471	0.009684	0.017478	0.012563	0.00824
10	0.037695	0.018467	-0.00375	0.015631	0.011312	0.007377
11	0.077493	0.01684	0.00554	0.014147	0.010298	0.006681
12	0.045603	0.015491	-0.00138	0.012929	0.009457	0.006108
13	-0.0057	0.014354	0.003355	0.01191	0.008748	0.005628
14	0.005218	0.013382	-0.00022	0.011045	0.008142	0.00522
15	0.05411	0.01254	0.002181	0.010301	0.007618	0.004868
16	0.056146	0.011804	0.000325	0.009654	0.00716	0.004562
17	0.008248	0.011154	0.001535	0.009086	0.006757	0.004294
18	-0.01039	0.010577	0.000564	0.008583	0.006398	0.004055
19	0.027366	0.010059	0.001166	0.008135	0.006077	0.003843
20	0.054902	0.009593	0.000652	0.007733	0.005788	0.003652

IV. Conclusion

This study has examined the persistence in the weekly stock returns of six countries, Argentina, Greece, Israel, Korea, Mexico and Turkey. Previous studies in this subject mostly applied Lo's modified *R/S*, the GHP log periodogram and frequency domain and time domain versions of the score test for testing the presence of the long memory in stock return series. In this study, using the reduced form of WML estimator, we find the evidence of fractional dynamics with long-memory features in 5 of the 6 series (except Israel). Also, the series are covariance stationary and exhibit long-term dependence behavior. This implies that a unit shock has no permanent effect on the value of stock returns, but has a permanent effect on the value of these stock prices. Thus, the level of these stock prices is unpredictable. For the Israel, stock return series is stationary and does not exhibit long-term dependence. As a consequence, the results of impulse response analysis and WML estimator show that these series are antipersistent processes and have low persistency.

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ARE INVESTORS AFFECTED BY THE WEATHER CONDITIONS: EVIDENCE FROM THE ISTANBUL STOCK EXCHANGE

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Abstract
Market anomalies in stock markets should be related to investors' trading strategies, which are based on their psychologies along with other factors. The fact that some weather variables affect investor's performance and mood can also affect market prices substantially. This paper examines cloudy, rainy and snowy days affect on the Istanbul Stock Exchange 100 (ISE-100) Index returns and the weak form efficiency for the ISE with a different approach. It has been found that cloudy and rainy days do not affect on ISE-100 Index returns while snowy days do. It has also been found that there exists evidence in favor of inefficiency of Turkish stock market in weak form.

I. Introduction

Although man has been considered as homoeconomicus in economics, literature especially observes market anomalies such as day of the week effects, January effect, holiday effect etc. Stock markets can give evidence that it could be possibly reversed.

There is a systematic approach in classical economics that people's choices are rational through their data in hand and proficiencies. The theory initially supposes that people behave logical and can calculate possibilities when taking their decisions. Originally as a psychological professor Kahneman's studies indicate a reverse situation and for investors' economic decisions their intuitions could substitute rational idea or they could prefer to use logical way in place of probability calculation (Yazıcı, 2003).

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Key words: Weather effect, ISE, Kruskal Wallis Test, Mann Whitney U Test and Unit Root Test.

In addition it can be said that a unified theory of human psychology based on the foundation of fundamental physical laws will help us distinguish genuine patterns in the financial markets from data mining (Chen, 2003).

Anomalies in stock markets should be related to investors' trading strategies, which are based on their psychologies along with other factors. The fact that some weather variables affect investor's performance and mood can also affect market prices, substantially, Dowling and Lucey (2002). At this point, the question whether it affects investors' psychology may be asked. Consequently, weather could be one of the reasons for market anomalies, so it should be investigated to find the evidence against Efficient Market Hypothesis.

It is a reality that human psychology is affected by weather conditions. The assumptions that some mental illnesses increase in spring and that cloudy days adversely affect human psychology while sunny days cause positive effects and even the expectation that earthquake may occur when the weather is too hot or when the humidity level is high according to Turkish people can be shown as a simple explanation for the relationship between psychology and weather.

There are several researches on weather effect on stock returns. Goetzmann and Zhu (2002) have investigated weather effects on traders for five major U.S. cities by using individual investors' account information. They have virtually reported no difference in individual's propensity to buy or sell equities on cloudy days as opposed to sunny days. However, the behavior of market makers may be responsible for the relation between returns and weather.

In respect of humidity, sunny, cloudy, snowy and rainy days, weather effect has been tested on stock returns and liquidity in literature. For example, Hirshleifer and Shumway (2001) have followed the same ways for 26 stock exchanges and reported that sunshine is highly significantly correlated with daily stock returns after controlling the sunshine and other weather conditions such as rain and snow, which are unrelated to returns.

Kamstra, Kramer and Levi (2002) claim that there is a seasonal effect related to the length of day and its effect on investor's psychology. To test this effect, they have used 12 stock exchange indexes in two hemispheres, four of which belong to United States. They have reported evidence of a seasonal related to the length of day.

Dowling and Lucey (2002) have investigated the weather effect on investors' mood; consequently, stock exchange returns, to use sunny, rainy days variables, humidity level and biorhythm variables for Ireland. They have reported that weather has an influence on investors' mood, thus, on determination of share prices.

With providing evidences in favor of weather effect on stock exchange returns, there are some researchers who claim that there is no effect or it can be neglected. Some samples of them are Loughran and Schultz (2003), Pardo and Valor (2002, 2003) and Kramer and Runde (1997). Loughran and Schultz (2003) have formed some portfolios with 4,949 firms' shares, which are located in 25 cities in United States and traded on the NASDAQ Stock Exchange. They have investigated the weather effect on these portfolios with respect to the investors who live in the same area where the firms CEO's live. They have reported that there is no cloudy days effect on portfolios returns.

Pardo and Valor (2002, 2003) have investigated the possible relation between weather and market index returns in the context of the Spanish market. To see whether or not there is an influence of the sunshine hours or humidity levels on the stock prices, independent of the trading system, they have used the daily closing values of the Madrid Stock Exchange Index. They have reported that there is no influence of sunshine hours humidity levels on the stock prices and this result is also independent of the trading system.

Another negative evidence has been given by Kramer and Runde (1997). They have investigated the weather effect for the Frankfurt Stock Exchange and found that short-term stock returns are not affected by the local weather conditions. Authors also say that the reason of presented different evidences about weather effect is due to different statistical methods used.

In this study it is being investigated whether the cloudy, rainy and snowy days have an effect on the Istanbul Stock Exchange 100 Index (ISE 100 Index) returns and the weak form efficiency for the ISE is tested with a different approach. The paper is organized as follows: Section I, briefly expresses the relationship between the stock returns and the weather and consequently the Efficient Market Hypothesis. This is followed by Section II by consideration of data and methodology while the empirical results are presented in Section III and conclusions are introduced in Section IV.

II. Data and Methodology

This study is conducted by using two kinds of data acquired from the Istanbul Stock Exchange (ISE) database and Istanbul/Göztepe Turkish State Meteorological Service database. The first data sets include returns which have been calculated by using daily closing values of the ISE 100 Index. The second data set consists of returns in which the data have been grouped by considering the cloudy, rainy and snowy days (Istanbul) relative to the ISE 100 Index. Both data sets have 3,662 observations and cover the period from October 26, 1987 to July 26, 2002. The ISE 100 Index returns are calculated as follows:

$$R_t = V_t/V_{t-1} \qquad (1)$$

Where, R_t denotes return on t day and V_t, V_{t-1} denotes closing prices on t and t-1, respectively.

The second data set indicates ISE-100 Index returns which have been achieved on cloudy, rainy and snowy days in Istanbul. The aim of this research is to test if there are any (significant) differences between the daily returns of the ISE 100 Index on cloudy, rainy and snowy days.

The service makes observation of the cloud data three times in a day with naked eyes and ranks it from zero to ten. Zero indicates the lowest cloudiness, which also means the highest sunny light where ten, indicates the highest cloudiness. The observations are made at 07.00 a.m, 14.00 p.m and 21.00 p.m. everyday. In this study, we have used the observations made between 07.00 a.m and 14.00 p.m. in consideration of the ISE trading hours and formed a new series calculating arithmetic mean.

Tufan and Hamarat (2003b) have used the non-parametric Kruskal Wallis Test on the same data set to evaluate if cloudy days affect the ISE 100 Index returns. The researchers have divided cloudy days into 10 groups (variables), while this study divides the cloudy days into 3 groups based on accepted international statistical standards. According to these standards, 0-2 indicates sunny days, 2.1-8 indicates cloudy days and 8.1-10 indicates the cloudiest days (Lough, 1992 and Erlat, 1997). On this basis, it is being evaluated whether there are any differences between the average returns for the groups.

The weather observatory station also simultaneously measures rainfall and cloudiness levels. The rainy days values indicate quantity of the rain which has fallen per meter square for the period from October 26, 1987 to July 26, 2002. A value of zero value is assigned to no rain days. These groups are being shown below:

A measurement range of: 0-0.09 indicates no rain, 0.1-10 indicates normal rain, 10.1-25 indicates medium intensity rain, 25.1-50 indicates light shower, 50.1-100 indicates heavy shower and 100> very heavy shower (Koç, 2001). Significant differences between average group returns are being evaluated on the basis of these ranges.

The weather observatory station measures snowfall depths as centimeters on the ground. If the ground is not fully covered by snow then the depth is indicated as -1.

Snowy day variables: In this research, days are divided into two groups: snowy and non-snowy days because only 136 non-snowy days were recorded out of 3,662 days in the observation record. On this basis an analysis was made between the group averages.

In literature, researchers usually use regression method such as Loughran and Schultz (2003), Goetzman and Zhu (2002), Dowling and Lucey (2002). On the other hand, there are also some researchers that use parametric and non-parametric methods such as Kramer and Levi (2002) and Pardo and Valor (2002, 2003).

Firstly, in order to investigate whether series are normally distributed or not we used skewness, kurtosis coefficients and Jargue-Bera Tests. After that we applied Augmented Dickey Fuller Test to investigate series non-stationary.

In order to test stationary, regression equation is used as follows (Gujarati, 1995):

$$Y_t = \rho Y_{t-1} + u_t \quad (2)$$

The result of $\rho=1$ indicates that stochastic variable Y_t has a unit root. So, it means that the series are not stationary.

If we have a reason to believe that the returns are not normally distributed, we can use a non-parametric test to evaluate the result. After applying the tests, it was determined that the data are not normally distributed after which we applied the Kruskal Wallis Test (KW) for cloudy and rainy days, while the Mann-Whitney U Test was applied for Snowy days.

To avoid the strong assumption of a normal distribution, we have used the Kruskal-Wallis Test (KW) (Freund et all. 1997) which is a non-parametric test. The Kruskal-Wallis Test is a rank-sum test that serves to test the assumption that k independent random samples come from identical populations and in particular that the null hypothesis $\mu_1=\mu_2..........=\mu_k$, against the alternative that these means are not all equal, Kruskall-Wallis Test has the following assumptions: (1) The variable of interest is continuous (not discrete). The measurement scale is at least ordinal, (2) the probability distributions of the populations are identical, except for location. Hence, we still require that the population variances are equal, (3) the groups are independent, (4) All groups are simple random samples from their respective populations. Each individual in the population has an equal probability of being selected in the sample. Because of k=2 in snowy days variables as snowy and non-snowy days, we applied Man Whitney U Test in place of Kruskal-Wallis when we test if k independent random sample comes from identical populations. This test has the following assumptions: (1) Variables are formed two independent samples such as $x_1, x_2,...., x_{n1}$ and $y_1, y_2,....,y_{n2}$, (2) Variables are independent, (3) Observed variables are continuous and random (4) The measurement scale is at least ordinal (Gamgam,1998).

In this study weather effect on stock exchange returns has been investigated, consequently weak form of Efficient Market Hypothesis has been tested with different approach.

III. Empirical Results

First, an analysis was made on whether or not the ISE 100 Index is normally distributed. On the basis of Jargue Bera tests, it was determined that the data series has a non-normal distribution with a skewness (α_3= 0 normal distribution), kurtosis (α_4= 0 normal distribution).

Similarly, it has been evaluated if the cloudy, rainy and snowy day group returns are normally distributed and it was determined that they are not.

After it was determined that the ISE 100 Index return series is not normally distributed, the series were evaluated using the ADF Unit Root Test using the hypothesis that H_0: $\delta=0$, $\rho=1$. Under the null hypothesis that $\rho=1$, the conventionally computed t statistic is known as the τ (tau) statistic, whose critical values have been tabulated by Dickey and Fuller on the basis of Monte Carlo simulations (Gujarati 1995).

Our null hypothesis is δ =0 and if the result $\rho=1$ will be found, it means that the series has a unit root. The absolute value of calculated τ statistics (40.24) exceeds the absolute value of McKinnon's critical values at 1% (3.43), 5% (2.86) and 10% (2.56) levels. So, we could not accept the null hypothesis that the ISE 100 Index returns series exhibits a unit root, which another way of saying that the ISE 100 Index returns series is stationary. In this case, I(0).

Similarly, after it has been determined that sub-groups of cloudy, rainy and snowy days returns are not normally distributed, the ADF Unit Root Test was applied.

Using the above hypothesis above it was found that the sub-groups of cloudy, rainy and snowy day returns are not normally distributed. Results are presented in Table 1.

Table 1: Descriptive and Stationary Statistics

	Return	N	Mean	Standard Deviation	Skewness	Kurtosis	Jargue-Bera (Prob.)	ADF Test Statistics ADF	1%	5%	10%
	ISE 100 Index Returns	3662	1,002	0,032	0,293	6,30	1716.29 (0,000)	-0,24	-3,43	-2,86	-2,56
Cloudiness	Sunny	1171	1,002	0,030	0,121	5,23	245.35 (0,000)	-22,19	-3,14	-2,86	-2,56
	Cloudy	1663	1,003	0,032	0,329	6,81	1037.20 (0,000)	-27,89	-3,43	-2,86	-2,56
	Cloudiest	828	1,003	0,034	0,379	6,19	371.36 (0,000)	-18,74	-3,44	-2,86	-2,56
Rains	No Rain	2382	1,002	0,032	0,433	7,20	1829.76 (0,000)	-32,96	-3,43	-2,86	-2,56
	Normal Rain	457	1,001	0,034	-0,156	5,07	83.64 (0,000)	-14,27	-3,44	-2,86	-2,57
	Medium Intensity	203	1,002	0,029	-0,017	3,32	1.051 (0,591)	-9,55	-3,46	-2,87	-2,57
	Light Shower	200	1,003	0,030	0,154	4,28	14.38 (0,001)	-9,48	-3,46	-2,87	-2,57
	Sağanak	189	1,001	0,028	0,073	4,74	24.15 (0,000	-9,84	-3,46	-2,87	-2,57
	Yoğun Sağanak	231	1,005	0,033	0,445	3,60	11.14 (0,003)	-11,21	-3,46	-2,87	-2,57
	Karlı Gün	75	0,995	0,034	0,489	3,91	5.607 (0,060)	-6,66	-3,52	-2,90	-2,58
	Karsız Gün	3587	1,003	0,032	0,291	6,37	1751.65 (0,000)	-39,95	-3,43	-2,86	-2,56

Note (*): α=1%
Source: ISE and Istanbul/Göztepe Turkish State Meteorological Service database.

After determining that the series are not stationary, the non-parametric Kruskal Wallis (KW) Test was applied to determine if there are any significant differences between the means of cloudy, rainy and snowy day return sub-groups. To test if there are any differences between the means of snowy day sub-group returns, the Mann-Whitney U-Test was applied. This test was applied because the snowy days are a sub category of the combined snowless and snowy days.

After determining the descriptive statistics of the data set, KW test was applied to find out if there are any significant differences between the means of the cloudy day returns sub-groups such as sunny, cloudy and the cloudiest

days. As it is shown in Table 2, there were no significant differences between the means of the cloudy day returns sub-groups and p>5%.

As can be seen in Table 2, there were no statistically differences between means of sub-groups of snowy days returns and p>%5.

Table 2: Kruskal Wallis Test Statistics for Cloudy Days Returns

Group	N	Median Rank	Chi Square (p)
Returns of sunny Days	1,171	1810,58	
Returns of Cloudy Days	1,663	1848,17	
Returns of Cloudiest Days	828	1827,61	0,883 (,643)
Total	3662		

The same test was applied for rainy days sub-groups. As can be seen in Table 3, significant statistically differences between means of sub-groups of rainy days returns could not be found and p>%5.

Table 3: Kruskal Wallis Test Statistics for Rainy Days Returns

Group	N	Median Rank	Chi Square (p)
Returns of No Rain Days	2,382	1832,73	
Returns of Normal Rainy Days	457	1812,55	
Returns of Medium Density Rainy Days	203	1818,47	
Returns of Light Shower Rainy Days	200	1850,73	1,040 (,959)
Returns of Heavy Shower Rainy Days	189	1792,96	
Returns of Very Heavy Shower Rainy Days	231	1882,69	
Total	3662		

Statistically significant differences have been found between the means of the snowy day sub-group returns with using Mann-Whitney U Test and p>%5. According to these results, snowy day returns are smaller than non-snowy day returns.

Table 4: Mann-Whitney U Test Statistics for Snowy Day Returns

Group	N	Median Rank	Z (p)
Returns of Snowy Days	75	1529,85	-2,497 (,013)
Returns of Non-snowy Days	3587	1837,81	
Total	3662		

IV. Conclusions

In this study it is being investigated whether the cloudy, rainy and snowy days affect the ISE 100 Index returns and the weak form efficiency for the ISE with different approach. It has been found that cloudy and rainy days do not affect the ISE 100 Index returns while snowy days do and an evidence that the Turkish stock market is inefficient in weak form has also been found. It can be said that snowy day returns are smaller than non-snowy day returns.

How we consider the trading behavior of investors living in different cities or countries can be questionable, however, those investors trading on the ISE may be living in different cities or countries. It can be claimed that the trading strategy decisions of those investors who live in different cities or countries and trade on the ISE are not being affected by weather conditions in Istanbul. In fact traders whose trading volume is highest usually live in Istanbul in Turkey. On the other hand, even though the investors live in different cities or countries, market professionals such as brokers and dealers who live in Istanbul affect their trading decisions.

As a result, we can say that cloudy and rainy days have no effect but there is a snowy day effect on the ISE 100 Index. Consequently, investors cannot make up an active strategy by using cloudy and rainy days variables while they can use snowy days variables for the Turkish Stock Market. In this study, we also failed to accept that the Turkish stock market is efficient in the weak form of efficiency.

This research supports Tufan and Hamarat's (a, b) studies' results. They have used just cloudy days variables with applying different tests. They have reported both causality and Kruskal Wallis Test results indicate that there is no cloudy days effect on the ISE 100 returns.

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GLOBAL CAPITAL MARKETS

The global economic recovery has been broadening while the global imbalances among major economies have continued to increase. The expansion has continued to be led by the United States and China, where the growth momentum has remained strong. Growth has been stronger than expected in the United States. In contrast, growth in Europe and Japan has been disappointing, Looking forward, global GDP growth is projected to moderate to 4.3 percent in 2005, 0.8 percentage point slower than in 2004.

In emerging markets, GDP growth in 2004 exceeded expectations in almost all regions, and continued—albeit generally slower—growth is projected during 2005, consistent with global developments. In emerging Asia, China's economic momentum remains very strong, notwithstanding tightening measures by the authorities, and investment remains unsustainably high; growth in India also remains quite robust.

The recovery has continued to be supported by favorable financial market conditions, with policy rates in most countries still low in real terms, although there has been some tightening in conditions recently as U.S. longterm interest rates have risen. Nevertheless, equity markets across the globe remain robust; long-run interest rates still appear well below equilibrium levels; and spreads are close to historical lows; private capital inflows to emerging markets have also been strong.

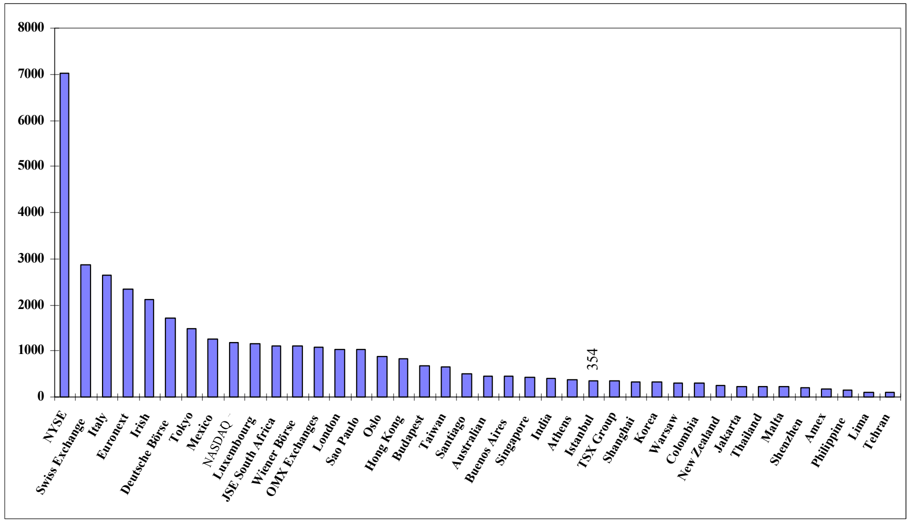
The performances of some developed stock markets with respect to indices indicated that DJIA, FTSE-100, Nikkei-225 and DAX changed by –2.1%, -0.4%, -7.3% and –2.2% respectively at July 13th 2005 in comparison with the Dec. 31st 2004. When US$ based returns of some emerging markets are compared in the same period, the best performer markets were: Egypt (82.9%), Colombia (33.5%), Russia (23.4%), Hungary (18.8%), S.Korea (17.0%), Turkey (13.6%), Mexico (13.0%), Peru (12.0%), Brasil (11.8%). In the same period, the lowest return markets were: Venezuela (-30.6%), China (-18.1%), Thailand (-8.6%) and Poland (-3.4%). The performances of emerging markets with respect to P/E ratios as of end-June 2005 indicated that the highest rates were obtained in Jordan (55.7), Argentina (31.7), China (19.6), India (19.4), Indonesia (17.6) and Czech Rep. (17.0) and the lowest rates in Venezuela (4.7), Brazil (8.7), Poland (8.8), Thailand (9.6), Russia (10.1), Pakistan.(10.4), Peru (11.0) and Turkey (11.5).

Market Capitalization (USD Million, 1986-2004)

	Global	Developed Markets	Emerging Markets	ISE
1986	6,514,199	6,275,582	238,617	938
1987	7,830,778	7,511,072	319,706	3,125
1988	9,728,493	9,245,358	483,135	1,128
1989	11,712,673	10,967,395	745,278	6,756
1990	9,398,391	8,784,770	613,621	18,737
1991	11,342,089	10,434,218	907,871	15,564
1992	10,923,343	9,923,024	1,000,319	9,922
1993	14,016,023	12,327,242	1,688,781	37,824
1994	15,124,051	13,210,778	1,913,273	21,785
1995	17,788,071	15,859,021	1,929,050	20,782
1996	20,412,135	17,982,088	2,272,184	30,797
1997	23,087,006	20,923,911	2,163,095	61,348
1998	26,964,463	25,065,373	1,899,090	33,473
1999	36,030,810	32,956,939	3,073,871	112,276
2000	32,260,433	29,520,707	2,691,452	69,659
2001	27,818,618	25,246,554	2,572,064	47,150
2002	23,391,914	20,955,876	2,436,038	33,958
2003	31,947,703	28,290,981	3,656,722	68,379
2004	38,904,018	34,173,600	4,730,418	98,299

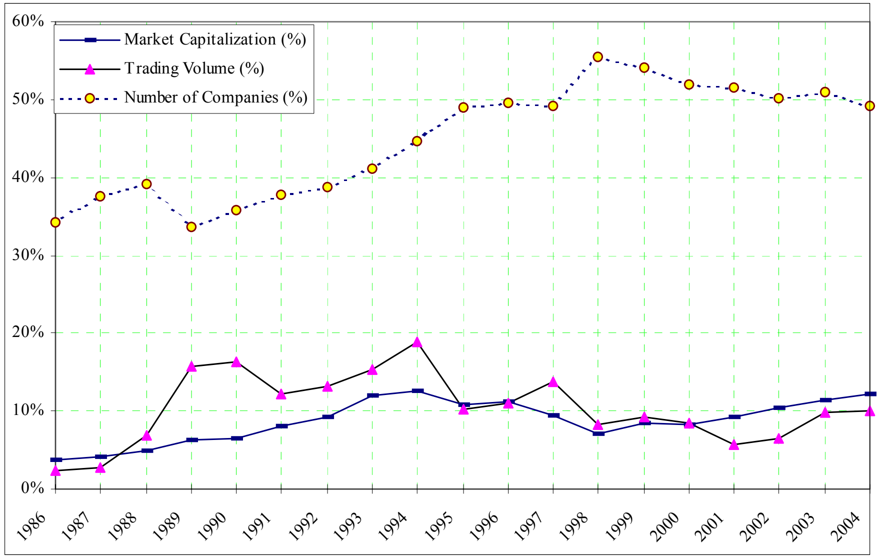
Source: Standard & Poor's Global Stock Markets Factbook, 2005.

Comparison of Average Market Capitalization Per Company (USD Million, June 2005)



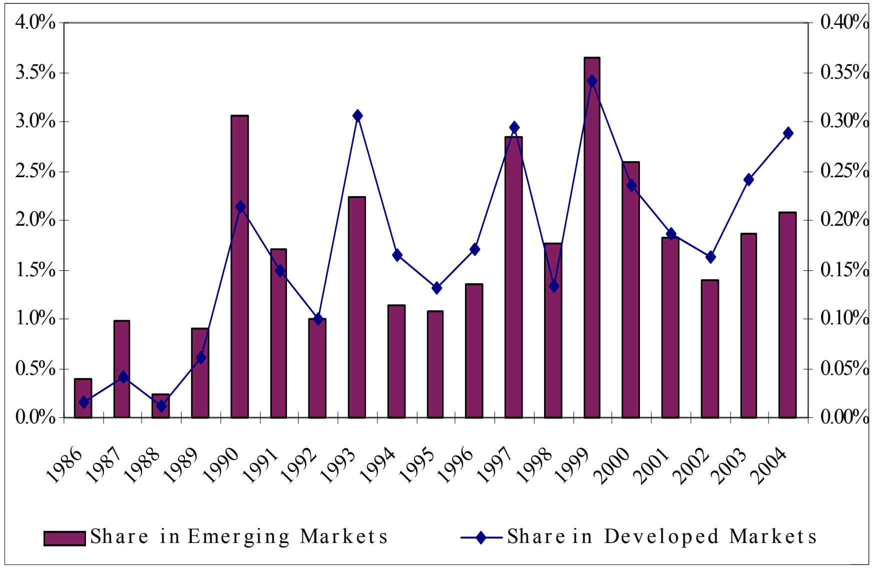
Source: FIBV, Monthly Statistics, June 2005.

Worldwide Share of Emerging Capital Markets (1986-2004)



Source: Standard & Poor's Global Stock Markets Factbook, 2005.

Share of ISE's Market Capitalization in World Markets (1986-2004)



Source: Standard & Poor's Global Stock Markets Factbook, 2005.

Main Indicators of Capital Markets (June 2005)

	Market	Monthly Turnover Velocity (June 2005) (%)	Market	Value of Share Trading (millions, US$) Up to Year Total (2005/1-2005/6)	Market	Market Cap. of Share of Domestic Companies (millions US$) June 2005
1	NASDAQ	256.09	NYSE	6,873,059	NYSE	12,865,337
2	Istanbul	178.04	NASDAQ	5,109,528	Tokyo	3,393,646
3	Spanish Exchanges (BME)	167.45	London	2,750,246	NASDAQ	3,387,939
4	Korea	151.18	Tokyo	1,683,844	London	2,733,565
5	Italy	143.81	Euronext	1,403,903	Euronext	2,285,875
6	Deutsche Börse	133.35	Deutsche Börse	891,292	Osaka	2,195,654
7	Taiwan	126.84	Spanish (BME)	812,671	TSX Group	1,239,049
8	OMX Exchanges	115.68	Italy	666,005	Deutsche Börse	1,119,777
9	London	111.45	Swiss Exchange	512,259	Spanish (BME)	920,479
10	Euronext	111.30	Korea	470,620	Hong Kong	895,298
11	Shenzhen	109.99	OMX Exchanges	464,376	Swiss Exchange	797,976
12	Oslo	109.57	TSX Group	409,251	Australian	721,138
13	Swiss Exchange	105.94	Australian	327,056	OMX Exchanges	709,390
14	NYSE	93.29	Amex	300,070	Italy	707,930
15	Thailand	92.97	Taiwan	263,309	Korea	496,924
16	Tokyo	92.15	Hong Kong	218,225	Taiwan	456,291
17	Australian	83.54	India	136,105	Mumbai	425,717
18	India	79.53	Shanghai	106,104	India	397,447
19	Shanghai	72.06	Osaka	102,420	JSE South Africa	389,324
20	TSX Group	64.00	Oslo	102,147	Sao Paulo	358,953
21	Budapest	63.22	JSE South Africa	90,108	Shanghai	271,736
22	Jakarta	54.92	Istanbul	89,996	Singapore	235,507
23	Irish	53.49	Sao Paulo	74,406	Mexico	190,087
24	Hong Kong	51.74	Shenzhen	68,744	Malaysia	173,830
25	Singapore	46.69	Mumbai	67,138	Oslo	159,773
26	JSE South Africa	44.30	Thailand	54,072	Santiago	121,362
27	Tel-Aviv	44.04	Singapore	52,453	Athens	120,046
28	New Zealand	42.80	Irish	34,856	Thailand	111,703
29	Athens	42.31	Athens	29,361	Wiener Börse	111,100
30	Sao Paulo	42.16	Malaysia	28,312	Shenzhen	109,952
31	Wiener Börse	39.26	Mexico	26,085	Irish	105,913
32	Warsaw	36.88	Jakarta	25,825	Istanbul	105,626
33	Mumbai	34.44	Tel-Aviv	24,258	Tel-Aviv	95,885
34	Malaysia	30.86	Wiener Börse	21,477	Amex	91,677
35	Mexico	27.49	Warsaw	13,975	Jakarta	78,344
36	Tehran	23.73	Budapest	11,206	Warsaw	68,044
37	Philippine	19.38	New Zealand	10,008	Luxembourg	47,319
38	Colombo	19.06	Santiago	8,290	Buenos Aires	45,023
39	Santiago	14.52	Tehran	4,675	Tehran	42,006
40	Ljubljana	12.46	Philippine	4,073	New Zealand	41,208
41	Buenos Aires	12.10	Buenos Aires	3,185	Philippine	34,942
42	Colombia	8.64	Colombia	2,195	Colombia	32,487
43	Lima	7.29	Lima	885	Budapest	30,517
44	Osaka	7.14	Ljubljana	610	Lima	20,414
45	Malta	3.65	Colombo	468	Ljubljana	7,441

Source: FIBV, Monthly Statistics, June 2005.

Trading Volume (USD millions, 1986-2004)

	Global	Developed	Emerging	ISE	Emerging / Global (%)	ISE/ Emerging (%)
1986	3,573,570	3,490,718	82,852	13	2.32	0.02
1987	5,846,864	5,682,143	164,721	118	2.82	0.07
1988	5,997,321	5,588,694	408,627	115	6.81	0.03
1989	7,467,997	6,298,778	1,169,219	773	15.66	0.07
1990	5,514,706	4,614,786	899,920	5,854	16.32	0.65
1991	5,019,596	4,403,631	615,965	8,502	12.27	1.38
1992	4,782,850	4,151,662	631,188	8,567	13.20	1.36
1993	7,194,675	6,090,929	1,103,746	21,770	15.34	1.97
1994	8,821,845	7,156,704	1,665,141	23,203	18.88	1.39
1995	10,218,748	9,176,451	1,042,297	52,357	10.20	5.02
1996	13,616,070	12,105,541	1,510,529	37,737	11.09	2.50
1997	19,484,814	16,818,167	2,666,647	59,105	13.69	2.18
1998	22,874,320	20,917,462	1,909,510	68,646	8.55	3.60
1999	31,021,065	28,154,198	2,866,867	81,277	9.24	2.86
2000	47,869,886	43,817,893	4,051,905	179,209	8.46	4.42
2001	42,076,862	39,676,018	2,400,844	77,937	5.71	3.25
2002	38,645,472	36,098,731	2,546,742	70,667	6.59	2.77
2003	29,639,297	26,743,153	2,896,144	99,611	9.77	3.44
2004	39,309,589	35,341,782	3,967,806	147,426	10.09	3.72

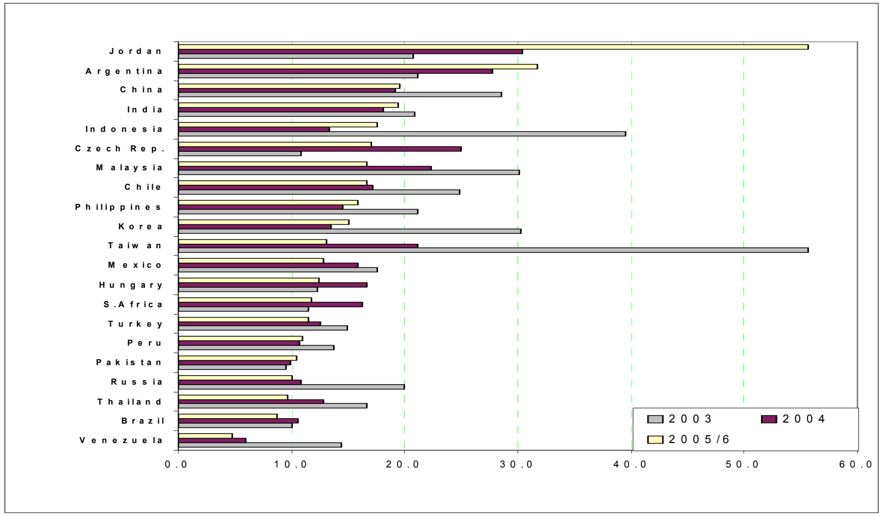
Source: Standard & Poor's Global Stock Markets Factbook, 2005.

Number of Trading Companies (1986-2004)

	Global	Developed Markets	Emerging Markets	ISE	Emerging / Global (%)	ISE/Emerging (%)
1986	28,173	18,555	9,618	80	34.14	0.83
1987	29,278	18,265	11,013	82	37.62	0.74
1988	29,270	17,805	11,465	79	39.17	0.69
1989	25,925	17,216	8,709	76	33.59	0.87
1990	25,424	16,323	9,101	110	35.80	1.21
1991	26,093	16,239	9,854	134	37.76	1.36
1992	27,706	16,976	10,730	145	38.73	1.35
1993	28,895	17,012	11,883	160	41.12	1.35
1994	33,473	18,505	14,968	176	44.72	1.18
1995	36,602	18,648	17,954	205	49.05	1.14
1996	40,191	20,242	19,949	228	49.64	1.14
1997	40,880	20,805	20,075	258	49.11	1.29
1998	47,465	21,111	26,354	277	55.52	1.05
1999	48,557	22,277	26,280	285	54.12	1.08
2000	49,933	23,996	25,937	315	51.94	1.21
2001	48,220	23,340	24,880	310	51.60	1.25
2002	48,375	24,099	24,276	288	50.18	1.19
2003	49,855	24,414	25,441	284	51.03	1.12
2004	48,806	24,824	23,982	296	49.14	1.23

Source: Standard & Poor's Global Stock Markets Factbook, 2005.

Comparison of P/E Ratios Performances



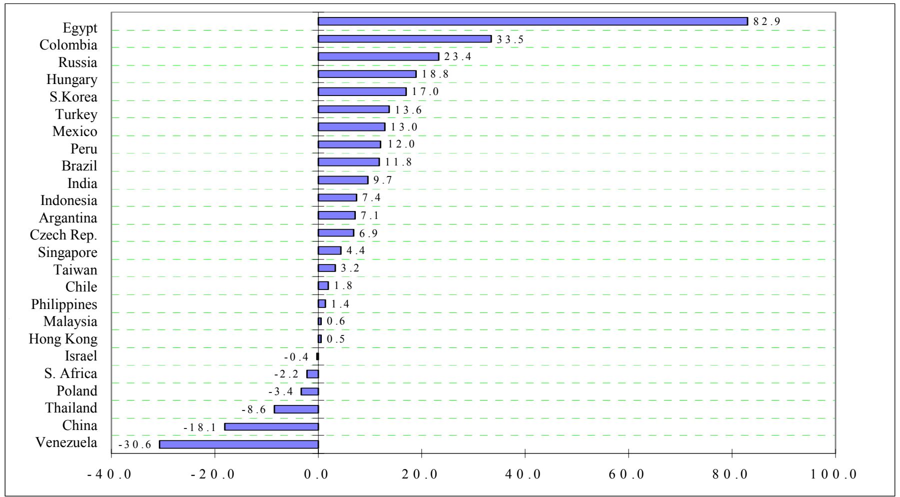
Source: IFC Factbook 2001. Standard & Poor's, Emerging Stock Markets Review, June 2005.

Price-Earnings Ratios in Emerging Markets

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005/6
Argentina	38.2	16.3	13.4	39.4	-889.9	32.6	-1.4	21.1	27.7	31.7
Brazil	14.5	12.4	7.0	23.5	11.5	8.8	13.5	10.0	10.6	8.7
Chile	14.6	14.7	15.1	35.0	24.9	16.2	16.3	24.8	17.2	16.6
China	27.8	34.5	23.8	47.8	50.0	22.2	21.6	28.6	19.1	19.6
Czech Rep.	17.6	37.1	-11.3	-14.9	-16.4	5.8	11.2	10.8	25.0	17.0
Hungary	17.5	27.4	17.0	18.1	14.3	13.4	14.6	12.3	16.6	12.4
India	12.3	15.2	13.5	25.5	16.8	12.8	15.0	20.9	18.1	19.4
Indonesia	21.6	10.5	-106.2	-7.4	-5.4	-7.7	22.0	39.5	13.3	17.6
Jordan	16.9	14.4	15.9	14.1	13.9	18.8	11.4	20.7	30.4	55.7
Korea	11.7	17.9	-47.1	-33.5	17.7	28.7	21.6	30.2	13.5	15.1
Malaysia	27.1	9.5	21.1	-18.0	91.5	50.6	21.3	30.1	22.4	16.7
Mexico	16.8	19.2	23.9	14.1	13.0	13.7	15.4	17.6	15.9	12.8
Pakistan	11.7	14.8	7.6	13.2	-117.4	7.5	10.0	9.5	9.9	10.4
Peru	14.2	14.0	21.1	25.7	11.6	21.3	12.8	13.7	10.7	11.0
Philippines	20.0	10.9	15.0	22.2	26.2	45.9	21.8	21.1	14.6	15.8
Poland	14.3	11.4	10.7	22.0	19.4	6.1	88.6	-353.0	39.9	8.8
Russia	6.3	8.1	3.7	-71.2	3.8	5.6	12.4	19.9	10.8	10.1
S.Africa	16.3	10.8	10.1	17.4	10.7	11.7	10.1	11.5	16.2	11.8
Taiwan	28.2	28.9	21.7	52.5	13.9	29.4	20.0	55.7	21.2	13.1
Thailand	13.1	-32.8	-3.6	-12.2	-6.9	163.8	16.4	16.6	12.8	9.6
Turkey	10.7	20.1	7.8	34.6	15.4	72.5	37.9	14.9	12.5	11.5
Venezuela	32.5	12.8	5.6	10.8	30.5	-347.6	-11.9	14.4	6.0	4.7

Source: IFC Factbook, 2004; Standard&Poor's, Emerging Stock Markets Review, June 2005
Note: Figures are taken from S&P/IFCG Index Profile.

Comparison of Market Returns in USD (31/12/2004-13/07/2005)



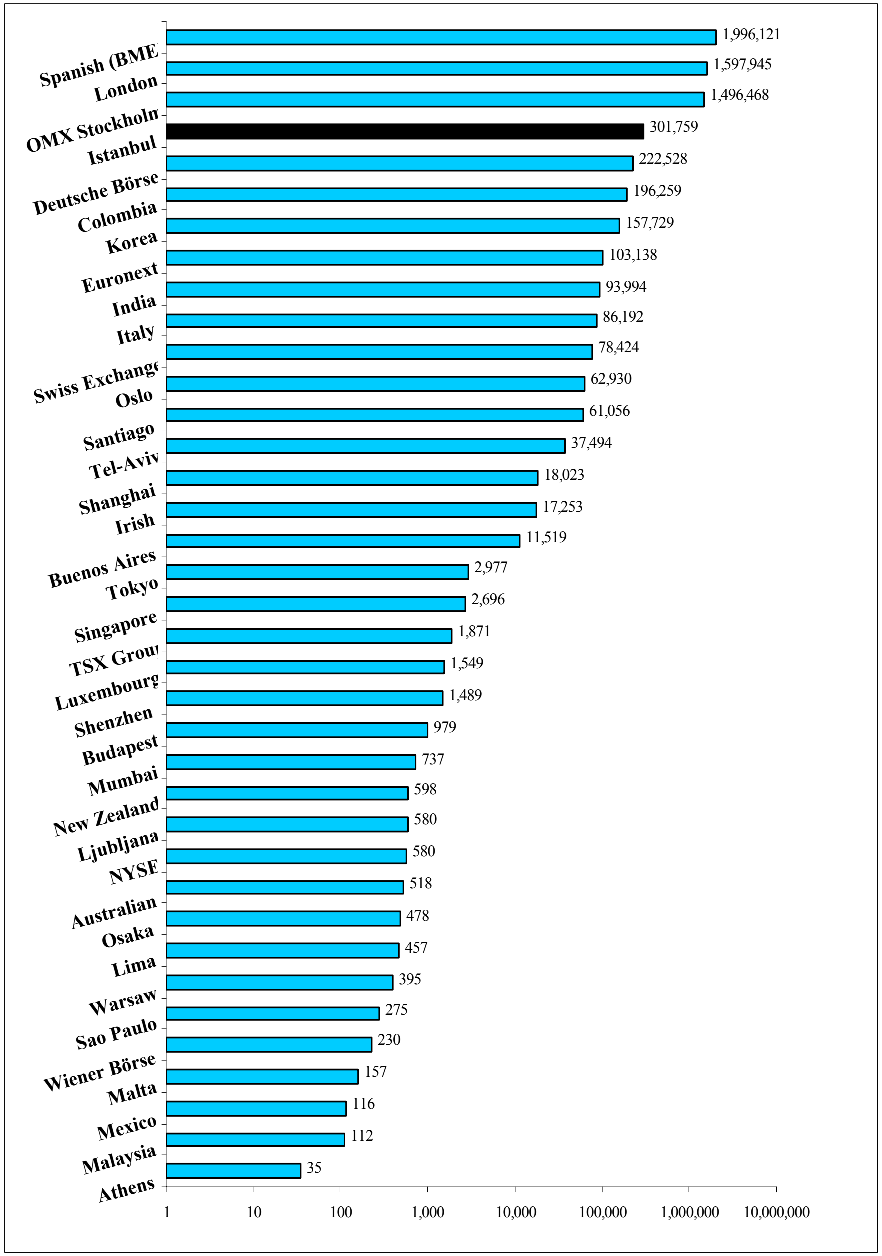
Source: The Economist, July 16th –22nd 2005.

Market Value/Book Value Ratios

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005/6
Argentina	1.6	1.8	1.3	1.5	0.9	0.6	0.8	2.0	2.2	2.5
Brazil	0.7	1.0	0.6	1.6	1.4	1.2	1.3	1.8	1.9	1.8
Chile	1.6	1.6	1.1	1.7	1.4	1.4	1.3	1.9	0.6	2.0
China	2.1	3.9	2.1	3.0	3.6	2.3	1.9	2.6	2.0	2.1
Czech Rep.	0.9	0.8	0.7	0.9	1.0	0.8	0.8	1.0	1.6	1.7
Hungary	2.0	4.2	3.2	3.6	2.4	1.8	1.8	2.0	2.8	2.8
India	2.1	2.3	1.8	3.3	2.6	1.9	2.0	3.5	3.3	3.6
Indonesia	2.7	1.4	1.5	3.0	1.7	1.7	1.0	1.6	2.8	3.1
Jordan	1.7	1.8	1.8	1.5	1.2	1.5	1.3	2.1	3.0	5.4
Korea	0.8	0.5	0.9	2.0	0.8	1.2	1.1	1.6	1.3	1.4
Malaysia	3.8	1.4	1.3	1.9	1.5	1.2	1.3	1.7	1.9	1.9
Mexico	1.7	2.3	1.4	2.2	1.7	1.7	1.5	2.0	2.5	2.4
Pakistan	1.5	2.3	0.9	1.4	1.4	0.9	1.9	2.3	2.6	2.8
Peru	2.5	2.0	1.6	1.5	1.1	1.4	1.2	1.8	1.6	1.6
Philippines	3.1	1.3	1.3	1.4	1.0	0.9	0.8	1.1	1.4	1.7
Poland	2.6	1.7	1.5	2.0	2.2	1.4	1.3	1.8	2.0	1.3
Russia	0.4	0.5	0.3	1.2	0.6	1.1	0.9	1.2	1.2	1.3
S.Africa	2.3	1.6	1.5	2.7	2.1	2.1	1.9	2.1	2.5	2.4
Taiwan	3.3	3.1	2.6	3.4	1.7	2.1	1.6	2.2	1.9	1.8
Thailand	1.8	0.8	1.2	2.1	1.3	1.3	1.5	2.8	2.0	1.9
Turkey	4.0	6.8	2.7	8.9	3.1	3.8	2.8	2.6	1.7	1.5
Venezuela	3.3	1.2	0.5	0.4	0.6	0.5	0.5	1.1	1.2	0.9

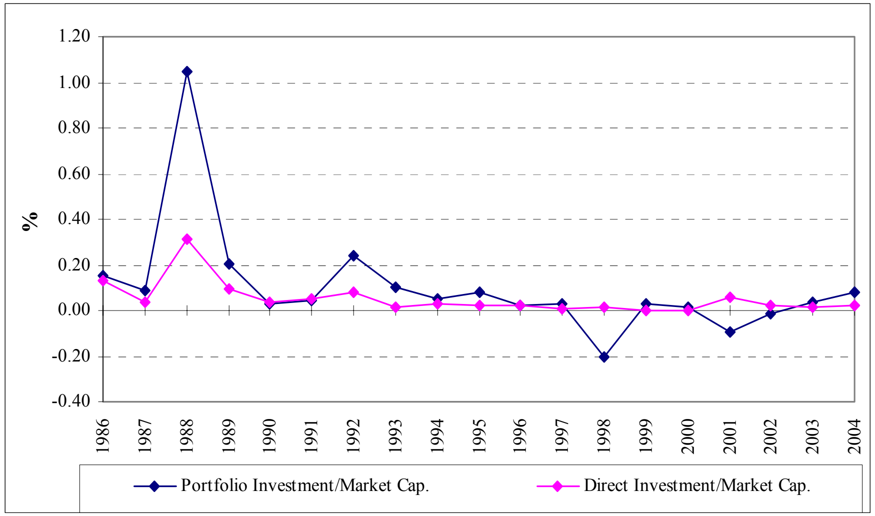
Source: IFC Factbook, 2004; Standard & Poor's, Emerging Stock Markets Review, June 2005.
Note: Figures are taken from S&P/IFCG Index Profile.

Value of Bond Trading (Million USD Jan. 2005-June 2005)



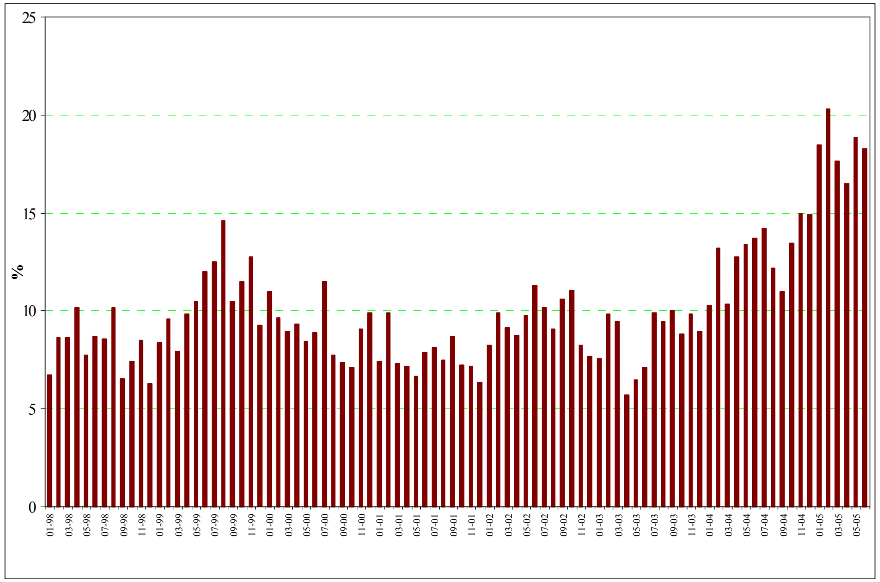
Source: FIBV, Monthly Statistics, June 2005.

Foreign Investments as a Percentage of Market Capitalization in Turkey (1986-2004)



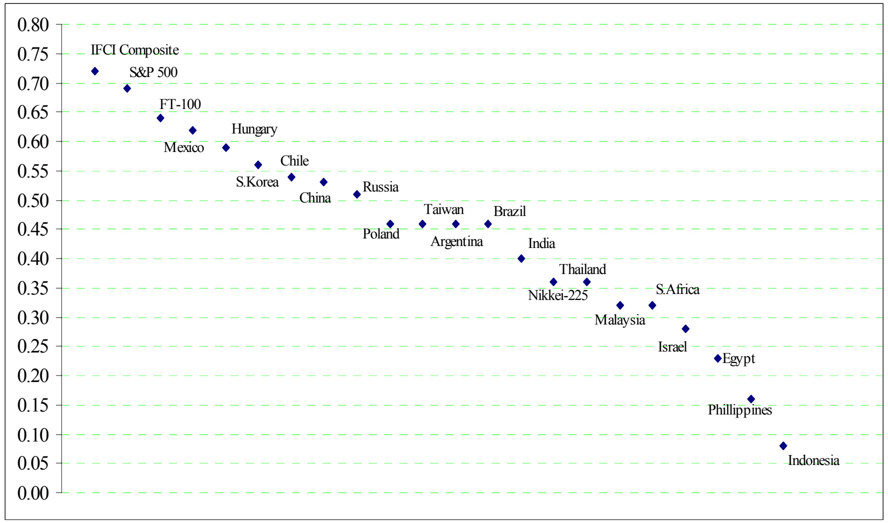
Source: ISE Data. CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE (Jan. 98-June 2005)



Source: ISE Data.

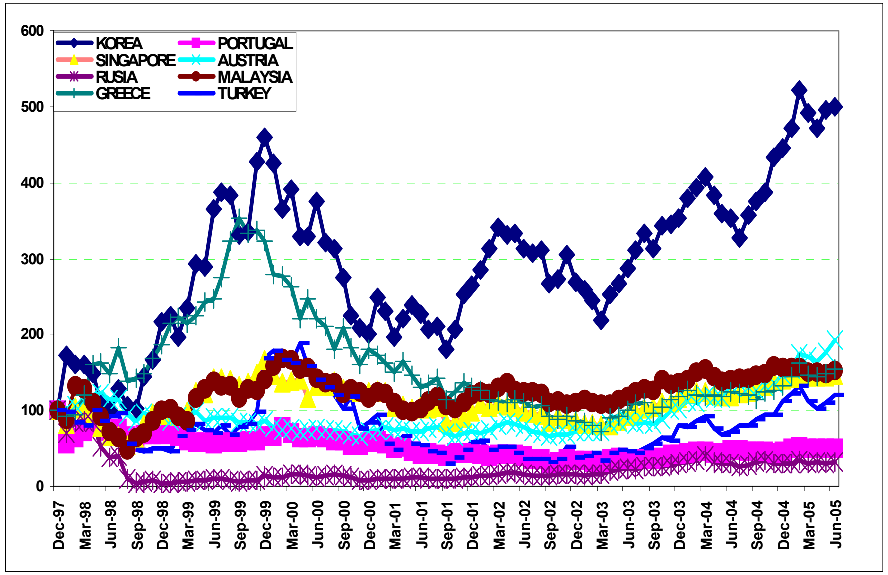
Price Correlations of the ISE (June 2000- June 2005)



Source: Standard & Poor's, Emerging Stock Markets Review, June 2005.

Notes: The correlation coefficient is between -1 and +1. If it is zero. for the given period. it is implied that there is no relation between two serious of returns.

Comparison of Market Indices (31 Dec 97=100)



Source: Reuters.

Note: Comparisons are in US$.

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ISE
Market Indicators

STOCK MARKET

	Number of Companies	Traded Value				Market Value		Dividend Yield	P/E Ratios		
		Total		Daily Average							
		(YTL Million)	(US$ Million)	(YTL Million)	(US$ Million)	(YTL Million)	(US$ Million)	(%)	YTL (1)	YTL (2)	US$
1986	80	0,01	13	---	---	0,71	938	9,15	5,07	---	---
1987	82	0,11	118	---	---	3	3.125	2,82	15,86	---	---
1988	79	0,15	115	---	---	2	1.128	10,48	4,97	---	---
1989	76	2	773	0,01	3	16	6.756	3,44	15,74	---	---
1990	110	15	5.854	0,06	24	55	18.737	2,62	23,97	---	---
1991	134	35	8.502	0,14	34	79	15.564	3,95	15,88	---	---
1992	145	56	8.567	0,22	34	85	9.922	6,43	11,39	---	---
1993	160	255	21.770	1	88	546	37.824	1,65	25,75	20,72	14,86
1994	176	651	23.203	3	92	836	21.785	2,78	24,83	16,70	10,97
1995	205	2.374	52.357	9	209	1.265	20.782	3,56	9,23	7,67	5,48
1996	228	3.031	37.737	12	153	3.275	30.797	2,87	12,15	10,86	7,72
1997	258	9.049	58.104	36	231	12.654	61.879	1,56	24,39	19,45	13,28
1998	277	18.030	70.396	73	284	10.612	33.975	3,37	8,84	8,11	6,36
1999	285	36.877	84.034	156	356	61.137	114.271	0,72	37,52	34,08	24,95
2000	315	111.165	181.934	452	740	46.692	69.507	1,29	16,82	16,11	14,05
2001	310	93.119	80.400	375	324	68.603	47.689	0,95	108,33	824,42	411,64
2002	288	106.302	70.756	422	281	56.370	34.402	1,20	195,92	26,98	23,78
2003	285	146.645	100.165	596	407	96.073	69.003	0,94	14,54	12,29	13,19
2004	297	208.423	147.755	837	593	132.556	98.073	1,37	14,18	13,27	13,96
2005	300	120.405	90.286	956	717	141.328	106.038	2,42	13,24	13,21	13,99
2005/Q1	300	72.453	54.910	1.169	886	134.350	99.866	2,02	13,41	13,53	14,22
2005/Q2	300	47.952	35.376	749	553	141.328	106.038	2,42	13,24	13,21	13,99

Q: Quarter
Note:
* Between 1986-1992, the price earnings ratios were calculated on the basis of the companies' previous year-end net profits. As from 1993,
  TL(1) = Total Market Capitalization / Sum of Last two six-month profits
  TL(2) = Total Market Capitalization / Sum of Last four three-month profits.
  US$ = US$ based Total Market Capitalization / Sum of Last four US$ based three-month profits.
* Companies which are temporarily de-listed and will be traded off the Exchange under the decision of the ISE's Executive Council are not included in the calculations.

Closing Values of the ISE Price Indices

YTL Based

	NATIONAL -100 (Jan. 1986=1)	NATIONAL - INDUSTRIALS (Dec. 31.90=33)	NATIONAL - SERVICES (Dec. 27,96=1046)	NATIONAL - FINANCIALS (Dec.31.90=33)	NATIONAL - TECHNOLOGY (Jun.30.2000=14.466,12)	'INVESTMENT TRUSTS (Dec 27,1996=976)	'SECOND NATIONAL (Dec.27,1996=976)	'NEW ECONOMY (Sept. 02, 2004 =20525,92)
1986	1,71	---	---	---	---	---	---	---
1987	6,73	---	---	---	---	---	---	---
1988	3,74	---	---	---	---	---	---	---
1989	22,18	---	---	---	---	---	---	---
1990	32,56	---	---	---	---	---	---	---
1991	43,69	49,63	---	33,55	---	---	---	---
1992	40,04	49,15	---	24,34	---	---	---	---
1993	206,83	222,88	---	191,90	---	---	---	---
1994	272,57	304,74	---	229,64	---	---	---	---
1995	400,25	462,47	---	300,04	---	---	---	---
1996	975,89	1.045,91	---	914,47	---	---	---	---
1997	3.451,--	2.660,--	3.593,--	4.522,--	---	2.934,--	2.761,--	---
1998	2.597,91	1.943,67	3.697,10	3.269,58	---	1.579,24	5.390,43	---
1999	15.208,78	9.945,75	13.194,40	21.180,77	---	6.812,65	13.450,36	---
2000	9.437,21	6.954,99	7.224,01	12.837,92	10.586,58	6.219,00	15.718,65	---
2001	13.782,76	11.413,44	9.261,82	18.234,65	9.236,16	7.943,60	20.664,11	---
2002	10.369,92	9.888,71	6.897,30	12.902,34	7.260,84	5.452,10	28.305,78	---
2003	18.625,02	16.299,23	9.923,02	25.594,77	8.368,72	10.897,76	32.521,26	---
2004	24.971,68	20.885,47	13.914,12	35.487,77	7.539,16	17.114,91	23.415,86	39.240,73
2005	26.957,32	21.888,05	13.789,35	40.033,96	9.415,89	15.460,20	20.759,71	27.032,51
2005/Q1	25.557,76	21.646,66	13.817,46	36.662,47	9.968,14	16.550,04	19.883,20	24.590,86
2005/Q2	26.957,32	21.888,05	13.789,35	40.033,96	9.415,89	15.460,20	20.759,71	27.032,51

US $ Based / EURO Based

	US $ Based								EURO Based
	NATIONAL - 100 (Jan. 1986=100)	NATIONAL - INDUSTRIALS (Dec. 31, 90=643)	NATIONAL - SERVICES (Dec. 27, 96=572)	NATIONAL - FINANCIALS (Dec.31, 90=643)	NATIONAL - TECHNOLOGY (Jun. 30,2000=1.360.92)	'INVESTMENT TRUSTS (Dec. 27, 96=534)	'SECOND NATIONAL (Dec. 27, 96=534)	'NEW ECONOMY (Sept. 02, 2004 =796,46)	NATIONAL - 100 (Dec. 31, 98=484)
1986	131,53	---	---	---	---	---	---	---	---
1987	384,57	---	---	---	---	---	---	---	---
1988	119,82	---	---	---	---	---	---	---	---
1989	560,57	---	---	---	---	---	---	---	---
1990	642,63	---	---	---	---	---	---	---	---
1991	501,50	569,63	---	385,14	---	---	---	---	---
1992	272,61	334,59	---	165,68	---	---	---	---	---
1993	833,28	897,96	---	773,13	---	---	---	---	---
1994	413,27	462,03	---	348,18	---	---	---	---	---
1995	382,62	442,11	---	286,83	---	---	---	---	---
1996	534,01	572,33	---	500,40	---	---	---	---	---
1997	982,--	757,--	1.022,--	1.287,--	---	835,--	786,--	---	---
1998	484,01	362,12	688,79	609,14	---	294,22	1.004,27	---	---
1999	1.654,17	1.081,74	1.435,08	2.303,71	---	740,97	1.462,92	---	1.912,46
2000	817,49	602,47	625,78	1.112,08	917,06	538,72	1.361,62	---	1.045,57
2001	557,52	461,68	374,65	737,61	373,61	321,33	835,88	---	741,24
2002	368,26	351,17	244,94	458,20	257,85	193,62	1.005,21	---	411,72
2003	778,43	681,22	414,73	1.069,73	349,77	455,47	1.359,22	---	723,25
2004	1.075,12	899,19	599,05	1.527,87	324,59	736,86	1.008,13	1.689,45	924,87
2005	1.176,98	955,65	602,05	1.747,91	411,10	675,00	906,38	1.180,26	1.142,69
2005/Q1	1.105,50	936,33	597,67	1.585,84	431,17	715,87	860,05	1.063,68	1.000,19
2005/Q2	1.176,98	955,65	602,05	1.747,91	411,10	675,00	906,38	1.180,26	1.142,69

Q: Quarter

BONDS AND BILLS MARKET

Traded Value

Outright Purchases and Sales Market

	Total		Daily Average	
	(YTL Million)	(US$ Million)	(YTL Million)	(US$ Million)
1991	1	312	0,01	2
1992	18	2.406	0,07	10
1993	123	10.728	0,50	44
1994	270	8.832	1	35
1995	740	16.509	3	66
1996	2.711	32.737	11	130
1997	5.504	35.472	22	141
1998	17.996	68.399	72	274
1999	35.430	83.842	143	338
2000	166.336	262.941	663	1.048
2001	39.777	37.297	159	149
2002	102.095	67.256	404	266
2003	213.098	144.422	852	578
2004	372.670	262.596	1.479	1.042
2005	268.354	201.029	2.130	1.595
2005/Q1	142.312	108.076	2.295	1.743
2005/Q2	126.042	92.953	1.969	1.452

Repo-Reverse Repo Market

Repo-Reverse Repo Market

	Total		Daily Average	
	(Y TL Million)	(US$ Million)	(Y TL Million)	(US$ Million)
1993	59	4.794	0,28	22
1994	757	23.704	3	94
1995	5.782	123.254	23	489
1996	18.340	221.405	73	879
1997	58.192	374.384	231	1.486
1998	97.278	372.201	389	1.489
1999	250.724	589.267	1.011	2.376
2000	554.121	886.732	2.208	3.533
2001	696.339	627.244	2.774	2.499
2002	736.426	480.725	2.911	1.900
2003	1.040.533	701.545	4.162	2.806
2004	1.551.410	1.090.477	6.156	4.327
2005	892.066	666.000	7.080	5.286
2005/Q1	394.243	299.150	6.359	4.825
2005/Q2	497.823	366.849	7.778	5.732

Q: Quarter

ISE GDS Price Indices (January 02, 2001 = 100)

YTL Based

	3 Months (91 Days)	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)	General
2001	102,87	101,49	97,37	91,61	85,16	101,49
2002	105,69	106,91	104,87	100,57	95,00	104,62
2003	110,42	118,04	123,22	126,33	127,63	121,77
2004	112,03	121,24	127,86	132,22	134,48	122,70
2005	113,00	123,41	131,41	137,24	140,98	128,45
2005/Q1	112,80	122,87	130,38	135,61	138,66	127,05
2005/Q2	113,00	123,41	131,41	137,24	140,98	128,45

ISE GDS Performance Indices (January 02, 2001 = 100)

YTL Based

	3 Months (91 Days)	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)
2001	195,18	179,24	190,48	159,05	150,00
2002	314,24	305,57	347,66	276,59	255,90
2003	450,50	457,60	558,19	438,13	464,98
2004	555,45	574,60	712,26	552,85	610,42
2005	601,34	624,86	778,20	619,72	684,25
2005/Q1	579,78	599,78	750,31	591,88	653,52
2005/Q2	601,34	624,86	778,20	619,72	684,25

ISE GDS Portfolio Performance Indices (December 31, 2003 = 100)

YTL Based

	Equal Weighted Indices (YTL Based)			Market Value Weighted Indices			
	EA180-	EA180-	EA GENERAL	PDA180-	PDA180+	PDA GENERAL	REPO
2004	125,81	130,40	128,11	125,91	130,25	128,09	118,86
2005	137,11	146,89	141,83	137,33	146,83	142,20	126,32
2005/Q1	131,92	139,26	135,47	132,10	139,13	135,65	122,70
2005/Q2	137,11	146,89	141,83	137,33	146,83	142,20	126,32

Q: Quarter