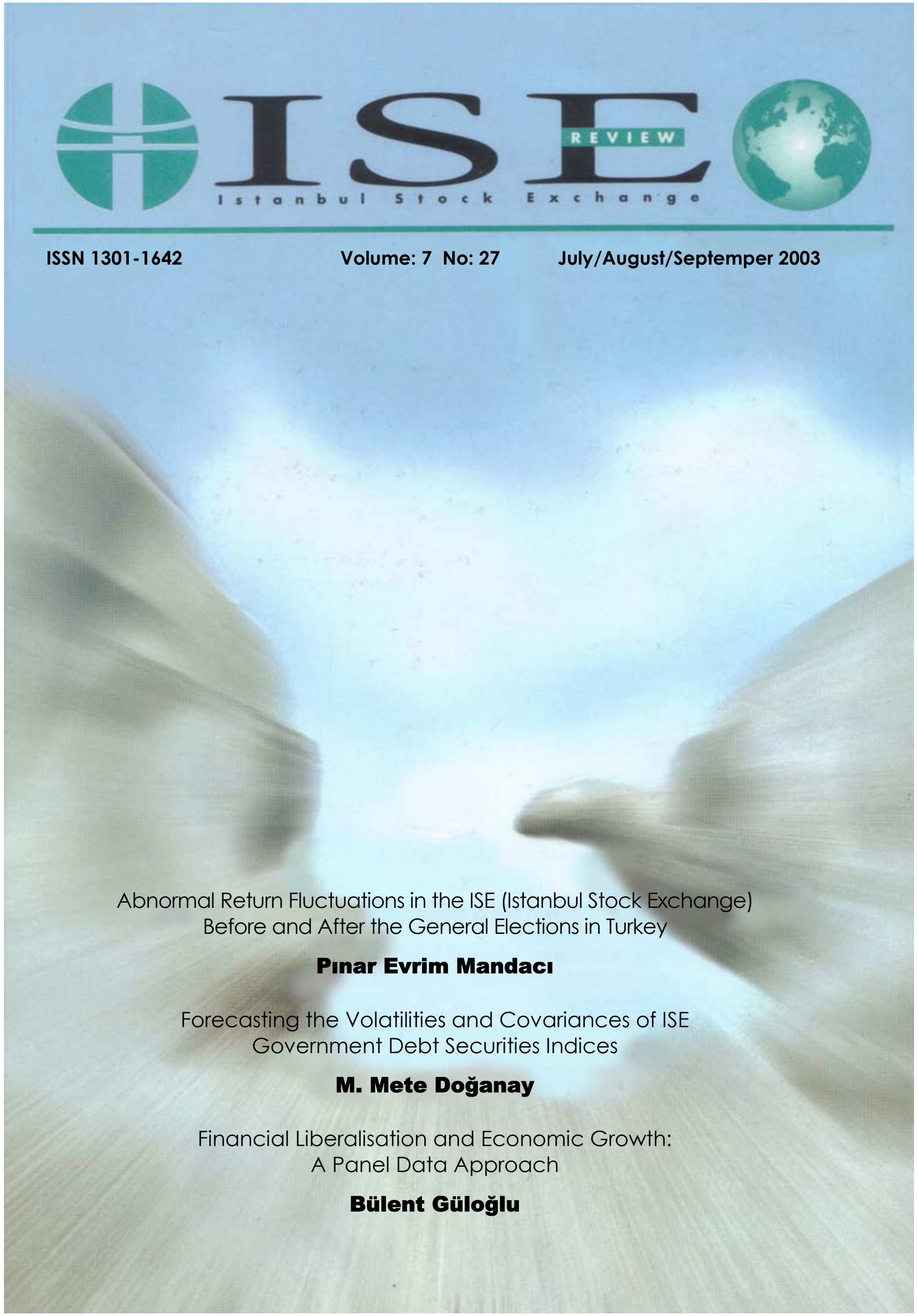

The ISE Review

Volume: 7 No: 27 July/August/Septemper 2003

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The ISE Review is included in the "World Banking Abstracts" Index published by the Institute of European Finance (IEF) since 1997 and in the Econlit (Jel on CD) Index published by the American Economic Association (AEA) as of July 2000.

The ISE Review Volume: 7 No: 27 July/August/Septemper 2003
ISSN 1301-1642 © ISE 1997

ABNORMAL RETURN FLUCTUATIONS IN THE ISE (ISTANBUL STOCK EXCHANGE) BEFORE AND AFTER THE GENERAL ELECTIONS IN TURKEY

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Abstract
The aim of this study is to evaluate the impact of general elections in Turkey on the ISE-100 index return. Since the ISE started its activities, Turkey has undergone four general elections, in sequence, on 20 November 1991, 24 December 1995, 18 April 1999, and lastly 3 November 2002. It is observed that the investors have been in expectation of outstanding price fluctuations on the verge and in the wake of general elections. By moving from this fact, in this study the ISE-100 index returns fifteen days before and after the general elections are to be analyzed. It follows that it is possible to obtain statistically significant abnormal returns within the mentioned periods. For instance, abnormal returns were witnessed three days before and two days after the general elections on 18 April 1999. Besides, in the first, second and fourth day following the general elections on 3 November 2002 a similar trend resurfaced. However, for the majority of the days proceeding or following elections, a statistically meaningful abnormal return was not observed.

I. Introuction

According to the efficient market theory that is introduced by Fama (1970), securities' prices fully reflect all kinds of information and so that the investor will not receive any abnormal return. However, the recent empirical studies on this issue argue that the efficient markets theory does not work and there are many anomalies. These anomalies are also used to test the market efficiency. In an inefficient market; by using the information on historical prices, other information that are freely available for all investors and information inside the company, investors can receive abnormal returns[1].

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[1] There are three levels of information that might be reflected in stock prices: "the weakly efficient markets hypothesis assume that all historical information is reflected in security prices, "the semi-strong efficient markets hypothesis assume that all public information is reflected in security prices, and "the strong efficient markets hypothesis" assume that all information is reflected in security prices (Francis, 1991).

There are many studies which test the efficiency of ISE. The studies testing the weak-form efficiency of ISE such as Muradoğlu and Ünal (1994), Balaban et all (1996), Kıyılar (1997), Kondak (1997) and Aksoy and Sağlam (2004), found that the ISE is inefficient even in the weak-form that investors could receive abnormal return in this market. Aksoy and Sağlam (2004) argue that the index value at the maximum level of trust (return/risk) to the market is investigated as an anomaly. In addition to the studies on the anomalies in ISE; Muradoğlu and Oktay (1993), Metin et all (1997) investigated the weekend effect. Karan (1994), Aydoğan (1994), Balaban (1995), Özmen (1997), Bildik (2000), Demirer and Karan (2000), and Karan and Uygur (2001) examine the days of the week effect and they investigated the Friday anomaly in the periods that they examined. Besides, Özmen (1997) found in-month and before-vacation anomalies. The tests of the dates/periods in the above studies measure the weak-form efficiency of the market. Besides these, in his study Karan (2000) found ignored firm anomaly, Kıymaz (1999) found the low price effect in the initial issues and Karan and Ekşi (2002) found the low price effect. Karan (1996) found the price/earning ratio effect, Demir et all (1996) found the market value of equity and negative earnings effects during the periods that they examine. In the same study they found June effect. In addition to these, Durukan and Mandacı (2003) found that market value equity, price/earnings and total sales/market value ratios are statistically significant.

As can be seen clearly from the studies above, ISE is not an efficient market and there are many anomalies which destroy the market efficiency so that investors could receive abnormal returns in this market. Because of that, the availability of the anomalies and all new anomalies those will be investigated are essential in the investors' side. In this study the existence of a new anomaly which has not been examined yet is stated. More clearly, in this study the abnormal returns are being analyzed before and after the dates of the general elections of Turkey.

It is observed that investors in the financial market generally are in the expectation of outstanding price fluctuations on the verge and in the wake of General elections. On the one hand, stagnation even withdrawals from the market may be expected once the outcome of elections is not clear. On the other hand, if the election results can be forecasted, the market may become very active even before elections. Generally, as soon as the election results are unveiled the uncertainties come to an end, financial market gains dynamism and the hopes for the development of the market in positive direction prevail. Hence, it is not astonishing to see that the investors rush in to the market as purchasers for high profits thanks to this positive atmosphere. Because, it is strongly believed that in Turkey, elections influence financial market along a short period. By the way, in the Turkish media editorials or statements underlining that the investors succeed to reap high profits from their investments in the financial market, are issued frequently. However, in the financial literature there is no serious scientific study investigating the relations between the general elections in Turkey and common stock returns. This gap in literature is an important reason that urges us to conduct this study. Hence, in this study, price fluctuations of ISE-100 index before and after the general elections which have been held in Turkey since the establishment of the ISE are being examined.

General elections are among the political risks that can affect the financial markets. "Political risk is the probability of occurrence of some political event that will change the prospects of the profitability of a given investment" (Cosset and Suret, 1995). Political risk grows as being subject to the government intervention in the economy and these interventions are conducted in varied ways such as barriers to capital flows, exchange and portfolio flow controls, taxes etc. In addition, political instability, elections, cabinet changes and faulty government actions are all considered as political risk. Corruption in emerging markets is another form of political risk as well.

In literature there are many studies that examine the impacts of economic factors (such as GNP, inflation, exchange rates and interest rates as well as growth rates) over financial markets. However, it follows from the literature review we conducted that the number of studies which examine the effects of political factors on financial markets is limited. Besides, most of the studies concerning this issue are especially on U.S and/or other major developed markets. There available some other studies as well which support the idea that political factors may affect the stock markets much more than economic factors especially in the emerging markets (Lessard (1985), Errunza and Losq (1986), Diamonte and others (1996), Perotti and Oijen (2001), Kim and Mei (2001), Chan and others (2001), Bilson and others (2002). According to Papaioannou and Tsetsekos, 'especially in the emerging markets, political risk causes economic risk, and in these markets political stability and economic policy often rest in the hands of a government leader. ' If the future of the leaders became not promising 'markets can respond violently' (Papaioannou, Tsetsekos, 1997).

Among the studies which analyze the influence of elections on financial markets, that of Foester and Scmitz is remarkable. Foester and Scmitz (1997) examined the four-year U.S. election cycle and found out that the stock returns had been higher during the third and the fourth year than those during the first two years. Reilley and Luksetich (1980); Herbst and Slinkman (1984); Huang (1985) and Lobo (1999) support the idea that elections are the most important source of uncertainty for the stock market. They claim that stock returns are lower or sometimes negative in the election year and positive in the years following elections. As for volatility, they found out that it is high in the election year. Pantzalis and others (2000) examined

the behavior of stock market indices of 33 countries in electoral times and handled a period spanning from 1974 to 1995. They found out a positive abnormal return during the two week prior to the election week. Santa-Clara and Valkanov (2003) examined the excess return in the stock market under both Democratic and Republican presidencies in US by moving from the data collected since 1927. They questioned the existence of any symbiotic relation between stock returns and presidential elections.

Finally, they unveiled that although the difference in stock returns obtained in Democratic and Republican periods were statistically significant; there was no significant evidence on meaningful stock price changes immediately before, during and immediately after elections. 'If the difference in returns is due to higher ex ante risk premium, we should observe large movement in stock prices when the uncertainty about which party wins the presidency is resolved.'(Santa-Clara, Valkanov, 2003).

The studies mentioned above other than that of Pantzalis and others and Santa-Clara and Valkonov mostly tended to compare stock market returns and/or risks in election times with the ordinary times in yearly basis. However, such a methodology will not be so fruitful when the case is highly volatile Turkish stock market. This study utilized from the same methodology that Pantzalis and others adopted and the results extracted from our study were compared with those drawn from their study. Yet, we could not reach parallel results with those of Pantzalis and others.

This study examines whether election times are the periods along which abnormal stock returns in the ISE can be secured or not. Although there are many political factors that should be analyzed, in this study we just try to examine the effects of elections. The study employs 'event study methodology.' This method has been used to measure if the securities' prices fully reflect all publicly available information or in other words, it measures the semi-strong-form efficiency of the market. With the help of this method, the abnormal returns fifteen days before and after the general elections are calculated and their statistical significance is tested. Besides, cumulative average abnormal returns for the different event windows before and after the elections are computed. Consequently, it is found out that especially for the post election event windows the cumulative average abnormal returns are statistically significant (except for the 1991 elections). This study is significant since there are no other studies available focusing on this subject. In this context, the paper is organized as follows; following the introduction, second section provides data and methodology, the empirical findings are analyzed in the third section, and finally, concluding remarks are given in the last section.

II. Data and Methodology

We obtained the election dates from www.tbmm.com internet address. The daily index values in TL terms on the ISE National Stock Market were drawn from the weekly bulletins of the ISE. We also calculated the daily returns.

The study employs ‘event study’ methodology which has gained common parlance nowadays. By taking the event date as a base this method is used to examine whether there are high deviations from the average returns in the common stock market recent before and after the event date. In the study, fifteen days period prior to and after the elections is chosen as ‘event window.’ The reason in the selection of fifteen-day interval is the assumption on the grounds that election will be respectively more effective in short term. In order to compute the abnormal returns, “Mean Adjusted Returns” methodology is adopted. This method assumes that the expected returns do not deviate much more from the historical returns, in other words, the expected return in the near future will be equal to mean returns in the recent past.

The reason why we did not employ the market adjusted return and use the mean adjusted return is that the first one is mostly used to compare the abnormal returns in the common stock bases with the index values. However, in this study while the effects of the general elections are tried to be measured not in the common stock bases instead in the index bases, it is thought that it would be enough to measure only the abnormal returns of the index.

The equation used to measure the abnormal returns, which shows the deviations from the mean return in the model could be stated as follows:

$$AR_t = R_t - \overline{R_i}$$

Where AR_t denotes abnormal return at time t and R_t represents the index return at time t. When we assume that i denotes each of the general elections, R_t denotes average index return of the pre-election period which is 15 to 360 days before (-15,-360) the election dates.

Accordingly, abnormal return in the ISE-100 index at any time t is the difference between the index return at time t and the average index return of the pre- election period which is 15 to 360 days before the election date. This difference is standardized by standard deviation to find standardized abnormal return measures.

$$AR_t = (R_t - \overline{R_i}) / \sigma(R_i)$$

Abnormal returns are then cumulated from day -15 to day +15 to form the cumulative average abnormal returns;

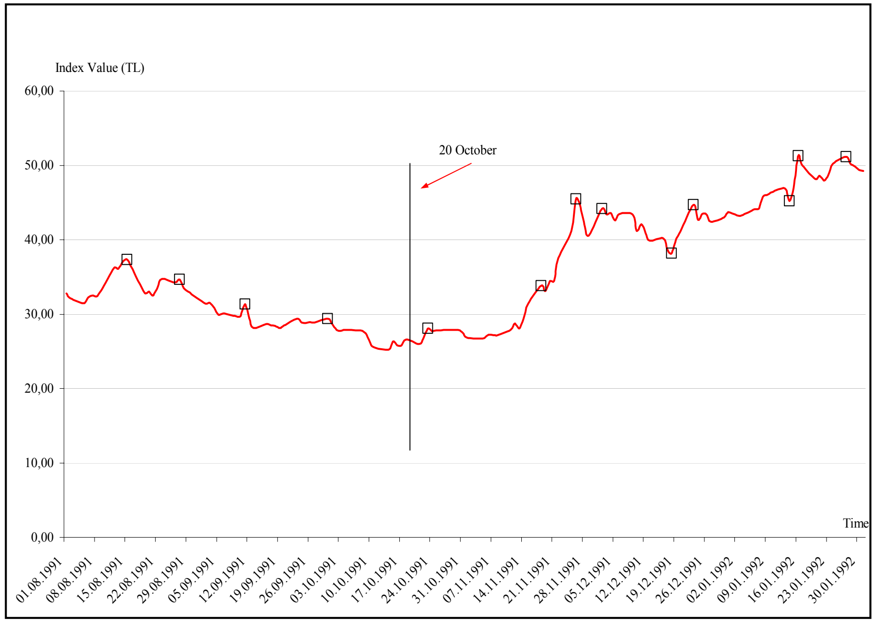
$$CAAR = 1/N\left[\sum_{t=-15}^{t=+15}(AR_t)\right]$$

Further, the t-statistics was used to test the statistical significance of the various periods’ cumulative average abnormal returns.

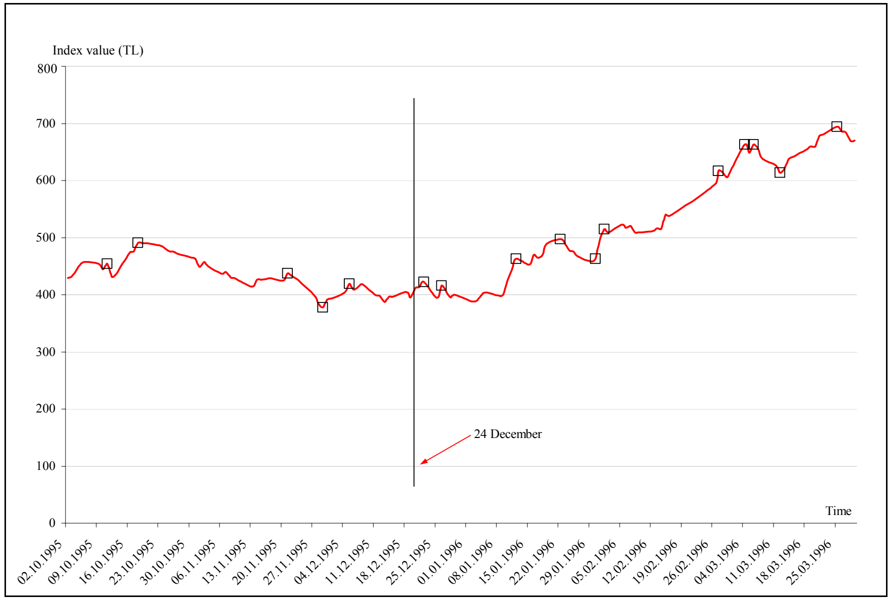
III. Empirical Results

The graphics below show the ISE index along a period of 60 days before and after the general elections and display peak and deep points.

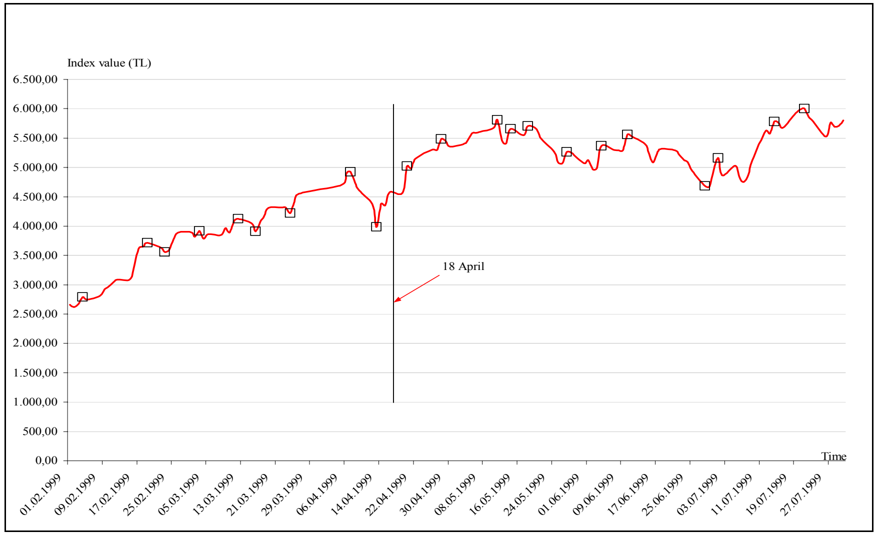
Graph 1: ISE-100 Index Values 60 Days Before and After 20 October 1991 General Elections



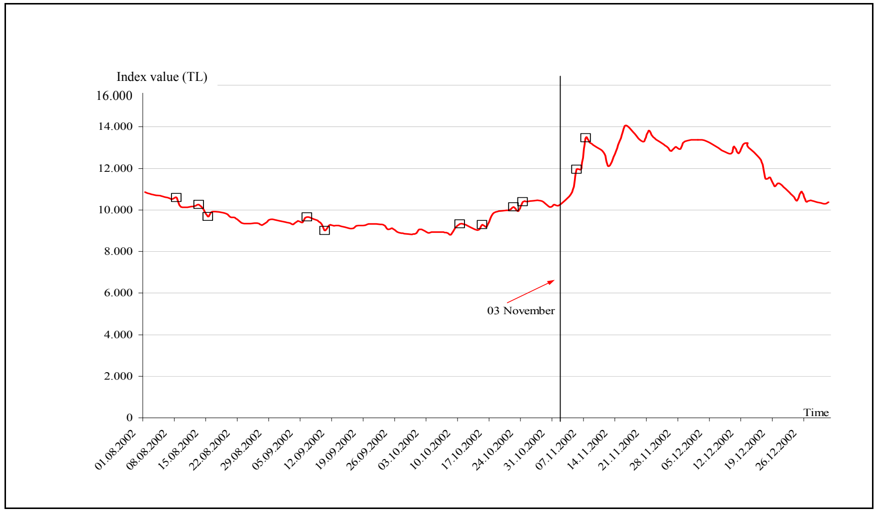
Graph 2: ISE-100 Index Values 60 Days Before and After the 24 December 1995 General Elections



Graph 3: ISE-100 Index Values 60 Days Before and After 18 April 1999 General Elections



Graph 4: ISE-100 Index Values 60 Days Before and After 3 November 2002 General Elections



It is observed that due to uncertainties about the post-election period, some withdrawals in the ISE-100 index occurred on the verge of 1991 and 1995 general elections. However, with the formation of the cabinet as well as dispersal of the clouds over the political prospect after the elections, an upward tendency was witnessed. The fact that the developments before the 1999 general elections furnished a clear cut vision on the future cabinet as well as its policies enabled the index to climb prematurely. This climb gathered its pace after the certification of the election results. On the other side, while the ISE-100 index remained stable before the 2002 general elections, right after the certification of the results it tended to rise.

However, statistical significance of the returns drawn from the involved rise in the ISE index should be measured. In Table 1, the tests of the single period abnormal return for the ISE-100 stock market are summarized. Pantzalis and others (2000) also handled a two-week period before and after the elections. They found out positive abnormal returns during the pre-election period. However in this most of the abnormal returns during the pre event period are not statistically significant. In reality, the decisions entailing early elections are taken three or four months before. It was initially assumed that besides elections, the decisions of early elections by the Turkish Grand National Assembly (TGNA) would have substantially influenced the stock market as well. Yet, empirical studies on the issue do not culminate in meaningful results.

Table 1: Abnormal Return Measures for Pre-election and Post-election Periods (-5,+15)

	1991 Elections			1995 Elections			1999 Elections			2002 Elections		
Day	AR	Z-Test	p	AR	Z-Test	p	AR	Z-Test	p	AR	Z-Test	P
-15	0,0198	0,5645	0,2877	0,0262	1,0291	0,1539	0,0015	0,0356	0,4840	-0,0011	-0,042	0,4840
-14	-0,0197	-0,5605	0,2877	0,0338	1,3293	0,0918	-0,0005	-0,0131	0,4960	-0,0299	-1,168	0,1210
-13	-0,0288	-0,8187	0,2061	-0,0261	-1,0264	0,1515	-0,0225	-0,5501	0,2912	0,0289	1,127	0,1314
-12	-0,0027	-0,0772	0,4681	0,0106	0,4177	0,3372	0,0450	1,1000	0,1357	-0,0106	-0,415	0,3409
-11	0,0074	0,2095	0,4168	0,0104	0,4073	0,3409	0,0306	0,7479	0,2266	0,0543	2,118	0,0174
-10	-0,0002	-0,0054	0,4960	-0,0477	-1,8769	0,0301	0,0326	0,7959	0,2119	0,0212	0,829	0,2033
-9	0,0009	0,0252	0,4880	-0,0064	-0,2527	0,4013	0,0394	0,9635	0,1685	0,0097	0,380	0,3520
-8	-0,0170	-0,4826	0,3156	-0,0270	-1,0629	0,1446	0,0059	0,1441	0,4443	0,0142	0,555	0,2912
-7	-0,0520	-1,4805	0,0694	0,0210	0,8265	0,2033	-0,0394	-0,9628	0,1685	-0,0190	-0,740	0,2297
-6	-0,0102	-0,2893	0,3859	-0,0003	-0,0125	0,4960	-0,0283	-0,6908	0,2451	0,0437	1,705	0,0446
-5	-0,0087	-0,2485	0,4013	0,0190	0,7470	0,2266	-0,0518	-1,2656	0,1020	0,0030	0,117	0,4522
-4	0,0466	1,3261	0,3707	-0,0246	-0,9687	0,1660	-0,0935	-2,2848	0,0113	0,0028	0,110	0,4562
-3	-0,0172	-0,4906	0,3121	0,0373	1,4678	0,0708	0,0944	2,3054	0,0104	-0,0288	-1,123	0,1314
-2	0,0008	0,0220	0,4920	0,0039	0,1519	0,4404	-0,0073	-0,1782	0,4286	0,0115	0,447	0,3264
-1	0,0321	0,9147	0,1814	0,0202	0,7933	0,2148	0,0515	1,2591	0,1038	-0,0031	-0,120	0,4522
1	-0,0198	-0,5623	0,2877	-0,0688	-2,7086	0,0034	-0,0045	-0,1107	0,4562	0,0599	2,339	0,0096
2	0,0308	0,8763	0,1894	0,0505	1,9869	0,0233	0,0950	2,3214	0,0102	0,0972	3,793	0,0000
3	0,0527	1,4991	0,0668	-0,0224	-0,8814	0,1894	-0,0078	-0,1904	0,4247	0,0025	0,098	0,4602
4	-0,0120	-0,3418	0,3666	-0,0313	-1,2323	0,1093	0,0339	0,8285	0,2033	0,1183	4,616	0,0000
5	0,0070	0,1994	0,4207	0,0113	0,4434	0,3300	0,0286	0,6988	0,2420	-0,0184	-0,719	0,2358
6	0,0052	0,1478	0,4404	-0,0330	-1,2997	0,0968	-0,0021	-0,0502	0,4801	-0,0341	-1,333	0,0918
7	-0,0136	-0,3860	0,3483	0,0033	0,1290	0,4483	0,0346	0,8461	0,1977	-0,0541	-2,110	0,0174
8	-0,0216	-0,6152	0,2676	0,0209	0,8227	0,2061	-0,0082	-0,2006	0,4207	0,0264	1,031	0,1515
9	-0,0029	-0,0828	0,4681	0,0117	0,4619	0,3228	-0,0162	-0,3969	0,3446	0,0440	1,716	0,0427
10	0,0049	0,1407	0,4443	-0,0144	-0,5674	0,2843	0,0071	0,1743	0,4325	0,0475	1,854	0,0322
11	0,0190	0,5409	0,2946	0,0025	0,0966	0,4020	0,0104	0,2552	0,3974	0,0337	1,314	0,0951
12	0,0016	0,0452	0,4801	0,0592	2,3296	0,0099	0,0230	0,5629	0,2877	-0,0485	-1,894	0,0294
13	0,0023	0,0662	0,4721	0,0447	1,7571	0,0392	0,0016	0,0388	0,4840	-0,0069	-0,268	0,3936
14	0,0285	0,8101	0,2090	0,0386	1,5196	0,0643	0,0026	0,0623	0,4761	0,0386	1,508	0,0655
15	0,0306	0,8706	0,1922	-0,0250	-0,9845	0,1635	0,0108	0,2629	0,3974	-0,0224	-0,872	0,0307

As observed in Table 1, it is run into an abnormal return in the first and the twelfth day following the general elections of 1995. In the fourth day preceding the general elections of 1999 an abnormal loss is observed. In the third day preceding and second day following the elections abnormal returns are obtained. As for the 2002 general elections, the first, second and fourth days after the elections saw abnormal returns. Ironically, in the mentioned periods around the general elections in 1991 no abnormal return is statistically significant.

Another noteworthy point in Table 1 is that in the day before the 1991, 1995 and 1999 general elections positive returns are witnessed whereas in the following day the returns turned into negative. Nevertheless the situation in the 2002 general elections is sharply contrasting. The reason is probably the optimistic expectations of investors on the grounds that eventually a single-party government rather than a weak coalition is underway.

In Table 2 the cumulative average abnormal returns and their t test values are given.

Table 2: Cumulative Average Abnormal Return (CAAR) Measures

Event Window	1991 Elections		1995 Elections		1999 Elections		2002 Elections	
	CAAR	t-test	CAAR	t-test	CAAR	t-test	CAAR	t-test
-30 to +30	0,0061	1,7993*	0,0035	0,5727	0,0046	0,9783	0,0036	0,8958
-15 to +15	-0,0002	0,5068	0,0047	0,5835	0,0091	1,2693	0,0124	1,7474*
-15 to 0	-0,0056	-0,5220	0,0047	0,5149	0,0041	0,2662	0,0061	1,0353
-10 to 0	-0,0048	-0,2905	0,0009	-0,0570	0,0006	0,0199	0,0052	0,8061
-5 to 0	0,0084	0,8736	0,0125	1,0720	-0,0011	-0,0396	-0,0032	-0,2010
0 to + 5	0,0094	0,8730	-0,0108	-0,6019	0,0293	1,5680**	0,0516	1,9679**
0 to + 10	0,0008	0,4158	-0,0058	-0,6773	0,0163	1,5156**	0,0286	1,6396**
0 to +15	0,0052	1,3737**	0,0046	0,3404	0,0142	1,9671*	0,0186	0,2628

*Significant at t=5% level
**Significant at t=10% level

The results achieved from the single period abnormal return measures are supported, even superseded by the results drawn from the cumulative average abnormal return measures (Table 2). Some of the cumulative average abnormal performance measures are statistically significant during the post-event periods, yet none of them is significant during the pre-event periods. This setting is inherited in the fact that investors opt for a ‘wait-and-see position’ on the verge of the elections due to the involved uncertainties. In the 1991 general elections, the cumulative average abnormal return of the (-30 to +30) event window is statistically significant at 5% whereas in (0 to 15) days event window it is statistically significant at 10 % level. The cumulative average abnormal return measures for all event windows of 1999 general elections are statistically significant. However, only (0 to + 5) days event window is statistically significant at 5% level. As for the rest, statistical significance can be observed at 10% level. The cumulative abnormal return measures reached after the 2002 general elections demonstrate that (0 to +5) days and (0 to +10) days event windows are statistically significant at 10% level whilst for the periods 15 days before and after the general elections the cumulative average abnormal return is statistically significant at 5% level. As for the cumulative average abnormal return measures before and after the general elections in 1995, they are not statistically significant.

IV. Conclusion

In this study it is examined whether abnormal returns in the ISE-100 are obtained or not in the days preceding and following the general elections. Since the ISE became operational, Turkey has undergone four general elections. In order to measure if abnormal returns are obtained in a single period around election times (fifteen days before and after the general elections) the z test methodology is used. Accordingly, from the empirical findings we can say that except 1991 elections we observed abnormal returns especially a few days after the general elections.

In addition to the single period abnormal return measures, by utilizing from the t-test we examined the significance of the cumulative average abnormal returns before and after the elections within some periods. Accordingly, cumulative average abnormal return of the event windows following the general elections is proved to have statistical significance. Yet, the 1995 general elections should be exempted from this. Probably, the outcomes relevant to 1995 are resulted from the economic crisis that the country underwent at the time. However, none of those preceding the general elections have statistical significance.

For the 2002 general elections, abnormal returns on the first, second and fourth days after the elections and the cumulative average abnormal returns for most of the post-event periods and for the period 15 days before and after the same general elections are found as statistically significant. This finding shows us that the effects of the last general elections on common stock market are much more than those of the others. What differ the 3 November 2002 general elections from the rest is the fact that it gave way to the formation of a single-party government instead of a fragile coalition in Turkey after long years. Investors used to think that weak coalitions would bring about economic instability and uncertainty in stock market. However, the expectation on the grounds that the new government would be able to take and implement vital economic decisions might lead to statistically significant abnormal returns right after the general elections.

As a last word, it was found that investors have been received abnormal returns just a few days and a few periods after some general elections since the establishment of ISE. The influence of some general elections on stock returns develops in positive direction particularly after the elections. Yet, the level of impact is depended on the optimistic expectations of investors as well as on the elimination of uncertainties. As long as the expectations are positive and prospect for the future political setting is clear, investors will tend to purchase common stock and manage to reap outstanding profits. On the other side, weak expectations may not influence the market deeply.

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The ISE Review Year: 7 No: 27 July/August/Septemper 2003
ISSN 1301-1642 © ISE 1997

FORECASTING THE VOLATILITIES AND COVARIANCES OF ISE GOVERNMENT DEBT SECURITIES INDICES

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Abstract

Financial institutions should forecast the volatilities and correlations (thus covariances) of the financial instruments in their portfolios in order to calculate their market risk exposure correctly. This study examines the price volatility and covariance of interest related securities. In this study, the volatilities and covariances of ISE GDS price indices returns, which are taken as proxy for returns of debt-related securities, are modeled by using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Exponentially Weighted Moving Average (EWMA) methods. The models having been estimated, out-of-sample forecasting performance of the models for the next day's variance and covariance are analyzed. The analyses show that in general GARCH models are more efficient to forecast both next day's variance and covariance. This result is in line with other studies in the literature which used different financial instruments.

I. Introduction

Financial institutions hold securities in their portfolios. Because they hold securities, they are exposed to market risk, which can be defined as the potential loss that a portfolio may incur due to the price fluctuations of the securities. Market risk has emerged as an important issue in the finance sector since 1970s, as a result of increased volatility of the financial instruments. The difficulties that several financial institutions have recently experienced both in Turkey and in other countries because of their security positions have prompted the national and international regulatory institutions to introduce new regulations on the measurement of market risk.

Banking Regulation and Supervision Agency (BDDK), which has the authority to impose regulations on banks in Turkey, published the regulation on Measurement and Assessment of Capital Adequacy of Banks in March 2003. Market risk in this regulation is defined as follows (BDDK, 2003):

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"General market risk is the risk of loss composed of 'interest rate risk', 'equity position risk' and 'foreign exchange risk', arising from changes in value of positions in the trading book due to changes in equity prices, interest rates and foreign currency exchange rates. Positions are made up of:

1) interest rate related debt securities,
2) equities,
3) other securities,
4) all asset and liability items denominated in different currencies which are included in the on and off balance sheet,
5) derivative contracts based on the instruments referred to above."

As can be understood from this definition, the essence of the market risk is the price fluctuations of the securities held in the portfolio.

It is an obligation for the financial institutions to measure the market risk correctly and maintain adequate capital to cover it. Several methods have been developed recently to measure the market risk, the most common of which is value at risk. The widespread use of value at risk stems from its ease to be interpreted. Because, value at risk provides for the managers of the financial institution and other related parties with a single number which indicates the loss that the financial institution may suffer in the next period (tomorrow, in ten days, next month etc.) as a result of the price fluctuations of the securities held in its portfolio. Value at risk in the aforementioned BDDK regulation is described as follows:

"Value at Risk (VaR) is the number, estimated by using various statistical methods that expresses the maximum loss for a given confidence interval and holding period which a bank may be exposed to as a result of changes in the value of its portfolio or its assets due to fluctuations in interest rates, foreign exchange rates and equity prices." (BDDK, 2003).

The most common method to calculate value at risk is the parametric method. It is necessary to know the volatilities of the individual financial instruments held in the portfolio and the correlations between them to calculate the value at risk by using this method. In fact, before the value at risk was introduced, the main method used to measure the risk of a financial instrument was to calculate its volatility. To measure the risk of a portfolio was to calculate portfolio's volatility by using the weights and the volatilities of the individual instruments that made up the portfolio and the correlations between them. The innovation that value at risk introduced was to express the risk not in terms of the volatility, but as the maximum monetary loss in a specific currency that a portfolio can incur in a given period for a specified probability. But as mentioned above, the method that is used to calculate value at risk also requires that volatilities and correlations be known. So, it is of utmost important to determine the volatilities and correlations in a satisfactory way in order to calculate value at risk more precisely.

The measure, which indicates the volatility of a financial instrument, is its standard deviation or the square of the standard deviation called variance. The correlation between two instruments is measured by the correlation coefficient. As the volatilities of the financial instruments have increased and, as a result, measurement of the market risk has emerged as an important issue, new methods to calculate standard deviation and correlation coefficient have been developed. Unlike the conventional methods, which assume that volatility and correlation remain constant over time, new methods recognize that volatility and correlation may change over time. New methods,called conditional methods, have been applied in many empirical studies conducted both in Turkey and abroad to model the volatilities of different financial instruments and currencies. But nearly in all the studies conducted in Turkey, volatilities of the Istanbul Stock Exchange (ISE) Stock Market Indices and foreign exchange rates have been modeled to measure the equity position risk and foreign exchange risk components of the market risk. Different from other studies, this study examines the interest rate risk component of the market risk. Changes in interest rates affect the market price of interest-related debt instruments such as treasury bills, government and corporate bonds. Since private companies have issued no debt securities in Turkey in recent years, the only securities of this kind are treasury bills and government bonds. In fact, treasury bills and government bonds account for approximately 91 % of all outstanding securities in Turkey and 81 % of securities held by the banks. Some banks, which invested heavily in treasury bills and government bonds, experienced financial difficulties in 2000 and 2001 when the market prices of government debt securities (GDS) dropped suddenly. For this reason, determining the price volatilities of GDS plays a significant part in calculating the financial institutions' value at risk, and thus measuring their market risk exposures. In this study, proper methods will be developed to model the volatilities of ISE GDS price index series, which are taken as proxy for the prices of debt-related securities, and to model the correlations between different series. By doing this, other studies related to equity position and foreign exchange risks are complemented with interest rate risk.

The article is organized as follows: In Section II theoretical background is presented which includes the concepts of volatility, correlation and covariance (which is necessary to calculate correlation) along with the methods to measure them; in Section III information about the ISE GDS price indices, whose volatilities and covariances will be determined, is presented; in Section IV volatilities of individual ISE GDS price index series and the covariances between different series are estimated by using various methods, and out-of-sample forecast power of these methods is examined; section V concludes the article.

II. Theoretical Background

Volatility, which is measured by standard deviation or its square variance, is the degree of dispersion of a financial instrument's return around a reference. This reference is the expected return of the instrument. Thus, volatility can be defined as the deviation of a financial instrument's return from its expected value. If this deviation is large, then the investor may incur a huge loss or earn a huge profit.

As mentioned before, one of the measures that is necessary to calculate value at risk is the standard deviation which indicates the volatility. Since value at risk
expresses the maximum amount of loss that a portfolio may incur in the next period, the volatility, which is used in the calculation, must be forecasted for the next period. There are three basic methods to forecast volatility (Hopper, 1996). The first method calculates the volatility from the historical return series of the instrument. The second method derives the volatility from option prices by using an option-pricing model. Volatility derived from the option prices is called implied volatility. The last method forecasts volatility based on judgment. Since there is no option market in Turkey yet and the judgmental volatility is based on subjective views, this article uses the first method to forecast volatility.

A financial instrument's standard deviation can be calculated from the historical return data by using the following expression.

$$\sigma = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t - \bar{r})^2} \qquad (1)$$

In this expression r_t is the return over the period t, $\bar{r}$ is the mean return (expected return), T is the number of periods. If, as examined later, expected return is assumed to be zero, then expression (1) is modified as follows:

$$\sigma = \sqrt{\frac{1}{T}\sum_{t=1}^{T}r_t^2} \qquad (2)$$

This is an equally weighted scheme in which the weights assigned to each squared return (r_t^2) is the same, that is 1/T. So, the standard deviation calculated by this method remains constant over time. But, recent studies have demonstrated that there is an autocorrelation between variances of returns, which is denoted by r_t^2. Variance (volatility) for the next period is affected by the volatilities of the pervious periods. For this reason, standard deviation does not remain constant over time, as suggested by the conventional method, but varies over time. Time varying standard deviation is called conditional standard deviation because the value of the standard deviation for the next period is conditioned on the standard deviations estimated for the previous periods.

There are two commonly used models to estimate conditional standard deviation. One of them is the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) whose GARCH (1,1) version has widespread use in financial econometrics. The other one is a modification of GARCH (1,1), which is called Exponentially Weighted Moving Avarege (EWMA) model. Both models assign more weight to recent squared returns. The GARCH (1,1) model developed by Bollerslev suggests that variance of returns follows a predictable process. The model estimates the conditional variance for the next period by using the latest squared deviation and the estimated variance for the previous period (Bollerslev, 1986; Gourieroux and Jasiak, 2001). The expression to estimate the conditional variance for the next period is as follows: (Here the expression for the conditional variance is shown. Conditional standard deviation is the square root of the conditional variance.)

$$r_t = bx_t + u_t \qquad (3)$$

$$\sigma^2_{t+1/t} = \alpha_0 + \alpha_1 u_t^2 + \beta\sigma^2_{t/t-1} \qquad (4)$$

First, the conditional mean is estimated by applying expression (3), and then by expression (4) conditional variance is estimated. x_t in expression (3) denotes independent variables. Lagged values of the dependent variable can also be used as independent variables. In expression (4) u_t^2 denotes the squared deviation from the conditional mean. Jorion proved that with daily data ignoring expected return and assuming zero mean does not cause any problem. (Jorion, 1995). This assumption has been made nearly in all theoretical and empirical studies and has not been objected to so far. With this assumption specification for the conditional variance is,

$$\sigma^2_{t+1/t} = \alpha_0 + \alpha_1 r_t^2 + \beta\sigma^2_{t/t-1} \qquad (5)$$

where $\sigma^2_{t+1/t}$ is the conditional variance forecast for the period t+1 given information up to and including period t, likewise $\sigma^2_{t/t-1}$ is the conditional variance forecast for the period t given information up to and including period t-1, r_t is the observed return in period t. In expression (5) α_0, α_1 and β parameters are estimated by applying maximum likelihood method. If $\alpha_1 + \beta \leq 1$, estimate is

persistent and variance can be forecasted for the period t+1. After estimating the parameters, it is important to conduct diagnostic testing to determine whether the model is satisfactory or not. ARCH-LM (ARCH-Lagrange Multiplier) test is one method to do diagnostic testing. The following model is estimated to calculate the test statistics.

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \dots\dots + \alpha_p u_{t-p}^2 \qquad (6)$$

In this regression model, u terms are the standardized residuals obtained from GARCH model. Here again, with zero mean assumption standardized r terms can be used. ARCH-LM tests the following hypothesis.

$H_0 : \alpha_1 = \alpha_2 = \dots\dots\dots = \alpha_p = 0$
H_1 : At least one α is different from zero.

The test statistic is (n-p) * R^2 which follows a chi square distribution with p degrees of freedom. n is the number of observations, p is the number lags, R^2 is the determination coefficient of regression model estimated by applying expression (6). Accepting the null hypothesis means that there is no additional ARCH effect, rejecting the null hypothesis means that there is additional ARCH effect and GARCH model is not sufficient to forecast the conditional variance.

There are a lot of empirical studies conducted both in Turkey and abroad in which GARCH models are applied to financial time series, Bollerslev et.al. (1992) in their study summarizes the research conducted abroad. In Turkey Telatar (1996) and Gönenç (2000) applied GARCH method to model the exchange rate volatility, Güneş and Saltoğlu (1998) applied the same method to model the volatility of the ISE Stock Market Price Index. They all got satisfactory results. On the other hand, Sevil (2001) is the first researcher in Turkey to handle volatility modeling within the framework of risk management and modeled the volatility of ISE National-100 Index in order to calculate the equity position risk. Karatepe et.al. (2002) applied the Conditional Capital Asset Pricing Model to forecast the stock returns of the companies composing ISE National-30 Index. They forecasted the conditional variances and covariances in order to apply the model.

Riskmetrics modified GARCH (1,1) and developed Exponentially Weighted Moving Avarege (EWMA) model whose essence is the following expression (J. P. Morgan, 1996):

$$\sigma^2 = (1-\lambda)\sum_{t=1}^{T}\lambda^{t-1}(r_t - \bar{r})^2 \qquad (7)$$

In this expression λ takes a value between zero and one inclusively and is called "decay factor", which shows how fast the weights of old observations decline. For example, if a 20-day period is considered (T=20) and λ is assumed to be 0.90, the weight applied to the oldest $(r_t - \bar{r})^2$ value by EWMA is calculated as follows:

$$(1\text{-}0.90) * 0.90^{19} = 0.0135$$

If equally weighted scheme is used, then the weight applied to the oldest value is calculated as, 1/20 = 0.05. For the same example, EWMA applies the weight 0.1 to the most recent $(r_t - \bar{r})^2$ value, whereas the equally weighted scheme applies the weight 0.05, which is the same weight applied to the oldest value. If the daily expected return is assumed to be zero, the EWMA volatility forecast for the next period derived by using expression (7) will be as follows:

$$\sigma^2_{t+1/t} = (1-\lambda)\sum_{i=0}^{\infty} \lambda^i r^2_{t-i} = (1\text{-}\lambda)\,(r_t^2 + \lambda r^2_{t-1} + \lambda^2 r^2_{t-2} + \lambda^3 r^2_{t-3} \ldots\ldots)$$

$$= \lambda\,\sigma^2_{t/t-1} + (1-\lambda) r_t^2 \qquad (8)$$

It is necessary to determine the value of λ to forecast volatility by using EWMA. The criterion used to determine optimal λ is root mean square error (RMSE). The optimal λ is the one which minimizes the RMSE. The next period's variance is, $\sigma^2_{t+1} = r^2_{t+1}$ with zero expected return assumption. The time t+1 forecast of variance made one period earlier is ($\hat{\sigma}^2_{t+1/t}$) which can be calculated by applying expression (8). Here, forecast error (ε_{t+1}) can be defined as follows:

$$\varepsilon_{t+1} = r^2_{t+1} - \hat{\sigma}^2_{t+1/t} \qquad (9)$$

Accordingly, RMSE is given by the following expression (J.P. Morgan, a.g.e):

$$\text{RMSE}_{\text{variance}} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(r^2_{t+1} - \hat{\sigma}^2_{t+1/t}(\lambda)\right)^2} \qquad (10)$$

In expression (10) the forecast value of the variance ($\hat{\sigma}^2_{t+1/t}$) is written as a function of λ, because different values of λ produce different forecasts. The purpose is to find the one which minimizes the RMSE.

Another measure used in value at risk calculations is the correlation between the returns of the instruments. Correlation coefficient measures the strength of the linear relation between to return series and is calculated as follows.

$$\rho = \frac{\sigma^2_{xy}}{\sigma_x \sigma_y} \qquad (11)$$

Where σ^2_{xy}, is the covariance between the returns of the instruments x and y which is defined by the following expression.

$$\sigma^2_{xy} = \frac{1}{T}\sum_{t=1}^{T}(r_{xt} - \bar{r}_x)(r_{yt} - \bar{r}_y) \qquad (12)$$

There are two basic methods to determine the covariance, one of which is to calculate it by applying expression (12), which is an equally weighted scheme that assumes time invariant covariance. The other method is a dynamic model, which assumes that covariance, like variance, may change over time. Models used to forecast the conditional variance of a single instrument can also be used to forecast the conditional covariance between two instruments with minor modifications.

GARCH (1,1) model can be modified as follows to forecast the conditional covariance. (Alexander, 1996). Zero expected return assumption that is proved to be plausible holds here again.

$$\sigma^2_{xy,t+1/t} = \alpha_0 + \alpha_1 r_{xt} r_{yt} + \beta \sigma^2_{xy,t/t-1} \qquad (13)$$

EWMA forecast of the conditional covariance is given by the following expression (J.P. Morgan).

$$\sigma^2_{xy,t+1/t} = \lambda\,\sigma^2_{xy,t/t-1} + (1-\lambda) r_{xt} r_{yt} \qquad (14)$$

Covariance forecast RMSE can be calculated similar to the variance RMSE. (J.P. Morgan).

$$\text{RMSE}_{\text{Covariance}} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(r_{x,t+1}r_{y,t+1} - \hat{\sigma}^{2}_{xy,t+1/t}(\lambda)\right)^{2}} \qquad (15)$$

Here the purpose is to determine the λ which minimizes $\text{RMSE}_{\text{Covariance}}$. Conditional variances and the conditional covariances having been determined, conditional correlation is forecasted by the following expression (J.P. Morgan).

$$\rho_{xy,t+1/t} = \frac{\sigma^{2}_{xy,t+1/t}}{\sigma_{x,t+1/t}\sigma_{y,t+1/t}} \qquad (16)$$

Correlations between different currencies and between different stock market indices have been modeled by using conditional methods. In one of these studies done by Longin ve Solnik (1995) GARCH method was used to model the correlations of stocks, which were traded in different markets, and it was found that correlations were time variant.

III. ISE GDS Price Indices

The market price of debt securities such as treasury bills, government and corporate bonds are affected by the interest rate variations. GDS price indices, constructed by ISE, are proxies for these changes. ISE GDS price indices are defined as follows:

"Price index indicates the price fluctuations of a characteristic bond as a result of changes in interest rates prevailing in the market." (ISE)

An increase or decrease in the value of the index indicates how much the price of the characteristic bill or bond has increased or decreased as compared to the base date. Price indices are computed for the maturities of 30, 91, 182, 273, 365 and 456 days. The base date for the indices based on 30-day and 91-day maturities is 25-26 December 1995; 273-day, 365-day and 456-day maturities is 2 January 2001. Two different indices are computed for 182-day maturity whose base dates are 25-26 December 1995 and 2 January 2001 respectively.

Indices are computed each day by using the prevailing weighted average prices of the zero coupon debt securities traded in ISE Bonds and Bills Market, Outright Purchases and sales Market (ISE). Kona (1997), who introduced the concept of bond indices in Turkey, explains in his article how to construct and calculate GDS price indices. As mentioned above, a change in price index indicates the price fluctuation of the characteristic bill or the bond, which will be matured in a certain period of time (like 30 or 91 days), as a result of changes in interest rates prevailing in the market. With this property ISE GDS price indices provide vertices for certain maturities which

can be used by the financial institutions to compute their market risk stemming from interest-related debt securities. The cash flows of zero coupon or coupon paying debt securities can be allocated to an appropriate vertex to compute value at risk. This method is called cash flow mapping. A financial institution has to know the volatilities of individual vertices and correlations between different vertices to compute value at risk by using this method. The next section deals with this issue.

IV. Analysis

4.1. Research Questions

There are not many studies in the literature comparing covariance models. But, there are studies in which the information content of different variance models is compared. West and Cho (1995) concluded that for shorter horizons (at most one week) GARCH models forecast exchange rate volatility more efficiently than EWMA. Jorion (1995) found that the implied volatility is the best method to model exchange rate volatility. Balaban (2000) modeled ISE stock market composite index by using several methods and concluded that ARCH models have more out-of-sample predictive ability. Riskmetrics states that the forecasts produced by GARCH and EWMA do not differ from each other significantly. Alexander (1996) recommends that GARCH forecasts be used for shorter holding periods. Butler (1999) claims that GARCH is more accurate but difficult to implement, on the other hand, EWMA is more practical and often achieves the accuracy of GARCH. As stated in the introduction, the price volatilities of interest-related debt securities have not been examined widely in the literature. In this study, this issue is handled and the volatilities of individual GDS price indices and covariances (as a result correlations) between pairs of indices will be modeled. In the light of the literature survey, this research addresses the following questions:

a. Are conditional variance in each series and conditional covariance between pairs of series valid?
b. If conditional variance and covariance are valid, which method provides better information about the next day's variance and covariance?
c. Is GARCH a better model to forecast volatilities and covariances of GDS price indices, which were found to be the case in other financial instruments?

4.2. Data

The daily values of the GDS price indices, computed and published by ISE for the maturities 30 days, 91 days, 182 days, 273 days, 365 days and 456 days are used. The values of the indices have been compiled from ISE Monthly Bulletins. Data in this study covers the period 01 March 2001-30 October

2003. There 670 samples in this period. Samples are divided equally as estimation period and forecast period.

Daily return of ISE GDS price index series are computed as follows and these return series are used in the analysis.

$$r_t = \ln\left(\frac{i_t}{i_{t-1}}\right)$$

where; i_t and i_{t-1} is the value of the index on day t and day t-1, respectively.

4.3. Modeling Conditional Variance

Before estimating conditional volatility models, stationarity of the return series are examined by using Augmented Dickey-Fuller Test. 25 lags are included in the test. Table 1 presents the results.

Table 1: Results of Augmented Dickey-Fuller Test

Series	Test Statistic
30 days	-5.73
91 days	-3.86
182 days	-4.40
273 days	-4.98
365 days	-5.36
456 days	-5.60
MacKinnon critical value for 0.05 level of significance = -2.87	

As can be seen from the table, the null hypothesis that there is unit root is rejected for each series which indicate that they are stationary.

Next, the indicators of conditional variance is investigated for each series. For this purpose, autocorrelations between r_t^2 values and Box Ljung Q statistics are calculated. Calculations showed that there is a relation between r_t^2 values, which is an evidence of the existence of conditional variance. Then, the conditional variance models are estimated for each series by using GARCH (1,1) and EWMA methods. Parameters estimated for GARCH (1,1) model are summarized in Table 2.

Table 2: GARCH (1, 1) Estimation (Variance)

Series	α_0	α_1	β
30 days	3.29 E^{-7}	0.337	0.736
91 days	8.49 E^{-7}	0.274	0.768
182 days	5.39 E^{-7}	0.289	0.710
273 days	1.05 E^{-6}	0.120	0.863
365 days	3.21 E^{-6}	0.130	0.849
456 days	6.87 E^{-6}	0.134	0.843
$\sigma^2_{t+1/t} = \alpha_0 + \alpha_1 r_t^2 + \beta\sigma^2_{t/t-1}$			

All parameters estimated are significant. Since the condition of $\alpha_1 + \beta \leq 1$ is not satisfied for 30 and 91 day series they are not persistent and the conditional variance for the next day cannot be forecasted by using GARCH (1,1). ARCH-LM test is applied to other series to find whether there is additional ARCH effect. Again, 25 lags are included. Table 3 presents the results.

Table 3: ARCH-LM Test Results

Series	Test Statistics	p
182 days	8.06	0.990
273 days	19.26	0.784
365 days	18.48	0.821
456 days	14.81	0.946
$\chi^2_{25}(0.05) = 37.7$		

As can be seen from Table 3, $H_0 : \alpha_1 = \alpha_2 = \dots\dots\dots = \alpha_{25} = 0$ is accepted for each series, which shows that estimated GARCH models are satisfactory. λ values estimated for EWMA model are presented in Table 4. They are the λs, which minimizes $RMSE_{variance}$ for each series.

Table 4 : EWMA λ Values (Variance)

Series	λ
30 days	0.53
91 days	0.70
182 days	0.90
273 days	0.82
365 days	0.90
456 days	0.89
$\sigma^2_{t+1/t} = \lambda\sigma^2_{t/t-1} + (1-\lambda)r_t^2$	

4.4. Forecast Performance of Variance Models

The out-of-sample forecast performance of GARCH (1,1) and EWMA models are examined by using RMSE values and regression model.

RMSE values show the forecast accuracy of the models. Table 5 contains out-of-sample RMSE values.

Table 5: RMSE Values (Variance)

Series	RMSE (EWMA)	RMSE (GARCH)
30 days	0.000004569	
91 days	0.000017150	
182 days	0.000036701	0.000038022
273 days	0.000116650	0.000115346
365 days	0.000258930	0.000257250
456 days	0.000456320	0.000435670

$$RMSE_{variance} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(r_{t+1}^2 - \hat{\sigma}_{t+1/t}^2\right)^2}$$

Forecast is made by using only EWMA model for 30 and 91-day series. EWMA is more accurate for 182-day series and GARCH (1,1) is more accurate for 273, 365 and 456-day series.

The regression model below is estimated for EWMA and GARCH (1,1) models to examine which model is more informative about next day's variance (volatility).

$$r_{t+1}^2 = a + b\hat{\sigma}_{t+1/t}^2 + e_{t+1} \qquad (17)$$

$\hat{\sigma}_{t+1/t}^2$ in expression (17) indicates the out-of-sample forecasted variance for the next day by using either EWMA or GARCH (1,1). Table 6 presents the results.

Table 6: Forecast Efficiency of Variance Models

	EWMA					GARCH (1,1)				
Series	T (a)	p (a)	b	t (b)	p (b)	t (a)	p (a)	b	t (b)	p (b)
30 days	4.06	0.000	0.111	1.167	0.244					
91 days	4.387	0.000	0.098	0.779	0.437					
182 days	1.889	0.058	0.556	3.437	0.001	2.841	0.005	0.381	3.527	0.000
273 days	2.114	0.035	0.557	4.639	0.000	1.106	0.270	0.680	4.497	0.000
365 days	1.066	0.109	0.636	4.284	0.000	1.036	0.301	0.690	4.676	0.000
456 days	1.707	0.089	0.630	4.415	0.000	0.975	0.330	0.693	4.712	0.000

If "a" is zero and "b" is close to one and statistically significant, then the model has predictive ability. Since only EWMA model is used to forecast the conditional variances of the 30 and 91-day series, independent variables in the regression models for these series are the variances forecasted by EWMA. As can be seen from Table 6, EWMA cannot forecast the next day's variance efficiently for 30 and 91-day series. In 182-day series EWMA; in 273, 365 and 456 day series GARCH (1,1) forecast the next day's variance efficiently.

4.5. Modeling Conditional Covariance

Fifteen series consisting of the cross products of GDS price indices (r_x*r_y) are constructed to model the conditional covariances. First of all, as was the case when the conditional variance was modeled, the stationarity of the series are examined by applying the Augmented Dickey-Fuller test. Test results indicate that all cross product series are stationary. Next, autocorrelations between r_x*r_y values and Box Ljung Q statistics are calculated to find out the existence of conditional covariance. Calculations provided statistical evidence that there is a relation between r_x*r_y values, which indicates the existence of conditional covariance.

Equation (13) is estimated for each series and the models are diagnosed by using ARCH-LM test. Test results indicate that there remains additional ARCH effect for $r_{30}r_{365}$ series, which means that GARCH (1,1) is not satisfactory to model the conditional covariance. For this reason, GARCH (2,1) is estimated by applying equation (18).

$$\sigma_{xy,t+1/t}^2 = \alpha_0 + \alpha_1 r_{xt} r_{yt} + \beta_1 \sigma_{xy,t/t-1}^2 + \beta_2 \sigma_{xy,t-1/t-2}^2 \qquad (18)$$

Equation (18) for $r_{30}r_{365}$ series having been estimated, ARCH-LM test is applied again and the hypothesis that there is no additional ARCH effect is accepted for this series too. Estimation of GARCH (1,1) and GARCH (2,1) models are summarized in Table 7.

Table 7: GARCH Estimation (Covariance)

Series	α_0	α_1	β_1	β_2	ARCH-LM
30-91 days	5.02 E^{-7}	0.280	0.766		
30-182 days	9.34 E^{-7}	0.129	0.862		17.59
30-273 days	7.83 E^{-8}	0.100	0.888		27.81
30-365 days	2.06 E^{-7}	0.155	0.446	0.382	21.92
30-456 days	2.56 E^{-7}	0.117	0.870		20.13
91-182 days	7.06 E^{-7}	0.117	0.869		23.66
91-273 days	1.60 E^{-7}	0.084	0.904		27.59
91-365 days	2.91 E^{-7}	0.096	0.891		24.37
91-456 days	4.66 E^{-7}	0.101	0.885		24.91
182-273 days	6.65 E^{-7}	0.087	0.892		23.77
182-365 days	1.03 E^{-6}	0.087	0.891		24.07
182-456 days	1.36 E^{-6}	0.086	0.892		17.33
273-365 days	1.81 E^{-6}	0.126	0.856		19.23
273-456 days	2.56 E^{-6}	0.124	0.865		17.10
365-456 days	4.63 E^{-6}	0.123	0.850		16.36

$$\sigma^2_{xy,t+1/t} = \alpha_0 + \alpha_1 r_{xt} r_{yt} + \beta\sigma^2_{xy,t/t-1}$$

$$\sigma^2_{xy,t+1/t} = \alpha_0 + \alpha_1 r_{xt} r_{yt} + \beta_1\sigma^2_{xy,t/t-1} + \beta_2\sigma^2_{xy,t-1/t-2}$$

$$\chi^2_{25}(0.05) = 37.7$$

All parameters estimated are significant. As can be seen from Table 7, $\alpha_1 + \beta \leq 1$ condition is not satisfied for 30-91 day series, which means that conditional covariance for the next day cannot be forecasted by GARCH (1,1) model. λ values which minimize $RMSE_{covariance}$ are presented in Table 8.

Table 8 : EWMA λ Values (Covariance)

Series	λ
30-91 days	0.58
30-182 days	0.84
30-273 days	0.95
30-365 days	0.81
30-456 days	0.73
91-182 days	0.90
91-273 days	0.91
91-365 days	0.76
91-456 days	0.68
182-273 days	0.84
182-365 days	0.75
182-456 days	0.70
273-365 days	0.86
273-456 days	0.88
365-456 days	0.90

$$\sigma^2_{xy,t+1/t} = \lambda\sigma^2_{xy,t/t-1} + (1-\lambda) r_{xt} r_{yt}$$

4.6. Forecast Performance of Covariance Models

Forecast performance of covariance models is evaluated by RMSE and regression as was done to evaluate the forecast performance of variance models. Table 9 presents the RMSE values.

Table 9: RMSE Values (Covariance)

Series	RMSE (EWMA)	RMSE (GARCH)
30-91 days	0.000008766	
30-182 days	0.000006101	0.000006457
30-273 days	0.000073450	0.00000738
30-365 days	0.000011140	0.00001093
30-456 days	0.000015060	0.00001458
91-182 days	0.000016620	0.00001725
91-273 days	0.000024770	0.00002466
91-365 days	0.000037570	0.00003654
91-456 days	0.000050510	0.00004825
182-273 days	0.000064540	0.00006380
182-365 days	0.000097280	0.00009470
182-456 days	0.000129800	0.00012500
273-365 days	0000017320	0.00017200
273-456 days	0.00022900	0.00022800
365-456 days	0.00034350	0.00034050

$$\text{RMSE}_{\text{Kovaryans}} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(r_{x,t+1}r_{y,t+1} - \hat{\sigma}^2_{xy,t+1/t}\right)^2}$$

Table 9 indicates that EWMA is more accurate to forecast the conditional covariance between shorter maturity indices. Regression model, which is expressed below, is estimated to find out the out-of-sample forecast efficiency of conditional covariance models and the results are presented in Table 10.

$$r_{x,t+1}r_{y,t+1} = a + b\hat{\sigma}^2_{xy,t+1/t} + e_{t+1} \qquad (19)$$

Table 10: Forecast Efficiency of Covariance Models

	EWMA					GARCH (1,1) or GARCH (2,1)				
Series	t (a)	p (a)	b	t (b)	p (b)	t (a)	p (a)	b	t (b)	p (b)
30-91 days	4.245	0.000	0.105	1.020	0.308					
30-182 days	4.204	0.000	-0.070	-0.380	0.701	2.392	0.015	-0.090	-0.420	0.673
30-273 days	2.473	0.014	-0.040	-0.150	0.882	1.756	0.080	0.100	0.446	0.659
30-365 days	1.978	0.050	0.080	0.517	0.605	0.156	0.121	0.082	0.404	0.686
30-456 days	1.852	0.065	0.060	0.477	0.634	1.387	0.166	0.064	0.313	0.754
91-182 days	2.952	0.003	0.290	1.470	0.142	1.368	0.172	0.281	1.452	0.148
91-273 days	1.984	0.048	0.471	2.650	0.008	1.369	0.172	0.526	2.684	0.008
91-365 days	2.495	0.013	0.364	3.000	0.003	1.326	0.186	0.519	2.813	0.005
91-456 days	2.703	0.007	0.314	2.930	0.004	1.237	0.217	0.515	2.838	0.005
182-273 days	2.005	0.046	0.553	4.317	0.000	0.591	0.555	0.746	4.056	0.000
182-365 days	2.482	0.014	0.480	4.412	0.000	0.538	0.591	0.760	4.139	0.000
182-456 days	2.713	0.007	0.446	4.396	0.000	0.518	0.604	0.766	4.161	0.000
273-365 days	1.873	0.062	0.598	4.576	0.000	1.086	0.278	0.680	4.593	0.000
273-456 days	1.749	0.081	0.617	4.460	0.000	0.980	0.328	0.656	4.561	0.000
365-456 days	1.618	0.107	0.637	4.294	0.000	0.925	0.356	0.723	4.682	0.000

As can be seen from Table 10, EWMA does not provide efficient forecasts for the next day's covariance. GARCH forecasts the next day's covariance efficiently for longer maturity series.

V. Conclusion

Autocorrelations and Box Ljung Q statistics calculated in the analysis imply conditional variance in each return series. For this reason, using conditional methods produces better forecasts for next day's volatility. It has been found that EWMA is the only method to model the volatilities of 30 and 91 days series, which are shorter maturities. EWMA produces more accurate out-of-sample forecast than GARCH (1,1) in 182-day series, which is also shorter maturity. But EWMA does not have predictive power for next day's volatility in 30 and 91 day series, however it provides some information for next day's volatility in 182-day series. Last day's volatility has considerable impact on next day's volatility in 30 and 91 days series, which is another finding of the analysis. GARCH (1,1) method's out-of-sample forecast error is smaller and this method forecasts efficiently the next day's volatility in 273, 365 and 456-day series.

Autocorrelations and Box Ljung Q statistics imply conditional covariance between return series. This finding suggests that it is more appropriate to use conditional methods to forecast covariance.

Both methods prove to be inefficient to forecast next day's covariance between 30 day and other maturity series on out-of-sample data. They are also inefficient to forecast next day's covariance between 91 and 182-day series. For other cross product series GARCH models produce better forecasts.

This study shows that GARCH methods are superior to forecast the volatilities and covariances of ISE GDS price indices. This conclusion is in line with other studies in the literature, which used other financial instruments.

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The ISE Review Volume: 7 No: 27 July/August/Septemper 2003
ISSN 1301-1642

FINANCIAL LIBERALISATION AND ECONOMIC GROWTH: A PANEL DATA APPROACH

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Abstract
The purpose of this paper[1] is to examine the effects of financial development on economic growth before and after the implementation of financial reforms. Using panel data averaged on five years we have carried out an empirical study including initially 43 countries covering five years intervals period from 1970 to 1994. However, the estimations concerning this period have given contradictory results and turned out to be insufficient to explain the influence of financial development on economic growth. We think that these unexpected findings may be results of the mixing of the countries, which have repressed their financial sectors with those, which have implemented financial reforms over two decades. Therefore, we have analysed the influence of financial development on economic growth before and after the implementation of financial reforms. The results show that, financial reforms could have positive effect on financial development in some cases and hence accelerate the economic growth.

I. Introduction

In recent years, there has been numerous conceptual and empirical works analysing the relationship between financial development and economic growth. Based on neoclassical or endogenous growth models, most of these studies tend to relate positively economic growth with financial development.

Theoretically, financial systems are supposed to have five functions (Levine,1997):

1) Facilitating the trade,
2) Diversifying and pooling of risk,
3) Efficiently allocating resources,
4) Mobilising savings,
5) Monitoring managers and exerting corporate control.

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[1] The author thanks Aykut Turan for proof checking the paper.

Using endogenous growth theory, many economists show that financial development contributes to improve the efficiency of capital allocation through various channels; for instance financial institutions' role of diversifying more efficiently investors' portfolio, (Levine, 1991; Saint Paul, 1992), collecting information on the efficiency of diverse investment projects and/or investors capacities (Greenwood and Jovanovic, 1990; King and Levine, 1993), improving management of liquidity risks etc. increases the possibility of choosing more productive investments. Finally the improvement of investment efficiency leads to higher levels of long-term growth rates[2].

Apart from this literature, in the earlier studies, McKinnon (1973), Shaw (1973), Kapur (1976), Galbis (1977) and Mathieson (1979) have already analysed the effects of financial liberalisation on the volume of saving and the quantity and the efficiency of investment.

At the empirical level, there have been also numerous studies examining the relationship between financial development and economic growth for a large number of developed and developing countries. Using purely cross-sectional or pooled cross-section and times series data (averaged over decades), many empirical analyses concerning the effect of financial intermediation on economic growth were carried out by King and Levine (1993), De Gregorio and Guidotti (1995) and Levine and Zervos (1996).

These studies generally covered the period from 1960 to 1985 and include all countries for which Heston and Summers (1988) data set is available. Almost all of them concluded that financial variables have significant impact on economic growth rate measured as percentage change in reel per capita GDP.

However, these results may be subject to some criticisms. Because, they are based on the crucial assumption of identical aggregate production function for all countries. But, it is clear from evidence that the production function may actually differ across countries.

Moreover, these results were obtained by using purely cross-country regressions. However, empirical studies conducted in the framework of single cross-country regressions could not explicitly take into consideration the differences in the production function (Islam,1995). In other words, it is econometrically difficult for cross-sectional studies to allow for the effect exerted by the quality of social, economic and political institutions in different countries on economic growth. Statistically, taking into account diverse characteristic of each country in this framework would entail lower degree of freedom, by equalising the number of observations to the number of countries in the sample.

[2] An overview of endogenous growth incorporating financial sector has been provided by Güloğlu (2000).

This shortcoming of cross-sectional data may be effectively overcome by the econometrics of panel data, which combines both the time and individual dimension of the observations. Using panel data, which increases the number of observations makes it possible to allow for individual country differences (due to the factors other than those incorporated in the regression) in growth performance. Such factors may be explained by differences in technological and institutional differences across countries (Berthelemy and Varoudakis, 1996, Islam, 1995). Thus, contrary to earlier studies, we followed a panel data approach in this study.

Furthermore, earlier pooled data studies have tended to use the data averaged over ten years. However using ten years averages as time interval may not be suitable if the period of the study is relatively short. Hence, this study has used the annual data for ten years interval period.

Unlike the earlier studies,[3] which have tended to conclude that financial variables have positive and significant effect on economic growth, empirical findings in this paper do not necessarily support the hypothesis that financial development affects significantly economic growth. Our empirical work initially covers the five years interval period from 1970 to 1995 and incorporates 43 developed and developing countries, which have reformed their financial sector during the last two decades (i.e, the estimations have been made by using pooled data averaged on five years). Later, the sample is divided according to stages of the financial reform process: pre-reform and post-reform period.

In order to clarify the effect of financial development on economic growth, we have proposed the hypothesis that the implementation of financial reforms may affect the efficiency of financial system and contribute to economic growth[4].

The paper is organised as follows: We describe data and methodology in the next section. This is followed by the econometric analysis, which investigates the empirical relationship between financial development and economic growth, before and after the implementation of financial reforms. We finalise the paper by some concluding remarks.

II. Data and Methodology

2.1. Financial indicators

In this section, we first conduct a panel data study using data averaged over five years intervals for the period 1970-1995[5] so that each country has five

[3] No matter the method with which they have been carried out.
[4] This hypothesis was originally tested by Berthelemy and Varoudakis (1996).
[5] This period is named "whole period".

observations (1970-1974, 1975-1979, 1980-1984, 1985-1990, 1990-1994). Our initial database includes 43 developed and developing countries, which reformed their financial sectors during the last two decades. Based on Roubini and Sala-i Martin (1992), King and Levine (1993), Johnston and Pazarbaşıoğlu (1996), we utilise four financial development and one financial repression indicators[6].

The first indicator representing financial development, which we call DEPTH[7], is the ratio of broadly defined money (M2Y) to GDP. This indicator measures the size of the formal financial sector relative to economic activity. The second one denoted by BANK, is the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets. It represents the capacity of banks to provide credit on the basis of their deposits. The third indicator of financial development, which is denoted PRIVATE is the ratio of claims on the nonfinancial private sector to total domestic credit (excluding credits to money banks). The fourth indicator is called PRIVY. It is defined as the ratio of claims on the nonfinancial private sector to GDP. The last indicator of financial development may reflect the relative importance of private sector to public sector in the economy. The expected signs of these financial indicators are all positive.

In addition to these indicators, we calculate another indicator proposed to represent the financial repression. This new indicator, which is named as RESERVES, is the ratio of deposit money banks reserves to M2Y. We introduce this variable in order to take into account the effects of banks's excess reserves on economic growth. Governments, which aim to repress financial sector, generally increase the obligatory reserves held by banks. The augmentation of obligatory reserves relative to money stock would cause an increase in the amount of resources, which are not transmitted to investment projects. The expected sign of the coefficients on this variable is thus negative.

2.2. Economic and Human Capital Indicators

This paper uses two economic indicators; the inflation rate and the degree of openness of economy as proxied by the sum of exports and imports divided by GDP. The rate of inflation is measured by percentage change in consumer price index. We expect the economic growth rate to be higher when the degree of openness increases (because the resources are utilised more efficiently when the

[6] Following Roubini and Sala-i Martin, financial repression could be defined as any kind of restrictions aiming at preventing "normal "development of financial sector such as credit rationing, granting of credit to privileged sector (selective credit policy), interest rate ceiling, high reserve requirement and barriers to entry into financial sector for residents and foreigners as well,
[7] The definition and calculation of the variables are presented in appendix 2.

economy is open to the foreign trade) and to be lower when inflation rate is higher.

In addition to these variables, we introduce population growth rate[8] (GPOP), as the human capital indicator in growth equation. According to the neoclassical economic growth theory, the marginal productivity of labour tends to decrease when population growth increases (Barro and Sala-i-Martin,1994). This neoclassical view is also supported by the endogenous growth theory, which argues that a large population could affect negatively the qualification and accumulation of human capital (Becker et al.,1990).

2.3 Specification of the Model

As in the earlier studies we use a conditional convergence model, first specified by Barro (1991). In the form of panel data it may be written as follows:

$$GRWTH_{i,t} = \alpha_i + \beta \ln(GDPI_{i,t}) + \delta_1 \ln GPOP_{i,t} + \eta L_{i,t} + \lambda FIN_{i,t} + +z_t + \varepsilon_{i,t} \qquad (1)$$

In equation 1, GRWTH stands for real per capita GDP growth rate averaged over five years intervals (i.e 1970-1974, 1975-1979, 1980-1984, 1985-1990, 1990-1994), lnGDPI is the natural logarithm of real per capita GDP in the beginning of each five years intervals (i.e in 1970, 1975, 1980, 1985, 1990). We include lnGDP in growth equation to test “convergence” assumption. The notion of conditional convergence is one of the implications of Solow (1956) and Swan’s (1956) models. It would be defined in terms of level of income or growth rate. In terms of level of income, convergence means that if countries have similar preferences and technology, the steady state levels of income for all countries will be same, and they will tend to attain the same level of per capita income.

In terms of the growth rate, it means that all countries will reach the same steady state[9] growth rate, given that technology is a public good to be equally shared. Note that convergence results from the neoclassical hypothesis of diminishing marginal returns to capital.

Barro and Sala-i-Martin state that “the level of income converges conditionally across countries, because the steady state level of per capita output and capital stock depend on the marginal propensity to save, the growth rate of population and the position of production function” (Barro and Sala-i-Martin, 1994, 11). Accordingly, the expected sign for the coefficient on lnGDP is negative.

[8] In addition we had introduced the secondary school enrolment rate and average schooling years in the total population over age 25 as human capital indicator but we did not maintain these variables in the model because of their insignificant coefficients.

[9] Steady state refers to the situation in which per capita output, capital stock, consumption grow at a common rate.

The term lnPOP represents population annual growth rate (in logarithmic terms). We take average of this variable over five years interval, so that we have also five observations of this explanatory variable for all countries.

FIN is the matrix of financial variables- that is DEPTH, BANK, PRIVATE, PRIVY and RESERVES. The matrix FIN contains each time two variables: one variable representing financial sector development and another representing financial repression. Financial variables are also averaged over five years interval. The L matrix includes the other explanatory variables, such as degree of openness of the economy to international trade and inflation rate averaged over five year intervals.

The terms α_i are dummy variables accounting for specific (country) effects[10]. They are assumed to reflect particular characteristics of each country, such as the abundance of natural resources, technological progress, functioning of social, political and economic institutions, which affect the production function. Islam shows that improvements in the country effects result in higher transitional growth rate. The terms z_t are also dummy variables representing time effects. They reflect the effects of the various shocks occurred through time (oil shocks, financial crisis etc.) on economic growth which are not taken into account by other explanatory variables.

2.4. Estimation of the Model

Due to the lagged variable LnGDPI, the economic growth model (1) we have used may be considered as a dynamic model. However, as noted by Sevestre and Trognon (1996), when a dynamic panel data model is estimated by within estimator[11], one can not obtain consistent estimators. The inconsistency of the estimators arise from the autocorrelated disturbance terms, which cause in turn the lagged endogenous variable to be correlated with those disturbances.

Balestra-Nerlove (1966) have shown that it is possible to get consistent estimators in an autoregressive error components model, by using a kind of instrumental variable method, which uses current and lagged values of the explanatory variables as instruments (except for lagged endogenous variable). In order to estimate model (1) through Balestra-Nerlove method, we should first introduce a set of dummy variables representing individual country effects in the model and then estimate it through instrumental variable method. Since this process is quite long to apply when the sample size is large, in practice one can use Frish-Waugh theorem which consists of taking the deviations from

[10] These effects are fixed through time for any country but vary across countries.

[11] Within estimator is also called Least Squares with Dummy Variables.

individual means for all variables and estimating transformed model by two stage least squares method[12]. We use Lagrange multiplier (LM) statistics to test for heteroscedasticity in the $\varepsilon_{i,t}$ (Greene,1997). The hypothesis that the errors are heteroscedastic may be formulated as:

$H_0 : \sigma^2_{\varepsilon 1} = \sigma^2_{\varepsilon 2} = \dots\dots\dots\sigma^2_{\varepsilon N}$ There is no heteroscedasticity
$H_A : H_0^{\,C}$ There is heteroscedasticity

Since, the $\varepsilon_{i,t}$ are residuals[13] for the fixed effects model, the LM statistics may be used for this model. However, Erlat (1997) argues that if there is a heteroscedasticity only in the $\varepsilon_{i,t}$ in random effects model, then the statistic LM may also be used in this case. Because, the α_i are wiped out during the within group transformation and the within estimator is a consistent estimator for random effects model. So one can test for heteroscedasticity in the $\varepsilon_{i,t}$ using the following LM test:

$$LM = \frac{T}{2}\sum_{i=1}^{N}\left[\frac{\hat{\sigma}_{\varepsilon_i}^{2}}{\hat{\sigma}_{\varepsilon}^{2}} - 1\right]^2 \sim X^2_{N-1}$$

Where $\hat{\sigma}_{\varepsilon_i}^{2} = \sum_{t=1}^{T}\varepsilon^2_{it} / T$ and $\hat{\sigma}_{\varepsilon}^{2} = \sum_{i=1}^{N}\sum_{t=1}^{T}\varepsilon^2_{it} / NT$

Note that, we can replace $\varepsilon_{i,t}$ by the within residuals obtained from model (1), when we test for heteroscedasticity for the random effects or fixed effects models.

In order to correct heteroscedasticity for the fixed effects model, we can transform that model and apply ordinary least squares as follows:

[12] For a detailed information see Sevestre and Trognon (1996)

[13] The terms $\varepsilon_{i,t}$ are not the residuals but the disturbances for random effects model.

If W is defined as W=diag$(\hat{\sigma}^{-1}_{\varepsilon 1},\dots\dots\hat{\sigma}^{-1}_{\varepsilon N}) \otimes I_t$, then we can transform the fixed effects models as $Wy^* = x_j^*\beta + W\varepsilon^*$, where y^* and x_j^* express deviations from individual country means.

For random effects case, heteroscedasticity[14] may be corrected by transforming each variable in the model such that :

$$Y^*_{it} = (Y_{it} - \theta_i \overline{Y}_{i.}) / \sigma_{\varepsilon i}$$

Where $\overline{Y}_{i.} = \sum_{t=1}^{T} Y_{it} / T$, $\theta_i = 1 - (\sigma_{\varepsilon i} / \sigma_{1i})$,

$\sigma^2_{1i} = T/\sigma^2_{\alpha} + /\sigma^2_{\varepsilon i}$, $\sigma^2_{\varepsilon i} = \sum_{t=1}^{T} \Re_{it} / (T - K + 1)$

Finally, $\Re_{it} = W\varepsilon^*$ and $\sigma^2_{\alpha} = \sum_{i=1}^{N}(\hat{\sigma}^2_{ui} - \sigma^2_{\varepsilon i})/N$

As we will see in model (2), the u_i are only the disturbances of random effects model.

2.5. Testing the existence of specific effects

In order to ensure that there are the specific country and time effects, we can form the following hypothesis and test it by using Fisher (Q) statistic.

$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \dots\dots\ \alpha_N = \alpha$ and $z_1 = z_2\dots\dots z_t = 0$ (absence of specific individual and time effects)

$H_A : H_0^{\,c}$ $$Q = \frac{(SS_r - SS)/(N + T - 2)}{SS/(N.T - N - T - K + 2)} \sim F \text{ distribution}$$

where SS_r is the sum of squares of residuals for the model estimated by ordinary least squares without dummy variables α_i and z_t. SS is the residual sum of squares of the model estimated by Balestra-Nerlove method. K is the number

[14] In this case we assume that the disturbances ($\varepsilon_{i,t}$) are heteroscedastic and the terms α_i are homocedastic.

of explanatory variables. N stands for number of countries and T represents the time.

If Q > F (N+2, N.T- N-T-K+2), the null hypothesis H_0 can be rejected so that we can accept the existence of country and time effects.

After having rejected the hypothesis of absence of specific country and time effects, we would carry out a Hausman test in order to decide on randomness or constancy of these effects. The hypothesis to test may be written in the following way:

$H_0: E(\varepsilon_{i,t} \mid X_{it})=0$ Country and time effects are random

$H_A: E(\varepsilon_{i,t} \mid X_{it}) \neq 0$ Country and time effects are constant

To test this hypothesis we can use Hausman (H) statistic as follows:

$$H =(b_{within}- b_{FGLS})' (Vb_{within}- Vb_{FGLS})^{-1} (b_{within}- b_{FGLS})$$

where, the terms b_{within} and b_{FGLS} represent, respectively, the within and feasible generalised least squares estimators and Vb_{within}, Vb_{FGLS} their corresponding variance-covariance matrix.

In the case that $H > X^2 (k_{within})$, H_0 is rejected. As might be seen from Table 1, the hypothesis of absence of individual and time effects and that of randomness of individual and time effects are rejected at the critical point for α=0.01. So there are individual and time effects which are constant rather than random.

2.6. Analysis of Estimation Results

The estimation results done by Balestra-Nerlove method for economic growth equation (1) are reported in table 1. They have striking similarities with the earlier studies. As can be seen from table 1, the coefficients on LnGDP are significant and have expected signs.

Table 1: Dependent Variable: GRWTH
Whole Period (from 1970-1974 to 1990-1994)

Explanatory variables	Eq.1	Eq.2.	Eq.3	Eq.4
LnGDPI	-0,046 (-2.6)***	-0,042 (-2,71)***	-0,028 (-1,58)**	-0,043 (-2,32)**
LnGPOP	0,83 (0,75)	1,90 (1,77)*	1,52 (1,30)	1.02 (0.89)
INF	-0,001 (-1,65)*	-0,00068 (-1,04)	-0,00067 (-1,08)	-0,00099 (-1,56)
OPEN	0,061 (3 ,81)***	0,057 (3,50)***	0,044 (2,70)***	0,062 (3,87)***
DEPTH	-0,0062 (-0,38)			
BANK		0,071 (4,48)***		
PRIVATE			0,055 (4,75)***	
PRIVY				-0,0031 (-0,196)
RESERVES	-0,036 (-2,54)**	-0,016 (-1,08)	-0,013 (-0,87)	-0,036 (-2,48)***
H	49,75***	58,26***	44,19***	56.46***
Q	4,12***	4,38***	3,92***	4,00***
Adj R^2	0.14	0.19	0,21	0.14
LM	2976***	3131***	2859***	2975***
N	215	210	215	215

Table is read through column. So the explanatory variables in the first regression (Eq.1) are LnGDPI, LnGPOP, INF, OPEN, DEBTH and RESERVES.
Numbers in parenthesis are t ratios. N is the number of observations. H and Q are Hausman and Fisher statistics respectively. LM stands for Lagrange Multiplier statistic. Adj R^2 is adjusted coefficient of determination.
*coefficients or statistics are significant at α=0.10 level of significance. ** coefficients or statistics are significant at α=0.05 level of significance. *** coefficients or statistics are significant at α=0.01 level of significance. The other coefficients or statistics are insignificant.
Due to unavailability of data on BANK ratio, Indonesia was excluded from the sample in Eq.2.

Table 2: Pearson Correlation Coefficients for Pre-reform Period

N=420	RESERVES	DEPTH	BANK	PRIVATE	PRIVY
GRWTH	-0.011 (0.81)	-0.00045 (0.99)	0.041 (0.39)	0.047 (0.33)	0.019 (0.68)

Note: Numbers in parenthesis are probabilities. N is the number of observations.

Thus, the hypothesis of conditional convergence may be true. The coefficients on the population growth rate (LnGPOP) are unexpectedly positive and insignificant. As expected, the coefficients associated with the inflation rate (INF) are negative but insignificant. The openness (OPEN) of economy has also expected positive coefficients implying that trade liberalisation is beneficial to economic growth.

The indicator of financial repression (RESERVES) has anticipated negative and significant coefficients implying the harmful effects of financial repression policies on economic growth. As shown in table 1, even if the growth equation is controlled for inflation rate, the influence of financial repression on economic growth remains significantly negative. In this respect, this result differs from Stiglitz's suggestion that the harmful effect of financial repression on economic growth will be mitigated, if the inflation rate is used with the financial repression indicators in the same regression.

With regards to the coefficients of financial development indicators, the variables BANK and PRIVATE have positive and significant coefficients while the variables DEPTH and PRIVY have positive and statistically insignificant coefficients. Contrary to the results obtained by earlier studies, this result does not necessarily indicate that the financial development has positive and significant influence on economic growth. In order to explain this paradoxical result, Berthelemy and Varoudakis make two hypotheses, one of which supposes that "the implementation of financial reforms may affect the efficiency of financial system and thus contribute to economic growth". To test this hypothesis, we isolate the effect of financial development on economic growth over ten years before and after the implementation of financial reforms.

III. Financial Reform and Economic Growth

According to McKinnon's (1973) and Shaw's (1973) financial liberalisation hypothesis, interest rate and credit ceiling, allocation of credit to preferred sectors, high reserve requirement, controls on capital movements are likely to decrease saving rate and prevent channelling of funds to more productive investment projects. Thus, during the financial repression period, the financial indicators would be negatively related to economic growth. For instance, an increase in DEPTH ratio may not necessarily represent the development of financial sector, if the government issues money in order to augment inflation tax base. Similarly, the augmentation of BANK, PRIVATE and PRIVY may cause simply an increase in the part of credit allocated to favoured and/or public enterprises. Finally, an increase in financial development ratios would have a negative influence on volume and efficiency of investment and thus lower economic growth.

Berthelemy and Varoudakis say that "The size of financial sector could not be a determinant of the economic growth as long as financial sector is repressed. Only after the liberalisation of financial sector does financial development affect positively economic growth" (Berthelemy and Varoudakis, 1996).

The correlations between economic growth and financial indicators are illustrated in table 2. They are all insignificant and support Berthelemy and Varoudakis' view. However, Pearson correlation coefficients may not be sufficient to explain the relations between economic growth and financial development. To do so, we need more sophisticated techniques. Thus using regression analysis we would estimate model (1) for the before and after financial reforms.

3.1. Financial Development and Economic Growth During Financial Repression Period

Following Johnston and Pazarbaşıoğlu (1995), the beginning of financial reforms is identified with the elimination of credit and interest rate ceilings. The reform period is identified with the ten years following the start date of the reforms and the pre- reform period is identified with the ten years preceding the start of financial sector reforms[15]. For instance, for Turkey the reform period covers 1985-1989. Thus the pre-reform period includes 1975-1984. Unlike the earlier studies, which reduced pre-reform period to five years, we use ten years interval period in order to increase the quality of estimations. In summary, we divide our initial sample following the stages of the financial reform process, namely pre-reform and post-reform period. Some arrangements are needed to estimate model (1) for pre-reform period: Since we estimate the model (1) for the pre-reform period (for ten reform years only), we have to use annual data rather than quinquennial data. Since the annual data do not allow us to observe convergence of real per capita income across countries, the real per capita GDP is excluded from the model.

After these arrangements, the model (1) can be written as follows:

$$GRWTH_{i,t} = Constant + \beta GPOP_{i,t} + \eta L_{i,t} + \lambda FIN_{i,t} + \; + \; u_{i,t} \qquad (2)$$

[15] The date of financial sector reforms is provided in appendix 1.

where $u_{i,t} = \alpha_i + \varepsilon_{i,t}$

In model (2), the term GRWTH stands for economic growth rate. GPOP is the population growth rate. The L matrix of explanatory variables includes the degree of openness (OPEN) and the inflation rate (INF). The matrix FIN is also matrix of financial variables, which contains DEPTH, BANK, PRIVATE, PRIVY and RESERVES. The component ε_i is the random disturbance characterising the ith observation and it is constant through time. Other component α_i stands for unobservable specific country effects.

Fisher (Q) and Hausman (H) statistics are given on table 3. The tests results show that there are specific country effects and these effects are random for each country. Thus, model (2) is estimated by Feasible Generalised Least Squares (FGLS) method. The estimation of model (2) by FGLS provides consistent estimators (Matyas and Sevestre, 1996).

The estimation results are shown on table 3. As can be seen, the degree of openness (OPEN) is negatively related to economic growth and this relation is significant at 0.10 level. This finding can be explained by the restrictions imposed on foreign trade during the financial repression period. In general, the financial and trade liberalisation are followed each other.

The financial indicators have "expected" signs for pre-reform period. The ratio RESERVES is negatively related to economic growth which shows that the excess reserves of commercial bank may be harmful for economic growth. But, the coefficients of this variable are insignificant except for equation five. The financial development indicators do not seem to be significantly related to economic growth, implying that during the financial repression period, the financial sector development represented through DEPTH, BANK, PRIVATE and PRIVY ratios does not have any beneficial effect on economic growth. This result confirms earlier empirical studies implemented by Berthelemy and Varoudakis (1996), Johnston and Pazarbaşıoğlu (1995), De Gregorio and Guidotti (1995) on the effect of financial sector development on economic growth during the financial repression period (or in the countries where financial sector is repressed).

Table 3: Dependent Variable: GRWTH Pre-Reform Period

Explanatory variables	Eq.5	Eq.6	Eq.7	Eq.8
GPOP	-3,29 (-2,49)***	-2,49 (-2,01)**	-2,49 (-2,47)***	-2,38 (-1,83)*
OPEN	-0,059 (-0,92)	-0,10 (-1,84)*	-0,094 (-1,74)*	-0,10 (-1,79)*
INF	-0,0076 (-1,95)**	-0,0069 (-1,76)*	-0,0069 (-1,77)*	-0,0072 (-1,85)*
DEPTH	-0,097 (-1,20)			
BANK		0,049 (0,58)		
PRIVATE			0,043 (0,61)	
PRIVY				0,029 (0,372)
RESERVES	-0,098 (-1,94)**	-0,064 (-1,40)	-0,064 (-1,37)	-0,066 (-1,41)
CONSTANT	0.072 (2.23)**	0.028 (0.63)	0.04 (1.05)	0.063 (2.041)**
H	9,10*	9,14*	9,23*	8,69*
Q	2,89***	2,80***	2,79***	2,82***
Adj R^2	0.21	0.24	0.23	0.21
LM	425239***	425783***	427775***	427780***
N	420	420	420	420

Note: Table is read through column. The explanatory variables are GPOP, OPEN, INF, DEBTH (BANK, PRIVATE, PRIVY) and RESERVES. Numbers in parenthesis are t ratios. N is the number of observations. H and Q are Hausman and Fisher statistics respectively. LM stands for Lagrange Multiplier statistic. Adj R^2 is adjusted coefficient of determination.

*coefficients or statistics are significant at α=0.10 level of significance. ** coefficients or statistics are significant at α=0.05 level of significance. *** coefficients or statistics are significant at α=0.01 level of significance. The other coefficients or statistics are insignificant.

Table 4: Pearson Correlation Coefficients for Pre-reform Period

N=430	RESERVES	DEPTH	BANK	PRIVATE	PRIVY
GRWTH	-0.10 (0.03)	0.22 (0.0001)	0.19 (0.0001)	0.10 (0.02)	0.13 (0.007)

Note: Numbers in parenthesis are probabilities. N is the number of observations.

In summary, our finding in this section is that during the financial repression period, financial sector development would not have any positive influence on economic growth. In the next section, we discuss the relationships between financial sector development and economic growth after the implementation of the financial reforms.

3.2. Financial Development and Economic Growth after Financial Liberalisation

The results reported in the previous section show that, financial sector development represented by DEPTH, BANK, PRIVATE and PRIVY ratios would not have a positive and significant influence on economic growth as long as financial sector is systematically repressed by government policies.

This section examines empirically the effect of financial sector development on economic growth after the implementation of financial reforms. The empirical study carried out in this section includes 43 reformist countries and ten years period following the start date of financial reforms. For example, for Turkey the post-reform period covers 1985-1994. Before the regression analysis, the correlations between economic growth and financial indicators are shown on table 4. The results indicate that economic growth is positively and significantly related to financial development and it is negatively and significantly related to financial repression indicator (RESERVES). Since the correlation analysis is not enough to reveal the relationships between economic growth and financial development we turn now to regression analysis.

In view of the availability of the data for the post-reform period, we introduced real interest rate (RINT) into model (2) and for this period we excluded RESERVES from model because of insignificant coefficients associated with this variable.[16] Real interest rate is defined as nominal deposit rate less the inflation rate. It is introduced to take into account the impact of real interest rate on the cost of capital and the volume of saving on economic growth[17].

[16] We had introduced also foreign direct investment into model for post-reform period. By transferring new technology, the foreign direct investment may increase the efficiency of investment and thus growth rate (Reisen, 1998, Welfers and Wolf, 1997). But as we can see in appendix 3, the coefficients of that variable (FDI) are all insignificant.

[17] To avoid multicollinearity problem between real interest rate and inflation we carried out the estimations separately.

Theoretically, higher equilibrium real interest rate should be associated with more efficient investment, higher rate of return on capital, higher savings and growth (Pill and Pradhan, 1997). Hence we can expect a positive relationship between real interest rate and growth. However as noted by Greenwald, Stiglitz and Weiss (1984), very high real interest rate may also cause adverse selection and moral hazard problems and result in rationing of credit. In this case, the coefficient associated with RINT may be negative.

As in the previous section, we estimate model (2) by feasible generalised least squares (FGLS) method. Fisher (Q) and Hausman (H) statistics reported on table 5-6 justify our using of this estimation method.

As can be seen from table 5 and 6, the coefficients associated with the population growth rate are negative and statistically significant. This finding supports the economic growth theories, which relate the population growth negatively to economic growth. The degree of openness of economy (OPEN) is positively and significantly related to economic growth after the financial reform period. This is an expected result. As we mentioned above, the trade liberalisation and financial liberalisation period follow each other. With regards to the coefficients on real interest rate (RINT), they are all positive as expected but their significance level is very low. This can be explained by the fact that along with the implementation of financial reform, the interest rate increases and excess demand for loans therefore decreases. An increase in real interest rate may raise the supply of loanable funds and thus the volume of investment. However if the interest rate increases continuously, the cost of the capital also increases and demand for loans falls. This causes in turn a decrease in the volume and the efficiency of investment.

Table 5: Dependent Variable: GRWTH Post-Reform Period

Explanatory variables	Eq.9	Eq.10	Eq.11	Eq.12
LnGPOP	-0,0013 (-1,87)*	-0,0012 (-1,80)*	-0,0015 (-2,24)**	-0,0015 (-2,19)***
RINT	0,00027 (1,50)	0,00026 (1,43)	0,00033 (1,80)*	0,00029 (1,65)*
OPEN	0,020 (1,90)**	0,022 (1,97)**	0,022 (1,96)**	0,023 (2,02)***
DEPTH	0,017 (1,93)**			
BANK		0,035 (2,84)***		
PRIVATE			0,011 (1,50)	
PRIVY				0,00079 (0,084)
CONSTANT	-0,0057 (-0.84)	-0,0025 (-2,27)**	-0,0086 (-0,96)	0,00042 (-0,060)
H	6,25	6,21	4,65	4,31
Q	2.88***	3.09***	3.01***	3.08**
Adj R^2	0.25	0.24	0.24	0.23
LM	45427***	44626***	45426***	45970***
N	430	430	430	430

Note: Table is read through column. The explanatory variables are LnGPOP, RINT, OPEN, DEBTH (BANK, PRIVATE, PRIVY). Numbers in parenthesis are t ratios. N is the number of observations. H and Q are Hausman and Fisher statistics respectively. LM stands for Lagrange Multiplier statistic. Adj R^2 is adjusted coefficient of determination.
* coefficients or statistics are significant at α=0.10 level of significance. ** coefficients or statistics are significant at α=0.05 level of significance. *** coefficients or statistics are significant at α=0.01 level of significance. The other coefficients or statistics are insignificant.

Table 6: Dependent Variable: GRWTH Post-Reform Period

Explanatory variables	Eq.13	Eq.14	Eq.15	Eq.16
OPEN	0,023 (2,10)**	0,024 (2,13)**	0,024 (2,16)**	0,025 (2,25)**
DEPTH	0,016 (1,81)*			
BANK		0,035 (2,46)***		
PRIVATE			0,013 (1,59)*	
PRIVY				-0,00033 (-0,036)
INF	-0,00068 (-2,77)***	-0,00061 (-2,47)**	-0,00078 (-3,13)***	-0,00072 (-2.92)***
LnGPOP	-0,0012 (-1,84)*	-0,0012 (-1,80)*	-0.0013 (-1.83)*	-0,0015 (-2,13)***
CONSTANT	-0,0053 (-0.77)	-0,022 (-2,00)**	-0,0095 (-1,06)	-0,00026 (-0,038)
H	4,14	4,61	2,73	2,79
Q	2.85***	3,06***	2,96***	3,03***
Adj R^2	0.26	0.25	0.25	0.25
LM	46566***	45413***	46462***	47080***
N	430	430	430	430

Note: Table is read through column. The explanatory variables are LnGPOP OPEN DEBTH (BANK, PRIVATE, PRIVY) and INF. Numbers in parenthesis are t ratios. N is the number of observations. H and Q are Hausman and Fisher statistics respectively. LM stands for Lagrange Multiplier statistic. Adj R^2 is adjusted coefficient of determination.
*coefficients or statistics are significant at α=0.10 level of significance. ** coefficients or statistics are significant at α=0.05 level of significance. *** coefficients or statistics are significant at α=0.01 level of significance. The other coefficients or statistics are insignificant.

The negative and significant coefficients on the inflation rate are seen from table 6. As in the pre-reform period, the inflation rate affects negatively economic growth in post-reform period.

The coefficients of two financial indicators DEPTH and BANK are positive and highly significant. The coefficients associated with the variable PRIVATE are significant only at 0.10 level, while those associated with PRIVY are statistically insignificant. These results show that after the implementation of the financial reforms, an increase in financial depth (DEPTH) and banking sector development (BANK) contribute to economic growth. These findings are also confirmed by the results on presented on the tables 7 and 8, which indicate that the average financial ratios of post-reform period for developed and developing countries are higher than those of pre-reform period. Hence if we consider only two financial indicators, (DEPTH and BANK) the hypothesis that "the implementation of financial reforms may affect the efficiency of financial system and thus its contribution to economic growth" may be true. Meanwhile, the other two financial ratios (PRIVATE and PRIVY) being insignificant may not be surprising. This is because, the two indicators measure only credit volumes and do not inform us how the credits are used. It should be noted that because of the absence of an efficient financial control and surveillance system in most of the countries, that undertook financial reforms, the credits are issued for corporation banks, construction industry and luxury consumption. Especially, in the countries where deposit insurances are available, the banks issued credits to the corporations with close ties and declared those credits as irrecoverable. Moreover, in the framework of structural adjustment policies, the fixed exchange rate regime is adopted or the evaluation of national money is anchored to a strong currency such as US dollars. After the liberalisation of capital movement, capital inflows have increased in most of the Asian and Latin America countries. As a result, currencies in these countries have appreciated in real terms and the banks wanted to benefit from the difference between domestic and foreign interest rate by borrowing loans from international market in foreign currency and lending them in national market. Then, transfer of the credits to the corporations with close-ties, luxury consumption and unproductive investment projects caused the increase of bad and irrecoverable credits ratios. Because of over-valued currencies, in many countries, the degree of international competitiveness decreased which caused exports to decline and imports to increase. Finally, this entailed the increase of the current account deficit, which was unsustainable and, led most of the countries to financial crisis. Argentina, Philippines, Finland, Ghana, Israel, Norway, Chile, Thailand, Uruguay and Venezuela suffered from a severe financial crisis. The insignificant coefficients of PRIVATE and PRIVY may be explained by those factors.

The table 7 and 8 present average financial ratios and economic growth rate of pre-reform and post-reform for developed and developing countries. As can be seen from the tables, the average growth rate of pre-reform period for developed and developing countries are 6 points higher than those of post-reform period. This result occurred despite the fact that the financial ratios PRIVATE and PRIVY for post-reform period are on average higher than those for pre-reform period.

Table 7: Averages of Economic Growth and Financial Ratios for Developing Countries

	GRWTH	DEPTH	BANK	PRIVATE	PRIVY
Pre-Reform Period	0.022	0.31	0.60	0.57	0.21
Post-Reform Period	0.016	0.38	0.71	0.71	0.28

Source: Author's calculations.

Table 8: Averages of Economic Growth and Financial Ratios for Developed Countries

	GRWTH	DEPTH	BANK	PRIVATE	PRIVY
Pre-Reform Period	0.025	0.59	0.87	0.73	0.52
Post-Reform Period	0.022	0.64	0.92	0.78	0.63

Source: Author's calculations.

IV. Conclusion and Recommendations

In this study, we have analysed the effects of financial development on economic growth before and after the implementation of financial reform by using panel data estimation methods. Our initial estimations on panel data, which include 43 countries and cover five years interval period from 1970 to 1994, have provided contradictory results. That is, the significance of financial development indicators varies substantially with the financial indicator used in the regressions. This unexpected result may arise from taking into account the time dimension of data in panel data regressions (Berthelemy and Varoudakis,1996). Therefore, cross-sectional data basis studies might lead to misleading results.

In order to explain the variation of the effect of financial development on economic growth over time, we have made the hypothesis that financial reforms that increase the efficiency of financial sector and thereby the quantity and quality of investment stimulate economic growth. To test this hypothesis we examined the effects of financial development before and after financial reforms.

Our empirical finding related to pre reform period (i.e financial repression period) shows that financial development does not affect significantly economic growth. The insignificant effect of financial development on growth would be explained by financial repression policies undertaken during this period. For instance, interest rate ceiling would reduce the amount of deposit collected by commercial banks. High reserve requirement ratio, and discount rate may decrease the volume of available funds for banks. As a result, some investment projects may not be undertaken due to the lack of credit.

The estimation results concerning the post-reform period indicate that the increase of the financial sector part in overall economy and the development of banking sector contribute significantly to economic growth. The estimation results also show that undertaking financial reforms does not guarantee for higher economic growth rate. Especially, if the resources are utilised inappropriately, the volume and efficiency of investment projects may be negatively affected. This argument is confirmed by the insignificant financial ratios and lower economic growth rate for post-reform period. The increase in credit volume may not be a good indicator of financial development. What is important is to allocate credit to more efficient investment projects.

In this respect, this study suffers from the lack of indicators, which are able to indicate that in which area the credits are used and how they affect the productivity of investment. On the other hand, the model used in this study takes into account only banking sector development and does not consider stock market development. But the stock market is an important component of financial system. After the implementation of financial reforms, stock market development has accelerated in developing countries. Further studies should incorporate stock market development in their analysis.

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The ISE Review Volume: 7 No: 27 July/August/Septemper 2003
ISSN 1301-1642 © ISE 1997

GLOBAL CAPITAL MARKETS

Following the low interest rate policies in the major financial centers in the first half of 2003, international financial markets continued to improve, economic activity and corporate earnings have made a strong recovery, most noticeably in the US, but also in other parts of the world. Since mid-2003, the recovery has broadened and productivity picked up with the GDP growth in the United States exceeding 8 % in annualised terms in the third quarter of 2003. In the euro area, the GDP also grew in the third quarter of 2003 by 0.4 % and the leading indicators have continued to improve. In Japan, significant structural imbalances remain, but the growth outlook is improving. Growth expectations for the other East Asian economies have improved as well.

In parallel to increasingly rapid global recovery, equity prices have risen strongly in both mature and emerging markets; bond spreads have dropped further; particularly for high-yield corporates and emerging markets. Financial flows to the emerging markets have rebounded and global equity markets have rallied strongly.

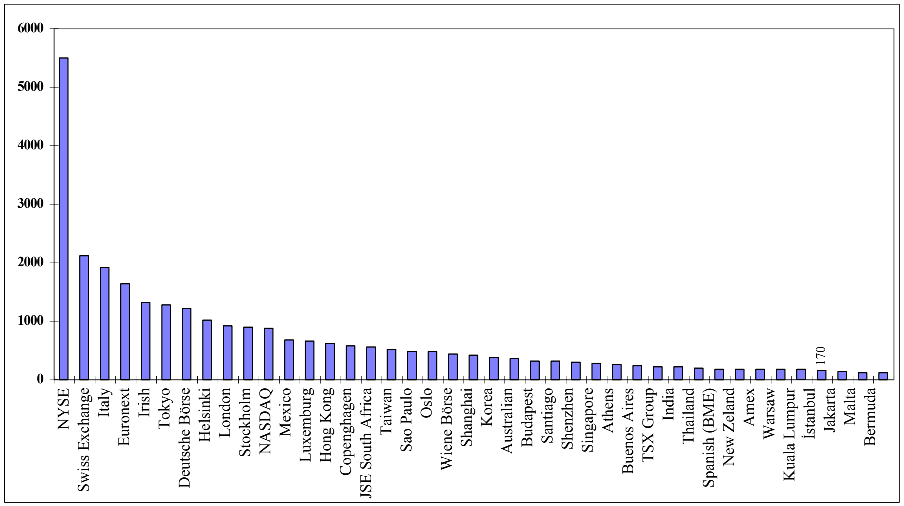
The performances of some developed stock markets with respect to indices indicated that DJIA, FTSE-100, Nikkei-225 and Xetra DAX increased by 13.5%, 9.6%, 29.5 % and 28.6% respectively at the end of September 2003 in comparison with the Dec. 31st 2002. When US$ based returns of some emerging markets are compared in the same period, the best performer markets were: Venezüella (82.4%), Argentina (81.9%), Brazil (79.3%), Thailand (73.4%), Russia (59.8%), Turkey (54.8%), Chile (54%) and Indonesia (52.2%). In the same period, the lowest return markets were: China (0.9%), Malaysia (14.1%), S.Korea (15.6%), S.Africa (18.4%) and Hungary (20.6%). The performances of emerging markets with respect to P/E ratios as of end-Sept.2003 indicated that the highest rates were obtained in Poland (123.9), Taiwan (69.5), Philippines (30.3), Indonesia (29.1), Korea (27.0) and Chile (25.3) and the lowest rates in Czech Rep.(9.0), Turkey (9.4), Brazil (9.6), S.Africa (10.4) and Hungary (11.8).

Market Capitalization (USD Million, 1986-2002)

	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

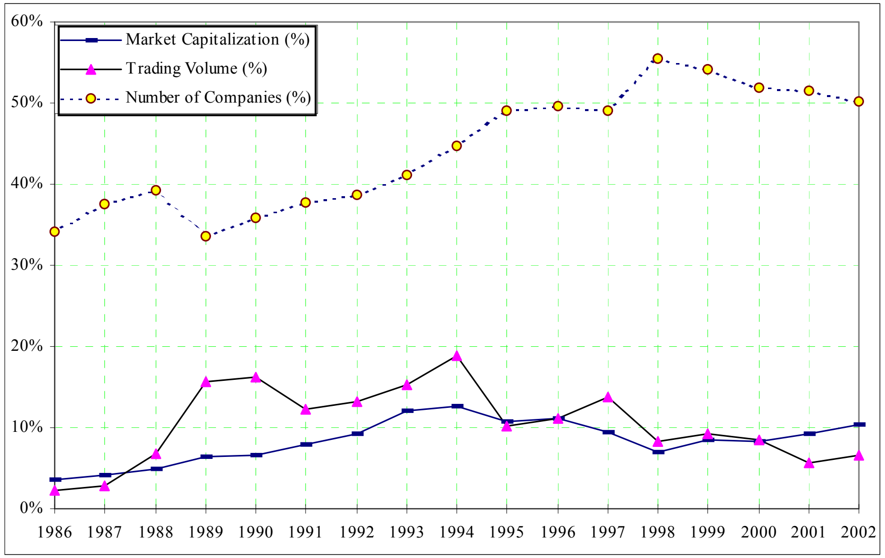
Source: Standard & Poor's Global Stock Markets Factbook, 2003.

Comparison of Average Market Capitalization Per Company (USD Million, Sept. 2003)



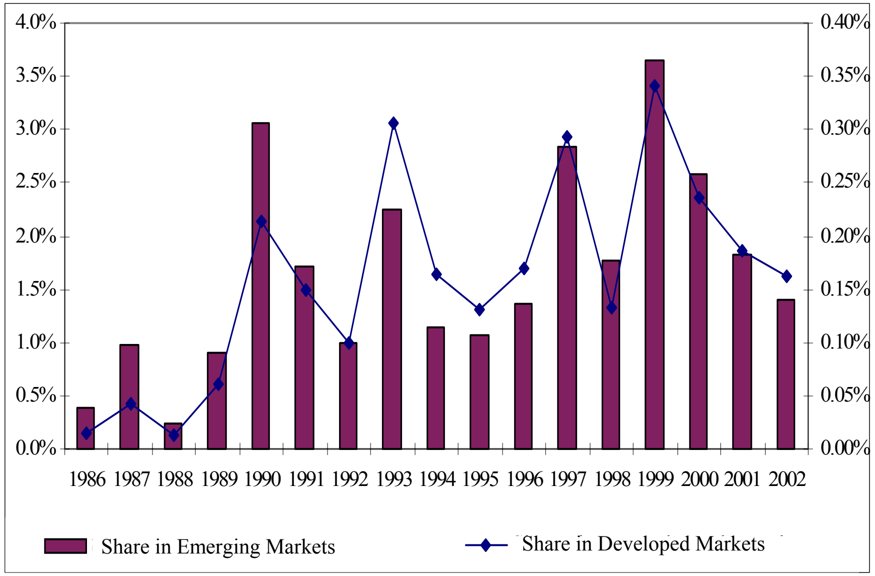
Source: FIBV, Monthly Statistics, Sept. 2003.

Worldwide Share of Emerging Capital Markets (1986-2002)



Source: Standard & Poor's Global Stock Markets Factbook, 2003.

Share of ISE's Market Capitalization in World Markets (1986-2002)



Source: Standard & Poor's Global Stock Markets Factbook, 2003.

Main Indicators of Capital Markets (Sept. 2003)

	Market	Monthly Turnover Velocity (Sept. 2003) (%)	Market	Value of Share Trading (millions, US$) Up to Year Total (2003/1-2003/9)	Market	Market Cap. of Share of Domestic Companies (millions US$) Sept. 2003
1	NASDAQ	288.04	NYSE	7,146,106	NYSE	10,119,388
2	Shenzhen	261.05	NASDAQ	5,035,144	Tokyo	2,746,471
3	Istanbul	203.69	London	2,589,129	NASDAQ	2,644,452
4	Taiwan	203.33	Tokyo	1,421,921	London	2,110,605
5	Korea	200.09	Euronext	1,405,243	Euronext	1,742,107
6	Spanish (BME)	161.70	Deutsche Börse	939,699	Deutsche Börse	841,460
7	Deutsche Börse	147.98	Spanish (BME)	662,833	TSX Group	771,224
8	India	146.86	Italy	608,579	Swiss Exchange	625,841
9	Italy	134.93	Swiss Exchange	459,748	Hong Kong	619,242
10	Helsinki	120.16	Taiwan	434,338	Spanish (BME)	578,726
11	Stockholm	116.70	Amex	423,238	Italy	523,803
12	Euronext	113.02	TSX Group	330,374	Australian	496,482
13	Shanghai	109.67	Korea	326,471	Taiwan	339,525
14	London	105.08	Bermuda	300,437	Shanghai	322,151
15	Thailand	102.20	Australian	269,921	Korea	256,154
16	Swiss Exchange	98.91	Stockholm	213,315	Stockholm	239,299
17	NYSE	92.64	Hong Kong	188,167	JSE South Africa	216,199
18	Oslo	89.64	Shanghai	184,169	Mumbai	205,346
19	Australian	79.63	India	126,428	India	185,837
20	Tokyo	78.65	Helsinki	120,501	Sao Paulo	181,735
21	TSX Group	65.87	Shenzhen	105,779	Kuala Lumpur	150,535
22	Singapore	64.44	Osaka	83,409	Shenzhen	150,010
23	Copenhagen	63.57	JSE South	72,414	Helsinki	145,911
24	Irish	63.14	Singapore	61,954	Singapore	135,535
25	Budapest	58.59	Istanbul	56,447	Mexico	108,826
26	Mumbai	57.53	Mumbai	56,165	Copenhagen	106,634
27	Hong Kong	44.63	Oslo	55,023	Athens	89,697
28	Athens	41.71	Thailand	54,621	Amex	89,011
29	New Zealand	39.31	Copenhagen	47,877	Thailand	81,456
30	Sao Paulo	36.41	Sao Paulo	44,057	Oslo	75,680
31	Jakarta	35.06	Irish	32,821	Santiago	74,446
32	JSE South Africa	35.05	Kuala Lumpur	32,216	Irish	72,166
33	Tel-Aviv	30.04	Athens	27,086	Tel-Aviv	58,421
34	Kuala Lumpur	26.76	Mexico	18,074	Istanbul	48,534
35	Warsaw	26.26	Tel-Aviv	11,867	Jakarta	47,314
36	Wiener Börse	24.87	Jakarta	9,475	Wiener Börse	46,297
37	Colombo	21.31	New Zealand	8,565	Warsaw	32,354
38	Mexico	20.30	Wiener Börse	8,000	Luxembourg	30,204
39	Tehran	18.49	Budapest	5,976	New Zealand	28,618
40	Ljubljana	15.44	Warsaw	5,895	Buenos Aires	26,278
41	Buenos Aires	10.18	Santiago	3,957	Philippine	22,171
42	Philippine	8.66	Tehran	2,641	Tehran	21,763
43	Santiago	8.42	Buenos Aires	2,010	Budapest	15,253
44	Lima	8.23	Philippine	1,403	Lima	12,609
45	Osaka	7.26	Lima	857	Ljubljana	5,792

Source: FIBV, Monthly Statistics, Sept. 2003.

Trading Volume (USD millions, 1986-2002)

	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

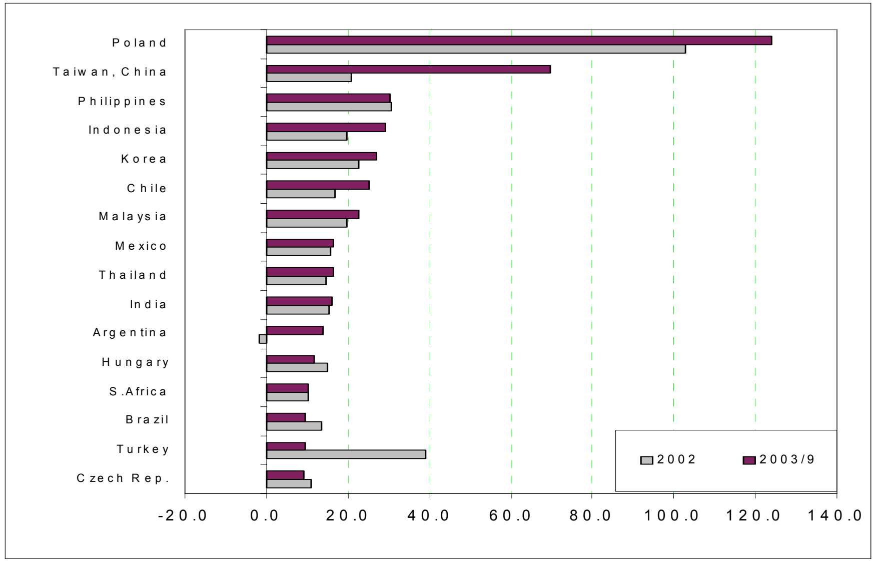
Source: Standard & Poor's Global Stock Markets Factbook, 2003.

Number of Trading Companies (1986-2002)

	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	5,937	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

Source: Standard & Poor's Global Stock Markets Factbook, 2003.

Comparison of P/E Ratios Performances



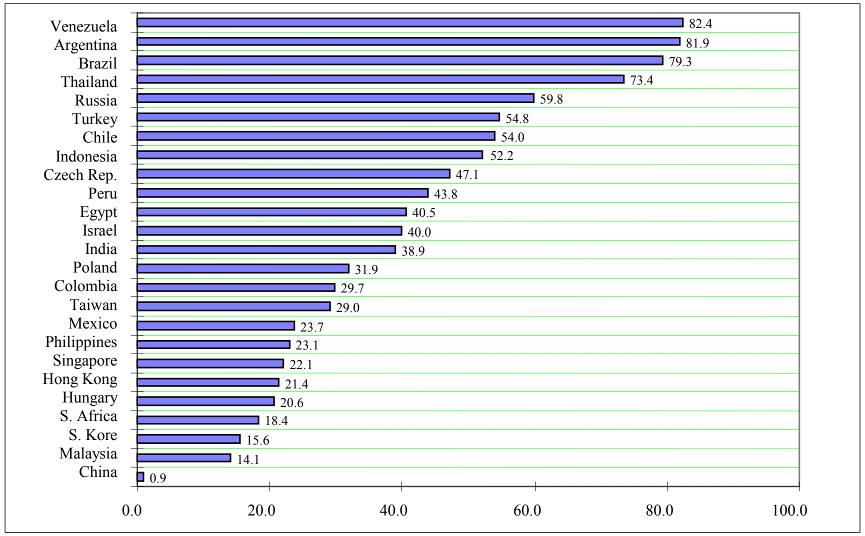
Source: IFC Factbook 2001. Standard & Poor's, Emerging Stock Markets Review, Sept. 2003.

Price-Earnings Ratios in Emerging Markets

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003/9
Argentina	17.7	15.0	38.2	17.1	13.4	39.0	293.3	38.4	-1.7	14.0
Brazil	13.1	36.3	14.5	15.4	7.0	25.1	11.7	8.9	13.7	9.6
Chile	21.4	17.1	27.8	15.9	15.1	37.7	31.8	17.1	16.8	25.3
Czech Rep.	16.3	11.2	17.6	8.8	-11.3	-14.8	21.0	5.6	11.1	9.0
Hungary	-55.3	12.0	17.5	25.2	17.0	18.2	14.3	13.3	15.0	11.8
India	26.7	14.2	12.3	16.8	13.5	22.0	14.8	12.3	15.4	16.1
Indonesia	20.2	19.8	21.6	11.2	-106.2	-10.5	-6.5	-14.1	19.8	29.1
Korea	34.5	19.8	11.7	11.6	-47.1	-27.7	19.3	24.9	22.7	27.0
Malaysia	29.0	25.1	27.1	13.5	21.1	-19.1	71.7	53.2	19.6	22.8
Mexico	17.1	28.4	16.8	22.2	23.9	14.1	12.5	13.2	15.6	16.6
Philippines	30.8	19.0	20.0	12.5	15.0	24.0	28.2	28.4	30.6	30.3
Poland	12.9	7.0	14.3	10.3	10.7	22.0	19.4	6.0	103.0	123.9
S.Africa	21.3	18.8	16.3	12.1	10.1	17.4	10.7	11.7	10.2	10.4
Taiwan, China	36.8	21.4	28.2	32.4	21.7	49.2	13.7	28.5	20.9	69.5
Thailand	21.2	21.7	13.1	4.8	-3.7	-14.5	-12.4	47.3	14.5	16.5
Turkey	31.0	8.4	10.7	18.9	7.8	33.8	15.2	69.5	39.1	9.4

Source: IFC Factbook, 2001; Standard&Poor's, Emerging Stock Markets Review, Sept. 2003.
Note: Figures are taken from IFC Investable Index Profile.

Comparison of Market Returns in USD (31/12/2002-1/10/2003)



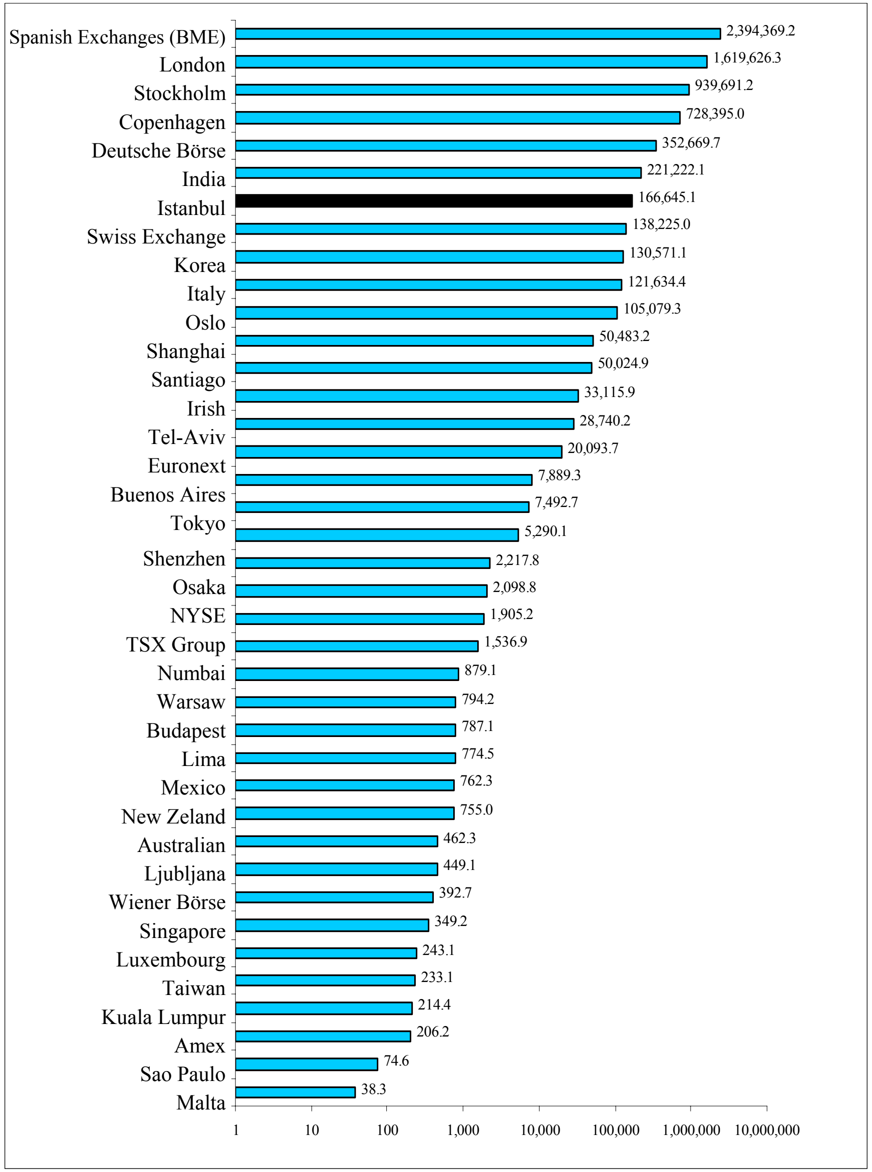
Source: The Economist, Sept. 4th 2003.

Market Value/Book Value Ratios (1994-2003/9)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003/9
Argentina	1.4	1.3	1.6	1.8	1.3	1.5	1.0	0.6	0.9	1.7
Brazil	0.6	0.5	0.7	1.1	0.6	1.6	1.4	1.2	1.3	1.4
Chile	2.5	2.1	1.6	1.6	1.1	1.8	1.5	1.4	1.4	1.7
Czech Rep.	1.0	0.9	0.9	0.8	0.7	1.2	1.2	0.8	0.8	0.9
Hungary	1.7	1.2	2.0	3.7	3.2	3.6	2.5	1.8	2.0	2.0
India	4.2	2.3	2.1	2.7	1.9	3.1	2.5	2.0	2.6	3.0
Indonesia	2.4	2.3	2.7	1.5	1.6	2.9	1.6	1.9	1.0	1.4
Korea	1.6	1.3	0.8	0.6	0.9	2.0	0.8	1.3	1.1	1.3
Malaysia	3.8	3.3	3.8	1.8	1.3	1.9	1.5	1.3	1.4	1.6
Mexico	2.2	1.7	1.7	2.5	1.4	2.2	1.7	1.7	1.6	1.9
Philippines	4.5	3.2	3.1	1.7	1.3	1.5	1.2	1.1	0.9	1.2
Poland	2.3	1.3	2.6	1.6	1.5	2.0	2.2	1.4	1.3	1.5
S.Africa	2.6	2.5	2.3	1.9	1.5	2.7	2.1	2.1	1.9	1.8
Taiwan, China	4.4	2.7	3.3	3.8	2.6	3.3	1.7	2.1	1.7	2.1
Thailand	3.7	3.3	1.8	0.8	1.2	2.6	1.6	1.6	1.7	2.3
Turkey	6.3	2.7	4.0	9.2	2.7	8.8	3.1	3.8	2.8	1.9

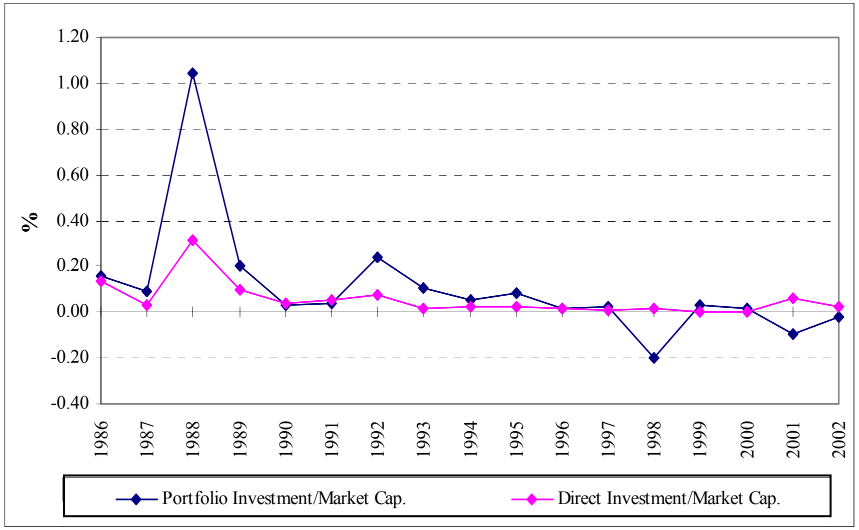
Source: IFC Factbook, 1996-2001; Standard & Poor's, Emerging Stock Markets Review, Sept. 2003.
Note: Figures are taken from IFC Investable Index Profile.

Value of Bond Trading (Million USD Jan. 2003-Sept. 2003)



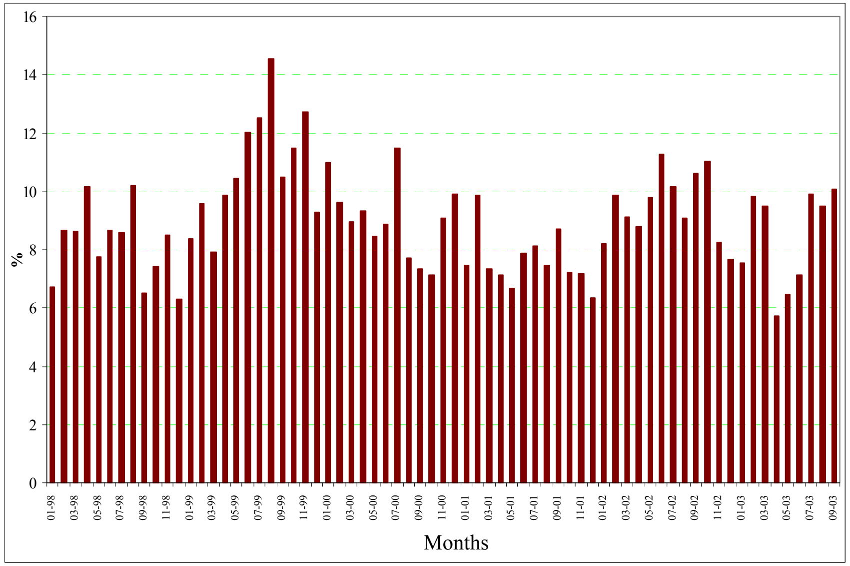
Source: FIBV, Monthly Statistics, Sept. 2003.

Foreign Investments as a Percentage of Market Capitalization in Turkey (1986-2002)



Source: ISE Data. CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE (Jan. 98-Sept. 2003)



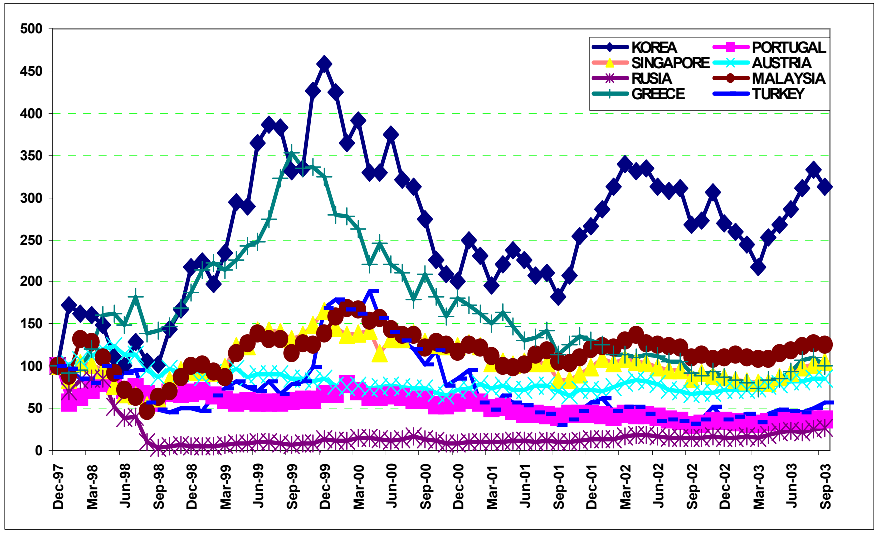
Source: ISE Data.

Price Correlations of the ISE (Sept. 1998- Sept. 2003)

Source : Standard & Poor's, Emerging Stock Markets Review, Sept. 2003.

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. For monthly return index correlations (IFCI) see. IFC. Monthly Review. Oct. 1999.

Comparison of Market Indices (31 Dec 97=100)



Source: Reuters.

Note: Comparisons are in US$.

The ISE Review Year: 7 No: 27 July/August/Septemper 2003
ISSN 1301-1642 © ISE 1997

ISE
Market Indicators

STOCK MARKET

	Number of Companies	Traded Value				Market Value		Dividend Yield	P/E Ratios		
		Total		Daily Average							
		(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)	(%)	TL(1)	TL(2)	US$
1986	80	9	13	---	---	709	938	9,15	5,07	---	---
1987	82	105	118	---	---	3.182	3.125	2,82	15,86	---	---
1988	79	149	115	1	---	2.048	1.128	10,48	4,97	---	---
1989	76	1.736	773	7	3	15.553	6.756	3,44	15,74	---	---
1990	110	15.313	5.854	62	24	55.238	18.737	2,62	23,97	---	---
1991	134	35.487	8.502	144	34	78.907	15.564	3,95	15,88	---	---
1992	145	56.339	8.567	224	34	84.809	9.922	6,43	11,39	---	---
1993	160	255.222	21.770	1.037	88	546.316	37.824	1,65	25,75	20,72	14,86
1994	176	650.864	23.203	2.573	92	836.118	21.785	2,78	24,83	16,70	10,97
1995	205	2.374.055	52.357	9.458	209	1.264.998	20.782	3,56	9,23	7,67	5,48
1996	228	3.031.185	37.737	12.272	153	3.275.038	30.797	2,87	12,15	10,86	7,72
1997	258	9.048.721	58.104	35.908	231	12.654.308	61.879	1,56	24,39	19,45	13,28
1998	277	18.029.967	70.396	72.701	284	10.611.820	33.975	3,37	8,84	8,11	6,36
1999	285	36.877.335	84.034	156.260	356	61.137.073	114.271	0,72	37,52	34,08	24,95
2000	315	111.165.396	181.934	451.892	740	46.692.373	69.507	1,29	16,82	16,11	14,05
2001	310	93.118.834	80.400	375.479	324	68.603.041	47.689	0,95	108,33	824,42	411,64
2002	288	106.302.343	70.756	421.835	281	56.370.247	34.402	1,20	195,92	26,98	23,78
2003	299	84.025.871	56.290	449.336	301	67.656.841	48.906	1,33	10,32	10,23	11,46
2003/Q1	299	22.156.660	13.487	382.011	233	51.935.078	30.570	2,41	11,35	11,38	10,31
2003/Q2	299	31.663.876	20.926	502.601	332	58.035.612	41.258	1,53	12,84	14,24	16,73
2003/Q3	299	30.205.334	21.878	457.657	331	67.656.841	48.906	1,33	10,32	10,23	11,46

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 pursuant to the decision of the ISE Executive Council are not included in the calculations.

Closing Values of the ISE Price Indices

	TL 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 (June, 30,2000=14.466,12)
1986	1,71	---	---	---	---
1987	6,73	---	---	---	---
1988	3,74	---	---	---	---
1989	22,18	---	---	---	---
1990	32,56	32,56	---	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	1.046,00	914,47	---
1997	3.451,--	2.660,--	3.593,--	4.522,--	---
1998	2.597,91	1.943,67	3.697,10	3.269,58	---
1999	15.208,78	9.945,75	13.194,40	21.180,77	---
2000	9.437,21	6.954,99	7.224,01	12.837,92	10.586,58
2001	13.782,76	11.413,44	9.261,82	18.234,65	9.236,16
2002	10.369,92	9.888,71	6.897,30	12.902,34	7.260,84
2003	13.055,90	12.474,24	7.472,10	16.732,78	6.288,67
2003/Q1	9.475,09	9.692,32	6.333,52	11.221,19	6.220,19
2003/Q2	10.884,43	10.944,97	7.128,17	13.159,34	5.642,86
2003/Q3	13.055,90	12.474,24	7.472,10	16.732,78	6.288,67

	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 (June 30,2000=1.360,92)	NATIONAL-100 (Dec.31, 98=484)
1986	131,53	---	---	---	---	---
1987	384,57	---	---	---	---	---
1988	119,82	---	---	---	---	---
1989	560,57	---	---	---	---	---
1990	642,63	642,63	---	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	572,00	500,40	---	---
1997	981,99	756,91	1.022,40	1.286,75	---	---
1998	484,01	362,12	688,79	609,14	---	484,01
1999	1.654,17	1.081,74	1.435,08	2.303,71	---	1.912,46
2000	817,49	602,47	625,78	1.112,08	917,06	1.045,57
2001	557,52	461,68	374,65	737,61	373,61	741,24
2002	368,26	351,17	244,94	458,20	257,85	411,72
2003	549,18	524,71	314,30	703,84	264,52	551,67
2003/Q1	324,55	331,99	216,94	384,35	213,06	349,47
2003/Q2	450,27	452,77	294,88	544,38	233,43	461,53
2003/Q3	549,18	524,71	314,30	703,84	264,52	551,67

Q: Quarter

BONDS AND BILLS MARKET

Traded Value

Outright Purchases and Sales Market

	Total		Daily Average	
	(TL Billion)	*(US$ Million)*	*(TL Billion)*	*(US$ Million)*
1991	1.476	312	11	2
1992	17.977	2.406	72	10
1993	122.858	10.728	499	44
1994	269.992	8.832	1.067	35
1995	739.942	16.509	2.936	66
1996	2.710.973	32.737	10.758	130
1997	5.503.632	35.472	21.840	141
1998	17.995.993	68.399	71.984	274
1999	35.430.078	83.842	142.863	338
2000	166.336.480	262.941	662.695	1.048
2001	39.776.813	37.297	159.107	149
2002	102.094.613	67.256	403.536	266
2003	143.893.363	96.270	765.390	512
2003/Q1	43.293.698	26.339	733.791	446
2003/Q2	45.167.173	29.970	716.939	476
2003/Q3	55.432.492	39.961	839.886	605

Repo-Reverse Repo Market

	Total		Daily Average	
	(TL Billion)	*(US$ Million)*	*(TL Billion)*	*(US$ Million)*
1993	59.009	4.794	276	22
1994	756.683	23.704	2.991	94
1995	5.781.776	123.254	22.944	489
1996	18.340.459	221.405	72.780	879
1997	58.192.071	374.384	230.921	1.486
1998	97.278.476	372.201	389.114	1.489
1999	250.723.656	589.267	1.010.982	2.376
2000	554.121.078	886.732	2.207.654	3.533
2001	696.338.553	627.244	2.774.257	2.499
2002	736.425.706	480.725	2.910.774	1.900
2003	710.108.826	471.741	3.777.175	2.509
2003/Q1	246.706.151	149.719	4.181.460	2.538
2003/Q2	209.800.659	139.064	3.330.169	2.207
2003/Q3	253.602.016	182.958	3.842.455	2.772

Q: Quarter

ISE GDS Price Indices (December 25-29, 1995 = 100)

	TL Based			
	30 Days	**91 Days**	**182 Days**	**General**
1996	103,41	110,73	121,71	110,52
1997	102,68	108,76	118,48	110,77
1998	103,57	110,54	119,64	110,26
1999	107,70	123,26	144,12	125,47
2000	104,84	117,12	140,81	126,95
2001	106,32	119,29	137,51	116,37
2002	107,18	122,57	145,86	121,87
2003	107,90	125,80	155,73	129,83
2003/Q1	107,03	121,75	143,06	117,23
2003/Q2	107,69	124,29	149,64	126,24
2003/Q3	107,90	125,80	155,73	129,83

ISE GDS Performance Indices (December 25-29, 1995 = 100)

	TL Based		
	30 Days	**91 Days**	**182 Days**
1996	222,52	240,92	262,20
1997	441,25	474,75	525,17
1998	812,81	897,19	983,16
1999	1.372,71	1.576,80	1.928,63
2000	1.835,26	2.020,94	2.538,65
2001	2.877,36	3.317,33	3.985,20
2002	3.718,40	4.667,82	6.241,47
2003	4.309,29	5.674,07	8.148,61
2003/Q1	3.930,32	4.989,31	6.837,34
2003/Q2	4.126,59	5.373,74	7.364,16
2003/Q3	4.309,29	5.674,07	8.148,61
	US $ Based		
1996	122,84	132,99	144,74
1997	127,67	137,36	151,95
1998	153,97	169,96	186,24
1999	151,03	173,47	212,18
2000	148,86	169,79	231,28
2001	118,09	136,14	163,55
2002	134,27	168,55	225,37
2003	184,31	242,68	348,51
2003/Q1	136,88	173,06	238,13
2003/Q2	173,57	226,03	309,75
2003/Q3	184,31	242,68	348,51

Q: Quarter

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

	TL Based				
	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)	General
2001	101,49	97,37	91,61	85,16	101,49
2002	106,91	104,87	100,57	95,00	104,62
2003	114,77	116,96	116,51	114,03	115,85
2003/Q1	105,17	101,26	95,05	87,82	100,87
2003/Q2	109,82	108,21	103,82	97,81	107,59
2003/Q3	114,77	116,96	116,51	114,03	115,85

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

	TL Based			
	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)
2001	179,24	190,48	159,05	150,00
2002	305,57	347,66	276,59	255,90
2003	427,21	521,13	409,03	404,41
2003/Q1	340,51	384,38	301,70	285,16
2003/Q2	378,28	461,45	362,19	316,80
2003/Q3	427,21	521,13	409,03	404,41
	US $ Based			
2001	7,34	7,79	6,62	6,14
2002	11,03	12,55	9,99	9,24
2003	18,27	22,29	17,49	17,30
2003/Q1	11,86	13,39	10,51	9,93
2003/Q2	15,91	19,41	15,23	13,33
2003/Q3	18,27	22,29	17,49	17,30

Q: Quarter