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INSTITUTIONAL INVESTORS AND STOCK MARKET DEVELOPMENT: A CAUSALITY STUDY

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Abstract
This article examines causality relationships between institutional investors and stock market development based on the panel data compiled from 23 OECD countries for the years 1982 through 2000. In order to test causality relationship, Sims' causality test based on Granger definition of causality was used in our study. Our empirical results provide evidence that there are statistically significant positive relationship between institutional investors and stock market development. The development of institutional investors is the Granger cause of stock market capitalization, whereas there are bi-directional causality relationship between institutional investor development and stock market liquidity. Research results support the idea that a country should promote the development of institutional investors for the establishment of well-developed securities market.

I. Introduction

The large momentum in the development of institutional investors and stock markets in the world has provoked considerable academic curiosity about the causal relationships between institutional investor development and stock markets development. Does institutional investor development lead or follow stock market development? Or are there any interactive causality between institutional investors and stock market development? Does the leading pattern in the causality change over the course of economic development? The answers to these questions bear important policy implications especially for developed and emerging economies.

In this study, we are trying to answer these questions analyzing panel data comprising 23 OECD countries with time series of 1982 through 2000. We construct an econometrical analysis that employs Sims test based on Granger's definition of causality for testing the causality relationship between institutional investor and stock market development. The remainder of the paper is organized as follows. Section II describes sample used in the study Section III describes research methodology and data used in the study. Section IV reports research findings. Section V gives a brief conclusion.

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II. Sample

Because we are interested in the examination of the causality relationship using panel data, the availability of comparable international data is a significant constraint. The panel data used in the research has been compiled from 23 OECD countries for the years 1982 through 2000. The countries and the years covered are shown in Table 1. All of the countries except Korea, Turkey and Mexico belong to the high-income economies[1]. Statistical data for stock markets, institutional investors and macroeconomic indicators are retrieved from 'OECD Institutional Investors: Statistical Yearbook', 'Standard & Poor's Stock Markets Fact book', and 'IMF International Financial Statistics' periodicals, respectively.

Table 1: Countries Included and the Analysis Period Covered

Country	Period	Country	Period
Australia	1989-2000	Luxembourg	1986-1999
Austria	1982-2000	Mexico	1991-2000
Belgium	1982-2000	Netherlands	1982-2000
Canada	1982-2000	Norway	1982-2000
Denmark	1990-1999	Portuguese	1987-2000
Finland	1983-2000	Spain	1982-2000
France	1982-2000	Sweden	1982-2000
Germany	1982-2000	Switzerland	1982-1999
Greece	1993-2000	Turkey	1987-2000
Italy	1987-2000	United Kingdom	1982-1999
Japan	1991-2000	USA	1982-2000
Korea	1982-2000		

III. Research Methodology

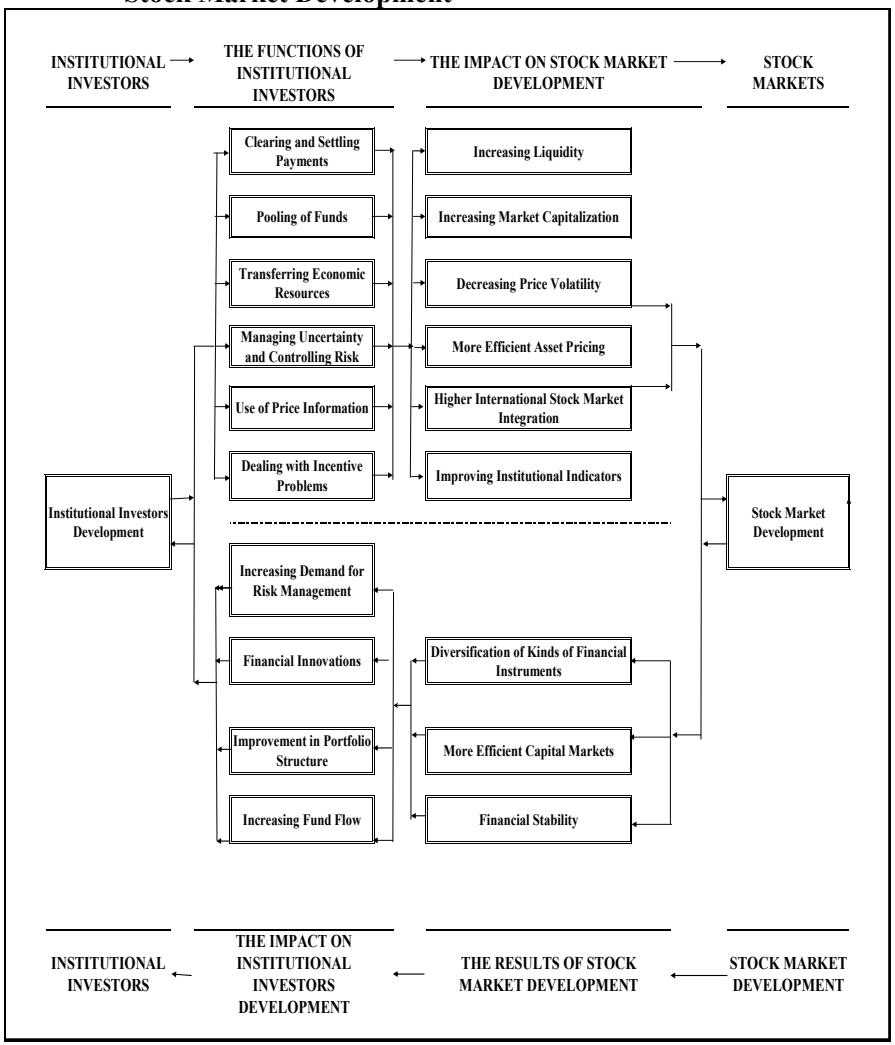
3.1. Research Model

Institutional investors are defined as specialized financial institutions which manage savings collectively on behalf of small investors, towards a specific objective in terms of acceptable risk, return maximization and maturity of claims (Davis, 1996). Their importance for the development of stock markets has been extensively mentioned in recent years. There are theoretical reasons, as well as empirical evidence, suggesting that the institutional investors have a nontrivial impact on the process of stock market development. Institutional investors may promote stock market development through their functions such as clearing and settling payments, pooling of funds, transferring economic resources, managing uncertainty, controlling risk, introducing financial

[1] Worldbank classifies countries with GNI per capita that is equal to $9,266 or more as high-income countries, countries with GNI per capita that is lower than $9,266 as low-income countries.

innovation, using price information, and dealing with incentive problems (Bodie, 1990; Davis, 1996; Vittas, 1998). These functions lead to increasing liquidity and market capitalization, decreasing price volatility, more efficient asset pricing, higher international stock market integration, improving institutional indicators of stock markets. This direction of causality from institutional investors to stock market development is called supply-leading causality relationship.

Figure 1: The Causality Relationship Between Institutional Investors and Stock Market Development



However in turn, stock markets development leads to the diversification of financial instruments, more financial stability and higher efficiency. These improvements increase demand for risk management, financial innovation, and portfolio management functions of institutional investors. This direction of causality from stock markets to institutional investor development is called demand-following relationship.

Vittas (1998) states that dynamic interaction process, that implies bi-directional causality relationship between institutional investors and stock market development, is more important and probable than unidirectional causality relationship. Institutional investors may support stock market development in earlier stages; however, stock markets development feeds the development of institutional investors in later stages. Figure 1 depicts the model of causality relationship between institutional investors and stock market development.

3.2. Econometric Test of Causality

In order to test causality relationship between institutional investor and stock market development, we choose to employ Sims (1972) test, based on Granger's (1969) definition of causality. In Sims approach, Granger causality relationship is expressed in two pairs of regression equations by simply twisting independent and dependent variables as follows:

$$X_t = \sum_{i=1}^{m} a_i X_{t-1} + \sum_{j=1}^{n} b_j Y_{t-j} + U_t \quad (1)$$

$$Y_t = \sum_{i=1}^{m'} c_i Y_{t-i} + \sum_{j=1}^{n'} d_j X_{t-j} + V_t \quad (2)$$

$$X_t = \sum_{i=1}^{m} a_i X_{t-1} + W_t \quad (3)$$

$$Y_t = \sum_{i=1}^{m'} c_i Y_{t-i} + Z_t \quad (4)$$

where (U_t, V_t, X_t, Z_t,)' is serially independent random vector with mean zero and finite covariance matrix. Equations (1) and (2) are called unrestricted, (3) and (4) restricted.

According to Granger's definition of causal relationships:

(A1) *X* causes *Y* (X→Y) if H: d_j=0, *j*=1, 2, . . ., *n'*, is rejected
(A2) *Y* causes *X* (Y→X) if H: b_j=0, *j*=1, 2, . . ., *n*, is rejected
(B) Feedback occurs (X↔Y) between *X* and *Y* if (A1) and (A2) hold
(C) *X* and *Y* independent if both hypotheses in (A1) and (A2) are not rejected.

In order to judge whether these conditions hold, Sims employ the following F-statistic to be applied to equations (1) and (2) relative to equations (3) and (4):

$$F = \frac{\left[\left(R^2_{UR} - R^2_R \right) / m \right]}{\left[\left(1 - R^2_{UR} \right) / \left(n - 2\ m - 1 \right) \right]} \qquad (5)$$

Where:

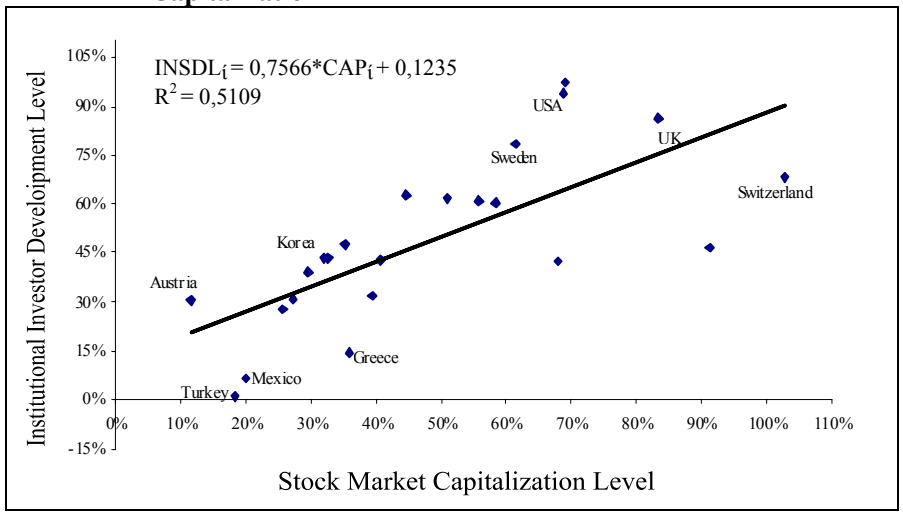
R^2_{UR} = the coefficient of determination of unrestricted equation
R^2_R = the coefficient of determination of restricted equation
n = the number of observations
m = the number of lagged periods

3.3. Research Variables

Devising an indicator for stock market development is not an easy task at all. Ideally, such an indicator should simultaneously reflect liquidity, volume of transactions, informational efficiency, degree of concentration, volatility, depth, legal and institutional, and other factors that determine the overall performance of a stock exchange. We use two different dimensions of the stock market development. These are stock market capitalization and stock market liquidity. As indicated in Demirguc-Kunt and Levine (1996), these dimensions would perform quite satisfactorily, since both volume and liquidity indicators have a strong positive correlation with other stock market development indicators. Stock market capitalization is measured by dividing total stock market capitalization value to GDP. Stock market liquidity is measured by dividing the size of stock market transactions relative to the size of the economy as a whole that is GDP.

Institutional investor development indicator used in this research is the ratio of total financial assets to GDP. The main reason underlying the usage of this ratio is the high positive correlation of total asset volume of institutional investors with their fund pooling and risk management functions.

Figure 2: The Institutional Investor Development Versus Stock Market Capitalization



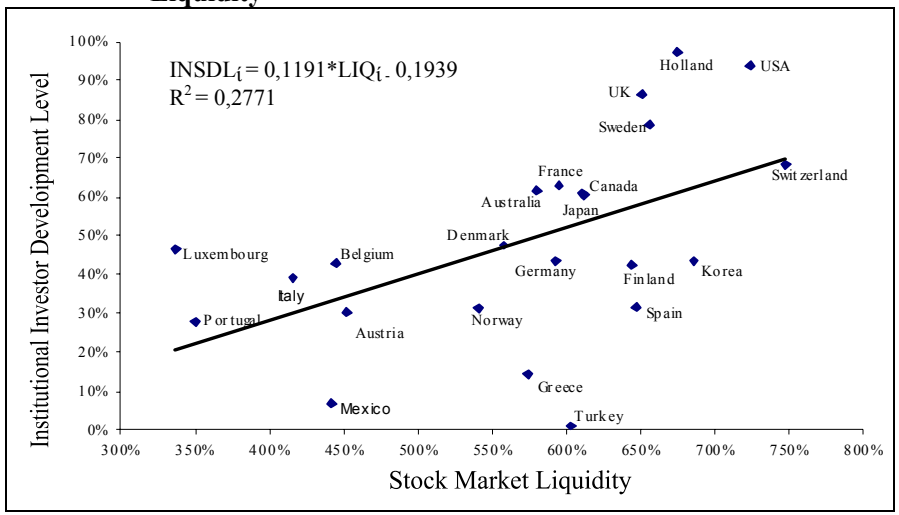
Note: This figure plots country-specific institutional investor development level (INSDL) data for 23 OECD countries versus stock market capitalization data. The institutional investor development level indicator is produced from following equation:
$INSDL_0$= ln(1+ Average ($INSDL_{1990}$; $INSDL_{1995}$; $INSDL_{2000}$))
Average ($INSDL_{1990}$; $INSDL_{1995}$; $INSDL_{2000}$) implies the arithmetic averages of 1990, 1995 and 2000 years INSDL values.
Stock market capitalization indicator is produced from following equation:
CAP_0= ln(1+ Average(CAP_{1990}; CAP_{1995}; CAP_{2000}))
Average (CAP_{1990}; CAP_{1995}; CAP_{2000}) implies the arithmetic averages of 1990, 1995 and 2000 years CAP values.

Figures 2 and 3 explore the relationship between institutional investor and stock market development indicators in more detail. We regress two stock market development indicators on institutional investor development indicator. Figure 2 show that there is a strong positive relationship (correlation coefficient is equal to 0.715) between institutional investor development level and stock market capitalization with some notable outliers (especially, Turkey and Mexico). The stock market capitalization is 18 percent of GDP in Turkey, whereas total financial assets of institutional investors are below than 1 percent of GDP. Similarly in Mexico, stock market capitalization exceeds 20 percent of GDP, whereas total financial assets of institutional investors are below than 7 percent of GDP.

The relationship between institutional investor development and stock market liquidity is plotted in Figure 3. This figure shows somewhat weaker, but significantly positive relationship between these two variables. The correlation coefficient between the institutional investor development and stock market liquidity is 0.526. However, there are a few countries (again, Mexico and Turkey) that do not fit the correlational pattern.

The statistically significant positive association between stock market development indicators and institutional investor development provides important precondition for conducting Granger causality study.

Figure 3: The Institutional Investor Development Versus Stock Market Liquidity



Note: This figure plots country-specific institutional investor development level (INSDL) data for 23 OECD countries versus stock market liquidity data. The institutional investor development level indicator is produced from following equation:
$INSDL_0 = \ln(1 + \text{Average}(INSDL_{1990}; INSDL_{1995}; INSDL_{2000}))$
Average ($INSDL_{1990}$; $INSDL_{1995}$; $INSDL_{2000}$) *implies the arithmetic averages of 1990, 1995 and 2000 years* INSDL *values.*
Stock market liquidity indicator is produced from the following equation:
$LIQ_0 = \ln(1 + \text{Average}(LIQ_{1990}; LIQ_{1995}; LIQ_{2000}))$
Average (LIQ_{1990}; LIQ_{1995}; LIQ_{2000}) *implies the arithmetic averages of 1990, 1995 and 2000 years* LIQ *values.*

3.4. Measurement Tests

In order to conduct Sims tests, the time series to be used must be prewhitened. First step in this process is the transformation of the series into a stationary one. This can be achieved by an appropriate degree of differencing logarithms of the series. We took the natural logarithms of the levels for all variables used in the analysis and then took the first difference. The stationarity of the time series at the first difference of each country is investigated applying the Augmented Dickey-Fuller (ADF) Unit Root Test (Dickey and Fuller, 1981) (Table A1 reported in the appendix). The results of these stationarity tests provide evidence that time series are stationary.

At the second step, autoregressive and autocorrelative nature of the time series is identified to see whether time series are autocorrelated (Tables A2-A4 reported in the appendix). There are some autocorrelation problems with

the research variables. Statistically significant autocorrelation functions are estimated in 4 cases out of total 23 for stock market capitalization, 3 cases out of total 23 for institutional investor development variables. No significant autocorrelation problem is identified for stock market liquidity variable. These results do not indicate any strong autocorrelation problem within the panel data.

IV. Research Findings

F-statistics for causality tests between institutional investors and stock market development indicators are reported in Tables 2 and 3**.**

Table 2: F-Statistics for Causality Tests Between Institutional Investor Development and Stock Market Capitalization

		3-Year Time Lag		2-Year Time Lag		
Country	**Time Series**	**INSDL→ CAP**	**CAP→INS DL**	**INSDL→ CAP**	**CAP→INS DL**	**Per Capita GDP, PPP Current (1999)**
Whole Sample: All OECD Countries	1982-2000	3.366**	1.684	0.481	0.19	
Whole Sample: Developed OECD	1982-2000	6.410***	3.185**	0.67	4.302**	
Whole Sample: Emerging OECD	1982-2000	0.511	6.136***	0.136	6.889***	
Australia	1989-2000	1.840	2.053	0.895	3.586	24,574
Austria	1982-2000	0.544	0.283	0.478	0.830	25,089
Belgium	1982-2000	1.783	1.585	1.089	4.014**	25,443
Canada	1982-2000	1.195	1.039	0.956	3.076*	26,251
Denmark	1990-1999	-	-	0.453	3.775	25,869
Finland	1983-2000	0.779	1.534	1.053	0.155	23,096
France	1982-2000	0.818	5.546*	1.800	0.722	22,896
Germany	1982-2000	0.507	0.059	0.620	0.188	23,742
Greece	1993-2000	-	-	1.035	-	15,414
Italy	1987-2000	2.039	0.222	0.211	0.047	22,172
Japan	1991-2000	-	-	10.540*	1.476	24,897
Korea	1982-2000	1.584	0.628	1.261	0.234	15,712
Luxembourg	1986-1999	-	-	2.052	-	42,769
Mexico	1991-2000	-	-	0.026	0.269	8,297
Netherlands	1982-2000	0.386	0.851	0.358	1.286	24,214
Norway	1982-2000	1.255	4.244**	4.041**	4.338**	28,433
Portuguese	1987-2000	3.657	11.434**	2.953	2.283	16,064
Spain	1982-2000	1.641	0.667	3.411*	1.800	18,079
Sweden	1982-2000	5.932**	1.191	5.116**	0.122	22,636
Switzerland	1982-1999	1.086	0.986	0.674	0.804	27,171
Turkey	1987-2000	4.982*	0.453	1.755	0.716	6,380
United Kingdom	1982-1999	0.449	0.372	0.211	0.474	22,093
USA	1982-2000	0.049	0.318	0.099	0.542	31,872

*, **, *** indicates significance at 10, 5, and 1% significance levels, respectively.

Note: This Table reports Sims' test F statistics for Granger Causality Tests between institutional investor development and stock market capitalization for 3 and 2-year time lags. Last column reports per capita GDP, PPP in US dollars for 1999 year.

Research findings provide support to the supply-leading hypothesis between institutional investors and stock market development indicators. We find out that using 3-year lag period institutional investor development variable is the statistically significant supply-leading Granger cause of stock market capitalization for whole sample of OECD countries. However, subsample analysis shows that emerging economies possess statistically significant demand-following causality pattern, i.e. institutional investor development is Granger cause of stock market capitalization. Country studies show that in the case of three countries (Spain, Japan, and Sweden) out of the twenty three countries covered within the analysis. Three countries (Belgium, Canada, and France) exhibits statistically significant demand-following causality pattern, i.e. stock market capitalization is Granger cause of institutional investor development. Only Norway displays statistically significant feedback (bi-directional) causality pattern between institutional investor development and stock market capitalization.

Table 3: F-Statistics for Causality Tests Between Institutional Investor Development and Stock Market Liquidity

		3-Year Time Lag		2-Year Time Lag		
Country	**Time Series**	**INSDL→ LIQ**	**LIQ→IN SDL**	**INSDL→ LIQ**	**LIQ→IN SDL**	**Per Capita GDP, PPP Current (1999)**
Whole Sample: All OECD Countries	1982-2000	3.177**	0.879	1.943	4.605**	
Whole Sample: Developed OECD	1982-2000	1.549	0.276	0.123	0.853	
Whole Sample: Emerging OECD	1982-2000	1.378	0.972	1.247	3.548**	
Australia	1989-2000	1.946	4.152	1.564	3.027	24,574
Austria	1982-2000	1.259	0.434	0.145	0.504	25,089
Belgium	1982-2000	0.156	0.216	0.103	0.427	25,443
Canada	1982-2000	0.298	0.888	0.367	1.157	26,251
Denmark	1990-1999			1.162	2.953	25,869
Finland	1983-2000	1.113	0.288	0.103	0.061	23,096
France	1982-2000	2.203	2.961	1.754	4.031*	22,896
Germany	1982-2000	0.401	3.187*	0.718	2.663	23,742
Greece	1993-2000			0.003	1.692	15,414
Italy	1987-2000	0.136	1.842	0.237	1.464	22,172
Japan	1991-2000			4.403	0.048	24,897
Korea	1982-2000	2.564	2.012	3.777*	0.545	15,712
Luxembourg	1986-1999			1.047	11.690*	42,769
Mexico	1991-2000			0.980	6.766*	8,297
Netherlands	1982-2000	0.196	0.754	0.013	0.982	24,214
Norway	1982-2000	2.612	0.414	3.160*	0.741	28,433
Portuguese	1987-2000	-	-	0.352	25.9*	16,064
Spain	1982-2000	0.470	3.354*	0.999	0.778	18,079
Sweden	1982-2000	0.582	2.215	0.458	1.551	22,636
Switzerland	1982-1999			17.833	0.294	27,171
Turkey	1987-2000	0.895	3.412	0.855	0.161	6,380
United Kingdom	1982-1999	3.490*	0.482	3.690*	0.015	22,093
USA	1982-2000	1.227	1.710	1.001	2.360	31,872

*, **, *** indicates significance at 10, 5, and 1% significance levels respectively.

Note: This table reports Sims' test F statistics for Granger Causality Tests between institutional investor development and stock market liquidity for 3 and 2-year time lags. Last column reports per capita GDP, PPP in US dollars for 1999 year.

The causality analysis of institutional investor development and stock market liquidity provide support to the feedback (bi-directional) causality pattern (Table 3). We find out that institutional investor development is statistically significant Granger cause of stock market liquidity for 3-year time lag period, whereas stock market liquidity is statistically significant Granger cause of institutional investor development for 2-year time lag period. A subsample analysis show that statistically significant causality pattern from stock market liquidity to institutional investor development occurs in emerging countries. Country analyses detect statistically significant supply leading causality relationship from institutional investor development to stock market liquidity for three countries (Korea, Norway, and U.K.) and demand following causality relationship from stock market liquidity to institutional investor development for six countries (France, Germany, Luxembourg, Mexico, Portugal, and Spain).

V. Conclusions

Our empirical results provide evidence that there are positive and statistically significant correlation between institutional investors and stock market development indicators. It appears there are bi-directional causality relationship between institutional investors and stock market development. Institutional investors creates necessary atmosphere for the development of stock markets, and in turn, the development of stock markets promote the development of institutional investors.

The research findings bear important policy implications. The dynamic interaction process between institutional investors and stock market development shows that promotion of institutional investors shouldn't be dependent on the prior development of stock markets. The country may undertake necessary reforms for the promotion of institutional investors for establishing well-developed security markets.

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Appendix

Table A1: The Augmented Dickey-Fuller (ADF) Unit Root Tests

Stationarity of the time series of research variables is tested by ADF Unit Root Test :

$$\Delta X_t = \beta_0 X_{t-1} + \sum_{t=1}^{n} \beta_i \Delta X_{t-i} + \varepsilon_t$$

The numbers on the table refer to β_0 coefficients.

Country	Time Series	ΔCAP_t	ΔLIQ_t	$\Delta INSDL_t$
Australia	1989-2000	-5,063***	-4,348***	-2,559**
Austria	1982-2000	-4,553***	-5,391***	-2,655***
Belgium	1982-2000	-3,766***	-2,722***	-10,400***
Canada	1982-2000	-4,698***	-4,225***	-1,896*
Denmark	1990-1999	-6,296***	-3,828***	-2,274**
Finland	1983-2000	-2,624**	-2,157**	-4,582***
France	1982-2000	-3,533***	-2,798***	-1,667*
Germany	1982-2000	-3,958***	-4,038***	-3,411***
Greece	1993-2000	-3,233***	-3,647***	-2,433**
Italy	1987-2000	-2,859***	-3,161***	-1,412
Japan	1991-2000	-3,472***	-2,827***	-2,030**
Korea	1982-2000	-3,534***	-3,027***	-5,140***
Luxembourg	1986-1999	-3,243***	-5,729***	-10,106***
Mexico	1991-2000	-5,947***	-4,810***	-3,949***
Netherlands	1982-2000	-3,983***	-4,005***	-5,180***
Norway	1982-2000	-4,428***	-4,560***	-3,999***
Portuguese	1987-2000	-2,448**	-2,494**	-5,336***
Spain	1982-2000	-3,748***	-2,917***	-2,556**
Sweden	1982-2000	-4,292***	-2,600***	-4,054***
Switzerland	1982-1999	-4,250***	-1,737*	-8,288***
Turkey	1987-2000	-6,003***	-3,180***	-4,260***
United Kingdom	1982-1999	-3,756***	-2,086**	-4,176***
USA	1982-2000	-5,333***	-2,900***	-2,667**

*, **, and *** refer to significance levels at 1, 5, and 10 percent.

Table A2: The Autocorrelation Analysis of Stock Market Capitalization

	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	Box - Ljung
USA	-0.39	-0.18	0.36	-0.21	-0.11	0.08	0.09	-0..05	9.41
Germany	-.0.09	-0.25	0.03	0.28	-0.15	-0.15	-0.28	0.17	8.64
Australia	-0,26	0.12	-0.44	0.04	-0.27	0.32	-0.06	0.17	13.38
Austria	-0.15	-0.51	0.10	0.37	-0.24	-0.26	0.18	0.16	16.58*
Belgium	-0.12	0.03	0.06	-0.05	0.03	-0.34	-0.12	-0.14	5.18
United Kingdom	-0.32	0.38	-0.15	0.01	-0.30	0.19	-0.40	0.14	15.88*
Denmark	-0.56	0.19	-0.11	0.02	-0.05	0.22	-0.43	0.31	19.37*
Finland	0.24	-0.19	-0.19	-0.23	0.22	0.13	-0.23	-0.25	10.04
France	-0.13	0.07	-0.16	0.03	-0.13	-0.05	-0.35	0.17	6.83
Netherlands	-0.23	-0.14	0.05	0.07	-0.15	0.06	-0.45	0.12	9.81
Spain	-010	0.19	-0.15	-0.35	-0.08	-0.32	0.00	0.14	8.87
Sweden	-0.25	0.11	0.05	-0.22	-0.06	0.02	-0.34	0.21	8.69
Switzerland	-0.26	-0.10	-0.07	0.27	-0.29	0.00	0.15	0.19	8.14
Italy	0.21	-0.19	-0.09	-0.05	0.00	-0.29	-0.27	0.07	7.11
Japan	0.04	0.03	0.02	-0.08	0.09	-0.12	-0.23	-0.04	2.75
Canada	-0.39	0.27	-0.09	0.17	-0.37	0.32	-0.34	0.17	17.78*
Korea	0.02	-0.40	-0.02	-0.02	0.09	0.06	-0.04	-0.20	5.56
Luxembourg	0.24	0.00	-.0.07	-0.49	-0.20	-0.03	-0.12	0.05	9.41
Mexico	-0.23	0.29	-0.09	-0.07	-0.01	0.10	-0.23	0.01	5.55
Norway	-0.21	-0.11	-0.38	0.26	0.03	0.18	-0.37	0.08	12.46
Portuguese	0.38	0.00	-0.36	-0.31	-0.34	-0.05	0.02	0.07	12.47
Turkey	-0.55	-0.02	0.13	0.21	-0.42	0.27	-0.05	-0.04	13.24
Greece	0.09	-0.14	0.06	-0.25	-0.23	-0.07	-0.19	0.12	5.68

* refer to significance levels at 5 percent level.

Note: This table reports autocorrelation values up to 8 lag period, Box-Ljung statistics and statistical significance of these statistics for stock market capitalization.

Table A3: The Autocorrelation Analysis of Stock Market Liquidity

	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	Box - Ljung
USA	-0.07	0.10	-0.06	0.28	-028	0.03	-0.09	-0.12	5.57
Germany	-0.17	0.55	-0.19	0.12	-0.26	-0.07	-0.06	-0.34	15.47
Australia	-0.22	0.14	-0.29	0.03	-0.53	0.23	0.05	0.08	13.65
Austria	-0.33	0.18	-0.22	0.24	-0.11	-0.09	-0.06	0.06	6.71
Belgium	o.25	-0.11	-0.15	-0.14	0.12	-0.13	-0.32	-0.41	13.04
United Kingdom	0.43	-0.25	-0.34	-0.12	0.00	0.00	-0.05	-0.15	9.83
Denmark	-0.25	-0.14	0.05	0.30	-0.06	-0.11	-0.16	0.06	5.67
Finland	0.38	-.0.27	-0.32	-0.26	-0.09	0.22	0.10	-0.20	12.15
France	0.04	-0.30	-0.15	0.01	-0.16	-0.04	-0.03	0.34	7.65
Netherlands	-0.23	0.11	-0.12	-0.18	0.03	0.02	-0.10	-0.16	4.10
Spain	0.06	-0.05	0.00	-0.25	-0.21	-0.22	0.07	-0.22	6.42
Sweden	0.15	-0.08	0.19	-0.19	-0.27	-0.18	-0.09	0.00	5.82
Switzerland	-0.19	-0.19	0.02	0.19	-0.23	-0.40	0.08	0.00	7.35
Italy	0.09	-0.32	-0.28	0.04	0.16	-.0.23	-0.20	0.16	9.25
Japan	0.33	0.07	0.01	-0.36	-0.37	-0.11	-0.08	-0.12	11.13
Canada	-0.31	0.21	-0.24	0.04	-0.36	0.15	0.11	0.16	10.31
Korea	0.19	-0.11	-0.29	-0.37	0.09	0.04	0.01	-0.08	7.28
Luxembourg	-0.39	-0.06	0.01	-0.31	0.45	-0.22	0.07	0.00	13.04
Mexico	-0.07	-0.28	0.10	-0.06	-0.30	0.25	0.18	-0.16	8.85
Norway	-0.31	0.19	-0.21	0.27	-0.31	0.28	-0.16	0.02	11.94
Portuguese	0.19	0.01	-0.04	-0.31	-0.21	0.00	-0.00	-0.17	5.01
Turkey	-0.08	0.13	-0.01	0.17	-0.30	-0.12	-0.17	0.06	4.96
Greece	-0.07	-0.18	0.13	-0.14	-0.24	-0.10	-0.06	0.03	3.93

* refers to significance levels at 5 percent level.

Note: This table reports autocorrelation values up to 8 lag period, Box-Ljung statistics and statistical significance of these statistics for stock market liquidity.

Table A4: The Autocorrelation Analysis of Institutional Investor Development

	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	Box -Ljung
USA	-0.20	-0.09	-0.25	0.16	-0.16	0.13	-0.26	0.27	9.40
Germany	-0.08	-0.08	-0.15	0.32	-0.11	-0.38	-0.24	0.08	10.40
Australia	-0,23	-0,08	0,06	-0,05	-0,09	-0,05	0,05	-0,01	1.39
Austria	-0.12	-0.06	-0.22	0.10	-0.19	-0.12	-0.21	0.22	6.47
Belgium	-0.05	-0.07	0.08	0.00	0.02	-0.05	0.02	-0.01	0.42
United Kingdom	-0.42	0.38	-0.21	0.27	-0.46	0.13	-0.22	0.20	19.51*
Denmark	-0.20	0.06	-0.07	0.09	0.12	-0.35	0.00	-0.15	6.19
Finland	-0.50	0.15	-0.34	0.25	0.04	0.00	-0.14	0.02	11.12
France	0.23	0.14	0.10	0.06	0.13	-0.05	-0.17	0.06	3.91
Netherlands	-0.46	0.14	-0.16	0.17	-0.19	0.17	-0.25	0.19	11.82
Spain	-0.04	-0.26	0.17	-0.09	-0.09	-0.07	0.18	-0.10	4.28
Sweden	-0.20	-0.02	-0.42	0.42	-0.25	0.11	-0.20	0.09	13.99
Switzerland	-0.67	0.32	-0.03	-0.02	0.06	-0.13	0.14	-0.17	14.15
Italy	0.38	-0.24	-0.10	0.07	-0.09	-0.13	0.08	0.11	5.22
Japan	0.02	-0.06	-0.15	-0.07	0.06	0.01	-0.25	0.00	3.79
Canada	-0.18	-0.15	-0.05	-0.09	0.03	0.09	-0.13	0.04	2.46
Korea	-0.32	-0.25	0.14	0.01	0.04	0.06	-0.05	-0.03	4.48
Luxembourg	-0.04	-0.15	-0.08	0.03	0.06	0.04	-0.14	-0.10	1.91
Mexico	-0.32	0.33	-0.03	-0.13	-0.23	0.02	-0.16	0.03	5.74
Norway	-0.25	0.09	-0.07	0.15	0.02	0.01	-0.30	0.32	8.90
Portuguese	-0.41	0.48	-0.04	0.11	-0.07	0.00	-0.07	-0.04	7.87
Turkey	-0.41	-0.31	0.41	-0.26	-0.01	0.27	-0.13	-0.22	16.36*
Greece	0.10	0.14	-0.28	0.10	-0.17	-0.10	-0.49	0.00	14.49*

* refers to significance levels at 5 percent level.

Note: This table reports autocorrelation values up to 8 lag period, Box-Ljung statistics and statistical significance of these statistics for institutional investor development.

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A RISK AND PROFITABILITY APPROACH TO BANK PERFORMANCE MEASUREMENT: THE CASE OF TURKISH COMMERCIAL BANKS

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Abstract
In this paper a risk-profitability approach is used to measure the performance of local and foreign commercial banks operating in Turkey over the period 1988-2000. At the first step of the two-step analysis method used, an ordinary least square model is used to estimate the efficiency differences of banks; as using profitability ratios (net interest margin, return on asset and return on equity) dependent variables and their standard deviations as independent variables. Foreign banks seem to be more efficient than local banks. At the second step several correlates are examined. The correlates are expected to be different risk measures of banks.

I. Introduction

In the related literature, banks are defined as financial intermediaries which borrow money from the surplus spending unit (SSU) and lend that borrowed money to the deficit spending unit (DSU). By doing this banks carry out four basic services:[1] liquidity intermediation, denomination intermediation, risk intermediation and maturity intermediation and arising from these services banks face liquidity risk, operational risk, credit risk and interest rate risk respectively.[2] Of course, a bank involving in foreign exchange activities will be subject to exchange rate risk. One can easily recognize that banks purchase these risks born of the nature of intermediation from the SSUs and DSUs both of which paying a reward to banks in exchange of transferring their risks to banks. Additional to these risks, all banks are exposed to insolvency risk as well. Therefore, the success of banks is assumed to be largely dependent on the correctly pricing of these risks overtaken by them and their efficiency in managing these risks[3] in order to achieve and/or protect their targeted profitability ratios.

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[1] See Sinkey p.35.

[2] An internationally active bank will serve f/x activities as facing f/x risk as well.

[3] For a detailed analysis and management of these risks see for example Toevs (1983), Stigum and Branch (1983), Sinkey (1988), Hempel, Coleman and Simonson (1988).

Based on the above expressed widely accepted definition of banks, it is not surprising to expect the performances of banks to be measured based on their risk and profitability preferences. However, in the literature on bank efficiency, contrary to the above definition, banks are widely considered as production units and their performances are measured accordingly. In this paper, an alternative approach is employed to measure the performances of banks within a risk and profitability context and then the estimated performances are correlated to the risks mentioned above.

II. The Literature Cited

In modelling the banking firm, academicians were concerned with both intermediation aspect of banking and production side as well, as paying a deeper attention to the former aspect. Academic works related to the intermediation aspect of banking firms directed specific attention to specific issues in banking. For example, DeLong (1967), Tarhan and Spindt (1983) investigate the role of liquidity in banking, whereas, Altman and Saunders (1998) and Crouhy, Galai and Mark (2000) underlines the importance of loan pricing and management. Many academicians, such as Blum and Hellwig (1995), Berger, Herring and Szegö (1995), Besanko and Kanatas (1996), Blum (1999) investigate the effects of capital adequacy on banks behavior. On the other hand, many academicians include risk management aspect of banking in their models. Chateau (1982) discusses the relationship between deposit capacity and risk-efficient rate settings, Szegö (1986) investigates the effects of financial insurance on the asset management activities of banks, Sprenkle (1987) discusses the effects of liability and asset uncertainties on the profit function of the banking firm. Diamond and Rajan (1998) employ liquidity risk in their approach to banking theory. However, only a few academics, such as Sealey and Lindley (1977) employed the production aspect of banking firms in explaining the behavior of banking firms. There are also some attempts for example; Pyle (1971) and Hart and Jaffe (1974), to link the portfolio theory with the behavior of banking firm.

Baltensperger (1980), underlines that a model which is expected to explain the behavior of banking firm must include (1) the characteristics of the two sides of the balance sheet or the intermediation aspect of banking firm, (2) the production aspect of banks and (3) all financial risks (mentioned above) that banks are exposed to. In his so called complete model of the banking firm (equation 1) the profit of banking firm; $E(\pi)$, is expected to be a function of spread; the difference between return on assets and cost of liabilities; $rE - tD$, operational cost; or the difference between non-interest earning assets and non-interest expenses (the burden) C (D,E), liquidity cost; L, solvency cost; S, and opportunity cost of capital; pW. The optimality requires all marginal returns and costs to be equaled in order to maximize profit.

$$E(\pi) = rE - tD - C(D,E) - L - S - pW \quad (1)$$

Based on Baltensperger (1980) model, the efficiency of a bank can also be divided into two parts. The first, and probably the most important part, can be named the "risk efficiency of banks". This part of efficiency is related to all variables in Baltensperger's model except for production cost and opportunity cost of capital. The second part of efficiency could be named the "cost efficiency of banks". This part is related to the production side of the banking firm, which is marked as "C (D,E)" in equation 1. Therefore, the measurement of the complete efficiency of a bank should include both parts of efficiency that can be derived from the Baltensperger's model.

There is a large amount of literature on the measurement of bank efficiency. However, almost all effort spent in this area is based on the measurement of bank efficiency through banks' performances related to their productivity. That can be named as production or cost efficiency of banking firm, which is related to only servicing side of banking firm as circumventing the risk management aspect of banks. The productive efficiency is credited to Farrel (1957) in the related literature.[4] The performance of banks based on their risk-return characteristics is yet to be investigated broadly since no consensus has yet been developed on the relationship between risk management and bank performances.[5]

Some researchers such as; Barr et all (December 1999), Işık and Hassan (2002), Işık and Hassan (2003), Rime and Stiroh (2003), Sturm and Williams (Article in Press 2004), used an input-output analysis to evaluate the production efficiency of banks. Generally the inputs used are salary expenses, premises and fixed assets, other non-interest expense, interest expense, purchased funds and etc. These inputs were assumed to produce some outputs such as earning assets, non-earning assets, interest income, non-interest income and etc. As employing Data Envelopment Analysis (DEA) technique, they estimate either technical efficiency or profit efficiency of banks. After that, the reasons behind the efficiency and/or inefficiency were investigated by the authors.

Işık and Hassan (2003) concluded that the managerial (technical) efficiency of Turkish banks has substantially improved after deregulation. Vennet (February 2002) concluded that superior profit efficiency of universal banks in Europe was related to their comparative information advantages acquired through their corporate insider status.

Mester (1996) used a stochastic cost frontier approach to measure the Third District Banks' degree of inefficiencies. Then she runs another model to investigate for the correlates of the banks' degree of inefficiencies as employing 15 different independent variables. The main conclusion she made

[4] See Laeven (2000).
[5] See Harker and Zenios (2000) p.12.

is that there was no correlation between size and efficiency and banking involved "learning by doing".

Berger and DeYoung (1997), as using a causality technique, investigates the relationship between cost efficiency, problem loans or credit risk and bank capital. Their results imply a two-way causality between problem loans and cost efficiency and a one way causality between poor capital adequacy and problem loans.

Leaven (1999) criticizes the efficiency measurements performed by the other academics for that they did not include the risk taking activities of banks and assuming that banks are risk neutral. In his working paper, as using DEA (Data Envelopment Analysis) he first measures the cost efficiency of banks in East Asian countries (Indonesia, Korea, Malaysia, The Philippines and Thailand) for the period 1992-1996. After that, he looks at the relationship between the risk taking activities of banks and their cost efficiencies through the ownership of banks. The results suggest that, the improved cost efficiency of banks mainly resulted from the excessive risk taking activities rather than true efficiency improvements. His results also shows that family and company owned banks tend to assume excessive risk and foreign banks tend to assume little risk. Leaven's results are interesting however they are far away from explaining how efficient banks are in terms of managing risks emerging from their intermediation activities. On the other hand, Altunbas et all. (2004) examines the relationship between capital, risk and efficiency for European banks. At their two-step model first they estimate the inefficiencies and then at the second step they investigate the correlates. Their empirical results, unlike the results of Leaven (2000), show that there is no relationship between efficiency and risk taking activities by banks.

Akhigbe and McNulty (2003) estimated the profit efficiency of small US banks. As using an input-output analysis based on cost frontier approach, they estimated the expected return on assets (ROA) and then they defined the profit efficiency as the degree of difference between actual ROA and predicted ROA. In terms of the correlates of the profit efficiency, in contrast to Mester (1996), they found statistically significant relationship between size and efficiency.

DeYoung, Hughes and Moon (2001) investigates the relationship between banks' risk taking activities and regulations. Using data for 356 national US banks, they employ a three-step model to investigate this question. At the first step, they use a structural model of production to estimate the risk and return parameters of those banks. After plotting these results on a scatter diagram they estimate a best practice risk-return frontier for all banks. The inefficiency of each bank is calculated as the difference between its actual return and estimated return. Finally, at the third step they correlate each bank's CAMEL rating to its return, risk, risk-return inefficiency and its size. Their main finding is that regulators not only distinguish between the risk taking activities of efficient and inefficient banks, but they also permit

efficient banks more latitude in their investment strategies than inefficient banks.

Berger and Mester (2000) targeted to open the "black box" which is defined to be the box containing the sources of the inefficiencies of financial institutions. They argue that there is no consensus upon the correlates of inefficiencies. Using the data for 6000 US commercial banks, they perform a research over the period 1990-1995. Holding the data set constant they examine three sources of inefficiency; (1) differences in the efficiency concept (cost efficiency, standard profit efficiency and alternative profit efficiency) used, (2) differences in the efficiency measurement methodology (13 different methods are used) within the context of these concepts and (3) the potential correlates of efficiency (under seven groups 35 different correlates are examined) that may explain some of efficiency differences that remain after controlling for the efficiency concept and measurement method. They found that the measurement method used has effects on the efficiency concept used. In terms of correlates their results are quite mixed and therefore they suggest the issues used in their work to be further researched in order to be better explained.

The commune feature of the above briefed academic works, related to bank efficiency measurement, is that they mainly focus on the production side of banking firm. The risk management activities of banks are not their main objective. However, as briefed above, almost all literature on banking firm, directly or indirectly, involve the risk management activities of banking firms. Therefore, it is thought that literature related with bank efficiency should include risk aspect of banking firm as well. However, only a few researcher such as; Leaven (1999) and DeYoung, Hughes and Moon (2001) included this argument in their works. This is considered as a controversy.

III. The Data and Process Used

The data used in this paper are of 30 local and foreign commercial banks operating in Turkey and three averages: total industry, local banks and foreign banks for the period 1988-2000. The banks which were overtaken by the Turkish authorities during the period of analysis are excluded from the analysis. The data were obtained from www.tbb.org.tr; the official website of the Banks' Association of Turkey.

In this paper, the performances of banks are estimated in relation with the risks assumed by them and therefore these measures are assumed not to be related with their scale features, but rather related to their scopes in terms of risk taking and management strategies.

The process used in this paper is an adopted form of the portfolio theory developed by Markowitz in 1950s. The whole idea of portfolio theory is selecting assets based on their expected returns and volatility or standard deviation in their returns. An asset with a high volatility is considered riskier

than another asset with the same return but lower volatility. Therefore, investors are suggested to invest in assets with lower risk within the group of assets with the same return. The correlates of this volatility in stocks' returns are further defined as systemic risk and non-systemic risk or firm specific risk.

In the model below, a similar process is adopted in terms of measuring the profitability of banks and their volatility thereof. The method used in this paper is rather simple and straightforward. At the first part of the process, three profitability ratios (of 30 local and foreign commercial banks and three industry averages) namely; net interest margin (NIM), return on assets (ROA) and return on equity (ROE), are observed for the period 1988-2000. These profitability ratios are used as proxies for returns used in portfolio theory.

NIM, defined as net interest income over earning assets, is assumed to be the reward of banks earned from the purchase and management of financial risks namely; credit risk, interest rate risk, foreign exchange rate risk and liquidity risk. As is well known variance in net interest income is expected to be the sum of variances in rates, in the mix of assets and liabilities and in the size of the balance sheet. However, when net interest margin is calculated, net interest income is divided by earning assets. By doing this, the size effect is assumed to be cleared. The variances in rates and in the mix of the balance sheet remain. Since the volatility in rates is out of control of banks, then the variation that banks can control remains to be the mix of their balance sheets. Therefore, financial risks that banks are exposed to are expected to be a result of banks' activities in altering the compositions of their balance sheets. Thus, NIM is assumed to be the sum of the price of these four financial risks plus banks' targeted profitability rate. Therefore, the success of banks in managing NIM is expected to be dependent largely on the correct pricing of these risks and the risk management techniques employed by them.

ROA, defined as net income (this includes both net interest income and income from non-interest activities or net operational income) over total assets, is assumed to be the reward earned from the management of above mentioned financial risks plus operational risk and banks' targeted profitability rates. Thus, ROA is expected to be exposed to four financial risks as well as operational risk which results from the operational activities of banks.

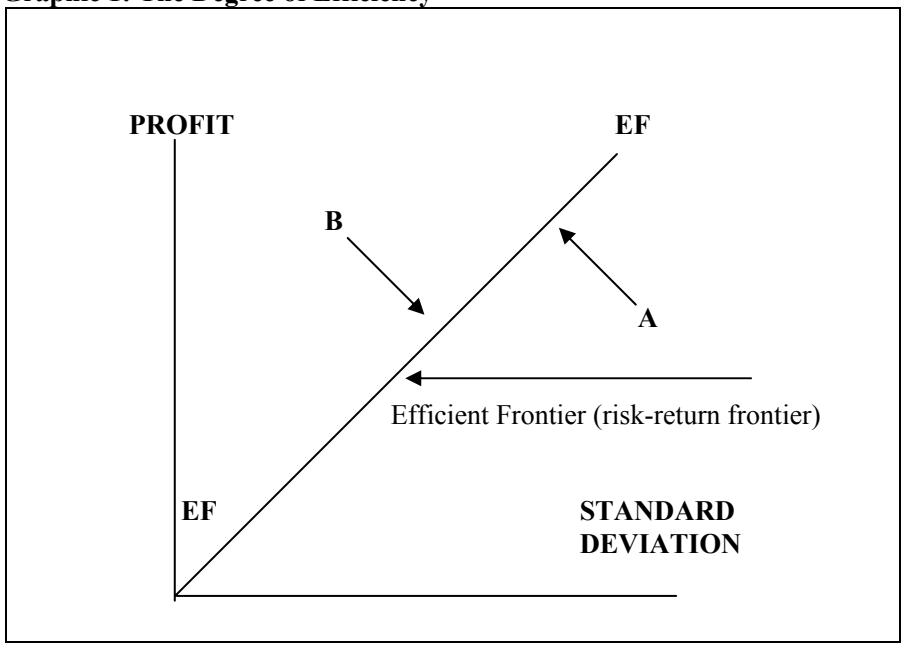
Finally, ROE, which is defined as net profit over capital, is assumed to be the prize received by banks for purchasing and managing financial risks, operational risk and leverage risk (capital risk) together with banks' targeted profitability ratios. As is well known ROE is a function of ROA and leverage multiplier (LM). Thus ROE is expected to include not only the effects of financial risks and operational risk, but also the effects of leverage as well.

After observing and collecting the above mentioned average profitability ratios of banks operating in Turkey for the period 1988-2000, they were plotted on three diagrams against their standard deviations. These three diagrams are similar to the diagram used in portfolio theory where the standard deviations are plotted against observed or expected returns.

Based on the findings of these three scatter diagrams, banks are then ranked according to their performances in NIM, ROA and ROE and their standard deviations. The standard deviation of these profitability ratios are expected to be resulted from the efficiency of banks managing the four financial risks plus operational risk and leverage mentioned earlier. The efficient (risk-return) frontier is estimated as using an ordinary least square (OLS) regression technique. A bank, which is situated above the efficient frontier, is assumed over efficient in managing its profitability ratios and financial and non-financial risks affecting its profitability ratios. On the other hand a bank which is below the efficient frontier is considered unsuccessful or under efficient in terms of managing risk and profitability management.

Needless to say, a bank with an efficient risk and profitability management system, is expected to be above the efficient frontier. That is to say that, banks owning efficient risk management systems will be expected to manage the above mentioned risks more efficiently and therefore have stabilized profitability figures and accordingly low standard deviations.

Graphic 1: The Degree of Efficiency



The efficient frontier (EF-EF line in Graph 1) is estimated through the use of an ordinary least square (OLS) regression technique. The regression shown in equation (2) is run to calculate each bank's potential profitability ratios. The degree of efficiency of banks is defined as the difference between potential (estimated) and observed or true profitability ratios.

$$\Pi_i = \alpha + \beta\, \partial_i + e \qquad (2)$$

Where, Π_i is profitability ratio for bank i, α and β are estimated coefficients, ∂_i is the standard deviation of bank i and finally e is error term. This regression was run three times as using observed NIM, ROA and ROE figures of banks operating in Turkey and their calculated standard deviations shown in Table 1. Banks are then ranked based on their estimated profitability ratios and standard deviations or risks. A bank situated on the upper level of the efficient frontier (Point B at Graph 1) will be considered more efficient in terms of risk and profitability management than a bank situated on the lower level of the efficient frontier (Point A at Graphic 1).

Table 1: Average Profitability Ratios and Standard Deviations of Local and Foreign Commercial Banks Operating in Turkey

BANKS	NIM & STD.DEV		ROA & STD.DEV		ROE & STD.DEV	
Industry	**7.9**	**2.9**	**2.1**	**2.0**	**30.1**	**38.2**
Local Banks	**7.9**	**3.0**	**2.1**	**2.2**	**28.5**	**46.0**
Ziraat	7.7	3.9	2.1	2.4	42.0	41.2
Halkbank	4.8	3.0	0.9	0.5	17.6	15.7
Vakıfbank	7.9	3.2	2.7	1.7	57.1	43.3
Adabank	8.4	10.0	4.8	6.7	21.4	28.4
Akbank	16.5	4.5	8.1	2.2	80.7	23.5
Körfezbank	16.0	7.4	9.3	4.4	170.1	97.6
Fiba Bank	20.8	10.3	3.3	4.8	66.6	71.9
Finans Bank	17.6	8.0	8.6	2.7	130.9	31.4
Koçbank	19.9	6.1	6.6	3.3	78.3	37.4
MNG Bank	28.9	14.8	10.7	8.3	59.0	64.5
Oyak Bank	21.8	13.4	11.4	9.9	62.0	43.0
Pamukbank	6.3	3.3	1.8	1.1	22.3	9.1
Sitebank	21.4	10.3	5.8	7.1	64.8	122.0
Şekerbank	8.0	2.8	2.4	1.6	27.3	20.0
Tekstilbank	17.0	6.1	6.0	2.9	99.6	51.5
Turkishbank	12.2	5.5	4.5	3.4	44.2	36.1
Dışbank	14.7	6.3	6.4	2.7	85.0	41.9
TEB	11.2	3.3	6.1	2.8	86.0	33.9
Garanti	14.1	5.5	5.9	1.8	78.3	28.4
İmar Bankası	1.7	7.5	1.1	1.3	18.6	25.7
İş Bankası	8.7	5.1	4.4	2.5	49.5	29.2
YKB	6.3	2.9	4.2	1.9	59.3	26.7
Foreign Banks	**15.9**	**6.1**	**6.4**	**2.9**	**86.4**	**40.9**
Arap Türk Bank	6.4	8.0	1.0	3.8	8.5	70.8
Bnp - Ak Dresdner Bank	19.2	6.1	8.1	3.0	76.3	28.0
Ottoman Bank	13.0	5.9	7.6	5.2	106.6	77.0
Abn Amro Bank	20.3	5.7	13.1	4.3	100.3	52.8
Bank Mellat	8.7	2.9	7.1	2.9	73.1	38.6
Citibank	20.9	9.4	7.2	6.5	82.8	67.2
Credit Lyonnais Turkey	12.6	11.6	4.4	8.7	31.2	66.2
Westdeutsche Landesbank	11.3	8.4	2.6	7.5	122.4	152.8

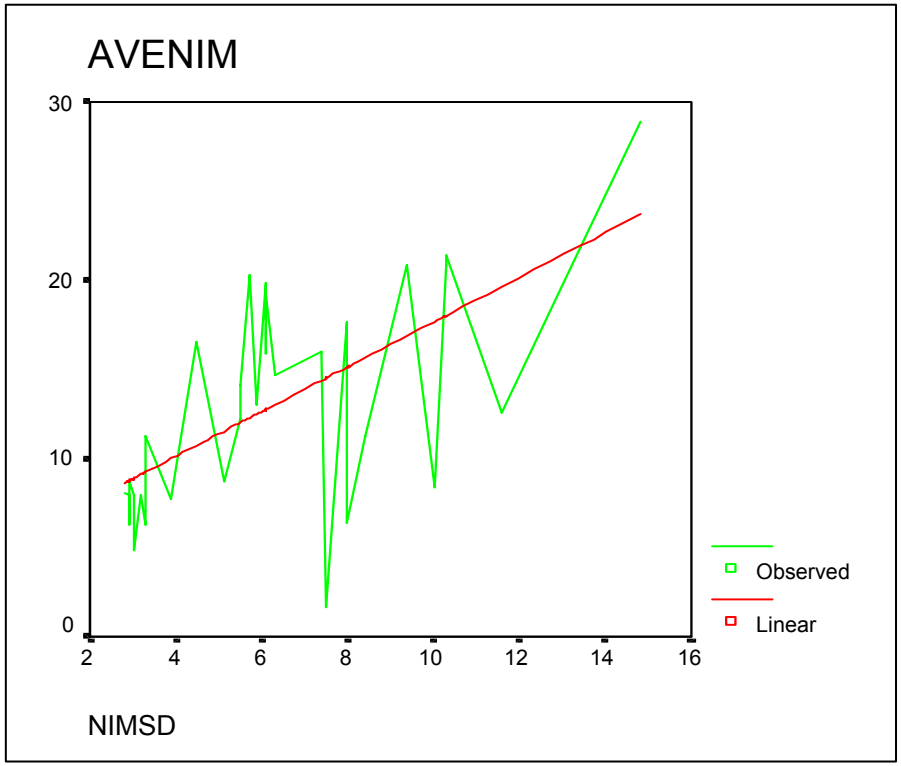
IV. Empirical Findings

As mentioned earlier, the process used in this paper has two stages. At the first stage, the efficiencies of banks are estimated through the risk-profitability approach described earlier. At the second stage the correlates of inefficiencies are investigated.

At the first stage, using equation 2 and data in Table 1, three regressions are run to estimate three efficient frontiers for banks in Turkey. These efficient frontiers are used as benchmarks in order to calculate the efficiencies of banks. The first regression is run to estimate the potential NIM figures of banks while using their standard deviations as independent

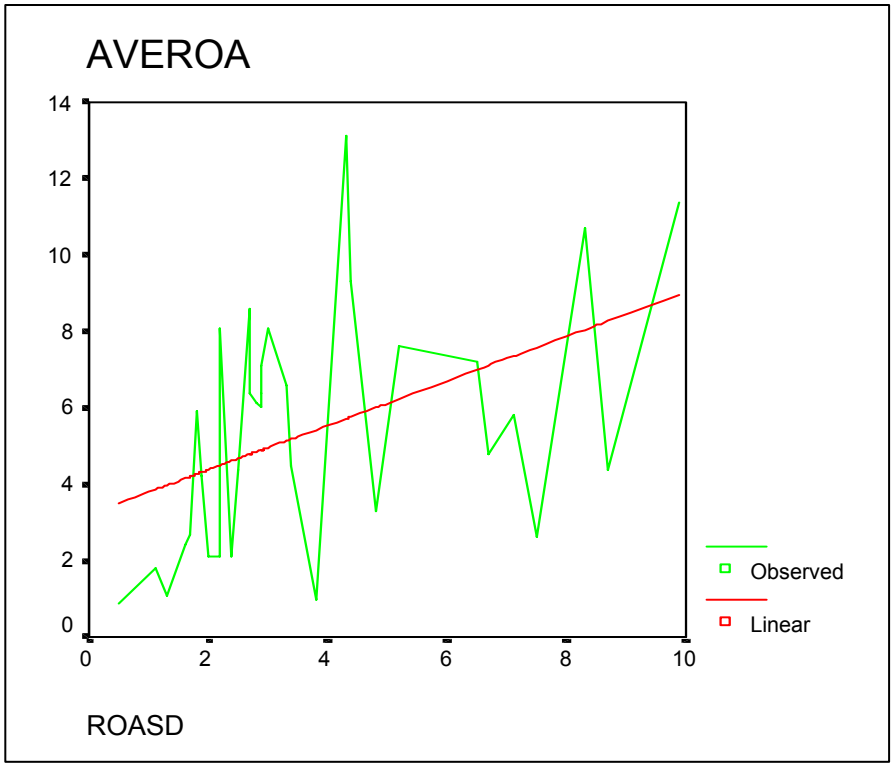
veriable. In Graph 2, curved line shows the observed NIM numbers for banks and linear line stands for the estimated or potential NIM numbers. Using the estimated linear line as a proxy for the efficient frontier, banks situated above linear line are assumed to be over efficient than banks situated below the linear line in terms of financial risk management activities. The standard deviations of the average NIM figures are expected to result from four financial risks mentioned earlier. Therefore, the estimated Efficiencies are expected to be highly correlated with these four financial risks. This regression measures a partial efficiency of banks in terms including four financial risks as ignoring operational risk. The correlates are investigated at the second stage of the analysis process used in this paper.

Graph 2: Average NIM Against Standard Deviations



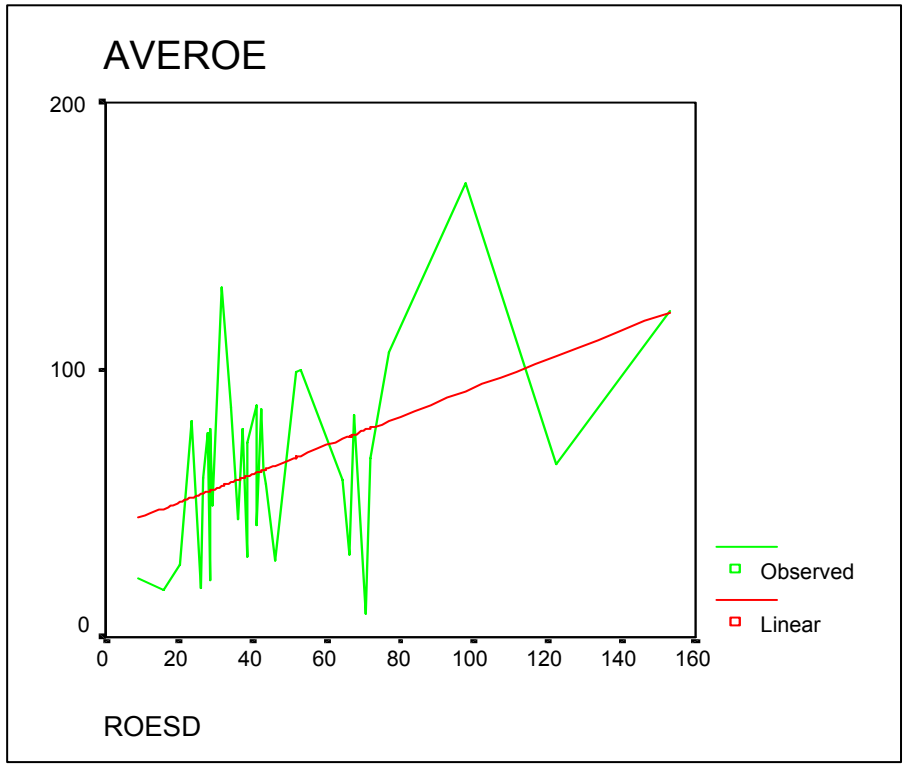
The second regression is run to estimate the relationship between the average ROA figures and their standard deviations. Graph 3 shows this estimated relationship. Again, the curved line stands for the observations or true averages of ROA of banks, while linear line stands for the estimated numbers of ROA for banks. Using this estimated linear line as a proxy for the efficient frontier, banks situated above the linear line are expected to be over efficient than banks situated below the linear line. The degrees of efficiency are expected to be highly correlated with four financial risks mentioned above plus operational risk. This regression also measures a partial efficiency since it excludes leverage risk. Operational risk is included because the ROA figures include non-interest earnings and non-interest expenses as well. The correlates are also tested at the second stage.

Graph 3: Average ROA Against Standard Deviations



Finally, the third regression is run to estimate the relationship between the average ROE figures and their standard deviations. Graph 4 shows this estimated relationship. The curved line shows the observed ROE figures and the linear line stands for the estimated ROA figures of banks. Using the linear line as a proxy for the efficient frontier, banks situated above the linear line are expected to be over efficient than banks situated below the linear line. The estimated efficiencies are expected to be highly correlated with four financial risks plus operational risk and leverage. Therefore, this is assumed to be a more complete efficiency measure than the other to efficiency measures. The correlates are investigated at the second stage.

Graph 4: Average ROE Against Standard Deviations



The regression results shown at Table 2 suggest that the linear line passing through the observed profitability figures are statistically significant at 1% level. The coefficients suggest a better relationship for NIM figures than ROA and ROE figures. That is probably all local and foreign banks' behavior towards managing financial risks are similar to each other whereas their approaches to operational activities and capital adequacy differ from each other.

Table 2: The Results of Regressions

REGRESSION	β Coef.	R^2	t Values	F Values	Durbin Watson
$NIM_i = \alpha + \beta\, \partial_i + e$	0,639	0,409	4,630	21,438	2.033
$ROA_i = \alpha + \beta\, \partial_i + e$	0,445	0,198	2,769	7,667	1.472
$ROE_i = \alpha + \beta\, \partial_i + e$	0,443	0,196	2,751	7,568	1.815

Note: All figures are significant at 1% level. There is no sign for autocorrelation.

This can be observed from the data in Table 1. The results of three regressions are products of the data in Table 1, which suggests that except for NIM figures, foreign owned banks have better profitability ratios per unit of risk than local banks. On the other hand, the local banks, with a few exceptions, have poorer risk and profitability ratios of ROA and ROE. The NIM figures per unit of risk is the same for local and foreign banks, whereas the same figure for ROA and ROE are 2.2 times and 3.5 times, respectively, in favor of foreign banks. This suggests, in general, foreign banks perform 2.2 and 3.5 times better than local banks in terms of ROA and ROE figures over standard deviations. This is reflected in regressions as well. For this reason the estimated linear line better fits for NIM than ROA and ROE.

Table 3: Estimated and Observed Profitability Figures and Differences Among Them

BANKS	ESTIMATED			OBSERVED			DIFFERENCE		
	NIM	ROA	ROE	NIM	ROA	ROE	NIM	ROA	ROE
Industry	**7.0**	**4.1**	**56.6**	**7.9**	**2.1**	**30.1**	**(0.9)**	**2.0**	**26.4**
Local Banks	**7.0**	**4.2**	**60.0**	**7.9**	**2.1**	**28.5**	**(0.9)**	**2.1**	**31.5**
Ziraat	7.6	4.3	57.9	7.7	2.1	42.0	(0.1)	2.2	15.9
Halkbank	7.0	3.4	46.6	4.8	0.9	17.6	2.2	2.6	29.0
Vakıfbank	7.2	4.0	58.8	7.9	2.7	57.1	(0.7)	1.3	1.7
Adabank	11.5	6.2	52.2	8.4	4.8	21.4	3.1	1.4	30.8
Akbank	8.0	4.2	60.1	16.5	8.1	80.7	(8.5)	(4.0)	(30.6)
Körfezbank	9.9	5.2	82.9	16.0	9.3	170.1	(6.2)	(4.1)	(87.2)
Fiba Bank	11.7	5.3	71.5	20.8	3.3	66.6	(9.2)	2.0	4.9
Finans Bank	10.2	4.4	53.6	17.6	8.6	130.9	(7.4)	(4.2)	(77.4)
Koçbank	9.0	4.7	56.2	19.9	6.6	78.3	(10.8)	(2.0)	(22.1)
MNG Bank	14.5	6.9	68.2	28.9	10.7	59.0	(14.3)	(3.8)	9.2
Oyak Bank	13.7	7.6	58.7	21.8	11.4	62.2	(8.2)	(3.8)	(3.5)
Pamukbank	7.2	3.7	43.7	6.3	1.8	22.3	0.9	1.9	21.4
Sitebank	11.7	6.4	93.7	21.4	5.8	64.8	(9.7)	0.6	28.9
Şekerbank	6.9	3.9	48.5	8.0	2.4	27.3	(1.1)	1.6	21.2
Tekstilbank	9.0	4.5	62.5	17.0	6.0	99.6	(8.0)	(1.5)	(37.2)
Turkishbank	8.7	4.7	55.7	12.2	4.5	44.2	(3.5)	0.2	11.4
Dışbank	9.1	4.4	58.2	14.7	6.4	85.0	(5.6)	(2.0)	(26.8)
TEB	7.2	4.5	54.6	11.2	6.1	86.0	(3.9)	(1.6)	(31.4)
Garanti	8.6	4.0	52.2	14.1	5.9	78.3	(5.5)	(1.8)	(26.0)
İmar Bankası	9.9	3.8	51.0	1.7	1.1	18.6	8.2	2.7	32.4
İş Bankası	8.4	4.3	52.6	8.7	4.4	49.5	(0.4)	(0.1)	3.1
YKB	7.0	4.1	51.5	6.3	4.2	59.3	0.6	(0.1)	(7.8)
Foreign Banks	**9.0**	**4.5**	**57.8**	**15.9**	**6.4**	**86.4**	**(6.9)**	**(1.8)**	**(28.7)**
Arap Türk Bank	10.2	4.9	71.0	6.4	1.0	8.5	3.9	3.9	62.6
Bnp - Ak Dresdner Bank	9.0	4.6	52.0	19.2	8.1	76.3	(10.2)	(3.5)	(24.3)
Ottoman Bank	8.9	5.5	73.8	13.0	7.6	106.6	(4.1)	(2.0)	(32.8)
Abn Amro Bank	8.8	5.2	63.1	20.3	13.1	100.3	(11.6)	(7.9)	(37.2)
Bank Mellat	7.0	4.5	56.7	8.7	7.1	73.1	(1.7)	(2.5)	(16.4)
Citibank	11.1	6.1	69.4	20.9	7.2	82.8	(9.8)	(1.1)	(13.3)
Credit Lyonnais Turkey	12.5	7.1	69.0	12.6	4.4	31.2	0.0	2.6	37.8
Westdeutsche Landesbank	10.5	6.5	107.3	11.3	2.6	122.4	(0.8)	4.0	(15.0)
Sum of Differences							**(131)**	**(16.8)**	**(149.3)**

Using the estimated regression results shown at Table 2, the potential or estimated NIM, ROA and ROE were calculated for all banks being analyzed. Table 3 contains the estimated and observed profitability figures and the differences between them for all banks. The correlates are expected to be four financial risks for efficiency differences in NIM; four financial risks plus operational risk for efficiency differences in ROA; and four financial risks and operational risk plus leverage risk for efficiency differences in ROE.

The differences between estimated profitability figures and observed profitability figures are shown in the third column of Table 3. The negative differences between estimated and observed figures, shown in parenthesis, suggest an over efficiency. Positive differences on the other hand stand for inefficiencies.

With respect to NIM figures, 26 banks have negative differences (over efficient) suggesting that they earned more than the estimated ratios based on the NIM regression. Only seven banks are inefficient with positive differences. The local banks are slightly over efficient but foreign banks are by far over efficient in comparison to the local banks and the whole industry.

The differences regarding the estimated and observed ROA figures are worse for local banks' average and the whole industry. Again the foreign owned banks outperform the local banks by far. Ten local banks and three foreign banks are inefficient as having positive differences. On the other 12 local banks and five foreign banks have negative differences suggesting that these banks' observed figures are greater than their estimated figures.

The results of ROE figures are similar to the ROA figures. The whole industry and the local banks' average figures are inefficient whereas the foreign banks' average figure is over efficient based on their risk and profitability features. Twelve local banks and two foreign banks are considered inefficient and the rest are over efficient.

V. The Correlates

The correlates expected to have some explanatory power in the efficiency differences with regard to the risk and profitability figures of banks estimated in the previous section are given in Table 4. The efficiency differences in NIM figures are expected to be explained by four financial risks mentioned earlier. However, due to the lack of information on the maturity mismatch of banks, although it is thought to be an important correlate, inclusion of interest rate risk to this work have not been possible[6]. Therefore, three financial risks; credit risk, exchange rate risk and liquidity risk, are used in examining the correlates of efficiency differences estimated in NIM. On the other hand, the estimated efficiency differences in ROA are expected to be highly correlated with financial risks plus operational risk. Thus operational risk is included in the examination process of ROA figures. For ROE the leverage risk is also included.

The definitions or measurements of correlates are given in Table 4. Using these measures as proxies for the earlier mentioned risks, three regressions are run to examine the explanatory power of these risk factors in the estimated efficiency differences.

[6] However, it is likely that liquidity risk includes interest rate risk partially.

Table 4: The Correlates of the Estimated Inefficiencies

CORRELATES	DEFINITION
CREDIT RISK	BAD LOANS/TOTAL LOANS
EXCHANGE RATE RISK	FOREIGN ASSETS/FOREIGN LIABILITIES
LIQUIDITY RISK	LIQUID ASSETS/DEPOSITS+OTHER BORROWINGS
OPERATIONAL RISK	NONINTEREST INCOME/NONINTEREST EXPENSES
LEVERAGE	TOTAL ASSETS/ SHAREHOLDERS' FUNDS

5.1. The Correlates of Efficiency Differences in NIM

Using a cross-sectional analysis, the following regression, shown in equation 3 is run to test the correlates of efficiency differences in NIM. Earlier in this work, estimated negative differences suggest over-efficiency, whereas positive differences stand for under-efficiency. The risk efficiency with respect to NIM estimated for banks operating in Turkey is negative in aggregate suggesting that, on average banks are over efficient in Turkey with respect to risk management activities. The sign for credit risk is expected to be adversely correlated with the measurement of efficiency. If the average efficiency difference is positive (an inefficient situation) then the expected sign for credit risk is assumed to be negative. That is to say that the more credit risk you have the more volatility you will observe in your profitability ratios and therefore the more inefficiency you will come across. Whereas if the average efficiency difference is negative (an over efficient situation) then the expected sign for credit risk is assumed to be positive. That is the more credit risk you have the less over-efficiency you will expect. Therefore, in our case the sign for credit risk is expected to be positive.

The expected sign for exchange rate risk is not straightforward. As is well known, a bank can have three positions of foreign assets over foreign liabilities; a positive, a negative and a neutral position. A bank with a positive position will earn money when exchange rate increases and loose money when exchange rate decreases. The opposite is true for a bank with negative position. Therefore, the sign depends on three factors; (1) the average position of banks; (2) the exchange rate risk measure shown in table 4, and (3) the fluctuation of parity over the period of analysis. Over the period of analysis the exchange rate risk was negative for banks (banks foreign assets were smaller than their foreign liabilities) and the parity increased decisively. Therefore, banks must have made losses due to exchange rate risk over the period of analysis. Accordingly, exchange rate risk, like credit risk, is expected to be adversely correlated with the efficiency differences measures shown in Table 3. Since the aggregate of efficiency differences is negative, accordingly, the expected sign for exchange rate risk is positive.

Unlike credit risk and exchange rate risk the sign for liquidity risk is hard to estimate. As it is well known, the more liquidity a bank has the less profit it will expect to have. However, in a volatile economic climate, like the economic situation in Turkey over the period of analysis, banks' assets and liabilities tend to have very short maturity. A high amount of assets and liabilities are locked in overnight lending. This situation makes liquid assets more attractive for banks since they offer competitive returns while carrying less risk than other assets. That is the more liquidity you have the more you will expect to be profitable while you will expect the related volatility to decline. Therefore, if that is true then the measure of liquidity risk will be correlated with the efficiency differences towards the same direction. Thus, in our analysis the sign is expected to be negative.

$$DIFFNIM_i = \alpha + \beta_1 CRISK_i + \beta_2 EXRISK_i - \beta_3 LIRISK_i + e \qquad (3)$$

Where, $DIFFNIM_i$ is the estimated efficiency differences of bank i in NIM, α and βs are estimated coefficients, $CRISK_i$ is the measured credit risk of bank i, $EXRISK_i$ is the measured exchange rate risk of bank i, $LIRISK_i$ is the calculated liquidity risk of bank i, and e is the error term.

Table 5: The Correlates of Efficiency Differences NIM

REGRESSION	β	t Value
CRISK	0,707	6,423[1]
EXRISK	0,255	2,379[2]
LIRISK	(0,715)	(6,379)[1]
R^2: 0,695	Durbin Watson: 2,133	F: 22,060

Note: 1: significant at 1% level, 2: significant at 5% level. There is no sign for auto-correlation.

The signs of the results shown at Table 5 are as expected. The signs of credit risk and exchange rate risk are positive; implying that the more risk a bank is imposed the less efficient it will be, whereas the sign for liquidity risk is negative. That implies that the more liquidity (the less risk) a bank has the more efficient it will be in terms of risk and profitability.

For banks operating in Turkey, credit risk and liquidity risk look more effective in terms of banks' risk efficiency regarding NIM. Whereas exchange rate risk look less important. This also means that probably almost all banks, more or less achieved the same results in managing their exchange rate exposure. However, their achievement in terms of credit risk and liquidity risk differ substantially so that a clear distinction can be made between efficient and inefficient banks. As mentioned earlier, foreign banks and a few local banks outperform all the other banks with regard to their NIM related risk and performances.

5.2. The Correlates of Efficiency Differences in ROA

Different from NIM analysis, operational activities of banks are included in the analysis due to the fact that ROA includes not only interest income and interest expenses, but non-interest income and expenses are also included. Since the average difference between estimated and observed ROA figures is negative, the signs of the correlates are expected to be the same as NIM regression. The following regression (equation 4) is run to test the correlates of efficiency differences in ROA.

$$DIFFROA_i = \alpha + \beta_1 CRISK_i + \beta_2 EXRISK_i - \beta_3 LIRISK_i + \beta_4 OPRISK_i + e \qquad (4)$$

Where, $DIFFROA_i$ is the efficiency difference of bank i in ROA, $OPRISK_i$ is the calculated operational risk for bank i, all other variables are as defined for the equation (3).

On the other hand, the sign for operational risk is expected to be negative. As shown at table 4, in this paper operational risk is measured as "non-interest income/non-interest expenses".[7] The unity; "1" becomes a benchmark for the figures of operational risk. A bank with a figure greater than "1" will be considered efficient in managing its operational activities i.e operational risk. On the other hand, a bank with a figure less than "1" will be considered inefficient. That is the greater figure a bank has the more efficient it is expected to be. Based on the measured figures used as proxies for operational risk, and remembering the negative average differences (a situation of over efficiency) the sign of operational risk is expected to be negative similar to liquidity risk. That means the more successful banks are in managing their operational activities the more efficient they will be.

[7] This stands for the result of operational risk rather than operational risk itself. However, due to difficulties in measuring operational risk this is used as a proxy for operational risk.

Table 6: The Correlates of Efficiency Differences in ROA

REGRESSION	β	t Value
CRISK	0,780	5,730[1]
EXRISK	0,119	0,768[2]
LIRISK	(0,644)	(4,905)[1]
OPRISK	(0,217)	(1,359)[2]
R^2: 0,608	Durbin Watson: 1,868	F: 10,846

Note: 1: significant at 1% level, 2: insignificant. There is no sign for auto-correlation.

The results shown in Table 6 are interesting. First of all, as in the results of NIM credit risk and liquidity risk have more explanatory power than exchange rate risk. The signs are as expected. In this regression, operational risk seems to be unimportant in terms of explaining the efficiency differences in ROAs. That implies that, almost all banks operating in Turkey have similar performances in terms of managing their operational activities so that statistically their operational differences do not have significant effects on their relative profitability performances. This can be a support for the argument that banks make all their earnings from net interest margin subject to financial risks.

5.3. The Correlates of Efficiency Differences in ROE

The correlates of efficiency differences in ROE, with regard to banks' risk management activities, are expected to include the effects of leverage as well as the other four correlates of ROA. As is well known ROE is a function of asset profitability and leverage. Therefore, leverage is expected to be a viable correlate of efficiency differences in our analysis regarding ROE figures of banks. The signs of correlates are expected to be the same as the correlates of ROA. The sign for leverage however can be either negative or positive depending on the risk level of banks.

Considering the relationship between the cost of capital, leverage and firm value; a certain level of leverage is expected to improve the efficiency of banks. But, after exceeding that certain level, it will start to adversely affect the efficiency of banks. The leverage used in this paper is not the inverse of the ratio of capital adequacy calculated for reporting to regulators. As shown in Table 4, the leverage is measured as "total assets/shareholders' funds". The following regression (equation 5) was run to test the correlates of efficiency differences in ROE.

$$DIFFROE_i = \alpha + \beta_1 CRISK_i + \beta_2 EXRISK_i - \beta_3 LIRISK_i + \beta_4 OPRISK + \beta_5 LERISK + e \quad (5)$$

Where, $DIFFROE_i$ is the efficiency differences of bank i in ROE, $LERISK_i$ is calculated leverage risk for bank i, other variables are as defined for the equation (4).

Table 7: The Correlates of Efficiency Differences in ROE

REGRESSION	β	t Value
CRISK	0,649	4,229[1]
EXRISK	0,432	2,515[2]
LIRISK	(0,216)	(1,126)[3]
OPRISK	(0,241)	(1,366)[3]
LERISK	0,295	1,632[4]
R^2: 0,546	Durbin Watson: 1,900	F: 6,499

Note: 1: significant at 1% level, 2: significant at 5% level, 3: insignificant, 4: significant at 10% level. There is no sign for auto-correlation.

The results of the last regression shown at Table 7 are in line with expectations and with the economic theory. The coefficients regarding credit risk, exchange rate risk and leverage are statistically significant at 1%, 5% and 10% confidence level respectively. Liquidity and operational risk seem to be insignificant. These results are slightly different than the results regarding NIM and ROA coefficients. The signs of the coefficients are as expected.

Again, the results suggest that banks' approaches to credit risk management differ from bank to bank so that banks' different approaches reflect in their performances. A slight difference is also witnessed in banks' approaches to exchange rate risk and leverage as well, although the significance level is not at comfortable levels. The reason for the relatively small effects of both leverage and exchange rate risk is thought to be resulted from the regulatory activities regarding capital adequacy and exchange rate positions hold by banks.

It must be underlined that, the statistically significant correlates do not suggest that banks' performances depend on them and the statistically insignificant correlates do not suggest that there is no relationship between them and banks' performances in ROE. But, it could be that, in the case of banks operating in Turkey, banks were applying similar approaches in managing their operational risks and liquidity risks, therefore, these two correlates were found statistically insignificant. Whereas, their approaches to credit risk, exchange rate risk and leverage risk were different. Therefore, these three correlates were found statistically significant.

VI. Conclusion

The efficiency of banks has been an important issue for the researchers over the last two decades. However, almost all effort spent in this area is related to the cost and/or production efficiency of banks measured with a technique called data envelopment analysis based on input-output analysis.

Based on the argument that banks are financial servicing companies and intermediating between economic units, which distinguish them from industrial firms, in this paper, an alternative approach is adopted to measure the efficiency differences of banks operating in Turkey. Due to the fact that banks being intermediary institutions their balance sheets and earnings are exposed to largely financial risks and partly to non-financial risks. Therefore, the performances of banks should be measured in conjunction with their risk management talents rather than with their production activities.

In the first part of this paper, using a cross sectional analysis, the performances of banks operating in Turkey were estimated as using an ordinary least square technique with dependent variable being banks observed profitability ratios (net interest margin, return on asset and return on equity) and independent variables being the standard deviation in their profitability ratios. After that, the difference between estimated and observed figures was calculated for each bank. These differences were used as proxies for efficiency differences for each bank. Then, in the second part the correlates of efficiency differences are examined.

The correlates were expected to be credit risk, exchange rate risk, liquidity risk and interest rate risk for net interest margin. The correlates included operational risk for return on asset and included leverage as well for return on equity. Theoretically all these risks are expected to have effects on the performances of banks.

The results obtained for banks operating in Turkey, on the other hand, say that, first of all credit risk seems to be a crucial part of bank management and accordingly it has a great effect on the efficiency of banks regarding all three profitability ratios. That is to say that, banks' approaches to credit risk management is different and therefore, their relative efficiencies depend

largely on their performances in managing the credit risk that they are exposed to.

Among the other risks, liquidity risk seems to have a large effect on net interest margin and return on asset. Exchange rate risk seems to have significant effects on net interest margin and return on equity. Operational risk seems to be irrelevant for all three profitability ratios. Leverage seems to have a relatively small effect on banks' performances regarding return on equity.

In general, in line with the economic theory, the results suggest support for that there is a relationship between risks and profitability performances for banks operating in Turkey. However, due to the volatile economic climate in Turkey and the small number of banks being analyzed the results should be considered carefully. Nonetheless, the same analysis can be applied to banks operating in developed countries for better and stronger comments.

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MONETARY POLICY ANALYSIS FOR TURKEY IN A GAME THEORETICAL PERSPECTIVE

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Abstract
The main goal of monetary authority is to create a stable output and price level in the economy. Policies to be used depend upon the relative weights of above goals for the monetary authority. Also, the expectations of other economic institutions are important for policy determination. Within this context, this research investigates various policies that the monetary authority should follow depending on the expectations of economic institutions in the country. In order to do that, we constructed a game theoretical model and showed which policy results in Nash equilibrium. The last point discussed in the research is the policy applications of the Central Bank of Turkey from 1990 to 2003.

I. Introduction

Monetary authority has to take several limitations into consideration when determining its policy goals. Development level of the country, public deficits, level of its independence from political authority, and contradictions among its own policies are some of the important limitations we can state. Under all these structural limitations, creating stability between price level (π) and output (y) can be considered the ultimate goal of the monetary authority. Relative weight of importance of these two variables from the perspective of monetary authority determines which policy to follow.

If it is accepted that policies of monetary authority are inflationist due to reasons such as financing budget deficits and decreasing real interest rates rather than price stability (Cukierman, 1992), the probability of deceiving private economic agents always exists. An unexpected monetary policy causes

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a change in resource allocation by creating a higher inflation level. These kinds of policies do not affect real variables in the long term and they harm monetary authority. Thus, the monetary authority has to gain trust of economic entities and follow such policies that serve for both goals mentioned above.

Trust of economic agent (credibility) depends upon how powerful the monetary authority is in affecting the expectations of these agents. The monetary authority gains this trust by declaring its own policies and applying them in a way that they are declared. Thus, modern monetary policies are based on rules. "Rules policies" include binding promises and expectations of private economic agents. This harmony facilitates both stability in price and output increasing.

Monetary authority can overcome credibility problem by deciding which policy to follow. It may choose "rules policy or discretion policy". The decision has to be made at this point first. This study analyzes both policies with help of loss function. Then, the results obtained will be discussed in a game theoretical framework. The last part of the study will discuss monetary policies of Central Bank of Republic of Turkey (CBTR) applied in 1990 through 2003.

II. Decisions Problem of Monetary Authority and Loss Functions

We assume all economic agents have the same kind of preferences and infinite lives when defining the loss function. Under this assumption, social welfare function coincides with individual welfare functions. We have this assumption in order to move from individual welfare functions to a social welfare function. Constructing such a function gives us the opportunity of analyzing choice problem (inflation or output) of monetary authority with the help of loss function. The starting point of monetary authority is to determine its loss function. The ultimate aim of monetary authority determines the shape of loss function. For instance, a monetary authority willing to fight inflation will have to minimize its loss due to this fight and necessary arrangements in a its monetary policy tools (Blanchard & Fisher, 1989).

Loss function can be defined as difference between monetary authority's targets and actual level of variables. A loss function includes both inflation stability and output stability. In other words, loss function of monetary authority consists of inflation deficit and output deficit in the economy. This function can mathematically be expressed as:

$$L = E\left[\sum_{0}^{\infty}(1+\delta)^{-t}\left(\left(\pi_t - \pi_t^*\right)^2 + b\left(y_t - y_t^*\right)^2\right)\right] \qquad (1)$$

Where π_t indicates de facto inflation level, π^* indicates inflation rate targeted by the monetary authority. y_t indicates output increase rate and y^* neutral output level. Also, the terms $(\pi_i - \pi^*)^2$ and $(y_i - y_t^*)^2$ indicate deviation from targeted inflation level and deviation from the output level, respectively. Also, the term $(1+\delta)^{-t}$ is a discount factor. The magnitude of discount factor determines policy application time of monetary authority. The longer the discount factor, the shorter the time horizon of policies and vice versa. Magnitude of discount factor can also be interpreted as an indicator of trust among economic agents in the economy (Kanchard & Fisher, 1989).

Relative weight of output increase rate has been showed by notation "b" in the equation. If b=0, loss function consists of inflation deviation only. In this case, changes in production level do not affect the loss function. On the other hand, if b>0, output deficit (or stability of real economy) has also been included into the loss functions. This situation is called "elastic price stability".

Long term loss function can be converted into a simple one term loss function for the sake of simplicity:

$$L = a\pi_t^2 + (y - ky^*)^2 \qquad (2)$$

As we can see from equation (2), the loss function of political authority depends upon both de facto inflation and output variations. The purpose of showing this relationship as a quadratic form is to avoid negative and positive fluctuations canceling each other out (Telatar, 1997). The other reason of using quadratic is to include policy deviations as a punishment into function. The term "k" in the equation (2) implies a disturbance effect and/or monopolistic/ oligopolistic structure of the market. If there are monopolistic tendencies in the market, the term "k" k will be greater than one. Monetary authority will try to minimize fluctuations in both inflation and output level (Clarerda v.d., 1999).

$$y = y^* + \alpha(\pi - \pi^e) \qquad (3)$$

Output level can be defined with Lucas supply function in modern monetary policies[1]. Effect of monetary authority's policies on output can be determined based on structure of the economy. The monetary authority will have the incentive to create unexpected inflation if output increase rate is determined according to equation (3). As can be seen from the equation, the monetary authority may use an expanded monetary policy and bring the economy into equilibrium where actual output level is higher than neutral output level (Erdoğan, 1997).

Inflation expectations, actual inflation and actual output increase rate should be considered simultaneously. Output increase rate depend upon inflation expectation of the private sector and situation of the monetary authority. In other words, expected inflation (π^e) is a decision variable that is determined by private sector. Actual inflation (π) is a policy variable of the monetary authority. Economic entities make their decision about future inflation rate according to the actual inflation rate and the decision of the monetary authority. Inflation policies of the monetary authority determine the future inflation rate. Thus, monetary authority implicitly determines future inflation rate while determining current inflation rate. The monetary authority may create a low inflation rate by using rules policy or create a higher inflation rate by using discretionary policy. Within this context, monetary policy determinations will be discussed with the help of loss function in the proceeding part of the paper. In addition, deterministic models will be used in order to ease political decision analysis.

2.1. Equilibrium in Deterministic Models

The relationship between dependent and independent variability is known in deterministic models. In other words, uncertainty is taken out of the model. Uncertainty can be distinguished into two parts: endogenous uncertainty and exogenous uncertainty. While endogenous uncertainty implies the relationship between tools and targets of monetary authority, exogenous uncertainty implies unexpected shock in the economy (Blackburn and Christensen, 1989). We, however, will assume no uncertainty in this study[2].

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[1] Arranged Lucas supply function includes not only expected inflation rate but also unexpected inflation. Thus, the equation becomes $y = y^* + \alpha(\pi - \pi^e) + b\pi^e - \varepsilon$. However, we still can disregard b, since the main term effecting the output is α coefficient. For more detailed information see, Telatar, (1996).

[2] Exclusion of non-deterministic models does not bring any deficiency to the study. Because non-deterministic models give similar result as well (persson & Tabellini, 1990).

2.1.1. Binding Political Environments

One of the policies that monetary authority can follow is the "rule" policy. In this policy, the monetary authority determines fix rules and applies them no matter what. In other words, rule policy does not include decision (McCallum, 2000). Thus, the monetary authority declares binding rules beforehand and follows them. By doing this, it put itself under obligations. There are legal sanctions for these obligations as well. Economic agents know this, and trust the monetary authority (Baro and Gordon, 1983). Since rational monetary authority chooses decreasing both current and future inflation level, it also determines inflation expectations ($\pi_t^e = \pi_t$). Thus, under the binding political environment value of de facto inflation rate minimizing the loss function will be zero ($\pi_t = 0$). Equation (2) can be converted into equation (4) by adding unexpected inflation into the loss function in binding political environment.

$$L = a\pi^2 + \left(y^* + \alpha\left(\pi - \pi^e\right) - ky^*\right)^2$$

$$\pi = \pi^e \Rightarrow \quad L = a\pi^2 + (k-1)^2 y^{*2} \tag{4}$$

In order to minimize this equation, we have to put zero for inflation. In other words, the value of inflation is zero under a binding political environment[3]. Thus, we can write this as follow:

$$L^c = (k-1)^2 y^{*2} \tag{5}$$

Under the assumption of using a binding policy, current output level will be equal to neutral output level and thus.

$$y^c = y^* + \alpha\left(\pi - \pi^e\right) \Rightarrow y^c = y^*$$

where c stands for rules can be written as:

$$L^c = (k-1)^2 y^{*2}$$

$$\pi^c = 0$$

$$y^c = y^*$$

[3] Inflation rate must be zero in binding policies. The most important reason for that is the difficulties in convincing private sector for decreasing the rate of inflaiton (Fisher, 1995). However, Walsh (1995) claims the opposite.

2.2. Non-Binding Political Environments

A non–binding environment gives the monetary authority flexibility of breaking its promises. This is called "time inconsistency". The main problem here is that the monetary authority may create a higher inflation than promised. Time inconsistency in monetary policies exits when the monetary authority chooses contrasting policies to inflation expectations and creates higher inflation (Lohmann, 1992). Monetary authority may show opportunistic behavior and creates very high inflation rate and thus gain profits if economic agents have very low inflation expectations[4].

If a policy is not the same at the beginning and at the end of the period in which it is put into effect, this is considered as a time inconsistency of that policy. In other words, if the monetary authority oblige itself to apply a policy in time (t), but uses another policy in time (t+1), there is a time consistency of that policy (Bierman and Fernandez, 2000). The extremist point of non-binding policy is cheating.

2.2.1. Cheating Policy

As can be seen from the expression below, if the monetary authority follows a policy differing from past inflation rates and expectations of economic agents, this is called "cheating" policy.

$$\pi_t > \pi_t^e = \pi_{t-1} = \pi_{t-1}^e$$

Let us assume for a moment for the sale of simplicity that inflation expectation of economic agents is zero ($\pi^e = 0$). The monetary authority choose those policies that minimize the cost of inflation.

$$L = a\pi^2 + \left(y^* + \alpha\left(\pi - \pi^e\right) - ky^*\right)^2$$

It is necessary to take the first deviate of loss function with respect to inflation in order to find the value of inflation rate[5]. We will use L^o for cheating policies.

$$\pi^\circ = \frac{\alpha(k-1)y^*}{a + \alpha^2} \tag{6}$$

[4] We use the word "profit" for y>y*. This creates increases in seigniorage incomes.
[5] A detailed prof for cheating policy has been given in Appendix A.

The term π° in equation (6) implies inflation rate under cheating policy. The value of loss function under cheating policy can bee written as:

$$L^{\circ} = \frac{1}{1+\alpha^2 a^{-1}}(k-1)^2 y^* \tag{7}$$

With the same logic, cheating policy output level can be written as

$$y = y^* + \alpha\left(\pi - \pi^e\right) \Rightarrow y^{\circ} = y^* + \alpha\pi^{\circ} \tag{8}$$

If the equilibrium value of cheating policy has been put into equation (8), we see that current output level exceeds neutral output level by the amount of $\frac{\alpha^2(k-1)}{a+\alpha^2}$.

$$y^{o} = \left(1 + \frac{\alpha^2 (k-1)}{a+\alpha^2}\right) y^* \tag{9}$$

Since cheating policy increases the current output by the rate of inflation, this is a utility situation for the monetary authority. This is the main incentive for monetary authority. However, if the game is dynamic and continuous, it is impossible for the monetary authority to use cheating policy. Thus, even though applying cheating policies is possible for one-shot games, it is not applicable for continuous games. Since the economic agent will not trust the monetary authority, it will have incentives to expect higher inflation rates. This will be enough for monetary authority for not using cheating policy. Output level increases in short term will disappear in the long term (Süslü & Baydur, 2002). As a result non-applicability of cheating policy reduces monetary policies into two dimensions. The first one is the binding policies that discussed previously, and the second one is discretionary policies. Inflation expectations of economic agents are not zero under discretionary policy.

2.2.2. Discretionary Policy

Under the discretion policy, the monetary authority uses random policies based on the conditions of the economy. This is a day-to-day policy rather than a rule policy (Taylor, 1993). In other words, a discretion policy is a policy that the monetary authority applies without any relationship among uncertain policies and a non – credible monetary authority.

This uncertainty affects the expectations of economic agents. Under discretionary policy, the monetary authority takes economic agents' inflation expectations given rather than trying to change their expectations. This creates output increases in short-run, however, in the long run, inflation expectations of economic agents increases (Romer, 1996). Inflation and output level obtained under discretionary policy[6] can be written as:

$$L^i = a\pi^2 + \left(y^y + \alpha\left(\pi - \pi^e\right) - ky^*\right)^2$$

$$\frac{L^i}{\partial\pi} = 0$$

$$\pi^i = \frac{\alpha(k-1)y^* + \alpha^2\pi^e}{a+\alpha^2} \tag{10}$$

As can be seen from equation (10), current inflation rate is not only related with choice of monetary authority, but also it is related with other economic agents' expectations. If economic agents act according to rational expectations hypothesis, the monetary authority can Project the inflation rate correctly. Under this assumption, inflation rate under discretion policy becomes:

$$\pi^i = a^{-1}\alpha(k-1)y^* \tag{11}$$

Since $\pi^e=\pi$ at equilibrium loss of the authority under discretionary policy becomes:

$$L^i = a\pi^2 + \left(\left(y^* + \alpha(\pi - \pi^e\right) - ky^*\right)^2 \tag{11'}$$

$$L^i = \left(1+\alpha^2 a^{-1}\right)(k-1)^2 y^{*2} \tag{12}$$

[6] A detailed proof for discretionary policy has been given in Apendix B. The term i is used for discreationary policy.

After these points, we can easily calculate current output level, since cheating on economic agents under this policy is not possible, de facto output 6 level will be equal to neutral output level. Equation (13) states this fact explicitly.

$$y_i = y^* + \alpha\left(\pi^i - \pi^e\right) \Rightarrow y_i = y^* \qquad (13)$$

Table 1 shows the result for three policy options discussed above

Table 1: Value of Loss Function and Main Macroeconomic Indicators

Policies Variables	c(Rule)	o (Cheating)	i (Discretion)
Loss Function (L)	$L^c = (k-1)^2 y^{*2}$	$L^\circ = \frac{1}{1+\alpha^2 a^{-1}}(k-1)^2 y^{*2}$	$L^i = (1+\alpha^2 a^{-1})(k-1)^2 y^{*2}$
Inflation (π)	$\pi^c = 0$	$\pi^\circ = \frac{\alpha(k-1)y^*}{a+\alpha^2}$	$\pi^{,} = a^{-1}\alpha(k-1)y^*$
Output (y)	$y^c = y^*$	$y^\circ = y^* + \alpha\pi$	$y^i = y^*$

Under non-applicability of cheating policy, we can compare the result of rule policy and discretion policy. In order to do that, we subtract loss function:

$$L^i - L^o = \left(1+\alpha^2 a^{-1}\right)(k-1)^2 y^{*2} - (k-1)^2 y^{*2} = \alpha^2 a^{-1}(k-1)^2 y^{*2} = b > 0$$

$$L^i - L^o > 0 \Rightarrow L^i > L^o$$

Since value of discretion policy is greater than that of rule policy, the monetary authority will apply rule policy. In addition, inflation rate will be lower and output increase will be greater under rule policy. Thus, this policy choice creates an environment for cooperative game and decreases inflation deficits[7] (Goodhart, 1989).

[7] This is called "the best policy" in economic literature. For more infornation see Srour, 2001.

III. Game Theoretical Analysis of Monetary Policy Applications

There are two sides in monetary policy applications: The monetary authority (i) is one side, private economic agents (j) on the other side. Since both sides are rational, they try to maximize their benefits. The welfare function of monetary authority can be written as:

$$U_i = \eta\left(\pi - \pi^e\right) - \pi^2$$

The term η indicates a conservative monetary authority's coefficient. The closer this term is to zero, the lower utility the monetary authority will get, or vice versa. Thus, the monetary authority determines the value of η.

The other players, private sector, however, try to project the inflation rate correctly in order not to find itself in unwanted surprises. The higher the projection error, the lower the utility for private sector. This can be written as:

$$U_j = -\left(\pi - \pi^e\right)^2$$

Table 2: Game Theory in Monetary Policy[8]

		Economic Agents	
		π^e = D	π^e = Y
Monetary Authority	π = D	0, 0	-2, -1
	π = Y	1, -1	-1, 0

If monetary authority chooses high inflation rate, while private sector is expecting a lower inflation, the equilibrium will be at (1,-1). This is the result of cheating policy explained above. However, this is a none-cooperative game. Thus, dominant strategy for private sector will be higher inflation as well (Cukierman, 1994). Thus, the equilibrium will be at (Y,Y) point. This situation can be explained as such: if Nash point is (D,D) for both sides, marginal utility of both will be zero, and the second deviations are negative (U_j=0, U_j<0). In other words, private sector maximize its utility, but this point is not an efficient point for monetary authority (U_i>0). As long as its marginal utility is negative, the monetary authority will have incentive to cheat. As can be seen from Table 2, if the Nash equilibrium was (D,D) initially, the monetary authority could have been increased it utility by creating higher

[8] We put some limitations to our model π=(0,1), D (Low inflation=0), Y (Higher inflation =1). Also, the assumption of η=2 has been made for the sake of simplicity. Using different number for η will not change the results discussed above.

inflation. As a result non-cooperative game result takes place in (Y,Y) point, (Romer, 1996).

Nash equilibrium at (Y,Y), however, is not an efficient point. Since, the monetary authority may increase its utility level without decreasing the utility level of private sector. This happened at (D,D) point. Thus, (D,D) is a pareto-optimum equilibrium point. However, this result is a cooperative game result. If the monetary authority follows rule policy, this can be considered as a cooperative game (Artigues & Vignola, 2002). In order to create price stability, the best way for monetary authority is to apply credible policies, and this can only be done by applying rule policies rule policies

In summary, a rule policy applied by the monetary authority converts the game into a cooperative game. Such a disciplinary rule policy increases credibility of the monetary authority (Canzoneri, 1985).

IV. Necessary Components for Success of the Rule Policy

Rule policy increases credibility of the monetary authority. This policy forces the monetary authority to keep its promises. If this happens, the difference between target values and actual values of the variables has been minimized. Thus, loss function also has been minimized. The monetary authority uses anchors to optimize its policies. Anchors are special instruments that give information to private sector, and put responsibility and shoulders of the monetary authority (Baydur & Süslü, 2002). Monetary authorities have to gain the trust of private sectors in order to reach the targeted inflation level. They cannot reach the target level without help of other institutions. If private sector trust the monetary authority, it will be easy to reach targeted levels of the variables. For this reason, anchors force the monetary authority to use credible policies.

Monetary authority either uses ultimate targets or intermediate targets, all applications are anchors. All anchors are considerable as binding promises and they create restriction for monetary policy applications (Telatar, 2002). In order for the monetary authority to reach its targets under rule policy, following three conditions must be met: First, the monetary authority has to have authority to fight inflation. In other words, it must be an independent entity. This independence gives the monetary authority a higher inflation "conservative coefficient". The more willingness of the monetary authority has the more successful the rule policy will be (Artigues & Vignola, 2002).

The second condition is that whole community must be in consensus on inflation stability. Since other private sectors can affect inflation targets due to their price maker roles. It will be very easy to reach a stable inflation rate if the above mentioned consensus between the monetary authority and community exists.

The third condition is that these should be suitable economic structure to apply monetary policies. For instance, structural problems must be solved previously in order to apply one of the anchors. There will be no credibility for the policies that are not powered by structural support (Fisher, 1997), structural shocks in the economy affect the result of rules policy. Usually, it is not easy in dynamic environments to put targets on a variable and reach that.

It may not be an easy task to reach target level if previously considered conditions change. As a result, the credibility of the monetary authority is affected negatively**.** Monetary authority must determine position for unforeseen conditions. For instance, a determined behavior of the monetary authority may change the behavior of private sector as well and may reduce the inflation level (Çolak et. al., 2004).

Rules policy followed by the monetary policy may not project all the shocks. Thus, the monetary authority is in a dilemma of following the rules policy or leaving the rules policy and losing credibility. One way to avoid this risk is to follow rules policy in normal periods and use discretion policy in risky periods (Flood and Isard, 1988). If the monetary authority faces big enough shocks in the economy, it should move from rules policy to discretion policy (Lohman ,1992), and rules policy should be started to be applied again after the shock. The monetary authority can reach successful policies by applying aforementioned policies.

V. Turkish Experience Between 1990 and 2002

As we explained in the theoretical part of the paper, success of rules policy depends on structural components supporting these policies. The most important component is the common consensus about the policy. This was one of the main problems of public sector in Turkey for a long time. Protocol signed in 1997 between CBRT and Treasury and agreement with IMF in 1998 may be considered as a consensus for decreasing inflation rate**.** Since, after 1997, condition for rules policy to be successful started developing and this has been certified with stand-by agreement with IMF in 1999. Even though crises in November and December are very harmful for the Turkish economy, they initiated the structural change in the economy. For instance, increasing the independence of CBRT, considering the laws needed to support this structural change have played a very imported role in succeeding the polices applied between 2000 and 2003. However, role of structural policies, even though it is important, has not been analyzed in this paper.

Monetary programs are the tools that declare how and why the anchors will be used for a specific period of time. CBRT has used various anchors such as exchange rate, inflation monetary magnitudes etc. Policies declared with monetary programs could be either rules or discretionary. On order to analyze what kind of policy is used during the period of 1990-2003, it is enough to look at if the CBRT has given any binding promises.

We can use three sub-periods when analyzing between 1990-2003 period: The first sub-period is 1990 to 1995. There were no binding promises made between these years. The second sub-period is from 1996 to 1997. This period can be considered a period in which indirect targets has been used. The third period is from 1998 to today. During these years inflation target has been declared and rules policy has been applied.

5.1. Evaluation of 1990-1995 Period

As can be seen from Table 3, the CBRT did not put any targets regarding inflation between 1990 and 1995. Instead, it aimed to create stability in prices. There are four variables in monetary program of this period. CBRT money, total domestic assets, total foreign assets and CBRT balance sheet.

Table 3: Monetary Program Targets and Actual Levels (%)

	1990 PT	1990 A	1991 A	1992 PT	1992 A	1993 PT	1993 A	1994 PT	1994 A
Balance Sheet	12-22	24.1	58.9	37-47	85	-	60	-	142
Total Domestic Liability	15-25	21.6	66.6	38-48	101	-	49	-	73
Total Domestic Assets	6-16	11.9	64.3	27-39	75	-	55	-	106
CBRT Money	35-48	26.6	82.6	40-50	100	-	46	-	51
CPI	-	53	59		62	-	58	-	120
Exchange Rate Reserve (Billion $)	-	-3.90	-2.75	-	-1.59	-	-2.29	-	-3.94

Source: Cbrt, PT: Program Target, A: Actual

In the first part of 1990's both public deficit increase and exogenous shocks (1991 Iraqi war, 1992 Europe Monetary Crisis, 1993-1994 uncontrolled increases in public expenditures) did not give opportunity to CBRT in using rules policy. As can be seen from Table 3, CBRT has not used rules policy and inflation target. Year 1995 is period that follows the agreement with IMF. Even though the CBRT put targets at domestic assets and be partially successful in that, we cannot reach a conclusion of rules policy applications. Because the CBRT has not made any binding promises for inflation targets.

The policies used between 1990 and 1995 are inflationist policies. Table 5 shows this fact. For instance, inflation rate increased from 50 % to 90 %. Thus, we can verify that discretionary policies cause an increase in inflation level.

5.2. Evaluation of 1996-1997 Period

The CBRT has used undeclared monetary program in 1996 and 1997. Also, Reserve Money has been taken as operational target of CBRT. The most important indicators of rule policy such as declaring the inflation and taking responsibility have not been applied by CBRT during this period. Thus, we accept the monetary policy of this period discretionary. Also another important indicator of discretionary policy is that behavior of CBRT shapes the projections of private sector (CBRT, Yearly Report, 1997, 80-97). As it can be seen from Table 4, reserve money has been taken as target, and both inflation and reserve money increased 80 %.

5.3. Evaluation of 1998-2004

Uncontrollable high inflation level has been started to felt by all parts of the economy before 1998. This increased the cost of production. Fighting with inflation became the most priority for the government and agreement between IMF and the Turkish government has been signed (CBRT, 1998). For that reason 1998 can be considered a mile-stone for Turkish economy.

The CBRT has used net domestic assets as operational target instead of reserve money. By targeting 50% increase in wholesale price index, an important requirement of rules policy has been met 1998. Even though the actual level of wholesale price index was 54.3% in 1998, level of domestic was taken low than targeted level. Thus, the CBRT has gained credibility in this year. 1999 was a transition year, since an agreement between CBRT and IMF has been signed.

In order to gain even more credibility, the CBRT converted the IMF agreement to a stand-by agreement. Since inflation rate was still too high, a unique macroeconomic policy packet declared by IMF, was a logical solution for the Turkish Economy.

Intention Letter submitted to IMF in 1999 has been approved by IMF officials, and a program for decreasing inflation put into effect. This program used monetary targets as well as exchange rate as anchor. Inflation targets in this program were 25% in 2000, 12% in 2001, and 7% in 2002, however, these targets have not been reached due to February 2001 crisis. Even though, a rule policy has been declared by CBRT, this crisis created a chaos in Turkish Economy, and thus, the CBRT has lost its credibility.

As Table 4 shows, program targets have been revised after the crisis. However, inflation could not be decreased enough with respect to exchange rate. As a result, this created an unstable political environment, capital movement to other countries, and considerable amount of budget deficit in

Turkish economy[9]. In order to handle this crisis, a new stand-by agreement has been signed with IMF in May 2001.

Economists agreed that stability program used in 2000 was a rule policy. CBRT has bought another country currency with high inflation in order to decrease inflation in Turkey. However, exit time from the anchor should be known precisely. Otherwise, it creates problems in banking sector, unbalanced budget, slow downs in the economy, like it happened in Turkey 2000.

After 2001, the CBRT has gained its independency[10], and aimed only one objective: price stability. While net domestic assets were target 2001 and 2002, monetary base and net international reserve has been used as performance criteria. As can be seen Table 4, aimed levels could not be reached in these variables. Structural precautions followed in 2002 resulted in a lower inflation level than targeted. A similar policy has been used in 2003, and trend of inflation continued to decline. The CBRT has reached its targets in 2003, and thus increased its credibility. This is a clear indication that the CBRT used rule policy.

As stated above, the CBRT has used rule policy in 2002 and 2003. As it can be seen from Table 4, expected consumer price index was 35% in 2002 and 20% in 2003. Actual levels, however, were 29% in 2002 and 19 % in 2003. It is expected that CPI will be less than 12% in 2004. Thus, the CBRT has gained credibility during these years.

As a summary, we can state that the period between 1998 and 2003 has experience a rule policy rather than discretion policy. As can be seen from Table 5, inflation rate is lower in those periods that rule policy is followed. The opposite is true for these periods that discretion policy is used. In addition to that, Table 5, clearly indicates that discretion policies cannot sustain the increase in output level, and thus creates on unstable growth. Our analysis in this increase in the output level cannot be sustained under discretion policy.

VI. Test of the Projections

As we state in theoretical part of the study, if a monetary authority has credibility, it will be easy for private sectors to accept and adopt polices of the CBRT. Also, trusting the CBRT creates lower inflation expectations in private sector agents. We have shown this argument gave theoretical part of the study. In this part of the paper, we will test credibility rate of CBRT.

This test can be done by using Swensson equation given below:

[9] Fixed Exchange rate policy is a rule policy, but this policy is not elastic to shocks. If the shocks are greater than a level that can be absorbed by the CBRT, it is more logical to follow a discretion policy. For more information regarding to exchange rate choice see (Agenor, 2000).

[10] Turkish Great National Assembly (TBMM) accepted the law number 4651 regarding independency of CBRT in April 2001.

$$\pi_t^e = \phi^* \pi^* + \sum^{j} (1-\phi^*)\pi_{t-j} \qquad (14)$$

Where ϕ^* is a "credibility coefficient". If ϕ^*=0, private agents do not have trust for the CBRT and if ϕ^*=1 the private sector agents completely trust the CBRT the notation j in equation (14) represent the length of delay.

As stated above we can test credibility of the monetary authority with equation 14 above. In order to that we have to estimate Ø* coefficient and compare the results for each sector. Under the assumption of rational expectations, equation (14) can be converted into equation (15) below:

$$\pi_t = a + b\pi_{t-1} + u_t \qquad (15)$$

$$b = 1 - \phi^* \qquad (15')$$

We have used stationary test before putting Consumer Price Index (CPI) into regression equation. Appropriate length of delay has been determined by creating cologrames for each CPI series. The results obtained for 1991-1997 period one given in Table 6. We have summed the "b" coefficients which show significance in their magnitudes.

Negative inflation levels in the Table, for instance AR(2), mean inflation rate is decreasing. We have looked the autocorrelation in order to test significance of the results. This test should be done with Breusch-Godfer Serial Correlation LM test. The hypothesis "Ho: Autocorrelation exist" has been rejected, since the value of F statistics is 0,278. The specification of the equation in Table 6 has been confirmed with Ramsy test. Since the F statistics has value of 1.615, we concluded that there is no error in model specification. Then, with the help of equation (15') we found a credibility coefficient (ϕ^*) for CBRT (1-ϕ^*=0.84).

Table 6: Credibility Coefficients for CBRT (1990-1997)

Least Square				
Sample period: 1990:02 1997:12				
Dependent variable: CPI I				
Variables	Coefficient	Std. Dev.	t-Statistic	Prob.
C	84.67782	8.569809	9.880946	0.0000*
AR(1)	1.302490	0.115909	11.23717	0.0000*
AR(2)	-0.344442	0.117153	-2.940112	0.0045*
AR(10)	-0.128938	0.064990	-1.983959	0.0514**
AR(13)	0.084315	0.060358	1.396912	0.1671
R^2	0.895527			
		F-statistic		141.4363
Durbin-Watson stat	1.990844	Prob(F-statistic)		0.000000

* Significance in 1% level, ** Significance in 5% level,
*** Significance in 10% level

This period in which the monetary authority has used a discretionary policies, credibility coefficient is 0.16. This is close to zero. So, credibility of the CBRT is very low. If we calculate the same coefficient for 1998-2003 period, we see from Table 7. that this number is 0.63 in 1998-2003 period. Credibility of the CBRT has increased significantly. Thus, we conclude that rules policy gives better results than discretion policy in fighting with inflation. Of course, the structural reforms made during 2000 and 2001 have important role in this, but the results supports the coefficients given in Table 7.

Table 7: Credibility Coefficients for the CBRT (1998-2003)

Least Square				
Sample period: 1990:02 1997:12				
Dependent variable: CPI				
Variables	Coefficient	Std. Dev.	t-Statistic	Prob.
C	-0.975317	0.253469	-3.847869	0.0003*
AR(1)	0.377739	0.103431	3.652100	0.0006*
AR(10)	-0.058990	0.111332	-0.529858	0.5984
AR(11)	-0.132433	0.137956	-0.959964	0.3414
R^2	0.601753			-0.785224
		F-statistic		20.02078
Durbin-Watson stat	1.574888	Prob(F-statistic)		0.000000

* Significance in 1% level, ** Significance in 5% level,
*** Significance in 10% level

We also tested if there is a structural change in Turkish Economy. This test should be done with the help of dummy variables. Table 8 gives the results obtained from structural change test conducted. We used monthly date and used 1 for after 2001, and zero to between 1998 and 2000 period.

Table 8: Structural Change

Least Square				
Sample period: 1998:03 2003:12				
Dependent variable: CPI				
Variables	Coefficient	Std. Dev.	t-Statistic	Prob.
C	-0.636152	0.302376	-2.103846	0.0402**
KUK	-0.997021	0.556717	-1.790894	0.0791***
AR(1)	0.334596	0.104598	3.198866	0.0024*
AR(10)	-0.066609	0.109925	-0.605950	0.5472
AR(11)	-0.129563	0.135126	-0.958831	0.3421
R^2	0.623665			
		F-statistic		17.23496
Durbin-Watson stat	1.573180	Prob(F-statistic)		0.000000

As it is shown in Table 8, the coefficients of the variables are significant in 10% level. Thus, we conclude that structural change has impact on the success fighting with inflation. Actually, these results were no surprise for us. They were expected and also should be this way too.

VII. Conclusions and Suggestions

This study analyzed the Turkish monetary policy applied between 1990 and 2003. Even though we used three periods, it may be reduced to two periods only: 1990-1997 and 1998-2003 periods. The CBRT used monetary programs in its policies during 1990-2003. Monetary authorities have free choice of selecting what kind of policy to follow: rules policy of discretion policy. The CBRT has used discretion policy between 1990 and 1997 and rules policy afterwards. The reason of discretion policy between 1990 and 1997 is because the monetary has not been supported by fiscal policies during this period.

The CBRT has used rules policy between 1998 and 2003 (with the exception of 2001 crises year) and became successful in its policies. Our econometric tests prove these facts.

When the rules and discretion policies are compared, the results obtained in rules policy suggest better solutions regarding inflation target. We found that credibility coefficient was 0.16 in 1990-1997 period, while this rate is 0.63 in 1998-2003 period. It is impossible for the CBRT to cheat in its policies.

Even though this study claims that rules policy gives better results than discretion policy, we should not underestimate the importance of structural precautions taken in the economy in the process of success.

We did not focus on limitations of both discretion and rules policy. If such policy limitations are also considered as a Pareto optimum point in Turkey, the success of rules policy is depend on how firm the CBRT stands on applying rules policy. Otherwise future may bring more and serious surprises to the Turkish economy.

Table 4: Monetary Program Targets and Actual Level (Billion TL)

	1995 PT	1995 R	1996 PT	1996 R	1997 PT	1997 R	1998 PT	1998 R	1999 PT	1999 R	2000 PT	2000 R	2001 PT	2001 R	2002 PT	2002 R	2003 PT	2003 R
NDA	-	393	-	-	-	-	700	579	-	-1319	-1308	1060	22400	17933	33.139	28.603	33.800	22.968[1]
NFA	-	53,1	-	-	-	-	-	-	-	-	10.400[R*]	13.038*	-600*	-304*	-9700*	-4164*	-6000*	1504*
Reserve Money	366	343	-	621	-	1184	-	-	-	-	-	-	-	-	-	-	-	-
Base Money	-	-	-	-	-	-	-	-	-	-	-	-	7750**	7140**	10.850	10.720	14.100	13877
Inflation	-	89[1]	-	84[1]	-	81[1]	50[1]	54.3[1]	-	65[1]	25[1]	32.7[1]	-	68[2]	35[2]	29.5[2]	20[2]	23[2]***

Reference: www.tcmb.gov.tr/Yearly Report, 1: CPI 2:WPI, PT: Performance Targets, R: Reality, R: Revision targets,* Billion $, **Reality Targets, *** End of September.

Table 5: Monetary Environments and Inflation Rates (5)

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Disc. Pol.	X	X	X	X	X	X	X	X		X Earthquake		X crisis		
Inf									X(NDA, Inflation)[1]		X(NFR-NDV-BM[2],Inflation)		X(NFR-BM-NDA, Inflation)	X(NFR-NDV-BM Inflation)
Inflation (1994)	52[1]*	55[1]*	62[1]*	58[1]*	120[1]*	89[1]**	84[1]**	81[1]**	54,3[1]**	65[1]**	32,7[1]**	68[2]**	29,5[2]**	23[2]**
GDP (1987 prices)	9.3	0.3	6.4	8.1	-6	7.9	7.1	8.2	3.8	-6	6.3	-9.5	7.7	-

Reference: www.tcmb.gov.tr, 1:CPI 2:WPI * 1987=100, **1994=100 TÜFE, (1987=100), 1. The terms in parenthesis indicate target level of variables.
2. BM. Base Money.

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Appendix A: Cheating Policy

Inflation

$$\frac{\partial L^{o}}{\partial \pi} = 0 ,$$

$$\frac{\partial L^{o}}{\partial \pi} = 2a\pi + 2\alpha\left(y^{*} + \alpha\pi - ky^{*}\right) = 0$$

$$a\pi + \alpha^{2}\pi + \alpha(1-k)y^{*} = 0$$

$$a\pi + \alpha^{2}\pi - \alpha(k-1)y^{*} = 0$$

$$\pi\left(a + \alpha^{2}\right) = \alpha(k-1)y^{*}$$

$$\pi^{\circ} = \frac{\alpha(k-1)y^{*}}{a + \alpha^{2}}$$

Value of loss function under cheating policy:

$$L^{\circ} = \alpha\pi^{2} + (y^{*} + (\alpha(\pi - (\pi^{e} = 0)) - ky^{*})^{2}$$

$$L^{\circ} = a\pi^{2} + \left(\alpha\pi - (k-1)y^{*}\right)^{2}$$

$$L^{\circ} = a\pi^{2} + \alpha^{2}\pi^{2} - 2\alpha\pi(k-1)y^{*} + (k-1)^{2}y^{*2}$$

$$L^{\circ} = \left(a + \alpha^{2}\right)\left(\frac{\alpha^{2}(k-1)^{2}y^{*2}}{\left(a + \alpha^{2}\right)^{2}}\right) - 2\alpha\frac{\left(\alpha(k-1)y^{*}\right)}{a + \alpha^{2}}.(k-1)y^{*} + (k-1)^{2}y^{*2}$$

$$L^{\circ} = \left(\frac{\left(\alpha^{2}(k-1)^{2}y^{*2}\right)}{a + \alpha^{2}}\right) - 2\left(\frac{\left(\alpha^{2}(k-1)^{2}y^{*2}\right)}{a + \alpha^{2}}\right) + (k-1)^{2}y^{*}$$

$$L^{\circ} = \left(\frac{\left(\alpha^{2}(k-1)^{2}y^{*2}\right)}{a + \alpha^{2}}\right)(k-1)^{2}y^{*}$$

$$L^{\circ} = \left(\frac{-\alpha^{2}}{a + \alpha^{2}} + 1\right)(k-1)^{2}y^{*}$$

$$L^{\circ} = \left(\frac{-\alpha^{2} + a + \alpha^{2}}{a + \alpha^{2}}\right)(k-1)^{2}y^{*}$$

$$L^{\circ} = \left(\frac{\frac{a}{a}}{\frac{a}{a} + \frac{\alpha^{2}}{a}}\right)(k-1)^{2}y^{*}$$

$$L^{\circ} = \frac{1}{1 + \alpha^{2}a^{-1}}(k-1)^{2}y^{*}$$

Output Level in Cheating Policy

$$y^{o} = (1 + \frac{\alpha^{2}(k-1)}{a + \alpha^{2}})y^{*}$$

Appendix B: Discretion Policy

Inflation

$$\frac{L^i}{\partial \pi} = 0$$

$$L^i = 2a\pi + 2\alpha\left(y^* + \alpha\pi - \alpha\pi^e - (k-1) - y^*\right)$$

$$\pi^i = \frac{\alpha\left(k-1\right)y^* + \alpha^2\pi^e}{a + \alpha^2}$$

According to Rational

$\pi^e=\pi$.

$$\pi^i = \frac{\alpha(k-1)y^* + \alpha^2\pi_i}{a + \alpha^2}$$

$$\pi^i - \frac{\alpha^2}{a+\alpha^2}\pi^i = \frac{\alpha(k-1)y^*}{a+\alpha^2}$$

$$\pi^i = \frac{\frac{\alpha(k-1)y^*}{a+\alpha^2}}{\frac{a+\alpha^2-\alpha^2}{a+\alpha^2}}$$

$$\pi^i = \frac{\alpha}{a}(k-1)y^*$$

$$\pi^i = a^{-1}\alpha(k-1)y^*$$

Value of loss function under Discretion Policy

$$L^i = a\pi^2 + \left(\left(y^* + \alpha(\pi - \pi^e\right) - ky^*\right)^2$$

$$= a\pi^2 + (k-1)^2 y^{*2}$$

$$L^i = a\left(\frac{\alpha}{a}(k-1)y^*\right)^2 + (k-1)^2 y^{*2}$$

$$L^i = \frac{a\alpha^2}{a^{2-1}}(k-1)^2 y^{*2} + (k-1)^2 y^{*2}$$

$$L^i = \left(1 + \alpha^2 a^{-1}\right)(k-1)^2 y^{*2}$$

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SINGLE-PRICE AUCTION SYSTEM FOR THE ISTANBUL STOCK EXCHANGE

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Abstract
In the single-price auction system, for a predetermined period of time, all the buy orders are collected to form a negatively sloped demand curve and all the sell orders are collected to form a positively sloped supply curve in order to get an equilibrium price and maximum amount of quantity transaction, as a result of the interaction of these two curves again in a predetermined time instant. The aim in this work is to enlighten the reader about the different applications of this system in different stock exchange markets all around the world, to comment on the advantages and disadvantages and to investigate its suitability to the Istanbul Stock Exchange (ISE).

I. Introduction

Electronic stock trade system has partially started in the Istanbul Stock Exchange (ISE) on 3rd December 1993 and became fully functional with all stocks tradable on an electronic environment after 21st October 1994. This system has increased transaction speed and amount considerably, but with increased interest of investors at the end of 1999 and the beginning of 2000 this increase has reached top levels and the system began to be pressured insistently. ISE management has considered the complaints of brokers of not being able to deliver the orders to the system on time and decided as an intermediate solution step to accept the delivery of orders with diskettes for the first session after 28th April 2000 and for the second session after 13th August 2001 until the start of Express-API system. Before the application of delivery of orders with diskettes, it was observed that accumulated orders of overnights caused high transaction volumes and some days it was also observed that not all the transactions could be processed. In these days the brokers preferred to differentiate their customers and gave priority to the ones with higher trading volumes and postponed the ones (mostly small investors) with lower volumes. This situation, however, gave rise to high volatilities in the morning hours (Küçükkocaoğlu, 2003). After the date 4th April 2002 the order transmission through Express-API system has started and the system has

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Key Words: Single-Price Auction System, Continuous auction system, ISE.

started giving faster responses with no difficulty. Although, it is observed that this situation has a positive effect on the liquidity in the start of sessions, the returns of the ISE market during the day continued to show a W shaped curve, i.e., at the start of the session high, at the middle of session low and at the end of the session high returns (Küçükkocaoğlu, 2004).

The finding in the literature that investigates returns during the day is that for most of the cases the stock prices are active at the start and end of sessions. Additional findings show that returns, total transaction volumes, volatilities, buy-sell orders, the price difference between buy and sell orders at the opening and end is significantly higher than the rest of the day. These anomalies are particularly observed in the first 30 minutes of the first session and in the last hour before the closing session leading to difficulties in effective price formation[1].

According to Wood, McInish and Ord (1985) and Harris (1989) one of the main reasons for the increase in the prices at the end of the day is the price difference between buy and sell that reaches its highest levels at the end of the day and that the prices at the end are formed mostly by buying orders.

For the increase in return and volatility, Admati and Pfeiderer (1988) state that accumulation of orders at the end of the day might be the reason.

According to Miller (1989) the reason for the increase in prices at the end of the day is the desire of index fund managers to increase the prices of stock belonging to the index in order to increase the index.

According to Amihud and Mendelson (1991) there are two types of reasons for the high return and volatility at the start of the first session. One of them is the accumulated information overnight and the other one is the different type of starting systems for the stock exchange markets.

Brock and Kleidon (1992), Gerethy and Mulherin (1992), Hong and Wang (2000) interpret the reason for the increase in the volatility at the end of the day as the escape of investors from risk after the close of the market by decreasing their positions in the stock market.

Madhavan, Richardson and Roomans (1997) explain the reasons for the increase in prices at the end of the day as the announcement of new information to the public, information based order flow, accumulated orders during the day, market makers effort to control the price of the stocks they posses, insider information, arrival of date of maturity for time deposits and cancellation of contracts, concentration of brokers on buy-sell transaction at the closing time of the market.

Another reason for higher prices at the opening is the finding of Madhavan and Panchapagesan (1999) on anomalies in opening and closing prices. Extreme unsystematic increases in closing prices cause the prices to be higher the next day.

[1] References for empirical works are Wood, McInish and Ord (1985), for theoretical works are Cohen, Maier, Schwartz and Whitcomb (1981), Admati and Pfeiderer (1988), Foster and Wiswanathan (1988), McInish and Wood (1988).

Cushing and Madhavan (2000) mention three reasons for the increase in prices near the close. First reason for the realized anomalies near the close is that buy-sell orders are supported with high transaction volumes. Second reason is excessive buy-sell orders of institutional investors and the third reason is the due time of derivative products near closing time of the session and their impact on the closing prices.

According to Block, French and Maberly (2000) institutional investors are the reason for the high return at the start and close of the market. Institutional investors give their orders more frequently in the following 30 minutes after the open and 30 minutes before the close of the market.

According to Zorlu (2000) high volatility in prices during the day can decrease reliance to the brokers and the market. The same situation is also true for institutional investors. This situation will cause difficulties for the funds buying or selling at considerable higher or lower prices than the average prices during the day. High price undulation during the day increases risk for the stock exchange investors and this requires higher risk premiums. It is also possible for investors with high transaction volumes to try to form artificial prices to protect themselves from this kind of risks. In this situation the stock exchange market will be adversely affected and also a crime according to law will be committed.

According to Hillion and Suominen (2001) the reason for volatility increase near close of the session is the increased difference between buy and sell orders and investors benefiting from price differences who want to close their positions. In addition, in markets where the "hidden order" option is available among the orders manipulative movements to increase stock prices is frequently observed.

As mentioned in our previous work (Küçükkocaoğlu, 2003), in the ISE some trading investors try to manipulate movements on closing price by using brokers or through their mediation. As long as the closing price is used as a performance measure, the continuation of such movements is inevitable.

In order to prevent the realized unsystematic and extreme price movements in opening and closing sessions and to decrease the volatility supporting these increases when considering the above mentioned findings it is beneficial to go through how opening and closing price mechanism is needed to be arranged in the ISE. In this subject the most suitable and radical solution method would be put special methods into action that arrange opening and closing price formation.

The aim in this work is to inform the reader about the different applications in Amsterdam, Arizona, Athena, Brussels, Euronext, Frankfurt, Hong Kong, London, Luxemburg, Korea, Kuala Lumpur, Madrid, Milan, NYSE, Paris, Taiwan, Tel Aviv, Toronto, Tokyo and Vienna stock exchanges and NASDAQ over the counter markets implemented Call Market (single-price auction session) system, to evaluate the advantages and disadvantages of the system and to investigate its applicability to the ISE. In this context,

section 2 describes the call auction procedure with an example, section 3 mentions the different applications of the call auction procedures, section 4 presents empirical findings on the advantages and the disadvantages of electronic call auction procedure, section 5 discusses its applicability to the ISE and concludes.

II. Call Market (Single-Price Auction System)

Single-price auction system is a session type where buy and sell orders are send to the system, for a predetermined time length after which again in a predetermined time instant, all the buy orders are processed to form a negatively sloped demand curve and all the sell orders are processed to form a positively sloped supply curve to combine these curves and to execute the suitable orders. The intersection of both curves gives the price and quantity of trade.

The distinction of single-price auction system from the continuous auction system already used in the ISE is that even if the buy-sell orders match each other while arrival to the system they are not processed until the arrival of transaction time. The aim in the system is to process the most possible orders at the same time and at "process price". The entire buy orders same as or above this price and the entire sell orders same as or below this price will only be processed at this "process price".

In order to concretize the process of call market system and price formation; in Table 1 below there is a sample of buy and sell orders and the prices they contain send to the system. Table 1 is made up of seven columns. The first column contains time send of the buy orders, the second one contains buy orders amount in lot, third one contains cumulative total of buy orders, fourth one contains suggested price for each buy/sell order, fifth one contains cumulative total of sell orders, sixth one contains sell orders amount in lot and the last one contains time send of the sell orders. Responding to the accumulated orders during the night will take place according to price and time priority as shown in the table in the following minutes after opening.

The suggested call market for the ISE is for the determination of opening and closing prices, therefore, the price mechanism given in Table 1 is made up of prices expected to be processed at transaction time. In the ISE the morning session starts at 9:30 and in the first 15 minutes participants send their orders through diskettes and Express-API also named as "electronic order transfer". However, the orders send to the system in this time period cause fluctuations in returns and increase volatility (Küçükkocaoğlu, 2004). The aim in single-price auction system is to reduce these fluctuations to minimum.

Table 1. Accumulated Orders in Suggested Call Market for the ISE

Time of buy order	Buy order amount (Lot)	Buy order cumulative total	Price	Sell order cumulative total	Sell order amount (Lot)	Time of sell order
01:30	50	50	2500	900	250	08:30
04:45	100	150	2400	650	150	09:25
08:55	200	350	2400	500	50	08:15
09:20	100	450	**2300**	450	100	09:20
07:15	150	600	2200	350	250	07:35
09:18	250	850	2200	100	50	01:18
08:45	50	900	2100	50	50	03:45

In the Table above buy and sell orders are listed between 2100 TL and 2500 TL in increments of 100 TL by price time priority. These orders are listed from highest to lowest price for buy orders and from lowest to highest for sell orders. Cumulative order totals are calculated from top to bottom in buy and in the opposite direction in sell orders. In the ISE's present electronic order transmission system, the session will start at 9:30 to process these orders according to price-time priority then these orders will have to wait until orders are entered to the system and then at the end time of this process they are going to be matched according to price time priority. If we assume that order entrance time ends at 9:45 and the orders are arranged according to price time priority by the system then the system will proceed to the price matching stage. In this stage, the opening prices for selected stocks for the first session and for this price the buy-sell orders met by the system will be determined. The sample given in the Table above shows the unique call market opening price of 2300 TL and hence the price above which all the buys and below which all sell orders are met. At 9:45 at this announced price a total of 450 lots from investors who accept to buy at a price of 2300 TL and above, and from investors who accept to sell at a price of 2300 TL and below will be processed. Unmatched orders will be transferred to continuous auction system and will be waiting for matches in this session.

The call market example explained above can be performed before the start of continuous auction session but can also be performed in the continuous auction session or at the end of it. In this context, it is beneficial that the call market system is performed in the opening (especially in the first) and closing sessions (especially in the last).

III. Different Application of Call Market

Call market system contains a pricing mechanism as explained above, but different application of this system is present in different markets. In this part information about different applications are presented.

3.1. Paris Bourse[2]

The Paris Bourse uses call auction procedure to open and to close the market. There are three primary reasons why the Paris Bourse introduced the call auction procedure. These are to enhance market quality and efficiency, to improve price discovery and to reduce transaction costs.

The Paris Bourse is divided into four parts (i.e. markets). The first market is the *Premier Marché*, comprised of the most liquid stocks. The second market is the *Second Marché*, made up by mid-cap stocks. The third market is the *Nouveau Marché*, comprised of high growth stocks, and the fourth is *Free Marché* where there is minimum regulation and free market conditions are in force.

To keep the transparency of the stock market at high levels, traders have the ability of entering, modifying as well as deleting their orders at the Pre-Call Auction Phase. At the Auction Phase, however, nobody can modify or delete his orders. The Paris Bourse introduced the call auction procedure to determine the opening prices of the markets in 1986. It utilizes the electronic call auction procedures to open the market at 10:00 a.m. and to close the market at 5:05 p.m. Transactions of less liquid stocks with call auction procedure runs twice a day, opening prices are set at 11:30 a.m. and closing prices are set at 4:00 p.m. At *Free Marché*, pricing with call auction takes place at 3:00 p.m. and at *Nouveau Marché,* pricing with call auction takes place twice a day 10:30 a.m. for the opening and 4:30 p.m. for the closing of the market.

The auction procedure consists of two phases in the Paris Bourse.

A. The Pre-Call Auction Phase

Orders are accumulated in the centralized order book from 8:30 a.m. to 10:00 a.m. for the opening session and from 5:00 p.m. to 5:05 p.m. for the closing session. Traders can enter, modify and delete their orders at this phase; however, no transaction takes place.

Studies on the pre-opening period found that in the last 10 minutes before the opening, indicative price moves towards to the opening price. This movement suggests that price discovery at the pre-opening period is effective (Thomas and Demarch, 2001).

[2] Paris Bourse has joined with the Brussels and Amsterdam stock exchanges to form the Euronext in the year 2000.

At the same time, opening prices maximizes trading volumes with minimum cost and very few unmatched orders are transferred to the continuous auction system.

B. The Auction Phase

Opening and closing prices are determined by the call auction procedure at 10:00 a.m. and 5:05 p.m. The last equilibrium price becomes the official opening and closing price. Orders are executed with this equilibrium price. Plus, the price above which all the buys and below which all the sells are met in this phase. From 10:00 a.m. to 5:00 p.m. trading is continuous; however, orders can be accumulated for the closing call auction phase.

3.2. Tel Aviv Stock Exchange

Tel Aviv Stock Exchange has started its computerized trading in 1991. In 1997, the new trading system, the Tel Aviv Continuous Trading (TACT) has introduced. As the oldest call auction pricing mechanism user, transactions of the call auctions procedures at the Tel Aviv Stock Exchange described below.

A. Determination of the Opening Prices

In this market the orders are collected between 8:30 a.m. to 10:00 a.m. The opening phase for shares, conducted with the call market method, begins at 10:00 a.m. and lasts about one minute. In this phase, it is not possible for the prices to deviate more than 10 percent from the closing prices in the previous day. Orders not executed in the opening phase are automatically transferred to the continuous trading.

B. Determination of the Closing Prices

Continuous trading runs until 3:30 p.m., in this phase, price fluctuations are unrestricted. At the closing phase, which runs from 3:30 p.m. to 3:45 p.m., closing prices are calculated as the volume weighted average of the prices discovered towards the end of the continuous trading. One of the main reason on the use of the volume weighted average rather than the call auction mechanism at close lies on the traders' tendency of transaction at close, closing with a call auction is very unattractive at the Tel Aviv Stock Exchange. This is also related with the call and the continuous market rules of the Tel Aviv Stock Exchange. For example, traders on the continuous auction could be anonymous but the traders on the call auction should be known. Orders sent to the call auction mechanism are smaller than the orders sent to the continuous auction mechanism. Traders can place larger orders at the continuous auction mechanism. It is also easy to manipulate the stock prices at the continuous auction mechanism than the call auction mechanism. Plus, traders have the freedom of buying and selling stocks at their desired price

levels at the continuous auction mechanism (Bronfeld, 2001). Trading closes at 3:45 p.m. and no orders may be submitted until the pre-opening phase of the following trading day.

3.3. Frankfurt Stock Exchange

Buy-sell orders in Frankfurt stock exchange are processed in two different structures named as Xetra and Xontro. Processed stocks in electronic trade containing Xetra operating system are matched using continuous auction. In each session start single-price auction session is implemented. In Xontro system trade is performed in session saloon through specialists (Makler) processed stocks and pricing is again determined from the specialists for the stock they are responsible. However, when the stocks start to show new trends with high volatilities during the day the price formation mechanism is reformed using single-price auction session. Traders can enter, modify and delete their orders at this phase. New information on order flows on the current order status is provided continuously and an indicative auction price is displayed for the possible execution. It is the price that would be fixed and declared if price determination were conducted at that time. The auction price is determined by the system and it is set to maximize the amount of shares that trade.

3.4. London Stock Exchange

In London Stock Exchange, before and after the continuous auction system single, price auction system is applied to determine opening and closing prices. In addition, in case of an extraordinary movement in the prices of a stock, the continuous auction is stopped and traders will have chance to reevaluate their investment decisions, which could last for 5 minutes, than the price determination phase switches to the call auction mechanism. The London Stock Exchange uses call market mechanism to improve price discovery, to offer an efficient pricing and to prevent the manipulative movements on stocks. Another use of the call market mechanism on the London Stock Exchange is to determine the closing price to prevent the price level deviations and trade size changes. If this closing price determined on the call auction does not fit into these policies than the closing prices are calculated as the volume weighted average of the prices discovered at the continuous trading phase.

3.5. Athens Stock Exchange

Call market is applied to determine the prices for stocks traded in Athens Stock Exchange to stocks under surveillance, with small liquidity or with small capitalization in specific hours every day. In addition, opening and closing prices are determined using single price auction sessions.

3.6. Hong Kong Stock Exchange

For all stocks traded in Hong Kong stock exchange before the start of continuous auction in the morning between 9:30-9:45 orders are collected afterwards the collected orders are matched between 9:45-10:00 to determine the opening price that allows the maximum amount of trade. In addition, the system accepts buy sell orders that are equal to the price obtained from single-price auction system.

3.7. New York Stock Exchange

In the New York Stock Exchange, besides the single-price auction session before the continuous auction, in any time period the single-price auction session can be applied by the responsible stock exchange experts during the day.

3.8. NASDAQ Over the Counter Market

NASDAQ is an over the counter market so there is no opening protocol. Officially the market operates between 9:30-16:00 and using NASDAQ's electronic communication system SelectNet before opening and after the close a similar session as single-price auction session is performed.

IV. Advantages and Disadvantages of the Single-Price Auction System

4.1. Advantages of the Single-Price Auction System

4.1.1. Decreases Price Fluctuations

In continuous auction system orders entered with different prices give rise to fluctuation and changes in stock prices and quantities in the order process book. These transactions are realized in different prices increasing the volatility of stocks and also allow the continuity of volatility by buying a stock at a lower price and selling it at a higher price or the opposite way round. On the other hand, in the single price auction system price fluctuations are reduced by the multiple matching of orders with one price.

4.1.2. Enables Effective Market Formation

One of the main critiques to the diskette order transmission system is that in stocks with insufficient passive orders, manipulative price movements are very easy to carry out in the stage of transmission of orders via diskette and therefore formation of an effective market is hard to ensure. It is also possible to observe manipulative movements in the continuous auction system in stocks with low capital, low free-float rate and limited daily transaction volume. In this stage, single-price auction system enables market formation in

one price with accumulated orders during the day or night. As a result of this fact price changes are minimized. While for each entered active order it is possible to affect the market but it is not possible to affect single-price auction system with active orders. Markets effectiveness becomes a matter of primary importance and not the effectiveness of orders in price formation.

4.1.3. Attracts Institutional Investors' Attention

In works done about the single-price auction system, it is observed that this system is preferred by institutional investors because all the orders are passive, when priced reasonably orders of large amount by investors are met by the system which is an advantage compared to the continuous auction system (Cohen and Schwartz, 2001). In continuous auction system orders of large amount send to the system give raise to disturbance in market equilibriums and excessive fluctuations in stocks prices. However, single-price auction system prevents that signal that could bring the market in disequilibrium, because the accumulated orders in the system are not announced at the same time if there is not enough match to the passive orders send to the system, the process is not being realized and this allows for effective price formation.

4.1.4. Increases Liquidity

In works done about transparency in the stock exchange markets, it is observed that the orders send during the continuous auction session are affected by news and sudden changes in active and passive structures in orders waiting to be met (Madhavan, Porter and Weaver, 2001). Changes of this type adversely affect the liquidity of stocks. However, news broadcasted during the single-price auction session increase the number of orders and hence the liquidity increases because during the session there is no transaction. In addition, in the time passed until the end of the session the broadcasted information will be available for more investors, the information will be evaluated and then the price entered into the system is more rationally determined (Kalın, 2002).

4.1.5. Eases Order Transmission

Investors who have the depth information in continuous auction system have the ability to change the prices while small and nonprofessional investors who do not have that information are usually unable to change the prices. However, in the single-price auction system the depth and content of orders are not given to investors, movement to change the prices are not allowed because all transactions will be processed at the same time.

4.1.6. Decreases Order Process Load in Continuous Action System

On their work about Frankfurt Stock Exchange, Kehr, Krahnen and Theissen (2001) observe that 10 percent of all orders are met in single-price auction system. Considering that continuous auction system compared to single-price auction system allows opportunity for longer buy and sell orders, single-price auction session applied only in specific time periods during the day meets 10 percent of all buy and sell orders send during the day ensures great convenience to investors and also to intermediate institutions.

4.2. Disadvantages of the Single-Price Auction System

4.2.1. Does not allow Active Processes

The greatest disadvantage of the single-price auction system is the session process call time instant that allows for transactions. The system does not allow for active transactions. On the other hand in continuous auction system the investors are able the make transactions at an instant time (Woodward, 2001).

4.2.2. Decreases Price Elasticity

Leaving low transaction volume stocks outside the continuous auction system and allowing them to be processed in single-price auction session at prices determined in one or two sessions and depending on these narrow price limits, and if there is an event that could affect the market order entrance, any transactions of these stocks will be prevented. However, if there are events that might affect the market, in sake of preventing the shrinking of stock traded volume in the single-price auction session, some rules may be formed to overcome this problem. For example, in the New York Stock Exchange market, if there are extraordinary situations detected when the orders are entered into the system then the continuous auction for this stock is stopped and the single-price auction session is applied (Kalın, 2002).

4.2.3. Might Cause Insufficient Participation

In the investor profile, depending on high percentages of investors giving importance to active transactions or insufficient number of investors preferring to be in single-price auction session might cause the single-price auction market to be formed with insufficient depth. Especially, it should not be expected from the investors who are price makers in the continuous price auction to participate in single-price auction session aiming to determine closing price.

V. Conclusion

On their work on the Paris Bourse, Hillion and Suominen (1998a, 1998b, 2001) investigated manipulative movements towards the closing time of the market and identified the reason for the closing price manipulation as stock market brokers. The authorities of the Paris Stock Exchange considered Hillion and Suominen's work and to prevent closing price manipulations and to determine the closing price in a different way and to remove the observed price and volatility anomalies, they changed the transaction times and closing method[3] in June 1998. After this change, the result for all stocks implemented the single-price auction system is that the new price mechanism has a more effective closing price and it is observed that closing anomalies decreased to low levels (Thomas, 1998).

According to findings of Amihud, Mendelson and Murgia (1990), who worked on prices and volatilities of the continuous auction system after the single-price auction session in Milan Stock Exchange, if continuous auction system is used in the opening session, the volatility of stock was high, on the other hand if the single-price auction system is used than it was low. Keeping in mind that the single-price auction system determines the price of a stock more correctly using supply and demand, it is the most efficient system for price formation.

If in the ISE, the single-price auction system is applied before opening and closing then the following facts will be observed:

i. Accumulated order load of the ISE members at the start of the session through various channels (all buy-sell systems resources are directed to order collection process because orders are not processed during the collection stage) will be sent in a short time to the single-price auction system with more intense order flow and the system will find the matching price with maximum transaction. Again a single-price auction session at the close of the market will prevent active price movement at the close of the market and the formation of closing price with one lot, and will enable fair closing prices
ii. Before the start of diskette session the reason for the activity in the first 15 minutes of the day was due to not having adequate market depth. After the start of diskette order transmission price movements have considerably decreased but order transmission using Express-API method has slightly cancelled that positive effect (Küçükkocaoğlu, 2004). The decrease in the price movement at the start of the session depends on the application of the single-price auction system.
iii. Before the start of the single-price auction session cancellaction or improvement of the accumulated orders in the system depending on

[3] Single price auction system is first applied in the Paris Bourse in 1986 to determine the opening prices. In May 1996 it is applied for stocks with low transaction volume, in July 1998 it is applied for all stock to determine the closing price.

market conditions is possible in this system, but after the start of the session it is not possible to make any interventions. This enables a more effective price formation.

iv. Attempts to increase the prices of stocks prior to the close of the market will be prevented.

v. Portfolio evaluation and performance of stock market broker according to the closing price in the single-price auction system be more effective and fair.

vi. The ISE will possess a transaction method that is accepted by many stock markets worldwide and with this system price movements and volatility during the day will be minimized.

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GLOBAL CAPITAL MARKETS

The global recovery has strenghtened and broadened since the first half of 2003. Industrial production has picked up in parallel with a strong rebound in global trade. The upturn is most rapid in the emerging Asia countries, particularly China and the United States followed by the euro area where there are signs of a pick up in fixed investment and the sharp pick up in global trade has boosted exports despite the stronger euro. Among the industrial countries, domestic demand is generally strongest in those countries with the largest current account deficits. While domestic demand growth has picked up substantially in emerging Asia, the regional current account surplus remains very large with exports supported by the rebound in the information technology (IT) sector as well as depreciating exchange rates. In Japan, GDP growth has continued to exceed expectations with strong external demand, particularly from China. Exchange market developments have been dominated by a further decline in the U.S. dollar, driven primarily by concerns over the sustainability of the US current account deficit.

Equity prices have risen strongly in both mature and emerging markets, bond spreads have dropped further,and financing flows to emerging markets have rebounded. The rise in the equity markets were mainly due to improvements in fundamental indicators, mainly the strengthening recovery, rising corporate profitability and low interest rates.

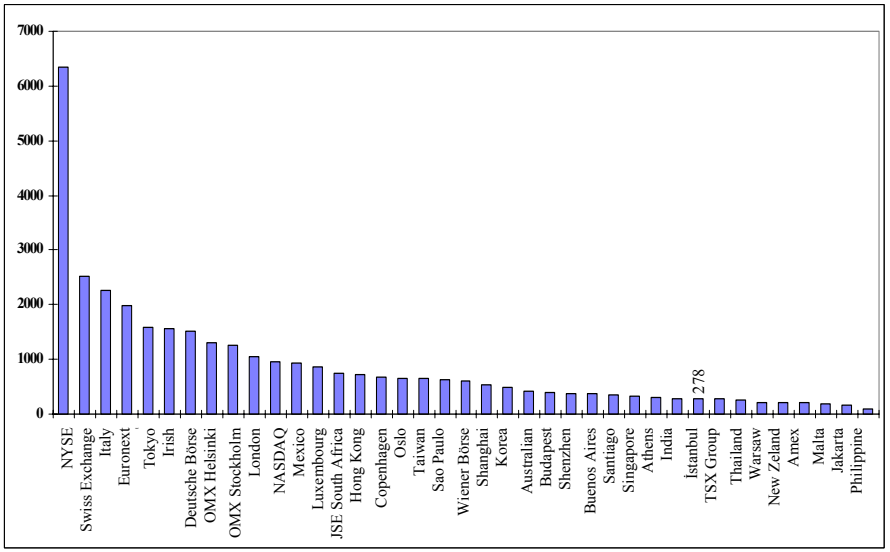
The performances of some developed stock markets with respect to indices indicated that DJIA, FTSE-100, Nikkei-225 and Xetra DAX increased by –0,9%, 0,6%, 13 % and –5,2% respectively at the end of March 2004 in comparison with the Dec. 31st 2003. When US$ based returns of some emerging markets are compared in the same period, the best performer markets were: Colombia (47,5%), Russia (32,7%), Peru (24,8%), Egypt (21,7%), Mexico (20,3%), Czech Rep. (20,1%), Hungary (20%), China (16,4%) and Turkey (15,9%). In the same period, the lowest return markets were: Thailand (-15,5%), Philippines (-2,4%), Chile (-2,2%), Brazil (-1,4%) and Hong Kong (0,5%). The performances of emerging markets with respect to P/E ratios as of end-March 2004 indicated that the highest rates were obtained in Taiwan (59,5), Indonesia (41,6), Malaysia (34,2), China (30,3), Russia (26,8) and Chile (25.2) and the lowest rates in Brazil (9.7), Pakistan.(10,7), Turkey (12,1), S.Africa (12,5) and Thailand (13,9).

Market Capitalization (USD Million, 1986-2003)

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

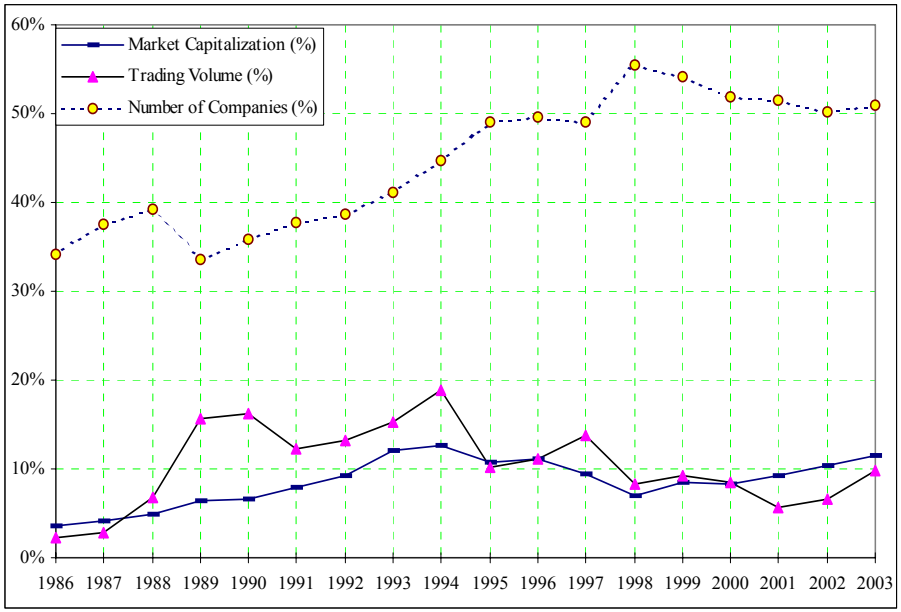
Source: Standard & Poor's Global Stock Markets Factbook, 2004.

Comparison of Average Market Capitalization Per Company (USD Million, March 2004)



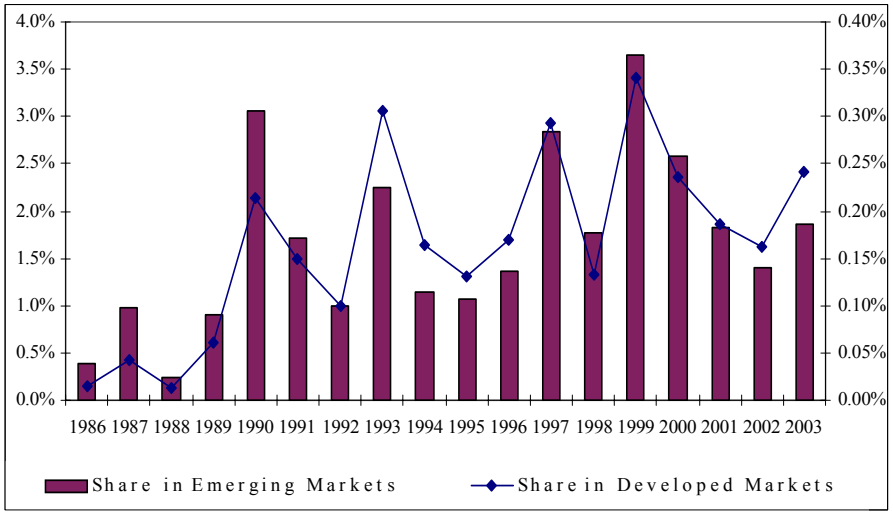
Source: FIBV, Monthly Statistics, March 2004.

Worldwide Share of Emerging Capital Markets (1986-2003)



Source: Standard & Poor's Global Stock Markets Factbook, 2004.

Share of ISE's Market Capitalization in World Markets (1986-2003)



Source: Standard & Poor's Global Stock Markets Factbook, 2004.

Main Indicators of Capital Markets (March 2004)

	Market	Monthly Turnover Velocity (March 2004) (%)	Market	Value of Share Trading (millions, US$) Up to Year Total (2004/1-2004/3)	Market	Market Cap. of Share of Domestic Companies (millions US$) March 2004
1	NASDAQ	286.26	NYSE	2,970,628	NYSE	11,670,642
2	Istanbul	235.36	NASDAQ	2,312,716	Tokyo	3,477,888
3	Taiwan	209.50	London	1,382,434	NASDAQ	2,832,942
4	Korea	189.19	Tokyo	822,970	London	2,454,481
5	Spanish (BME)	174.04	Euronext	657,287	Osaka	2,252,494
6	Thailand	157.22	Deutsche Börse	463,273	Euronext	2,054,663
7	Deutsche Börse	149.82	Spanish (BME)	294,694	Deutsche Börse	1,023,705
8	Italy	135.04	Taiwan	263,124	TSX Group	971,498
9	India	125.53	Italy	252,925	Hong Kong	740,799
10	OMX Stockholm	125.46	Swiss Exchange	227,541	Spanish (BME)	722,660
11	OMX Helsinki	117.73	TSX Group	188,116	Swiss Exchange	717,437
12	Euronext	113.81	Amex	159,569	Australian	612,214
13	London	110.32	OMX Stockholm	140,027	Italy	606,358
14	Swiss Exchange	108.37	Hong Kong	137,827	Taiwan	433,817
15	Shenzhen	106.96	Korea	135,887	Shanghai	421,643
16	Oslo	102.34	Shanghai	128,090	Korea	339,702
17	Tokyo	91.94	Australian	122,726	OMX Stockholm	326,902
18	NYSE	89.66	India	77,626	JSE South Africa	290,350
19	Shanghai	89.50	Shenzhen	73,090	Mumbai	274,876
20	Singapore	84.87	OMX Helsinki	69,588	India	254,096
21	Australian	80.30	Istanbul	45,496	Sao Paulo	229,725
22	Copenhagen	70.94	Bermuda	43,339	Shenzhen	187,484
23	TSX Group	69.46	Thailand	41,528	OMX Helsinki	182,837
24	Irish	64.62	JSE South Africa	37,833	Malaysia	182,108
25	Budapest	62.79	Mumbai	37,474	Singapore	160,749
26	Hong Kong	60.33	Singapore	35,171	Mexico	145,004
27	JSE South Africa	51.64	Oslo	34,332	Copenhagen	122,315
28	Mumbai	51.29	Osaka	33,475	Athens	105,794
29	Athens	51.17	Copenhagen	28,990	Thailand	104,429
30	Sao Paulo	44.09	Sao Paulo	26,519	Oslo	103,436
31	Jakarta	42.32	Malaysia	22,002	Amex	100,105
32	Malaysia	41.15	Mexico	13,987	Santiago	86,021
33	New Zealand	40.06	Athens	13,665	Irish	84,434
34	Tel-Aviv	38.78	Irish	13,530	Istanbul	79,878
35	Warsaw	33.36	Tel-Aviv	8,934	Tel-Aviv	78,243
36	Wiener Börse	29.05	Jakarta	7,562	Wiener Börse	63,305
37	Colombo	27.85	Wiener Börse	5,637	Jakarta	57,449
38	Mexico	27.52	New Zealand	3,872	Warsaw	40,525
39	Tehran	26.09	Warsaw	3,681	Buenos Aires	38,518
40	Philippine	14.44	Tehran	3,545	Luxembourg	37,495
41	Buenos Aires	13.08	Budapest	3,011	New Zealand	33,832
42	Ljubljana	12.96	Santiago	2,126	Tehran	29,392
43	Santiago	10.66	Buenos Aires	1,544	Philippine	22,526
44	Osaka	6.71	Philippine	887	Budapest	19,666
45	Lima	5.77	Lima	413	Lima	18,025

Source: FIBV, Monthly Statistics, March 2004.

Trading Volume (USD millions, 1986-2003)

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

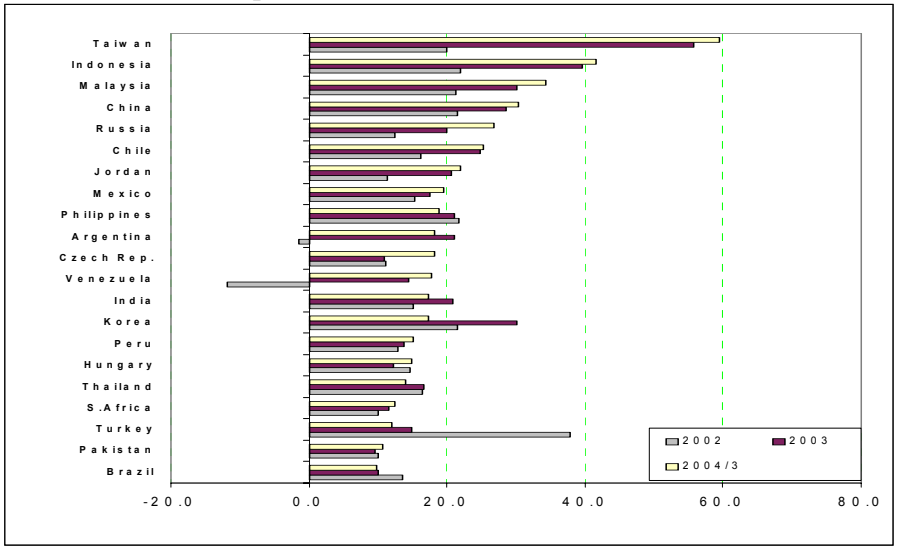
Source: Standard & Poor's Global Stock Markets Factbook, 2004.

Number of Trading Companies (1986-2003)

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

Source: Standard & Poor's Global Stock Markets Factbook, 2004.

Comparison of P/E Ratios Performances



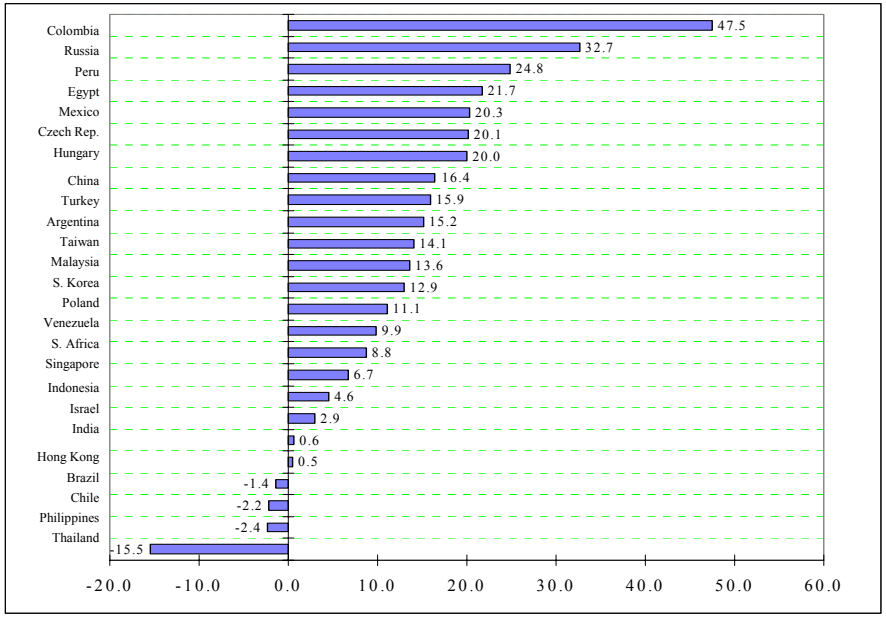
Source: IFC Factbook 2001. Standard & Poor's, Emerging Stock Markets Review, March 2004.

Price-Earnings Ratios in Emerging Markets

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004/3
Argentina	15.0	38.2	16.3	13.4	39.4	-889.9	32.6	-1.4	21.1	18.3
Brazil	36.3	14.5	12.4	7.0	23.5	11.5	8.8	13.5	10.0	9.7
Chile	17.1	14.6	14.7	15.1	35.0	24.9	16.2	16.3	24.8	25.2
China	16.7	27.8	34.5	23.8	47.8	50.0	22.2	21.6	28.6	30.3
Czech Rep.	11.2	17.6	37.1	-11.3	-14.9	-16.4	5.8	11.2	10.8	18.2
Hungary	12.0	17.5	27.4	17.0	18.1	14.3	13.4	14.6	12.3	14.8
India	14.2	12.3	15.2	13.5	25.5	16.8	12.8	15.0	20.9	17.4
Indonesia	21.4	21.6	10.5	-106.2	-7.4	-5.4	-7.7	22.0	39.5	41.6
Jordan	18.2	16.9	14.4	15.9	14.1	13.9	18.8	11.4	20.7	21.9
Korea	19.8	11.7	17.9	-47.1	-33.5	17.7	28.7	21.6	30.2	17.2
Malaysia	25.1	27.1	9.5	21.1	-18.0	91.5	50.6	21.3	30.1	34.2
Mexico	28.4	16.8	19.2	23.9	14.1	13.0	13.7	15.4	17.6	19.5
Pakistan	15.0	11.7	14.8	7.6	13.2	-117.4	7.5	10.0	9.5	10.7
Peru	14.5	14.2	14.0	21.1	25.7	11.6	21.3	12.8	13.7	15.2
Philippines	19.0	20.0	10.9	15.0	22.2	26.2	45.9	21.8	21.1	18.9
Poland	7.0	14.3	11.4	10.7	22.0	19.4	6.1	88.6	-353.0	-392.5
Russia	-	6.3	8.1	3.7	-71.2	3.8	5.6	12.4	19.9	26.8
S.Africa	18.8	16.3	10.8	10.1	17.4	10.7	11.7	10.1	11.5	12.5
Taiwan	21.4	28.2	28.9	21.7	52.5	13.9	29.4	20.0	55.7	59.5
Thailand	21.7	13.1	-32.8	-3.6	-12.2	-6.9	163.8	16.4	16.6	13.9
Turkey	8.4	10.7	20.1	7.8	34.6	15.4	72.5	37.9	14.9	12.1
Venezuela	12.0	32.5	12.8	5.6	10.8	30.5	-347.6	-11.9	14.4	17.8

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

Comparison of Market Returns in USD (31/12/2003-31/04/2004)



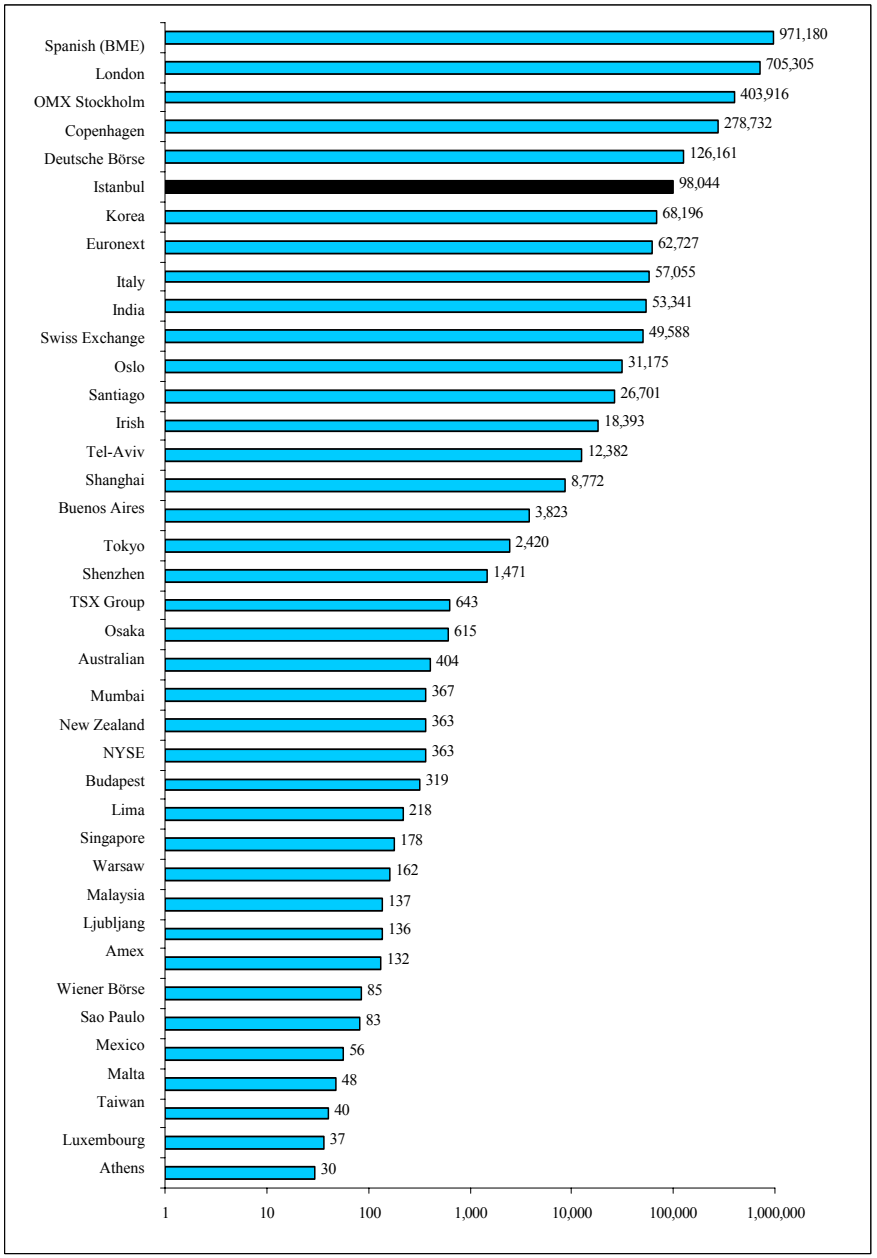
Source: The Economist, April 3rd –9th 2004.

Market Value/Book Value Ratios

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004/3
Argentina	1.3	1.6	1.8	1.3	1.5	0.9	0.6	0.8	2.0	1.9
Brazil	0.5	0.7	1.0	0.6	1.6	1.4	1.2	1.3	1.8	1.8
Chile	2.1	1.6	1.6	1.1	1.7	1.4	1.4	1.3	1.9	1.9
China	1.0	2.1	3.9	2.1	3.0	3.6	2.3	1.9	2.6	2.7
Czech Rep.	0.9	0.9	0.8	0.7	0.9	1.0	0.8	0.8	1.0	1.2
Hungary	1.2	2.0	4.2	3.2	3.6	2.4	1.8	1.8	2.0	2.4
India	2.3	2.1	2.3	1.8	3.3	2.6	1.9	2.0	3.5	3.5
Indonesia	2.7	2.7	1.4	1.5	3.0	1.7	1.7	1.0	1.6	1.7
Jordan	1.9	1.7	1.8	1.8	1.5	1.2	1.5	1.3	2.1	2.2
Korea	1.3	0.8	0.5	0.9	2.0	0.8	1.2	1.1	1.6	1.6
Malaysia	3.3	3.8	1.4	1.3	1.9	1.5	1.2	1.3	1.7	2.0
Mexico	1.7	1.7	2.3	1.4	2.2	1.7	1.7	1.5	2.0	2.3
Pakistan	2.2	1.5	2.3	0.9	1.4	1.4	0.9	1.9	2.3	2.5
Peru	2.8	2.5	2.0	1.6	1.5	1.1	1.4	1.2	1.8	2.0
Philippines	3.2	3.1	1.3	1.3	1.4	1.0	0.9	0.8	1.1	1.0
Poland	1.3	2.6	1.7	1.5	2.0	2.2	1.4	1.3	1.8	2.0
Russia	-	0.4	0.5	0.3	1.2	0.6	1.1	0.9	1.2	1.6
S.Africa	2.5	2.3	1.6	1.5	2.7	2.1	2.1	1.9	2.1	2.0
Taiwan	2.7	3.3	3.1	2.6	3.4	1.7	2.1	1.6	2.2	2.3
Thailand	3.3	1.8	0.8	1.2	2.1	1.3	1.3	1.5	2.8	2.4
Turkey	2.7	4.0	6.8	2.7	8.9	3.1	3.8	2.8	2.6	2.6
Venezuela	1.6	3.3	1.2	0.5	0.4	0.6	0.5	0.5	1.1	1.4

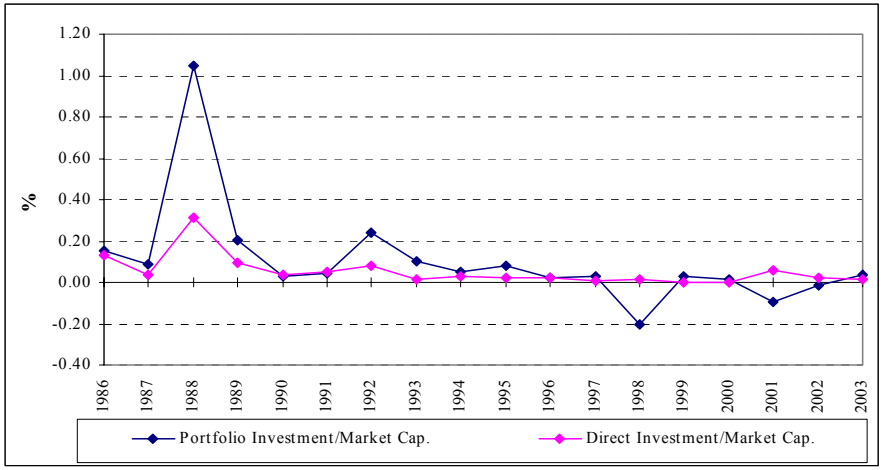
Source: IFC Factbook, 2004; Standard & Poor's, Emerging Stock Markets Review, March 2004.
Note: Figures are taken from S&P/IFCG Index Profile.

Value of Bond Trading (Million USD Jan. 2004-March 2004)



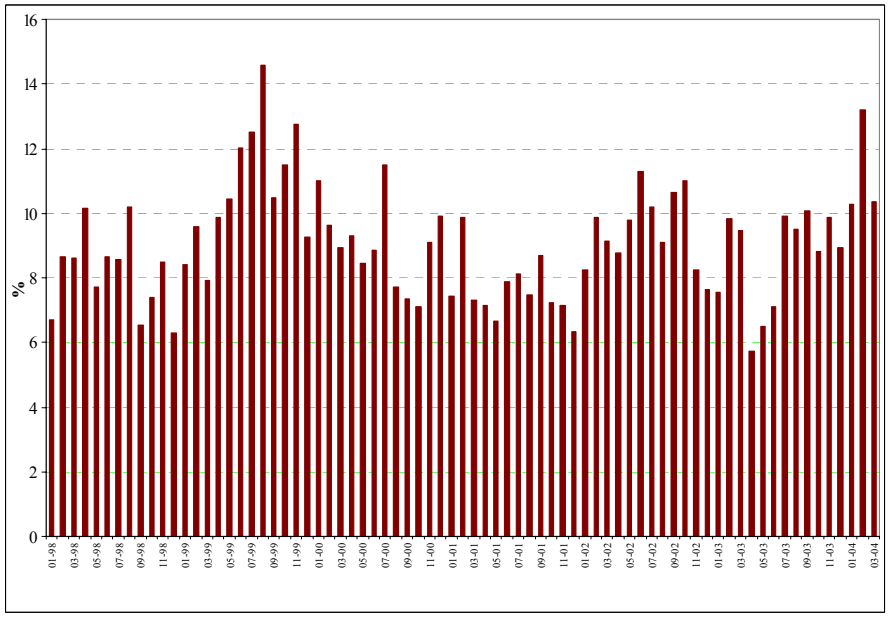
Source: FIBV, Monthly Statistics, March 2004.

Foreign Investments as a Percentage of Market Capitalization in Turkey (1986-2003)



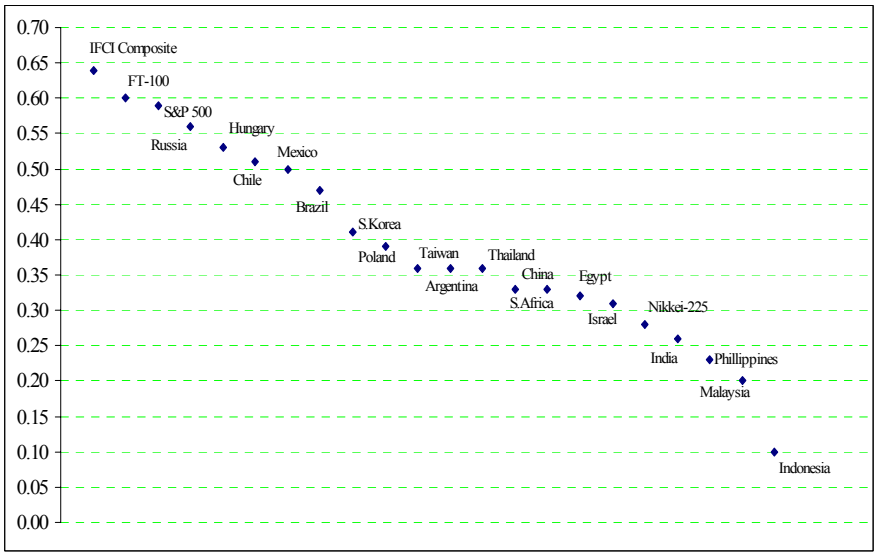
Source: ISE Data. CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE (Jan. 98-March 2004)



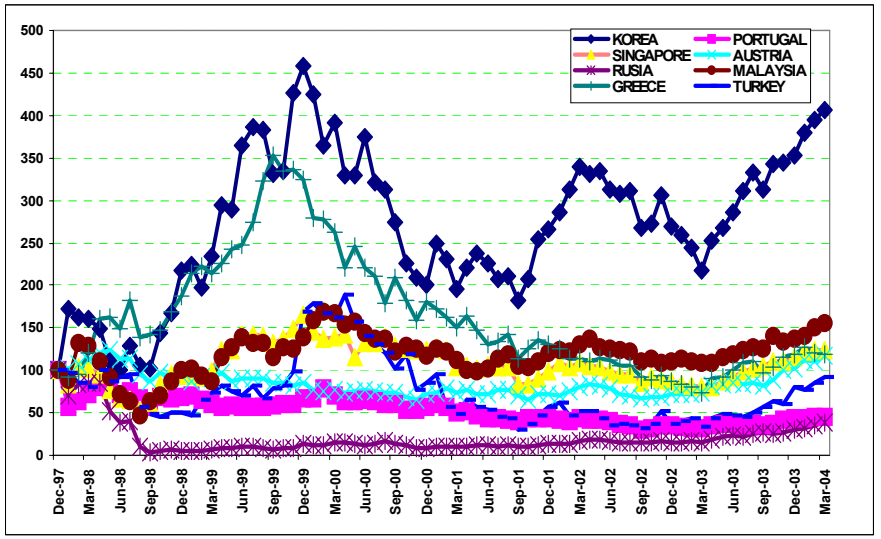
Source: ISE Data.

Price Correlations of the ISE (March 1999- March 2004)



Source: Standard & Poor's, Emerging Stock Markets Review, March 2004.
Notes: The correlation coefficient is between -1 and +1. If it is zero. for the given period. it is implied that there is no relation between two serious of returns.

Comparison of Market Indices (31 Dec 97=100)



Source: Reuters.
Note: Comparisons are in US$.

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ISE
Market Indicators

STOCK MARKET

	Number of Companies	Traded Value				Market Value		Dividend Yield	P/E Ratios		
		Total		Daily Average							
		(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	285	146.644.967	100.165	596.118	407	96.072.774	69.003	0,94	14,54	12,29	13,19
2004	287	60.237.356	45.436	1.003.956	757	104.719.476	79.981	1,10	15,88	15,43	16,92
2004/Q1	287	60.237.356	45.436	1.003.956	757	104.719.476	79.981	1,10	15,88	15,43	16,92

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 Capitilization / Sum of Last four US$ based three-month profitsCompanies which
* are temporarily de-listed and will be traded off the Exchange under the decison of ISE's Board of Directors 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 (Jun.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	18.625,02	16.299,23	9.923,02	25.594,77	8.368,72
2004	20.190,83	18.048,52	11.158,96	27.260,09	8.385,06
2004/Q1	20.190,83	18.048,52	11.158,96	27.260,09	8.385,06

US $ Based

EURO Based

	NATIONAL - 100 (Jan. 1986=100)	NATIONAL - INDUSTRIALS (Dec. 31, 90=643)	NATIONAL - SERVICES (Dec. 27, 96=572)	NATIONAL - FINANCIALS (Dec.31, 90=643)	NATIONAL - TECHNOLOGY (Jun. 30,2000=1.360.92)	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	778,43	681,22	414,73	1.069,73	349,77	723,25
2004	897,37	802,15	495,95	1.211,56	372,67	860,01
2004/Q1	897,37	802,15	495,95	1.211,56	372,67	860,01

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	213.098.128	144.422	852.393	578
2004	80.138.069	60.456	1.313.739	991
2004/Q1	80.138.069	60.456	1.313.739	991

Repo-Reverse Repo Market

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
1905	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	1.040.533.364	701.545	4.162.133	2.806
2004	323.266.363	244.105	5.299.449	4.002
2004/Q1	323.266.363	244.105	5.299.449	4.002

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	108,13	126,91	159,57	129,31
2004	108,06	126,86	160,05	130,87
2004/Q1	108,06	126,86	160,05	130,87

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

TL Based

	30 Days	91 Days	182 Days
1996	222,52	240,92	262,20
1905	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	4.438,46	5.917,78	8.498,61
2004	4.572,71	6.114,37	8.878,41
2004/Q1	4.572,71	6.114,37	8.878,41

USD $ Based

1996	122,84	132,99	144,74
1905	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	188,62	251,48	361,16
2004	206,64	276,31	401,22
2004/Q1	206,64	276,31	401,22

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	118,04	123,22	126,33	127,63	121,77
2004	119,84	125,71	129,31	130,87	120,58
2004/Q1	119,84	125,71	129,31	130,87	120,58

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	457,60	558,19	438,13	464,98
2004	489,10	600,56	473,53	500,27
2004/Q1	489,10	600,56	473,53	500,27

US $ Based

2001	7,34	7,79	6,62	6,14
2002	11,03	12,55	9,99	9,24
2003	19,45	23,72	18,62	19,76
2004	22,10	27,14	21,40	22,61
2004/Q1	22,10	27,14	21,40	22,61

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

TL Based

	EA180-	EA180-	EA GENERAL	PDA180-	PDA180+	PDA GENERAL	REPO
2004	106,45	107,34	106,80	106,39	107,34	106,84	104,88
2004/Q1	106,45	107,34	106,80	106,39	107,34	106,84	104,88

Q: Quarter