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THE EFFECTS OF ASIAN CURRENCY CRISIS ON FINANCIAL INSTITUTIONS: THE ISE EXPERIENCE

Halil KIYMAZ & Osman KILIC*

Abstract

This paper aims to investigate the effects of the Asian currency crisis on Turkish financial institutions. The sample consists of 52 financial institutions traded at the Istanbul Stock Exchange during the crisis period. The jump diffusion model is employed to assess the contagious influence on the performances of stocks of institutions. The empirical findings show that the jump process is the dominant feature of all portfolios, indicating that the currency crisis surprised the market participants. Furthermore, there is increased volatility from the non-event period to the event period, suggesting that financial institutions stocks are affected by the crisis.

I. Introduction

The Asian financial crisis has received great attention from academicians and practitioners. The crises hit essentially the most successful and fastest growing segment of the world. An important aspect of Asian crisis is that it has occurred after several years of outstanding economic performance. For example, the annual GDP growth in five Asian countries (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) averaged close to 8% over the last ten years. Furthermore the region was the major recipient of capital inflows from developed economies. In this sense, the Asian crisis can be viewed as a crisis of success mainly caused by a boom of international lending followed by sudden withdrawal of funds. For example, net private inflows dropped from $93 billion to $-12.1 billion during the crisis.

The Asian currency crisis has also influenced other countries adversely. It is argued that the currency crisis appears to pass contagiously from

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one county to another. Contagion is likely to spread more easily to countries, which are tied by international trade linkages and to countries with similar macroeconomic circumstances. In this regard, the emerging markets are probably more likely to be influenced from such crisis. The purpose of this paper is to investigate the possible effects of the Asian currency crisis on Turkish financial institutions by employing a jump diffusion model. The jump diffusion model is regarded as superior to the pure diffusion model in describing stock returns because the release of unexpected information in generally associated with discrete jumps in stock prices. Since the Asian currency crisis involves with series of events, it provides a good avenue to employ a jump diffusion model to analyze the effects of events on stock prices of financial institutions. The results, furthermore, may shed some lights on the issue of market efficiency with respect to global events such as a currency crisis, taking place in the Southeast Asia.

The paper is organized into five sections. Section II presents a brief overview of Asian currency crisis. Section III outlines the data and method of estimating parameters. Empirical findings are reported in Section IV. Finally, Section V provides a summary and concludes paper.

II. Asian Currency Crisis

2.1. Beginning of Crisis

The problem with Asian crisis started in Korea and Thailand in early 1997. For example, Hanbo Steel in Korea collapsed with $6 billion in debts, followed by Sammi Steel and Kia Motors in following months. These bankruptcies pressured several banks, which have channeled foreign borrowing to these firms. In Thailand, on the other hand, Samprasong Land missed payments due on it foreign debt in February, resulting in massive fall in real estate market and pulling the financial institutions down which had lent heavily to property firms. The removal of support from a major finance company by Thai government accelerated the withdrawal of foreign funds and resulted in the currency depreciation on July 2, 1997. The devaluation of Thai baht triggered the major capital outflows from East Asia. The following factors are cited as the major reasons for the Asian currency crisis (Radalet and Sachs, 1998): Bank failures; corporate failures; political uncertainty; Contagion effect; and inappropriate intervention by the IMF. The withdrawal of foreign funds essentially triggered a chain reaction, which quickly developed into a financial panic. The

Asian crisis is considered as a good example of how financial panics can create deeper effects on a whole financial system.

2.2. Economic Indicators Prior to Crisis

One of the aspects of the Asian crisis is that it was unpredicted by market participants and market analysts. The economic performances of the Asian countries prior to crisis may provide a better understanding of what caused the currency crisis in Asian countries. Table 1 reports the main economic indicators of the Asian countries during 1990-1996 period. Panel A of Table 1 shows that GDP growth rates are very high in all of the Asian countries, averaging about 7% during this period. The highest GDP growth occurs in Malaysia with 8.6% followed by Singapore and Thailand with 8.4% and 8.1%, respectively. The continuing growth rates lead to excessive optimistic expectations that high growth rates will persist in the future. Panel B of Table 1 shows inflation rates in Asian countries. During the period of 1990-1996, the inflation rates seem to be declining. Indonesia, Singapore, Hong Kong have experienced the highest average inflation rates of 8.7%, 10.1% and 8.7%, respectively, while others have moderate inflation rates. High inflation may be a sign of the vulnerability of fixed exchange rate regime to a speculative attack. High inflation leads to domestic currency appreciation and losses of international competitiveness, eventually diminishing the credibility of the pegged exchange rate.

Panel C of Table 1 outlines the current accounts of involved countries as a percentage of GDP. It shows that Asian countries experienced large current account deficits for several years before the currency crisis occurred. With the exception of Singapore and to some extent South Korea, all countries had current account deficit. Malaysia and Thailand have the severe and consistent case of current account deficit during the period of 1990-1996. For example, the current account deficit in Thailand is around 8% during this period. Malaysia also experienced with similar patterns. The numbers clearly indicate that current account is closely related with currency crisis. Countries with high current account deficit tend to have currency crisis, while countries with current account surplus are able to get away from currency crisis relatively unharmed.

2.3. Capital Flows in Asian Countries

The capital inflows and rapid reversal of capital are cited as the main reason of the currency crisis in Asian countries. One aspect of the crisis is that it has occurred after several years of outstanding economic perfor-

mance in the region. Particularly, the region was the major recipient of capital inflows in 1990s. During this period, the capital inflows were higher than the current account deficits of these countries. Table 2 reports the combined external financing activities in Indonesia, Malaysia, Philippines, South Korea and Thailand. The current account balances of these countries were US$ -24.6 billion in 1994, US$ -41.3 billion in 1995 and US$ -54.9 billion in 1996. The corresponding external financing, on the other hand, were US$ 47.4 billion, US$ 80.9 billion, and US$ 93.0 billion, respectively. The excess capital inflows essentially created growing imbalances in accumulation of short-term debt. The large capital inflows are tied to both internal economic policies and world market. Liberalization of capital movement internationally let new bond and equity funds, new bank syndicates flow borders quickly as low interest rates in the US and Japan favored the move of capital to promising Asian markets. The excessive optimistic outlook of Asian economies also played a role in major capital inflow to these countries. Table 2 further shows the magnitude of the reversal of the capital inflows to Asian countries. Based on the Institute of International Finance estimates, net private inflows dropped from US$ 93 billion in 1996 to -US$ 12.1 billion in 1997. Most of these changes in capital inflows came from commercial banks (from US$ 55.5 billion in 1996 to -US$ 21.3 billion in 1997).

Table 3 reports the balance of payments in five Asian countries during the period of 1985-89 and 1990-96. The most noticeable pattern is the increase in capital and financial account as a percentage of GDP. All of the countries under consideration experienced increase in their capital account in latter period. Malaysia and Thailand are the countries, showing the most severe case of increase.

The currency crisis in Asian countries has influenced other countries around the world adversely. A currency crisis in a country or region is generally expected to affect countries with close ties to country in crisis and countries with similar macroeconomic circumstances. Emerging markets may be considered in this group and hence are more likely to be adversely affected by the crisis. The Turkish capital market is considered as one of the fastest growing emerging market in the world. This paper aims to provide an emerging market evidence of how a currency crisis may affect financial institutions in an emerging market.

III. Data and Methodology

3.1. Data

The sample consists of 52 publicly traded Turkish financial institutions. The sample divided into five portfolios: banks (12), holdings (12), insurance (6), investment trusts (14), and leasing (8). The raw data for jump diffusion process consist of the daily closing prices of common stocks of financial institutions[1]. To ensure the presence of sufficient number of observations to estimate the jump diffusion model, we take 100 trading days spanning from January 1, 1997 to June 30, 1997 as non-event period, and 142 trading days spanning from July 1, 1997 to February 20, 1998 as event period.

Table 4 shows the summary statistics on the resulting data. The portfolios each have different degrees of skewness. Each of the portfolios is significantly leptokurtotic at 1 % level. The level of leptokurtosis may be explained by the non-constant number of jumps because returns are drawn from distributions whose variance depends on the number of realized jumps.

3.2. Methodology

The Jump diffusion model is employed to measure the effects of Asian currency crises on Turkish financial institutions. A jump-diffusion process is composed of Wiener process which captures fluctuations in asset prices caused by strategic trading by informed traders, and the sum of a discrete number of jumps (determined by a Poisson process) which are individually normally distributed and which capture any effect of residual information made public. Any news release related to Asian currency crisis should produce two effects on stock prices of financial institutions. The first one is that a reaction of stock prices to news conveyed through order flow and the second one is a reaction to residual information that is made public through announcement. The jump-diffusion process is very suitable to differentiate these two effects and superior to pure diffusion model.

If S_t is the stock price at time t, then the jump-diffusion process is represented by the following equation.

$$Z_t = (\alpha - 1/2\ \sigma^2) + \sigma B_t + \sum_{n=1}^{N_t} K_t \qquad (1)$$

[1] For the Jump-diffusion process, returns are calculated as the first differences of logged prices and then scaled by a factor of 10,000.

Where;

$$Z_t = In\ (S_t / S_{t-1}) \quad (2)$$

B_t is a standard Brownian motion, N_t is an independent Poisson process with $\lambda > 0$. K_t is a random variable that measures the size of the Poisson jump at time t, which is assumed to be independent of N_t. α is the instantaneous mean of the diffusion process and σ is the instantaneous standard deviation of the diffusion process. λdt is the probability that stock prices will have a jump in a small time interval.

There are two parts in this jump-diffusion process. One is $Z_{1t} = (\alpha - 1/2\ \sigma^2) + \sigma B_t$ representing the continuously changing part, and the other is

$$Z_{2t} = \sum_{n=1}^{N_t} K_t$$

representing the discontinuously changing part. We make the assumption that jump sizes are normally distributed with mean μ and variance δ^2. The density function of a jump-diffusion process is then given by

$$f(Z) = \sum_{n=0}^{\infty} \{1/[2\pi(\sigma^2+\delta^{2n})]^{1/2}\}\{\exp(-(Z-\alpha+(\sigma^2/2)-\mu n)^2/2(\sigma^2+\delta^2 n))\}e^{-\lambda}\ \lambda^n/n!\} \quad (3)$$

Substituting the density function into the log-likelihood function will give us the following log-likelihood function for jump-diffusion process (with a constant suppress for jump-diffusion process).

$$L=-T\lambda+ \sum_{t=1}^{T} \ln(X_t) \quad (4)$$

Where;

$$X_t = \sum_{n=0}^{\infty} \frac{1}{(\sigma^2 + \delta^2\ n)^{1/2}} \exp\left[\frac{-(Z_t-\alpha+ \frac{\sigma^2}{2} - \mu n)^2}{2(\sigma^2 + \delta^2\ n)}\right] \lambda^n/n! \quad (5)$$

The parameters α and σ^2 are the mean and variance of the diffusion process. This is a Wiener process, which forms the baseline for the return on each day. Appended to this are a discrete number (i.e., 0, 1, ...) of jumps. The number of jumps is determined from the Poisson parameter, λ. This may be interpreted as the average number of jumps per day. Each

jump is a draw from a normal distribution with mean and variance of μ and δ^2.

Maximum likelihood estimation technique is used to obtain parameter estimates of the model. We assume continuously compounded daily returns of stock prices and numerically maximized the log-likelihood function with respect to a parameter vector (α, σ^2, μ, δ^2, λ)

The jump-diffusion process is estimated during the non-event and event periods. Any changes in the mean and variance of the jump process during the event period compared to the non-event period would measure the effects of public announcements, whereas any shift in the diffusion process would measure the effect of trading.

IV. Empirical Results

The results of the empirical investigation for the residual effects of news coming to the market about Asian crisis on Turkish financial institutions are presented in Table 5 and 6. Table 5 Panel A and B show the parameter estimates during the non-event and event period. Most of the parameter estimates of all portfolios are significantly different from zero. The variance of the diffusion process is dominated by the variance of the jump process for all portfolios during the non-event and event periods. The mean number of jumps on average is above three per day for all portfolios. For the whole portfolio the jump process dominates the diffusion process. This indicates that the news about Southeast Asian crisis was surprised to the market participants. They have reacted to the news rapidly and the stock prices incorporated the residual effects of the news.

When we examine each portfolio group individually, we notice that the mean number of jumps has increased by 23.3% in the event period. This implies that the information about the Asian currency crisis was surprise to the market participants. We can see the similar type of increases in the mean number jumps in the event period of the portfolios of Leasing, Investment Trust, and Insurance by 106.47%, 50.24%, and 31.85% respectively. There is a drop, however, in the mean number of jumps in the event period for Holding and Banks portfolios by 9.04% and 26.11% respectively, although the variance of the jump process increases by 34.61% and 3.08% in the event period.

The differences in parameter estimates between the event and non-event periods are presented in Table 6. For all the portfolios, the difference of the means and variances of the diffusion process from the non-event to the event period are not statistically different. But, almost all increases

in the volatility from the non-event to the event period comes from the jump process. There is a decline in the variances of the diffusion process from the non-event to the event period whereas the variances of the jump process increases.

The results suggest that the jump process is the dominant feature of all portfolios. The mean number of jumps is above three, the variance of the jump process is more than the variance of the diffusion process, and the variance of the diffusion process is small. These results show that the event related news that caused the large jumps in the stocks prices during the event period surprised the market participants. The high mean number of jumps also shows that the amount of event related news during the event period is almost the same for individual stocks in all portfolios.

Furthermore, the following features seem to be common across these portfolios. First, the variance of the jump process dominates the variance of the diffusion process. Second, the variance of the diffusion process is small. This may indicate that the random noise affects the all portfolios equally. The final noteworthy point is that the variance of the jump process is large, possibly suggesting that the information inherent in these jumps is more surprising to the market participants. These results seem to suggest that Asian crisis has increased the volatility in Turkish financial markets and market participants did not predict this increased volatility. But they have reacted to the new information rapidly.

In event studies one of the concern is that whether a new flow of information is incorporated into stock prices. The hypothesis based on the argument that efficient markets incorporate new information rapidly in stock prices is called “new information hypothesis”, which indicates that researchers should use relatively small event windows for their studies. The alternative hypothesis is called “the information leakage hypothesis”, which argues that the information leaked to the market before it is made public.

In the light of this argument on the efficient market hypothesis, the results show that the market for the Turkish financial institution stocks is efficient. The market participants reacted to the news about the crisis in Southeast Asia rapidly and the effect of the news reflected on the stock prices of the financial institutions. This is an interesting result in a sense that the ISE is still a developing market and that there are many speculative moves in the market. Nevertheless, the findings support the efficient market view for the financial institution stocks in this particular event.

V. Summary and Conclusions

This paper investigates the effects of the Asian currency crisis on Turkish financial institutions by employing a Jump-diffusion model. The Asian currency crisis is considered as a crisis of panics, which occurred as a result of sudden withdrawal of funds flowing to the region over the years. This paper illustrates that the currency crisis can transmit to other countries and adversely influence other economies. The sample consists of 52 financial institutions traded at the Istanbul Stock Exchange during the crisis period. The empirical findings show that the jump process is the dominant feature of all portfolios, indicating that the currency crisis surprised the market participants. Furthermore, there is increased volatility from the non-event period to the event period, suggesting that financial institutions are adversely affected by the crisis.

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Table 1: Economic Performances in Asian Countries

Panel A: GDP Growth Rates (%)							
Countries	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**Average 1991-1996**
Hong Kong	4.9	6.2	6.2	5.5	4.4	5.0	5.4
Indonesia	6.9	6.5	6.5	7.6	8.2	7.9	7.3
S. Korea	9.1	5.1	5.8	8.6	8.9	7.1	7.4
Malaysia	8.4	7.8	8.4	9.2	9.5	8.2	8.6
Philippines	-0.5	0.3	2.1	4.4	4.7	5.7	2.8
Singapore	7.3	6.3	10.4	10.0	8.7	7.3	8.4
Taiwan	7.6	6.8	6.3	6.5	6.0	5.7	6.5
Thailand	8.4	7.8	8.3	8.9	8.7	6.7	8.1
e: estimated growth.							
Panel B: Inflation Rates (%)							
Countries	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**Average 1991-1996**
Hong Kong	11.6	9.3	8.5	8.2	8.6	5.9	8.7
Indonesia	9.4	7.6	9.6	8.5	9.4	8.0	8.8
S. Korea	9.3	6.2	4.8	6.2	4.5	4.9	6.0
Malaysia	4.4	4.7	3.6	3.7	5.3	3.6	4.2
Philippines	18.7	8.9	7.6	9.1	8.1	8.4	10.1
Singapore	3.4	2.3	2.3	3.1	1.8	1.3	2.3
Taiwan	3.6	4.5	2.9	4.1	3.7	3.1	3.7
Thailand	5.7	4.1	3.4	5.2	5.7	5.9	4.9
Panel C: Current Account (% of GDP)							
Countries	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Hong Kong	8.4	6.6	6.6	8.1	1.9	-2.2	0.6
Indonesia	-4.4	-4.4	-2.5	-0.8	-1.5	-4.3	-3.4
S. Korea	-1.2	-3.2	-1.7	-0.2	-1.5	-1.9	-4.9
Malaysia	-2.3	-9.1	-4.1	-10.1	-11.5	-13.4	-5.9
Philippines	-6.3	-2.5	-3.2	-6.7	-3.7	-5.1	-5.9
Singapore	9.5	12.4	12.4	8.5	18.1	17.9	16.3
Thailand	-8.7	-8.6	-8.6	-6.5	-7.2	-9.0	-9.2

Source: IFS International Financial Statistics, 1997.

Table 2: External Financing of Five Asian Economies[a] (Billions of dollars)

	1994	1995	1996	1997[b]	1998[b]
Current account balances	-24.6	-41.3	-54.9	-26.0	17.6
External financing (Net)	47.4	80.9	92.8	15.2	15.2
Private flows (Net)	40.5	77.4	93.0	-12.1	-9.4
Equity investment	12.2	15.5	19.1	-4.5	7.9
Direct equity	4.7	4.9	7.0	7.2	9.8
Portfolio equity	7.6	10.6	12.1	-11.6	-1.9
Private Creditors	28.2	61.8	74.0	-7.6	-17.3
Commercial banks	24.0	49.5	55.5	-21.3	-14.1
Non-Bank private creditors	4.2	12.4	18.4	13.7	-3.2
Official Flows (net)	7.0	3.6	-0.2	27.2	24.6
Int'l financial institutions	-0.4	-0.6	-1.0	23.0	18.5
Bilateral creditors	7.4	4.2	0.7	4.3	6.1
Resident lending/other (net)	-17.5	-25.9	-19.6	-11.9	-5.7
Reserves (excluding gold)	-5.4	-13.7	-18.3	22.7	-27.1

a: Indonesia, Malaysia, Philippines, South Korea and Thailand

b: forecast

Source: Institute of International Finance, Inc. "Capital Flows to Emerging Market Economies" January 29, 1998.

Table 3: Balance of Payments 1985-1996 (% of GDP)

	Indonesia		Korea		Malaysia		Philippines		Thailand	
	1985-89	1990-96	1985-89	1990-96	1985-89	1990-96	1985-89	1990-96	1985-89	1990-96
Current Account	-2.5	-2.5	4.3	-1.7	2.4	-5.6	-0.5	-3.3	-2.0	-6.8
Balance of trade	5.9	4.5	3.6	-1.2	13.7	3.2	-2.9	-8.7	-2.2	-4.7
Export	21.9	24.2	30.7	25.0	56.1	73.2	17.1	17.4	22.9	29.6
Import	-15.9	-19.7	-27.2	-26.2	-42.5	-70.0	-20.0	-26.1	-25.1	-34.3
Capital and Financial Account	3.5	4.1	-2.5	2.5	0.5	9.6	1.4	5.5	4.2	10.2
Direct inv. (net)	0.5	1.2	-0.1	-0.3	2.4	6.9	1.0	1.1	1.1	1.5
Portfolio inv. (net)	-0.0	0.9	0.2	1.9	1.0	-1.0	0.2	0.3	1.2	1.5
Equity securities	0.0	0.5	0.0	0.8	0.0	0.0	0.0	0.0	0.8	0.7
Debt securities	-0.0	0.4	0.1	1.1	1.0	-1.0	0.2	0.3	0.4	0.9
Other investments	3.0	2.0	-2.4	1.0	-2.8	3.8	0.2	4.0	2.0	7.1
Monetary authorities	0.0	0.0	-0.0	-0.0	0.0	0.0	-0.6	0.0	0.0	0.0
General government	2.6	0.5	-1.2	-0.3	-1.7	-0.3	2.3	1.1	0.2	-0.4
Banks	0.0	0.4	-0.8	0.1	-1.0	1.8	-0.2	1.4	0.2	3.5
Other sectors	0.4	1.2	-0.4	1.2	-0.0	2.4	-1.2	1.6	1.5	4.0
Financing	-0.1	-1.1	-1.7	-0.6	-2.9	-5.0	-1.8	-1.8	-3.0	-3.6
Reserve assets	-0.2	-1.0	-1.4	-0.6	-2.7	-5.0	-1.0	-1.7	-2.7	-3.5

Table 4: Summary Statistics for Returns

	Banks n=12	Holdings n=12	Insurance n=6	Inv. Trusts n=14	Leasing n=8	All Financials n=52
Mean	49.12	59.85	35.43	53.18	23.21	51.74
Variances	9.05	11.54	8.27	8.11	6.45	7.10
Skewness	-0.41	-0.31	-0.27	0.08	-0.46	-0.51
Kurtosis	2.28***	1.77***	2.06***	1.91***	1.41***	2.36***

*** is statistically significant at 1% level.

Table 5: Parameter Estimates of the Jump-Diffusion Model

Banks n=12				
Process	**Variable**	**Estimate Of**	**Non-Event Period**	**Event Period**
Diffusion	α	Parameter	-14.72	-17.01
		Std-error	(97.51)	(42.35)
	σ^2	Parameter	3.42	77.20
		Std-error	(212.64)	(82.82)
Jump	μ	Parameter	10.96	46.17
		Std-error	(17.04)	(13.73)
	δ^2	Parameter	26297.61	27106.34
		Std-error	(23670.06)	(6050.39)
	λ	Parameter	3.83	2.83
		Std-error	(4.02)	(0.52)
Holdings n=12				
Diffusion	α	Parameter	8.84	-29.50
		Std-error	(15.53)	(34.70)
	σ^2	Parameter	1.09	25.23
		Std-error	(42.94)	(65.31)
Jump	μ	Parameter	1.84	39.73
		Std-error	(9.00)	(13.01)
	δ^2	Parameter	24991.76	33642.56
		Std-error	(27745.60)	(7636.51)
	λ	Parameter	3.87	3.52
		Std-error	(4.62)	(0.75)
Insurance n=6				
Diffusion	α	Parameter	19.17	-18.66
		Std-error	(16.52)	(33.04)
	σ^2	Parameter	24.66	29.77
		Std-error	(31.34)	(66.72)
Jump	μ	Parameter	11.46	19.40
		Std-error	(12.94)	(9.24)
	δ^2	Parameter	34425.55	20909.20
		Std-error	(9107.76)	(5019.54)
	λ	Parameter	2.70	3.56
		Std-error	(0.47)	(0.81)

Inv. Trusts n=14				
Process	**Variable**	**Estimate Of**	**Non-Event Period**	**Event Period**
Diffusion	α	Parameter	546.62	1474.30
		Std-error	(821.20)	(6254.21)
	σ^2	Parameter	1447.01	2880.39
		Std-error	(1642.40)	(12495.38)
Jump	μ	Parameter	105.81	10.83
		Std-error	(29.88)	(22.21)
	δ^2	Parameter	46944.22	15396.89
		Std-error	(13097.37)	(11206.99)
	λ	Parameter	2.09	3.14
		Std-error	(0.52)	(2.92)
Leasing n=8				
Diffusion	α	Parameter	-50.12	8.07
		Std-error	(5.74)	(15.01)
	σ^2	Parameter	7.71	645.34
		Std-error	(9.31)	(19.69)
Jump	μ	Parameter	20.14	53.96
		Std-error	(10.03)	(0.55)
	δ^2	Parameter	23472.15	134.97
		Std-error	(5812.16)	(2.13)
	λ	Parameter	3.09	6.38
		Std-error	(0.54)	(0.28)
All Financial n=12				
Diffusion	α	Parameter	-37.89	-1.37
		Std-error	(1334.32)	(0.42)
	σ^2	Parameter	305.47	0.27
		Std-error	(2661.75)	(0.51)
Jump	μ	Parameter	63.59	17.43
		Std-error	(33.93)	(5.40)
	δ^2	Parameter	17831.58	14762.00
		Std-error	(6593.12)	(2666.27)
	λ	Parameter	3.52	4.34
		Std-error	(1.67)	(0.57)

Table 6: Comparison of Parameter Estimates from the Non-Event and the Event Periods.

	Banks n=12		Holdings n=12		Insurance n=6		Inv.Trusts n=12		Leasing n=8		All Financial n=52	
Event / Nonevent	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
$(\alpha_e - \alpha_{ne})$	80.40	0.11	-2274.83	0.04	-5.47	0.02	927.68	0.18	58.18	3.62	36.53	0.03
$(\sigma_e^2 - \sigma_{ne}^2)$	-591.41	-1.29	-3786.54	0.02	-4.53	0.00	1433.38	0.14	637.64	70.4	-305.21	-0.12
$(\mu_e - \mu_{ne})$	-1.48	-0.16	-29.17	0.00	-3.61	-0.08	-94.98	-2.55	33.82	0.34	-46.16	-1.34
$(\delta_e^2 - \delta_{ne}^2)$	3223.20	0.00	-23073.53	0.00	391.1	0.00	-31547.33	-3.15	-23337.18	-4.67	-3069.59	-0.31
$(\lambda_e - \lambda_{ne})$	0.53	-0.12	0.45	0.04	-1.07	7.64	0.96	0.035	3.29	5.46	0.81	0.46

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FORECASTING STOCK PRICES BY USING ALTERNATIVE TIME SERIES MODELS

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Abstract

The purpose of this paper is to compare the forecast performance of alternative time series models, namely VAR in levels, stochastic seasonal models (SSM) and error correction models (ECM) at the Istanbul Stock Exchange (ISE). Considering the emerging market characteristic of the ISE, stock prices are estimated by using, money supply, inflation rate, interest rates, exchange rates and budget deficits. Then, in an out-of-sample forecasting exercise from January 1995 through December 1995, comparisons will be given as to the performance of alternative forecasting models at different forecast horizons of short, medium and long terms, respectively. Empirical results showed that ECM captures market movements much better.

I. Introduction

Although various empirical studies show that stock prices are highly volatile (Shiller, 1989) and unpredictable (De Bondt, 1991), for many others, the selection of accurate price forecasting models is a topic of considerable interest. Previous research also indicates that stock prices and economic activity (Fama, 1981; Cohrane, 1991) are correlated. Macroeconomic variables constitute an important set of independent variables in forecasting stock prices, especially in the thin equity markets of developing countries, where the volume of trade is low, information on company performances is limited and untimely, and capital accumulation is dominated by the state. Therefore, in the thinly traded stock markets of controlled economies, macroeconomic variables are expected to be good predictors of stock price forecasting models. While most studies in forecasting stock prices are limited to the US and the UK markets (Jung and Boyd, 1996), studies in emerging markets are of equal importance to insti-

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tutional and private investors, who trade securities in the so-called global market and who can benefit from international diversification.

This study compares the forecast performance of three time series models that employ macroeconomic variables as predictors of stock prices in the Istanbul Stock Exchange (ISE). Muradoglu and Metin (1996) provide evidence that stock prices and macro-economic variables cointegrate at the ISE. It is known that there is an error-correction representation which is isomorfic to cointegration, and this indicates that stock prices can be forecasted. Therefore, the Error Correction Model (ECM) is estimated empirically and its forecasting performance is compared to the performance of well known alternative empirical models; namely the Vector Autoregressive Model (VAR) and the Stochastic Seasonal Model (SSM) (Franses, 1998) and (Franses and Koehler, 1998). The VAR model yields constant estimates over time while the ECM has a dynamic component due to the error correction term, and where the SSM considers the periodicity of the data while yielding constant estimates.

This study, which is based on the econometric modeling outlined above, aims to forecast ISE index for the period of January-December 1995 by using the sample period between January 1986 and December 1995. The sample period, which is used in this study, is particularly selected by ourselves in a way that it includes April 4, 1994 financial crises. The ISE index had some relatively small and large variations after the end period of the data set. However, due to our desire to include only the 1994 crisis rather than the other fluctuations in the modeling the data set is compiled to cover up to end of 1995 period.

The paper is organized as follows. First we present a brief description of the data. Second, we analyze the time series properties of the data by testing for seasonal unit roots (Franses, 1991). Third, we empirically estimate all three models and compare their forecast performances. Finally, conclusions are presented.

II. The Data

The data set consists of monthly observations since the establishment of the ISE between January 1986 and December 1995. Stock prices are represented by the monthly index value of the ISE Composite Index (ISE). Considering the cointegration relationship in Muradoğlu and Metin (1996) and the availability and the higher frequency of use of information by the ultimate investor, the following variables are used as predictors of stock prices: Budget deficit which is not announced on a monthly basis is

represented by the advances of the Central Bank to the treasury (A). Interest rates (R) are depicted by the monthly compounded value of the T-bill rate. The Turkish lira-U.S dollar exchange rate (E) is included due to the frequent open market operations of the Central Bank using dollar reserves. Inflation (P) is measured by the consumer price index and money supply is represented by M1[1]. None of the series are seasonally adjusted.

III. Testing for Seasonal Unit Roots

Since the statistical properties of different seasonality models are distinct, and since seasonality is quantitatively important in many aggregate series, the imposition of one kind when another is present can result in serious bias or loss of information (Beaulieu and Miron, 1993). In this study, deterministic seasonality is modeled by seasonal dummies, and stochastic seasonality is tested by using the method developed by Franses (1991) for monthly data.

[1] Although not reported here, all models are also estimated by M2, but forecast performances do not change in any of the models.

Table 1: Results of Tests for Seasonal Unit Roots in Monthly Aggregate Series (null: I(1,1))

	ISE	E	M1	M2	P	A	R	CV's 5%
t:π_1	-1.91	0.980	-3.23	-3.030	0.950	-0.73	0.99	-3.24
t:π_2	-1.98	-1.59	-1.50	-1.370	-1.11	-1.10	-0.77	-2.65
t:π_3	-0.80	-1.41	-1.32	-1.790*	-1.89**	-1.54	-0.62	-1.71
t:π_4	-2.21	0.510	-1.83	-0.860	-0.93	-2.32	-1.46	-3.82
t:π_5	-2.53	-0.20	-0.63	-1.510	-1.36	-2.59	-2.75	-2.99
t:π_6	-2.40	-0.37	-1.71	-2.050	-1.46	-2.19	-1.03	-3.12
t:π_7	-0.97*	-0.50*	-0.43*	-1.040*	0.750*	0.45*	-0.39*	-0.12
t:π_8	-0.36	0.210	-1.25	0.330	-1.74	-1.08	-0.37	-3.15
t:π_9	-2.44	0.050	-1.53	-0.450	-1.21	-1.37	-0.95	-2.54
t:π_{10}	-2.56	-1.35	-1.58	-1.090	-0.48	-1.31	-1.00	-3.07
t:π_{11}	0.030	-1.27*	-1.19*	-0.180	-1.47*	-0.31	-0.18	-0.73
t:π_{12}	-2.03	-0.80	-1.08	-0.300	-0.90	-1.09	1.310	-3.16
F:$\pi_3=\pi_4=0$	2.840	1.070	2.55	2.210	2.100	4.29	5.73*	5.53
F:$\pi_5=\pi_6=0$	3.380	0.170	3.25	2.210	0.700	3.36	1.47	5.84
F:$\pi_7=\pi_8=0$	3.380	0.170	7.670*	1.400	2.800	1.16	0.65	5.90
F:$\pi_9=\pi_{10}=0$	4.230	1.250	1.620	0.460	0.720	1.23	2.29	5.71
F:$\pi_{11}=\pi_{12}=0$	2.860	1.970	2.790	0.000	2.100	1.12	3.73	5.84
F:$\pi_3=..=\pi_{12}=0$	5.660*	1.500	5.490*	1.770	12.10*	3.06	1.77	4.45

Note: An auxiliary regression to be estimated is:

$\varphi^*(B)y_{8,t}=\pi_1 y_{1,t-1}+\pi_2 y_{2,t-1}+\pi_3 y_{3,t-1}+\pi_4 y_{3,t-2}+\pi_5 y_{4,t-1}+\pi_6 y_{4,t-2}+\pi_7 y_{5,t-1}+\pi_8 y_{5,t-2}+$

$\pi_9 y_{6,t-1}+\pi_{10} y_{6,t-2}+\pi_{11} y_{7,t-1}+\pi_{12} y_{7,t-2}+\mu_t+\varepsilon_t$

If $\pi_1=0$, then the presence of root 1 cannot be rejected. There will be no seasonal unit roots if π_2 through π_{12} are significantly different from zero. π_1 and π_2's are one sided tests whereas the other t-tests are two sided.

The auxiliary regressions include constant, trend, eleven seasonal dummies, and twelve lags of the dependent variable. The procedure and the results of the seasonal unit root tests are outlined in Table 1. The t statistic on π_1 indicates a strong unit root at the non-seasonal frequency at 5% level for all series indicating that they are all I(1). There is also strong evidence that a seasonal root is present in exchange rates (E), budget deficit (A), and interest rates (R) indicating that these series are I(1,1) and that $(1-B^{12})$ filtering is required to eliminate the stochastic seasonality. For stock prices (ISE), M1, and inflation (P), stochastic seasonality is rejected, but the remaining deterministic seasonality can be modeled by using 11 seasonal dummies.

IV. Macroeconomic Forecasting of Stock Prices

4.1. Forecasting Models

In this study we use three different models to forecast stock prices by using macroeconomic variables. The first, is the VAR model which requires regressing each current (non-lagged) variable on all the variables in the model lagged five times[2]:

$$y_{it} = \alpha_{io} + \sum_{i=1}^{6} \sum_{j=1}^{5} \alpha_{ij}\, y_{ij,t-j} + \varepsilon_{it} \qquad 1$$

where y_{it} is the vector variables [ISE, E, M1, P, A, R]; i=1..6 stands for the variables and j=1..5 stands for the number of lags[3].

The second is the SSM which requires the variables to be transformed to annual differences of monthly growth rates as described by Box and Jenkins (1970). Considering the results in Table 1, we applied $\Delta_1\Delta_{12}$ filter assuming the presence of 13 roots on the unit circle, two of which are at the zero frequency:

$$\Delta_1\, \Delta_{12}\, y_{it} = \alpha_{io} + \sum_{i=1}^{6} \sum_{j=1}^{5} \alpha_{ij}\, \Delta_1\, \Delta_{12}\, y_{ij,t-j} + \varepsilon_{it} \qquad 2$$

where Δ denotes the level of differencing.

The third is the seasonal ECM estimated for the variables reported as cointegrated in Muradoglu and Metin (1996). The ECM suggested by Engle and Granger (1987) is a dynamic system in which the error correction term represents deviations from a long run equilibrium relationship, while short run dynamics are represented by lagged differenced terms. The seasonal ECM is expressed as:

$$\Delta_{12}\, y_{it} = \alpha_{io} + \alpha_{i1}\, y_{ij,t-12} + \sum_{i=1}^{6} \sum_{j=1}^{5} \alpha_{ij}\, \Delta_{12}\, y_{ij,t-j} + \varepsilon_{it} \qquad 3$$

2 The highest number of lags allowed in VAR, ECM and SSM are to be limited by five for each of six variables by using PcFiml of Doornik and Hendry (1994).

3 We also specified and estimated a first differenced VAR model, results not reported here do not change conclusions. Also Holden (1995) indicates that "For non-stationary variables which are cointegrated the use of only first-differenced variables in the VAR is incorrect."

4.2. Empirical Results

Table 2 reports the forecast statistics of one-step-ahead forecasts of the VAR, SSM and ECM specifications for out of sample periods between January-June 1995; January- September 1995; and January-December 1995. Cumulative χ^2(NH)/NH for N equations and H forecasts, is an index of numerical parameter constancy. Forecast F(NH,T-k) test, where k is the number of parameters to be estimated, is based on the forecast error is also reported as a better calibrated test statistic (Chong and Hendry, 1986) and (Clements and Hendry, 1998).

For the VAR model, Cumulative χ^2 values which are above two for all out of sample forecast periods as well as the forecast F values imply that parameter values have altered from the sample period. For the SSM and the ECM specifications, parameter constancy is accepted for all out of sample forecast periods except between January-December 1995, indicating that the forecasting ability of these models is stronger at shorter horizons than in longer ones.

Table 2: The Forecast Statistics of One-Step-Ahead Forecasts of the VAR, SSM and ECM Specifications

Out of sample forecast periods	Forecast statistics	VAR specification	SSM specification	ECM Specification
January-June 1995	Cumulative χ^2(NH)/NH	χ^2(36)/36=3.633	χ^2(36)/36=0.778	χ^2(36)/36=1.251
	Forecast F(NH,T-k) test	F(36,66)=2.200 [.0027]**	F(36,64)=0.524 [0.9811]	F(36,65)=0.847 [.7020]
January-September 1995	Cumulative χ^2(NH)/NH	χ^2(54)/54=3.434	χ^2(54)/54=1.122	χ^2(54)/54=1.598
	Forecast F(NH,T-k) test	F(54,63)=2.041 [.0034]**	F(54,61)=0.744 [.8653]	F(54,62)=1.065 [.4030]
January-December 1995	Cumulative χ^2(NH)/NH	χ^2(72)/72=3.217	χ^2(72)/72=20.240	χ^2(72)/72=17.227
	Forecast F(NH,T-k) test	F(72,60)=1.874 [.0066]**	F(72,58)=13.190 [.0000]*	F(72,59)=11.293 [.0000]*

*significant at 1%
**significant at 5%

Table 3 reports the forecast standard errors (FSE), mean forecast errors (MFE) and the mean squared forecast error (MSFE) used to evaluate the forecast performance of one step ahead forecasts for the SSM and the ECM that passed the parameter constancy tests.

The FSE, used as a measure of forecasting diagnostics is in favor of the ECM model as indicated by the smaller values of the statistic. MFE, which shows the average bias, indicates that while the ECM underpredicts systematically, the SSM overpredicts during the first 6 months and under-

predicts afterwards. However, the absolute values of the MFE are smaller for SSM than for the ECM. A better calibrated measure of forecast performance is the MSFE that measures the relative predictive accuracy of the forecast models. The MSFE indicates that for all out of sample periods, the ECM outperformed the SSM.

Table 3: The Forecast Standard Errors (FSE), Mean Forecast Errors (MFE) and the Mean Squared Forecast Errors (MSFE)

Out of sample forecast periods	Forecast statistics	VAR specification	SSM specification	ECM specification
January-June 1995	MFE	-0.27683	-0.20384	0.35587
	FSE	0.19832	0.66167	0.18392
	MSFE	0.11552	0.47936	0.16047
January-September 1995	MFE	-0.13227	0.05219	0.26539
	FSE	0.24282	1.13548	0.47371
	MSFE	0.07457	1.29204	0.29483
January-December 1995	MFE	-0.23322	0.01905	0.18150
	FSE	0.27080	1.15938	0.41802
	MSFE	0.12772	1.07675	0.20768

V. Conclusions

Muradoglu and Metin (1996) presents evidence that the Turkish stock exchange is inefficient with respect to monetary variables. This suggests that profit opportunities exist for domestic and foreign investors who can use these easily accessible variables for forecasting stock returns. A variety of profitable trading rules can be based on the available information on macroeconomic policies by examining several forecasting models.

This study aims to forecast the ISE index by using the sample period which is selected, in particular, in a way that it includes April 4, 1994 financial crises. In this study forecasting period is January-December 1995 and the periods of January-June 1995, January-September 1995 and January-December 1995 are forecasted. Well specified models forecasting stock returns at the ISE are the SSM, which assumes 13 unit roots on the unit circle, and the seasonal ECM model, that incorporates long run as well as short run influences of the data. However, the error measurement of the models indicate that the ECM outperforms the SSM in all three periods. The SSM adjusts in a manner that updates only the seasonal

information in the short run. Thus, the ECM which has an error correction term that adjusts the deviations from a long run equilibrium, indicates market movements with greater clarity.

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THE GOALS OF THE MONETARY POLICY IMPLEMENTATIONS IN TURKEY

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Abstract

In this paper, monetary policy goals of the Central Bank of the Republic of Turkey and relative weights attributed to them by the Bank are examined statistically for the period covering January 1989-April 1998. For this purpose, initially, a policy response function is constructed for the Bank. By applying Granger causality test and the variance decomposion process on the policy response function, the goals that were followed and relative weights swich were attributed to them are identified. The Granger causality test and variance decomposion process reveals that the objectives of the Turkish Central Bank in monetary policy implementations are to provide the stability of the foreign exchange rate, prices and money supply with relatives weights, respectively.

I. Introduction

In Turkey, the monetary policy is conducted by the Central Bank of the Republic of Turkey. The Turkish Central Bank Statute has specified clearly the principle and the goals of monetary policy that the Central Bank is supposed to follow. According to the statute, the monetary policy must be consistent with the economic development plans and the annual programs. This principle requires that the Central Bank should adopt the annual program target figures on the main economic variables and design its monetary policy in compliance with these targets. Steady economic growth, price stability, foreign exchange rate stability and financial market stability are then declared as the main goals of the monetary policy to be assured (Morgil, 1998).

In essence, the Law has merely brought the limitations on the Central Bank's final targets by specifying the goals and not prevented the Bank from making choice among the defined goals in anyway. Besides, some

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factors that could be summarised under the headings of current economic structure, economic conjuncture and conflicts among the defined goals do not allow the accomplishment of the goals simultaneously. These factors have compelled the Bank to make a choice among the goals and directed them towards achieving those goals. Existence of the conditioning factors that forces the Bank to choose among the goals and govern the choices have been pronounced officially various times.

The factors that affect and dictate the Bank's choices among the goals come from three different sources. These factors can be subjected to a triple-classification under the stated headings of the previous paragraph. If we accept the first group as consisting of factors connected with economic structure, the major conditioning factor that belongs to this group is the current stage of economic development. A central bank, conducting monetary policy in a developing economy, could not adhere to the single-goal-monetary policy strategy that has been embraced by the developed western countries' central banks in the recent years and defined by "establishing price stability". While determining its goals, the Central Bank has behaved in a manner that considers the real economy, the financial markets, the balance of payments and inflation altogether because Turkey has a developing economy (Erçel, 1998a). Actually, the Central Bank Law itself has also embodied this approach while designating the goals.

Another important conditioning factor that has been placed in the first group related to the economic structure is the enormous share of the public sector in the economy and statutory and institutional regulations that favour the public sector. The Central Bank is subjected legitimately to provide finance to the public sector under the specified conditions. This obligation has led the Central Bank to finance the increased public sector deficit and restrained the Bank from aiming at price stability. Success of the Central Bank by following a monetary policy aiming at price stability requires the other authorities' adherence to price stability goal, as well. At the beginning of the 1998, for instance, after the government's declaration of its determination to reduce inflation and the Treasury's attempt to implement a financial program, it has been possible for the Central Bank to follow the policy of price stability. Generally, if the share of the public sector in the economy is large, achieving a consensus on the monetary policy goals among the present authorities becomes essential as regards to monetary policy.

The Central Bank's insufficient independence from the political authority is one of the important conditioning factors driving the Bank's goal selection. It is believed that if the Central Bank chooses the price stability

goal, it will have to be independent from political authority in order to act towards achieving that goal. In recent theoretical discussions, the goal of "establishing the price stability" has been defended as a unique goal of the monetary policy for an independent Central Bank, and its independence level has been rated according to the importance given to price stability.

Economic conjunctural factors could be considered as a second group that forces the Bank to change the goals and their priorities in favour of one of them. Because of economic conditions, providing stability in the financial markets has dominated other goals in the period of 1994-1997 is a good example of displaying the significance of these factors. As a fundamental part of financial stability, the foreign exchange rate stability has been preferred to other goals like price stability.

The third group conditioning factors forcing the Bank to make a choice among the goals are the conflicts among the defined goals. In order to give an example, as the depreciation of the foreign exchange rate may improve the current account balance, it may contribute to an acceleration in the inflation rate. Therefore, the current account balance and inflation goals could not be produced simultaneously and these goals exclude each other. Foreign exchange rate depreciation is not allowed in the period when the inflation is the most serious problem. In contrast to this, it is allowed when the current account balance is the primary problem (The Central Bank, 1998).

Under the restriction and guidance of the already mentioned conditioning factors and the others, the Central Bank determines the goals of the monetary policy. At this point, which monetary policy goals and in which order have been followed by the Central Bank is an important issue that should be clarified. There are various motivations for studying the subject. In addition to being a scientific exercise of interest in its own right, it could also enable us to compare the official statements with the realised implementations which in turn will provide an evaluation to be made on monetary policy implementations, objectively. In addition, it could provide insights for future monetary policy prospects, the Central Bank's independence degree and economic factors that force the Central Bank to make certain policy choices. It is expected that the study could contribute to overall understanding on the monetary policy applications in Turkey.

In this paper, the Central Bank's monetary policy goals and relative weight attributed to them are examined statistically. The inquiry covers the period between January 1989 and April 1998 and employs monthly data. Monetary policy goals are handled on the basis of variables. What is meant specifically here by a policy goal variable is a final target variable

which is desired to take some predetermined value and then retain it for a while. It is assumed that, if an expected deviation from the targeted value emerge, the Central Bank reacts to it through changing the value of the monetary policy (control) variable by using monetary policy tools. In sum, a goal variable is defined such that the Central Bank tries to stabilise around its targeted value.

In the following section II, a Central Bank's decision problem and its solution as a policy response function is presented via a simple theoretical example. The insights gained from this second section are then used in the proceeding sections. The third section covers the specification of the Central Bank's policy response function. Specifically, the variables and the form of the function are determined. The fourth section includes the statistical analysis of the Central Bank's policy response function defined in the preceding section. Furthermore, the findings are reported, interpreted and some comparisons are made in this section. The study is completed in the conclusion section by commenting on the results.

II. An Analytical Representation of a Central Bank Decision Problem and its Solution

The question of "what goals are followed by a Central Bank" can be handled equivalently by asking the question of "to which variables a Central Bank responds by changing the value of its policy variable when these variables are subject to expected deviations from the targeted growth rates". The insights that enable this transition can be presented through a simple theoretical example.

A Central Bank's decision problem can be framed as a dynamic optimisation problem with constraints (Cecchetti, 1998). In the context of determining the monetary policy goals, the solution to the dynamic optimisation problem gives the Central Bank policy response function. The parameters of the policy response function reflect the preferences of the bank as to policy goal variables. Therefore, the first question transforms to the question of "to which variables a Central Bank responds by changing the value of its policy variable when these variables are exposed to expected deviations from the targeted growth rates" and is answered via the policy response function (Bernanke and Mihov, 1996).

Let us explain the dynamic optimisation problem and its solution by means of an example. Consider a simple economy that exists in three periods, (t=0, 1 and 2). For simplicity, suppose that there are only two variables that the Central Bank can goal either one or both. These are money

growth rate and inflation rate. Assume that the bank's policy variable is interbank money market interest rate. Money stock is defined as (M) and price level as (P) in logarithmic terms. The logarithms of the money stock and price level are denoted as m_t and p_t, respectively. In period 0, the values of the log price level are given as (p_o), the log money stock as (m_o) and the Central Bank policy variable as (i_o). In periods 1 and 2, the price level and the money stock evolve according to the following structural equations:

$$p_t=m_t+\varepsilon_{pt} \quad \text{(II-1)}$$
$$m_t=-\lambda i_{t-1}+\varepsilon_{mt} \quad \text{(II-2)}$$

At the same time, these equations are the constraints of the Central Bank optimisation problem. Equation (II-1) indicates that prices depend on the money supply (m_t) and other stochastic factors (ε_{pt}), such as velocity shocks. According to equation (II-2) money stock is effected by stochastic factors and by the one-period lag of the policy variable (i_{t-1}). It is also assumed for simplicity that the error terms affecting prices and money are random walks:

$$\varepsilon_{pt}=\varepsilon_{p,t-1}+\eta_{pt} \quad \text{(II-3)}$$
$$\varepsilon_{tm}=\varepsilon_{m,t-1}+\eta_{mt} \quad \text{(II-4)}$$

Where, the η's are i.i.d. mean zero random variables.

At the beginning of the period 0, the Central Bank sets growth targets to prices and money supply for the periods t=0, t=1 and t=2. Ignoring how the growth rate targets are determined, the equation (II-1) implies that expected growth rates of the variables are equal: $E_o(p_2-p_o)=E_o(m_2-m_o)$. Therefore, consistency requires the targeted growth rates of price and money to be the same. Without significant loss of generality, both of the targets could be set to zero. The zero growth rates target means that the levels of the variables are targeted.

In period t=1, interim values of prices and money arise. Since, i_o is given, these interim values depend only on the realisations of (η_{pt}, η_{mt}). Because of these stochastic factors, interim values of the variables are different from the period t=0's values. Therefore, in t=1 actual growth rates of the variables are different from zero (the targeted rates). When the realisations of the variables (p and m) are different from the targeted values on them, how the Central Bank adjusts its policy variable in the interim pe-

riod (i_1) in response to new situation is an issue to be considered.

In this new situation, how the Central Bank will adjust its policy variable depends on its goals. The goals govern the Central Bank's decision on whether to respond or not and, if it responds, the size of the response. Therefore, at this point, which variable is really intended as a goal variable by the Central Bank becomes important. Beginning from period t=0, setting a value to a variable by the Central Bank is not sufficient alone to goal the variable. When some variables deviated from their targeted values, to what sort of variables' deviations and to what extent the Central Bank responds display the Central Bank's actual policy preference on goals.

A Central Bank's behaviour, through policy variable against the realisations in the interim period 1, could be explained by means of the dynamic optimisation framework's objective function. In accordance with the heretofore thoughts, the Central Bank objective function can be defined in terms of variables' deviations from their targeted values (growth rates). In this situation, the Central Bank's objective function in period t=1, in a loss function form is:

$$E_1\left[\frac{1}{2}(p_2-p_0)^2+\frac{\alpha}{2}(m_2-m_0)^2\right]+\frac{\beta}{2}(i_1-i_0)^2 \qquad \text{(II-5)}$$

Where $E_1[.....]$ signifies the expectation conditional on information available in t=1. Equation (II-5) indicates that the Central Bank's loss depends on the expected square deviations of inflation and money growth from their targeted values. Since targeted growth rates for money and price have been taken as zero, these targeted growth rates have disappeared in (II-5). α and β are the parameters that reflect the Central Bank's preference on monetary policy goals. The parameter α is a measure of relative weight given by the Central Bank to money growth rate target. When $\alpha=0$, the Central Bank is not concerned with money growth rate as a goal variable. The last term in (II-5) captures an interest rate-smoothing motive of the Bank. Although the term states that interest rate volatility is perceived as a loss factor, the interest rate itself is not a final target variable.

Given the loss function in (II-5), minimising it mathematically with subject to (II-1) and (II-2) yields the

$$i_1^* = \frac{\lambda[(\varepsilon_{m1}+\varepsilon_{p1}-p_0)+\alpha\lambda(\varepsilon_{m1}-m_0)+\beta i_0}{\lambda^2(1+\alpha)+\beta} \qquad \text{(II-6)}$$

optimal value of the policy variable in period t=1.

According to equation (II-6) the optimal value of the policy variable in period 1 (i_1^*) depends both on the behavioural parameter (λ) and the policy maker's preference parameters (α and β). In period 0, the expected value for policy variable is $E_o(i_1^*)$. The innovation in i_1^* relative to its expectation as of period 0 is $[i_1^*-E_o(i_1^*)]$. The innovation in the policy variable can be defined by using model parameters and stochastic terms:

$$i_1^*-E_0(i_1^*) = \frac{\lambda[(\eta_{m1}+\eta_{p1})+\alpha\eta_{m1}]}{\lambda^2(1+\alpha)+\beta} \qquad \text{(II-7)}$$

As seen in equation (II-7), how the Central Bank would adjust its policy variables depends on policy preference parameters in the objective function, as well. The policy variable responds to interim innovations in the forecasts of inflation and money growth, with relative weights that depend on the importance of attributed to money deviations from the targeted values in the Central Bank's loss function. When α=0, the Central Bank puts no weight to deviations of money growth target, therefore, does not change the value of policy variable except insofar as money affects price stability.

The innovation in the policy variable can be related to the innovations in the expectations of inflation and money growth rates. The expectations of inflation and money growth rates for period 2 are formed in periods 0 and 1, sequentially. In period 1, the revisions in the inflation and money growth expectations can be defined, respectively, as follows:

$$E_1 p_2 - E_0 p_2 = -\lambda[i_1^* - E_0 i_1^*] + \eta_{m1}+\eta_{p1} \qquad \text{(II-8)}$$

$$E_1 m_2 - E_0 m_2 = -\lambda[i_1^* - E_0 i_1^*] + \eta_{m1} \qquad \text{(II-9)}$$

By doing algebraic manipulation on equations (II-7), (II-8) and (II-9), the innovation in the policy variable is obtained with respect to revision in expectations of inflation and money growth rates as follows:

$$i_1^* - E_0 [i_1^*] = \frac{\lambda}{\beta} [(E_1 p_2 - E_0 p_2) + \alpha(E_1 m_2 - E_0 m_2)] \qquad \text{(II-10)}$$

In equation (II-10), revisions in expectations are seen in terms of the

variables log levels instead of growth rates. This is the result of mathematical manipulation, and the difference is superficial. If we pick the variable p, period 2 expectations for it that are formed in periods 1 and 2 are both defined relative to p_o. Because p_o is a common factor, this term disappears in the course of subtraction. So, actually, equation (II-10) involves innovations in growth rate expectations.

In equation (II-10), as in equation (II-5), targeted growth rates for the variables do not appear. However, this result is not directly related to the zero growth rate targets. If we think about equation (II-10) and consider the first term in the big bracket, the expectations E_o and E_1 can be defined as expected deviations from targeted inflation rate. For period 2, the targeted inflation rate is set at the beginning of period 0 and does not change by the expectation formation period. So, period 2 targeted inflation rate is a common factor for both periods' expectations (E_o and E_1). This common term disappears during the subtraction operation. Therefore, for instance, innovation in the inflation expectations and innovation in the deviations of inflation expectations from targeted inflation rate are equal to each other in this example. In sum, equation (II-10) summarises the response of policy variable to innovations in the expected deviations from targeted growth rates.

The equation (II-10) represents a Central Bank's policy response function, which describes variability in the monetary policy variable as a reaction to innovations in expectations. A Central Bank, which has perceived the expected deviation from the targeted rate as a cost itself and tried to minimise this cost, responds to expected changes in growth rates of the variables by a relative weight given by the Bank itself to each one. Relative weights seen in the response function reflect the objective function's relative weights. Choosing $\alpha=0$ means that the Central Bank does not perceive the money growth deviations as a loss by itself as long as it does not affect the inflation rate. When $\alpha=0$, the Central Bank does not respond to innovation in money growth expectations. Therefore, when $\alpha=0$, setting a money growth target is irrelevant. In conclusion, the answer to the question of which variables are followed as a goal variables can be found by identifying variables which the Central Bank responds to expected deviations from their targeted rates. Starting from the estimation of defined response function, the objective function's goal variables and relative weights given to them can be discovered statistically.

III. Specification of the Turkish Central Bank Policy Response Function

By using the insights that have been presented in the preceding section,

the Central Bank's monetary policy goals and relative weights given to each one will be identified. In order to achieve it, in this section, an analogue of the response function (II-10) will be designed for the Central Bank by specifying its candidate goal variables and functional form.

To construct a response function, initially, the variables of it must be specified. Dependent variable of a response function is required to be monetary policy instrument (variable). A policy instrument is also a variable that plays the role of a policy indicator. In the context of monetary policy, policy instrument is targeted and controlled by a Central Bank during its daily operations. This variable is called operational target variable, as well. An operational target variable, depending on Central Bank's operating procedure, is either a reserve aggregate or a short run interest rate of a money market in which a Central Bank operates actively. Initially, the Central Bank's operational target variable should be identified to employ as a policy variable of the response function. But, the Central Bank, during the period under investigation, has changed its operational target variable frequently and has not stuck to any single policy variable constantly. This fact makes it difficult to find an adequate policy indicator. However, it is thought that the interbank money market interest rate has been chosen and followed most frequently by the Central Bank as a policy variable than the alternative variables.

The Central Bank has been conducting operations similar to open market operations on the interbank money market since the market has been organised. The Central Bank has been endowed to perform operations through repurchase agreements. These improvements have enabled the Central Bank to target an interest rate operationally. Thanks to these tools, the Central Bank has gained the ability to fine-tune the money market interest rate. The Central Bank affects the interbank interest rate by changing its own interest rate quotations and transactions volume in the market. The Central Bank intervenes to the interest rate in the direction of changes in expectations held by itself (The Central Bank, 1998). By giving bid-ask quotations and by providing short term loans to banks under the transaction limitations, the Central Bank could control the interbank interest rate. The interbank money market interest rate has been used often as an instrument that responds to the changes in the Central Bank's expectations. In the light of these considerations, henceforth, the statistical analysis will be accomplished by accepting the interbank interest rate as a policy instrument variable.

While specifying the explanatory variables of the Central Bank response

function, the conditioning factors on the Bank's decision process must be taken into consideration, previously. In this context, the facts that a Central Bank in a developing country is unable to restrict itself with a unique price stability goal and is forced to take into account real economy, financial markets and balance of payments together must be considered, firstly. When the legislative authority had been defining the Central Bank's goals, it embraced these parts of the economy. Therefore, the goal variables declared by the Law should be included to the list of explanatory variables.

Because of structural, legal and institutional factors, the Central Bank's independence has not been enough with respect to choosing goals of monetary policy, yet. Therefore, the variables that reflect the Bank's dependence to the other authorities should be included to the Central Bank's response function. The government's fiscal policy and the Treasury's debt and cash management policies influence the Central Bank's monetary policy decision. Specifically, these policies could urge the Central Bank to change, postpone or loose the existed monetary policy goals (Serdengeçti, 1998).

The stance and credibility of the fiscal policy could be restrictive on the Central Bank's policy preferences (Dedeoğlu 1998). Expansive fiscal policy, instead of being an exceptional practice, has almost been a rule in Turkey for a long time. Expansive fiscal policy practice, at first hand, creates inflation. At the second hand, the considerable deviations of the budget realisations from the programmed budgets, by reducing credibility and predictability of the budget, increase uncertainty in the economy, and in turn, feed the inflation. Due to these developments, price stability goal that the Central Bank is supposed to follow could be ignored and the goal of struggling with financial instability created by uncertainty could be fallowed.

The effects of the expansive and lower credible fiscal policy on the Central Bank's policy preferences stems not only from the Central Bank's legal obligation to finance public sector under specified conditions but also other factors. The Central Bank is dependent on the public sector because of the huge share occupied by the public sector in the economy, especially in financial markets through borrowing activities. When the Treasury experiences difficulties in borrowing and disturbs the interest rates, the Central Bank could suspect that in future the borrowing conditions would be worsened and the Treasury's borrowing would be more difficult which would make the Central Bank's monetary policy entirely inapplicable. Taking this into consideration, the Central Bank is inclined towards the monetary policy goal of establishing stability in the financial markets. Even if the money supply could be under the complete control of the

Central Bank, in order to prevent borrowing crises that would come out in the public sector, the Central Bank expands money supply by financing public sector at the expense of price instability.

The dependence created by fiscal and debt management policies on the Central Bank's monetary policy imposes the financial stability goal to exist in the Central Bank's objective function together with price stability goal. Here, with the financial stability, foreign exchange rate stability and interest rate stability are meant together. The Central Bank by itself may wish the stability of above-mentioned variables, as well. But, fiscal and debt management policies could make more urgent providing the stability of these variables.

In addition to fiscal and debt management policies' direct role on determination of the goal variables and their priorities in the Central Bank's objective function, hence the policy response function, they play also an indirect role on them as well. In the policy response function, the policy variable has been defined as a function expected and targeted values of the potential goal variables. The Central Bank responds to variations in expectations through the policy variable. In the course of forming expectations, the Central Bank uses information on fiscal and debt management policies. In the process of expectation formation, consolidated budget balance, public sector balance, public sector borrowing requirement and public sector domestic borrowing interest rate are the main indicators that convey information to the Central Bank on the policy realisations. In the study, the public sector's domestic borrowing interest rate is employed for the purpose of capturing public sector effects via the expectation formation channel. As domestic borrowing interest rate is affected from both fiscal and debt management policies and monthly data are available on it, it is preferred.

In the explanations heretofore, it has been implied that the Central Bank would be mainly concerned with the price, production, foreign exchange rate and financial stabilities for various reasons. Although it has not been mentioned yet, a Central Bank may have a motive to acquire and enhance its credibility. For this purpose, a Central Bank may intend the stability of monetary aggregates or interest rates. In Turkey, interest rates is a variable that have been generally subjected to intensive political pressures (Erçel, 1996). While the possibility of an interest rate has been followed as a goal variable for credibility consideration is small, it is high for a monetary aggregate. Therefore, a monetary aggregate is added to the list of goal variables.

In the course of application, the Central Bank's industrial production index (Y) will be used as an indicator of production. For price level (P), simple average of the State Institute of Statistics' retail and consumer prices indices; for the foreign exchange rate (E), one USA dollar's Turkish liras equivalent; for the monetary aggregate (M), M2Y measure; and for domestic borrowing interest rate (i), the Treasury's domestic borrowing interest rate series are employed. Starting with these variables, the Central Bank response function has been constructed.

To develop the Central Bank's policy response function suppose that x is a logarithmic variable that takes the value x_t in period t. In period t, n-step ahead expected growth rate of x is defined as $E_t(x_{t+n}-x_t)$. Here, $E_t(\ldots\ldots)$ signifies the expectation conditional on information available in t. Expected growth rates for all variables are defined in the same way. Expected growth rate of production $E_t(y_{t+n}-y_n)$, expected inflation rate $E_t(p_{t+n}-p_n)$, expected depreciation rate of foreign exchange rate $E_t(e_{t+n}-e_n)$ and expected growth rate of money supply $E_t(m_{t+n}-m_n)$ are the variables that are included in the Central Bank policy response function. To identify the Central Bank's monetary policy goals, the policy response function has been constructed in a vector autoregression (VAR) form with respect to lags of all these expected rate variables and the first difference of the policy variable ($\Delta i_t=i_t-i_{t-1}$) itself as follows:

$$\begin{aligned}\Delta i_t = \text{Constant} &+ \alpha_1 E_{t-1}(y_{(t-1)+n} - y_{t-1}) + \alpha_2 E_{t-2}(y_{(t-2)+n} - y_{t-2}) + \ldots + \alpha_L E_{t-L}(y_{(t-L)+n} - y_{t-L}) + \\ &\beta_1 E_{t-1}(p_{(t-1)+n} - p_{t-1}) + \beta_2 E_{t-2}(p_{(t-2)+n} - p_{t-2}) + \ldots + \beta_L E_{t-L}(p_{(t-L)+n} - p_{t-L}) + \\ &\lambda_1 E_{t-1}(e_{(t-1)+n} - e_{t-1}) + \lambda_2 E_{t-2}(e_{(t-2)+n} - e_{t-2}) + \ldots + \lambda_L E_{t-L}(e_{(t-L)+n} - e_{t-L}) + \\ &\varphi_1 E_{t-1}(m_{(t-1)+n} - m_{t-1}) + \varphi_2 E_{t-2}(m_{(t-2)+n} - m_{t-2}) + \ldots + \varphi_L E_{t-L}(m_{(t-L)+n} - m_{t-L}) + \\ &\delta_1 \Delta i_{t-1} + \delta_2 \Delta i_{t-2} + \ldots + \delta_L \Delta i_{t-L} + u_t\end{aligned} \qquad \text{(III-1)}$$

In equation (III-1), α, β, λ and φ are the coefficients that display the extent and direction of the effects of n-period in advance of the expected growth rates of the variables with various lags on dependent variable. δs are autoregressive coefficients that reflect the dependent variable's contingency to its own past realisations. L represents the common lag length. n denotes in-sample forecast step number. The n-month ahead in-sample forecasts are used as expected values. $E_{t-L}(\ldots\ldots)$ signifies the n-period ahead calculated forecast that is conditional on information available in period t-L and measures the expected growth rates. In equation (III-1), the policy

variable is in first differences. Equation (III-1) is different from (II-10) because of using the lags of the variables. Besides being as a requirement of the VAR methodology, the lags reflect delays in the information gathering and the decision making process. Another difference is that in equation (III-1) the variables are defined in expected values instead of changes in expected values. However, this is not a serious problem because of the variables are included with their lags, the variations in expectations enter by themselves. Other differences that could be found between (II-10) and (III-1) result from the simplifying assumptions made deriving the (II-10). In advancing from simple model economy to actual economy these assumptions are relaxed. In a dynamically unconstrained economy, targets, expectations, expectation formation periods are all changing and moving. Under these conditions, the best way to handle the problem is to treat the expectational variables in growth rates. Equation (III-1) will be sufficient to answer the questions posed earlier.

IV. The Identification of the Turkish Central Bank Monetary Policy Goals

The question of "to which variables, when they are subjected to expectational deviations from their respected targeted values, the Central Bank responds by adjusting its policy variable" will be taken as a question of "which variable's expectational variations do predict the variations in the policy variable, statistically". The variables that have predicted power to the policy variable are then the goal variables that the Central Bank has followed. So, the variables with predictive power to the policy variable are identified statistically as goal variables of the Central Bank monetary policy.

As it is well known, a relation between a variable and other variable that predicts the variations in the former, statistically, is a prediction relation. A kind of this relation is called "Granger causality" relation. If a variable contributes to the prediction of variations in another variable, the former is called as Granger cause of the latter. To determine a variable's Granger causes, Granger causality test is applied. The test identifies whether a variable defined in various lags as a whole predicts the other variable statistically meaningful.

To identify the variables that would predict the variations in the Central Bank's policy variables, Granger causality test is implemented on the equation (III-1). But, before the test is conducted, it is required by the definition used in (III-1) that expected values of the candidate goal variables be computed. Expected values can be computed by using various methods. In this study, expected values are computed by means of vector au-

toregressions method. Computed n-step ahead in-sample forecast values are then accepted as expected values and used in following stages. The forecast-aimed VAR model has been constructed such that it shares the same variable with the policy response function plus the domestic borrowing interest rate. In the forecast-aimed VAR model, all variables except the interest rates are defined in log levels.

The lag length for the forecast-aimed VAR model has been specified by applying Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC). Both criterions suggest that selecting the lag number, which minimises the sum of squared errors with adjusted by a specific rule (Enders, 1995). Here, it has been seen that as the number of lags increasing computed AIC and SBC values have become smaller. Therefore, by considering the shortness of sampling period, it has been decided that six lags would be sufficient.

The forecast-aimed VAR model with six lags is estimated and used to compute in-sample forward forecasts for the candidate goal variables. The computed in-sample forecast series are then used in following stages as the Central Bank's expectation series on the variables. It is not obvious what period-ahead expectations the Central Bank has taken into considerations. But, intuitively, it is expected that this period could not be longer in an economy experiencing uncertainties. From this standpoint, it is reasonable to assume that the Central Bank acts according to three-month ahead expectations. Here, in this study, three-month ahead in-sample forecasts will be employed as expected magnitudes.

Following the computation of forecast, for every variable (e.g., for x), expected growth rates $E_t(x_{t+n} - x_t)$ are obtained by extracting period t actual values (x_t) from the n-period ahead expected values [$E_t(x_{t+n})$]. In equation (III-1) the expected growth rates of the variables except the policy variable (the interbank money market interest rate) are computed in this way and used. The policy variable is in first differences and defined as a function of its own and other expected growth rate variables' lags. Granger causality tests are applied on this set up.

The implementation of Granger causality test needs to specify the lag length of the VAR model, firstly. While deciding the lag length, special attention has been given satisfying two special conditions. The first condition is that the error term should not bear autocorrelation. For this purpose, the VAR model has been estimated by using six different lag lengths from 1 to 6, one by one. Under every lag number, by employing the Lagrange Multiplier (LM) and Ljung-Box (L-B) (Q) tests, autocorrelation in

error term has been detected. Second condition is that sum of squared errors should be small. To satisfy the second condition, under the every lag number, AIC and SBC values have been computed. The VAR with the lag length, which does not keep autocorrelation in the error term and induces the smallest AIC and SBC values have been chosen. This lag number has been adapted as an optimal lag length. Table 1 indicates that six lags are optimal for the Granger causality test. Therefore, the Granger causality test should be conducted on the VAR with six lags of every variable.

Table 1: The VAR Model Lag-length Test Results[(1)]

Lag Number	LM Test p-value	L-B (Q) Test p-value	AIC Value	SBC Value
1	0.69	0.71	-2402	-2386
2	0.19	0.58	-2490	-2461
3	0.27	0.36	-2511	-2469
4	0.01	0.85	-2545	-2490
5	0.01	0.97	-2581	-2514
6	0.05	0.81	-2621	-2542

[(1)]The LM and L-B (Q) tests' Ho hypotheses assert that in the error term autocorrelation does not exist. If the computed marginal significance level (p-value) is smaller than the selected significance level (α), Ho hypothesis is rejected.

Table 2 displays estimated VAR equation being employed during the Granger causality test. Although, the equation's coefficients and their individual t test results do not concern us directly, it is seen beneficial to report them here because of their manifesting themselves in the Granger test and variance decomposition process.

Table 2: The Estimated VAR Equation
Dependent Variable (The Policy Variable): Interbank Money Market Interest Rate (Δi_t)
Estimated by Least Square method
Monthly data from 1989:12 to 1998:04
Usuable Observations: 97
Degrees of Freedom: 65
R^2 : 0.642932 $\bar{R}^2$=0.472638

Explanatory Variable[(1)]	Estimated Coefficient	Standart Error	Computed t-statistics	p-value
$E_t(p_{t+3}-p_t)\{1\}$	-0.91	0.61	-1.48	0.141
$E_t(p_{t+3}-p_t)\{2\}$	0.87	0.40	2.13	0.036
$E_t(p_{t+3}-p_t)\{3\}$	-1.43	0.52	-2.71	0.008
$E_t(p_{t+3}-p_t)\{4\}$	1.68	0.55	3.04	0.003
$E_t(p_{t+3}-p_t)\{5\}$	0.42	0.60	0.69	0.490
$E_t(p_{t+3}-p_t)\{6\}$	0.23	0.48	0.48	0.632
$E_t(e_{t+3}-e_t)\{1\}$	0.24	0.16	1.51	0.134
$E_t(e_{t+3}-e_t)\{2\}$	0.24	0.18	1.31	0.192
$E_t(e_{t+3}-e_t)\{3\}$	-0.41	0.20	-2.01	0.047
$E_t(e_{t+3}-e_t)\{4\}$	0.07	0.21	0.33	0.738
$E_t(e_{t+3}-e_t)\{5\}$	0.17	0.21	0.81	0.415
$E_t(e_{t+3}-e_t)\{6\}$	-0.46	0.18	-2.43	0.017
$E_t(y_{t+3}-y_t)\{1\}$	-0.07	0.14	-0.48	0.632
$E_t(y_{t+3}-y_t)\{2\}$	0.10	0.15	0.67	0.500
$E_t(y_{t+3}-y_t)\{3\}$	0.07	0.16	0.43	0.665
$E_t(y_{t+3}-y_t)\{4\}$	-0.12	0.15	-0.77	0.440
$E_t(y_{t+3}-y_t)\{5\}$	-0.06	0.14	-0.42	0.671
$E_t(y_{t+3}-y_t)\{6\}$	-0.24	0.14	-1.72	0.089
$E_t(m_{t+3}-m_t)\{1\}$	-1.33	0.66	-2.02	0.045
$E_t(m_{t+3}-m_t)\{2\}$	-0.24	0.50	-0.48	0.629
$E_t(m_{t+3}-m_t)\{3\}$	0.63	0.64	0.98	0.329
$E_t(m_{t+3}-m_t)\{4\}$	-0.92	0.54	-1.71	0.091
$E_t(m_{t+3}-m_t)\{5\}$	-0.49	0.70	-0.69	0.490
$E_t(m_{t+3}-m_t)\{6\}$	0.78	0.70	1.10	0.271
Δi_t {1}	-0.32	0.11	-2.91	0.004
Δi_t {2}	-0.27	0.11	-2.43	0.017
Δi_t {3}	-0.31	0.10	-2.88	0.005
Δi_t {4}	-0.06	0.10	-0.65	0.515
Δi_t {5}	-0.13	0.09	-1.41	0.162
Δi_t {6}	-0.21	0.08	-2.45	0.016
Sabit	11.53	7.48	1.54	0.128

[(1)] $[E_t(y_{t+n}-y_t)]$= expected growth rate of production; $E_t[(p_{t+n}-p_t)]$= expected inflation rate; $[E_t(e_{t+n}-e_t)]$= expected depreciation rate of foreign exchange rate; $[E_t(m_{t+n}-m_t)]$= expected growth rate of money supply; $[\Delta i_t=i_t-i_{t-1}]$= first difference of the policy variable. Figures in parenthesis at the first column are the lags of the variables. T test Ho hypothesis asserts that the coefficient is equal to zero. If the computed marginal significance level (p-value) is smaller than the selected significance level (α), Ho hypothesis is rejected.

The Granger causality test results are presented on the Table 3. From the table it is understood that expected inflation rate, expected depreciation rate of foreign currency and expected growth rate of money supply are the Granger causes of the policy variable. These variables have predictive power to forecast the changes in the policy variable, statistically. In contrast, expected growth rate of production is not the Granger cause of the policy variable. According to these findings, the Central Bank responds to changes in expected inflation rate, expected depreciation rate of foreign currency and expected growth rate of money supply by adjusting its policy variable, the interbank money market interest rate. Therefore, the Central Bank has aimed at stabilising these variables. Although p-values of F test have some implications about the goals that the Central Bank has assigned more weight, it not completely clear yet. By applying the variance decomposition to the policy variable's forecast error variance, relative weight (priority ordering) that the Central Bank has attributed to each variable can be found.

Table 3: The Granger Causality Test Results [1]

Variables	$E_t(y_{t+3}-y_t)$	$E_t(p_{t+3}-p_t)$	$E_t(e_{t+3}-e_t)$	$E_t(m_{t+3}-m_t)$	Δi_t
F-test p-value	0.45	0.024	0.01	0.047	0.000

[1] The Granger causality test's Ho hypothesis asserts that the explanatory variable, evaluated with all lags jointly, does not contribute to predict changes in the dependent variable. That is, all lag coefficients of the explanatory variable are jointly equal to zero. If the computed marginal significance level (p-value) is smaller than the selected significance level (α), Ho hypothesis is rejected.

Variance decomposition process yields somewhat different, but more conceivable information on the relation that has been provided by estimating the VAR model. Generally, in a VAR model, it is not easy to understand from the estimated coefficients how a variable affects other variable as a whole because of overparameterisation.

Variance decomposition process covers the following stages. First, vector moving average (VMA) form of the VAR model is obtained. By using VMA form, forward period forecasts of the variables are computed for various time horizons. Then forecast error variances of the variable are computed for different forward periods. Finally, the forecast error variances of the variable for different time horizons are decomposed with respect to disturbance terms. These variance decomposition results represent the vector moving average coefficients in a relative (%) and cumulative

form on a dynamic scale. The vector moving average coefficients manifest themselves through the variance decomposition process. The issues of what period ahead an independent variation in an explanatory variable begins to affect the dependent variable, how long it takes to reach a maximum effect and whether the effect is permanent or not can be traced from the variable's shares in the dependent variable forecast error variances.

Variance decomposition results can be accepted as the quantitative dimension of the Granger causality test. Therefore, the variance decomposition is conducted on the same VAR model used in the Granger causality test. Table IV.4 reports the interbank interest rate (the policy variable) variance decompositions with respect to disturbance terms. The principal outcomes that result from the table and their implications are presented as follows:

Table 4: The Interbank Interest Rate Variance Decomposition (The Policy Variable)

Forecast step	Standard Error	Price	Exchange Rate	Production	Money Supply	Interest Rate
1	7.15497888	0.00	0.00	0.00	0.00	100.00
2	9.85219004	11.12	9.43	0.07	2.54	76.82
3	11.89181138	12.51	13.08	0.75	18.37	55.28
4	12.88427566	10.80	24.21	0.79	15.98	48.19
5	13.07460435	10.49	23.51	1.71	16.75	47.52
6	13.25817352	10.20	24.79	1.74	16.76	46.49
7	15.11608228	19.74	26.22	1.63	16.02	36.37
8	15.91424255	21.55	29.01	1.49	15.11	32.81
9	16.13304034	22.29	28.90	1.70	14.81	32.27
10	16.26105110	22.68	28.51	2.34	14.64	31.81
11	16.41196508	23.34	28.13	2.65	14.63	31.23
12	16.58723611	23.82	27.89	2.89	14.47	30.89
13	16.66846022	23.65	27.80	3.32	14.41	30.79
14	16.71272974	23.60	27.66	3.41	14.40	30.91
15	16.74267046	23.58	27.56	3.41	14.36	31.07
16	16.78104097	23.61	27.44	3.44	14.49	31.00
17	16.83766563	23.66	27.42	3.45	14.59	30.86
18	16.87356972	23.73	27.43	3.44	14.64	30.74
19	16.88317140	23.71	27.39	3.44	14.73	30.71
20	16.89613399	23.68	27.35	3.43	14.84	30.67
21	16.92378506	23.74	27.29	3.42	14.95	30.57
22	16.94591899	23.73	27.27	3.42	15.07	30.49
23	16.95508388	23.73	27.25	3.41	15.13	30.46
24	16.95740129	23.73	27.24	3.42	15.14	30.45

- The Central Bank's biggest response is to the changes in expectations on the pace of depreciation of the Turkish Lira against foreign exchange rates. Six periods later, the size of the Central Bank's reaction to it reaches a maximum point. This result implies that the Central Bank gives highest priority to foreign exchange rate stability, and hence, financial stability. This fact reveals that the highest priority given to financial stability can be interpreted as the most serious concern that confronts the Central Bank. At the same time, it exhibits how restrictive factors are the fiscal and debt management policies for the Central Bank.
- In the priority rank given by the Central Bank, changes in expected growth rate of money supply has taken the second place in the first six periods. After the first six periods, the weight given to changes in expected inflation rate replaces the money supply expected growth rate. However, as a whole, the weight given to inflation dominates the weight given to money growth and takes a place after the foreign exchange rate depreciation.
- The Central Bank 's response to changes in expected inflation rate increases in the long term. This result can be interpreted that the Central Bank goals the price stability goal in the long run.
- In the short term, the Central Bank 's higher response to changes in money supply expected growth rate imply that the Central Bank takes the credibility of itself a serious issue and tries to acquire and enhance it. This outcome may be also taken as an indicator of the Central Bank's efforts to improve own monetary control. As it is well known, in the last decade, to improve its control on the money supply, the Central Bank has been spending substantial effort. Therefore, it can be said that the Bank has responded to changes in expected growth rates of money supply more sensitively in the short run.
- The Granger causality test has shown statistically that changes in the expected growth rate of the production do not have a predictive power on the changes in policy variables. However, the variance decomposition process reveals that expected growth rate of production has a very small effect on the policy variable in the long run.
- As a policy variable, the interbank interest rate is an endogenous variable that is highly affected from the changes in expectations of other variables. Its own shocks' share in its own forecast error variances are less then 50 percent except the first two period and converges to 30 percent. This result implies that the Central Bank tailors its actions to economic conditions broadly.

The preceding findings of the study exhibit, by themselves, common or average preferences pattern on monetary policy goals in practice under the covered period. For some shorter time intervals in the overall period, the possibility that the Central Bank could made different policy choices is not ignored. As the sample period is not long enough to divide it sub-periods, it is not possible to discover likely differences by doing the foregoing statistical analysis. However, it can be detected whether the deviations occur or not from the average tendency by comparing qualitatively the average pattern with official declaration on monetary policy goals and its realisations in various sub-periods. From this viewpoint, firstly, 1996-97 period's and then 1998 period's declared monetary policy goals and their realisation will be compared with the general findings of the study. Because the findings represent an average pattern, it is expected that this pattern would persist in the next years unless external and internal economic conditions and national economic structure change.

During the 1996-97 period, the Central Bank has conducted monetary policy with the monetary programs without public announcing. Over these years, monetary policy has been directed to the goals of providing and preserving stability in the financial markets (Erçel, 1998b). The stability in financial markets has been defined as a situation of lack of price volatility and uncertainty in the markets. Regarding the first aspect of the financial stability, the Central Bank has tried to prevent rapid price fluctuations in both the short-term Turkish lira and the foreign currency markets by observing the consistency between the prices in these markets and the general balances of the economy. In order to reduce the uncertainty, the manipulation of the people's expectations on inflation has been considered. It has been believed that high inflation is the main source of the uncertainty in the economy. Therefore, the Central Bank has resolved to announce its own inflation forecasts and its intention of basing its monetary policy on those forecasts. Although the Central Bank has not aimed at price stability directly, the declaration of inflation forecasts, even if higher level, would contribute eliminating uncertainty in the market has been anticipated.

The primary goal stated for the 1996-97 period as of providing and preserving stability in the financial markets is consistent with the finding that foreign exchange rate stability as part of financial stability has had the first priority. In this period, the Central Bank has followed the strategy of improving its foreign exchange position, reducing its net domestic assets and creating reserve money parallel to increase in net foreign assets. This

strategy together with the legal regulation that limits the short term advances from the Bank to the Treasury and the loans to other public-institutions at an increasing rate have introduced the desired stability to the financial markets. Therefore, the realisations in this period are also in line with the main results of the study. Introduction of the amendment on the credit quantity from the Bank to the public sector by leading the Bank to be confronted with less constraints has enabled the Central Bank to follow the price stability as a primary goal of its monetary policy in coming years.

For the year 1998, price stability had been considered as the primary goal of the monetary policy by the political authority. By the beginning of the year, a medium term stabilisation and structural adjustment program that covered three years' period intending to minimise the opportunity cost of fighting inflation in terms of production and employment had been decreed by the Government (The State Planning Organisation, 1998). The program, which targeted to reduce the inflation rate to single digit numbers at the end of the three year period, has anticipated the first year's annual inflation rate measured by the wholesale price index as 50 percent. In compatible with this target, the gross national product annual growth rate has been specified as 3 percent. While achieving these targets, the 1998 Annual Program has been designated to accomplish structural reforms, to decrease budget deficits and to increase medium and long run economic growth potential. The program, considering the budget deficits as the main reason of inflation, has included measures to decrease budget deficits in order to control inflation. In this context, fiscal policies that would improve the primary surplus of the budget by the end of year have been formulated. Meanwhile, the Treasury has announced its finance program.

At the beginning of 1998, in harmony with the 1998 Annual Program, the Central Bank has planned a monetary policy that aims at stability in prices and gives support to the overall objective and determined attitude to reduce inflation. The political authority's decisiveness to reduce inflation has encouraged the Bank to give first priority to price stability goal and try to reach low inflation target rate. The Bank has prepared and announced a monetary program in consistent with these objectives. However, by the beginning of the second half of the year, because of the changing internal and external conditions, ensuring stability in the financial markets has become a primary problem and gained first priority again. Despite this, in conformity with its general attitude, the Bank has insisted

on its determination to reduce and control inflation.

At the first half of 1998, the Bank has announced two consecutive quarterly monetary programs. These programs are similar with respect to goals and the variables that the Bank has to control. Therefore, they could be handled together and compared with the findings of the study. The priorities listed in the first half of the monetary program, that is enumerating the price stability goal at the top, does not match with the priority list found in the study. The first half realisations meet the programs' goals. The practices of allowing reserve money to expand parallel to increases in net foreign assets, sterilisation of excessive liquidity created by rapid increase in net foreign assets through open market operations, non-use of the short term advances and credit to the public sector from the Central Bank have led to a decrease in net domestic assets of the Bank. In addition, the improvement in the primary surplus of the budget owing to slowdown in the growth rate of the domestic debt stock diminished the pressure on the monetary aggregates. Because of these developments, at the end of the first half of the year, inflation rate has converged to and captured the midyear 70 percent annual target. Consequently, in addition to the declared range of goals, the realisations have also mismatched with the study's findings due to the first priority given to inflation target. For the first half of the year, there are deviations from the ordering of goals found in the study.

The Southeast Asian Crisis, broke out in the second half of 1997, has begun to effect the Turkish economy by the beginning of the second half of 1998. Therefore, at the second half of the year the economy has encountered with a different external and internal conjuncture. The Russian Crisis starting in August 1998 has further reinforced the negative conjuncture. These events have led to changes in goals and intermediate targets of the monetary policy relative to the first half of the year. With the outbreak of the Russian crisis, the Southeast Asian crisis, which started in the second half of 1997, has been spread worldwide. Under this conjuncture, ensuring stability in financial markets has become more urgent and severe problem. Hence, the goal of ensuring stability in financial markets has taken priority relative to price stability. Although, at the second half, the price stability goal has lost its first priority, the Bank has restrained itself from inflationary attempts. However, the capital outflows and narrowed borrowing facilities from international financial markets created by the global crisis has increased the share of the domestic borrowing in the public sector finance. In spite of increasing control over the budget deficits, the huge size of outstanding debt stock and gradually increasing necessity

of financing budget deficits from domestic markets, coinciding with lost of confidence in the global financial markets, has increased instability in the domestic financial market. Under those circumstances, the Central Bank has struggled to preserve stability in financial markets and, especially, lessen the pressure on foreign currency. At the same time, the Bank has supplied liquidity to the economy as required by its economic activities without accelerating inflation. Especially, after the Russian crisis, to eliminate the liquidity squeeze due to the Treasury's borrowing difficulty from international markets and the capital outflows, the Central Bank has funded the market with liquidity through open market operations by lessening net domestic assets target as opposed to the first half of the year.

At the second half of 1998, the monetary program's revealed goals and realisations are both more consistent with the findings of the study concerning to the first half of the year. The stability in financial markets has been ensured despite the facts of negative internal and external economic condition, increase in uncertainty raised by the tax reforms and the early elections. While price stability has lost its first priority, the end of year inflation target has been attained by the contributions of (i) the contraction in domestic demand produced by both the contraction in the financial system and the progress in the primary surplus of the budget, (ii) the contraction in foreign demand caused by the global crises, (iii) the controls on public prices, (iv) the decrease in petroleum prices in terms of the dollar. Conjunctural factors as well as policy implementations have determined inflation realisation at the second half of the year.

The results of 1998 imply that some conditioning factors effecting the choice of monetary policy goals have gradually become less restrictive than before. Especially, binding role of the budget on the monetary policy has reduced due to the new legal regulations and arrangements. However, compatibility issue between the fiscal and monetary policy is going on to be limiting factor on the monetary policy. In addition to fiscal policy, the necessity of managing the outstanding debt stock is an important factor commanding the choice of monetary policy goals depending on internal and external economic conjuncture.

V. Conclusion

The Granger causality test and the variance decompositions have identified that the Turkish Central Bank's monetary policy goals have been to provide the stability of foreign exchange rate, price and money supply. The Central Bank responds to fluctuations in expected growth rates of the-

se variables by adjusting its policy variable, the interbank money market interest rate. Among the goal variables, the Central Bank gives the highest priority to establishing the exchange rate stability.

The findings represent the general tendency on the monetary policy goals in the period under investigation as a whole. They do not dismiss the possibility that, at different times, different preferences on monetary policy goals might have been followed. The results describe merely the dominant or average preference pattern. According to qualitative comparison made after 1995, the findings of the study confirm with the Central Bank's official declarations on the goals of monetary policy implementations and realisations except for the first half of 1998. As long as public sector's great share in the economy, especially in the use of financial markets' resources could not be narrowed, it is expected that this identified pattern would go on in the future.

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GLOBAL CAPITAL MARKETS

In the first quarter of 2000, the world economy continued to grow with the accelerated economic activity. The outlook for world and, in particular, OECD region growth has improved substantially in the recent months. The US economy grew between the range 5-6 % in the first quarter of 2000 although there were fears of inflation and current account imbalance with the US running a wide deficit. The surge in economic activity has caused a rise in productivity and a decrease in unit labor costs. Europe also recovered with the high rate of employment declining. Meanwhile , the rate of inflation has moved through the 2 % ceiling set by the European Central Bank due to rising oil prices, which are also affecting global inflation. Japan which had shown negative economic growth figure in the last quarter of 1999, showed positive signs that the Japanese economy has more recently been improving as Japan's industrial-production growth was revised up to 8.7 % in the 12-months to February.

Emerging market economies have continued to improve in the first quarter of 2000. While equity prices rallied, exchange rates have stabilized and yield spreads in external debt markets have begun to ease. The improvement in the economic and financial outlook for Latin America and East Asia was attributable to the policy responses to the recent crisis. Reflecting a further recovery in economic activity and rising investor confidence, domestic financial conditions in the emerging market economies generally continued to improve in the second half of 1999 and early 2000. This was, in particular, the case for emerging equity markets, which exhibited a sharp increase in the final months of 1999, as fears of higher U.S. interest rates and Y2K-related problems eased, information technology-related stocks climbed in the United States, and economic prospects for both East Asia and Latin America continued to improve. The global equity indices in the last three months produced modest returns. At the beginning of the year there was a short lived, sharp sell-off in technology and telecom stocks. Interest was quickly re-ignited with the announced merger between AOL and Time Warner.

The performances of some developed stock markets with respect to indices indicated that DJI decreased by -0.69 %, FTSE-100 by -1.39 %, while Nikkei-225 increased by 9.68 % on March 31 as of January 4. When

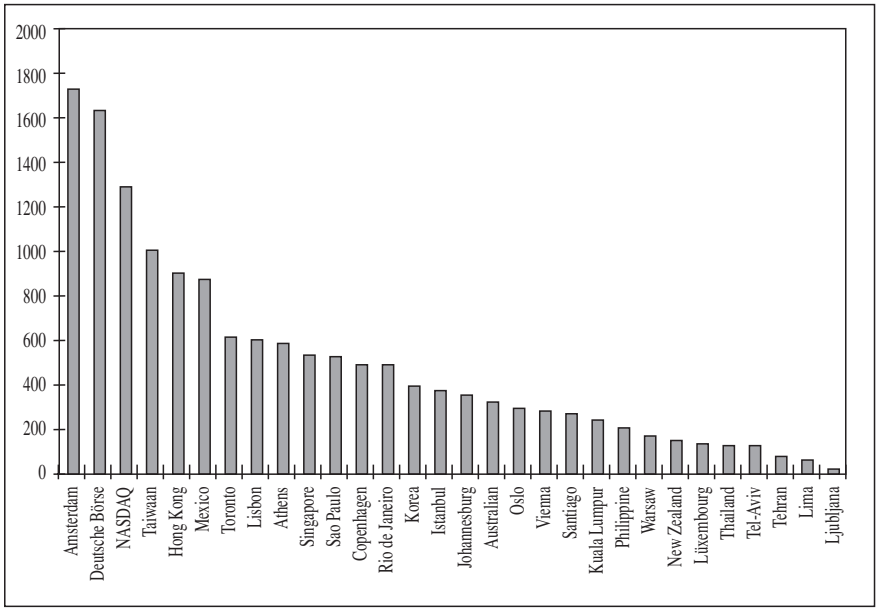
US$ based returns of some emerging markets are compared in the first quarter of year 2000, China is the best performer with 31.1 %, Russia and Czech Republic follow with 30.8 % and 29 % respectively. In the same period Philippines, Greece and Indonesia are the worst performers that caused their investors lose -22.3 %, -19.3 % and -18.5 % respectively. The two other low performing markets are Thailand and Singapore with -15.3 % and -14.6 % returns, respectively. In this period Istanbul Stock Exchange's performance is 2.7 % return. The performances of emerging markets with respect to P/E ratios as of end-March indicated that the highest rates were obtained in Taiwan-China (56), Argentina (44.9), Chile (42.1), Turkey (34.3) and the lowest rates in Korea (-24.1), Malaysia (-23.5), Czech Republic (-19.5), Thailand (-12.3), Indonesia (-8.4) and Jordan (12.4).

Market Capitalization (USD Million, 1986-1999)

	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

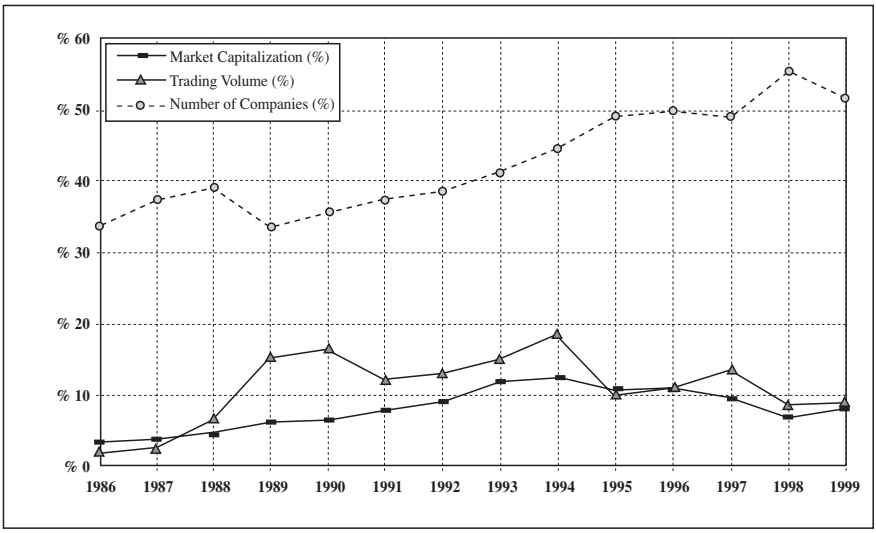
Source: IFC Factbook 2000.

Comparison of Average Market Capitalization (USD Million, March 2000)



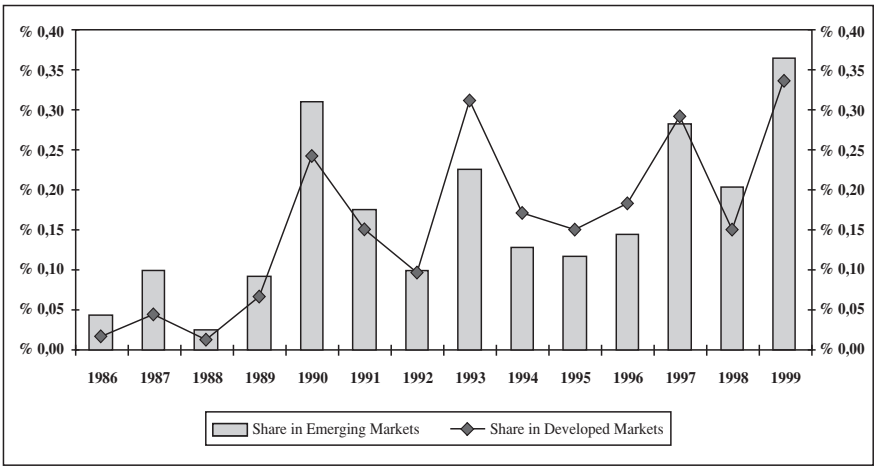
Source: FIBV, Monthly Statistics, April 2000.

Worldwide Share of Emerging Capital Markets (1986-1999)



Source : IFC Factbook 2000.

Share of ISE's Market Capitalization in World Markets (1986-1999)



Source: IFC Factbook, 2000.

Main Indıcators of Capital Markets (March 2000)

	Market	Turnover Velocity	Market	Value of Share Trading (millions USD $) Up to Year Total (2000/1 - 2000/3)	Market	Market Cap. of Share of Domestic Companies (millions USD $)
1	Korea	349.3%	Nasdaq	5,992,859.5	NYSE	11,243,963.1
2	NASDAQ	320.3%	NYSE	3,009,070.8	NASDAQ	6,252,603.0
3	Taiwan	319.4%	London	1,350,718.8	Tokyo	4,466,116.7
4	Paris	243.7%	Deutsche Börse	801,583.3	Osaka	3,018,795.7
5	Madrid	217.8%	Tokyo	784,130.7	London	2,833,156.3
6	Istanbul	154.0%	Paris	639,165.9	Paris	1,530,726.3
7	Brussels	139.8%	Taiwan	390,817.3	Deutsche Börse	1,466,303.3
8	Deutsche Börse	132.7%	Italy	381,200.5	Toronto	886,899.0
9	Italy	114.8%	Madrid	304,438.0	Italy	789,290.0
10	Athens	114.2%	Korea	199,728.7	Amsterdam	681,418.2
11	Oslo	109.4%	Amsterdam	193,226.6	Switzerland	681,150.0
12	Stockholm	88.6%	Toronto	180,734.2	Hong Kong	651,141.1
13	Amsterdam	83.5%	Osaka	163,841.6	Taiwan	467,410.5
14	Thailand	81.2%	Switzerland	160,815.6	Madrid	441,693.6
15	Switzerland	80.6%	Hong Kong	146,624.7	Stockholm	438,587.1
16	NYSE	79.7%	Stockholm	143,448.8	Bilbao	416,130.7
17	Lisbon	77.6%	Barcelona	91,550.0	Australian	405,017.0
18	Singapore	77.0%	Bilbao	81,901.1	Helsinki	393,940.7
19	Irish	73.7%	Australian	67,970.4	Barcelona	389,009.5
20	Barcelona	69.8%	Helsinki	64,361.6	Korea	273,978.7
21	Bilbao	68.5%	Brussels	63,981.0	Sao Paulo	245,389.8
22	Copenhagen	64.6%	Istanbul	43,057.5	Rio de Janeiro	241,736.4
23	Hong Kong	64.4%	Athens	40,492.2	Johannesburg	230,154.6
24	Toronto	62.7%	Sao Paulo	31,888.8	Kuala Lumpur	178,117.3
25	London	62.1%	Singapore	29,553.1	Singapore	168,400.5
26	Tokyo	57.5%	Kuala Lumpur	29,220.2	Athens	163,106.7
27	Australian	55.6%	Copenhagen	24,416.8	Mexico	160,903.9
28	Helsinki	55.3%	Johannesburg	24,065.9	Brussels	159,428.7
29	Sao Paulo	54.6%	Oslo	20,782.4	Copenhagen	115,664.0
30	Warsaw	51.0%	Lisbon	19,488.9	Istanbul	109,197.0
31	Jakarta	49.4%	Mexico	14,206.5	Irish	74,539.7
32	Kuala Lumpur	46.5%	Irish	12,703.8	Tel-Aviv	73,158.5
33	Philippine	46.0%	Tel-Aviv	10,610.5	Lisbon	72,356.9
34	Tel-Aviv	45.3%	Thailand	9,567.5	Santiago	71,836.1
35	New Zealand	45.2%	Warsaw	6,281.5	Oslo	61,036.5
36	Johannesburg	36.6%	Jakarta	5,376.4	Buenos Aires	59,252.7
37	Vienna	34.3%	Philippine	3,496.9	Thailand	46,720.4
38	Mexico	31.0%	New Zealand	3,355.3	Philippine	45,147.1
39	Ljubljana	27.0%	Vienna	3,298.2	Warsaw	36,523.1
40	Lima	23.3%	Buenos Aires	2,844.0	Luxembourg	35,507.2
41	Buenos Aires	20.3%	Rio de Janeiro	2,670.6	Vienna	30,850.7
42	Tehran	13.1%	Santiago	1,638.5	New Zealand	24,818.3
43	Santiago	12.2%	Tehran	1,426.7	Tehran	20,273.1
44	Osaka	11.2%	Luxembourg	827.7	Lima	12,435.3

Source: FIBV, Monthly Statistics, April 2000.

Trading Volume (USD millions, 1986-1999)

	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

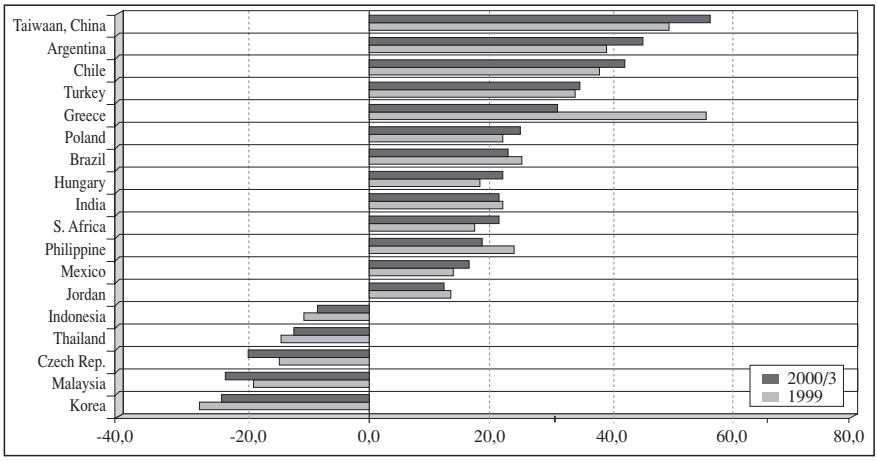
Source: IFC Factbook 2000.

Number of Trading Companies (1986-1999)

	Global	Developed	Emerging	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	49,640	23,326	26,314	285	53,01	1.08

Source: IFC Factbook 2000.

Comparison of P/E Ratios Performances (1999/12-2000/3)



Source : IFC Factbook 1999; IFC, Monthly Review, March 2000.

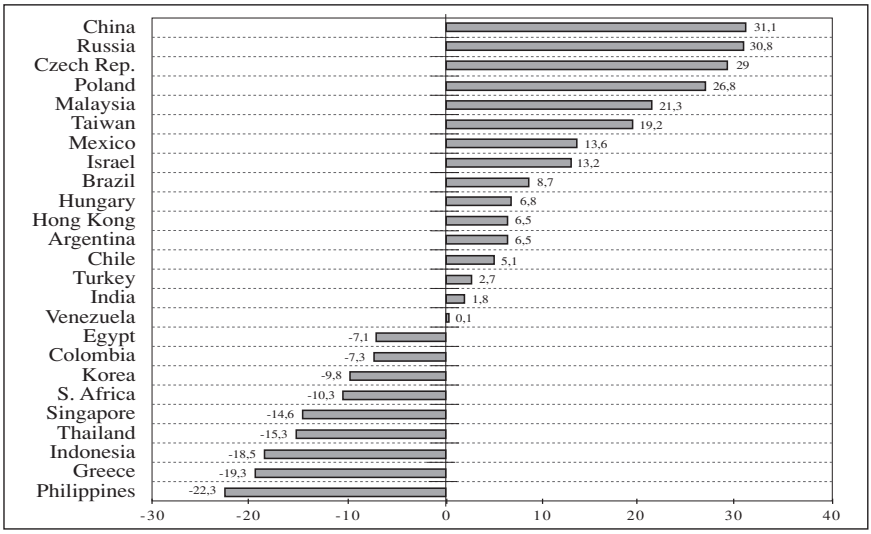
Price-Earnings Ratios in Emerging Markets (1993-2000/3)

	1993	1994	1995	1996	1997	1998	1999	2000/3
Taiwan, China	34.7	36.8	21.4	28.2	32.4	21.7	49.2	56.0
Argentina	41.9	17.7	15.0	38.2	17.1	13.4	39.0	44.9
Chile	20.0	21.4	17.1	27.8	15.9	15.1	37.7	42.1
Turkey	36.3	31.0	8.4	10.7	18.9	7.8	33.8	34.3
Greece	10.2	10.4	10.5	10.5	13.1	33.7	55.6	31.1
Poland	31.5	12.9	7.0	14.3	10.3	10.7	22.0	24.9
Brazil	12.6	13.1	36.3	14.5	15.4	7.0	25.1	22.7
Hungary	52.4	-55.3	12.0	17.5	25.2	17.0	18.2	22.0
India	39.7	26.7	14.2	12.3	16.8	13.5	22.0	21.5
S. Africa	17.3	21.3	18.8	16.3	12.1	10.1	17.4	21.0
Philippines	38.8	30.8	19.0	20.0	12.5	15.0	24.0	18.8
Mexico	19.4	17.1	28.4	16.8	22.2	23.9	14.1	16.5
Jordan	17.9	20.8	18.2	16.9	12.8	15.9	13.6	12.4
Indonesia	28.9	20.2	19.8	21.6	11.2	-106.2	-10.5	-8.4
Thailand	27.5	21.2	21.7	13.1	4.8	-3.7	-14.5	-12.3
Czech Rep.	18.8	16.3	11.2	17.6	8.8	-11.3	-14.8	-19.5
Malaysia	43.5	29.0	25.1	27.1	13.5	21.1	-19.1	-23.5
Korea	25.1	34.5	19.8	11.7	11.6	-47.1	-27.7	-24.5

Source : IFC Factbook 1999; IFC, Monthly Review, March 2000.

Note : Figures are taken from IFC Global Index Profile.

Comparison of Market Returns in USD (31/12/1999-29/03/2000)



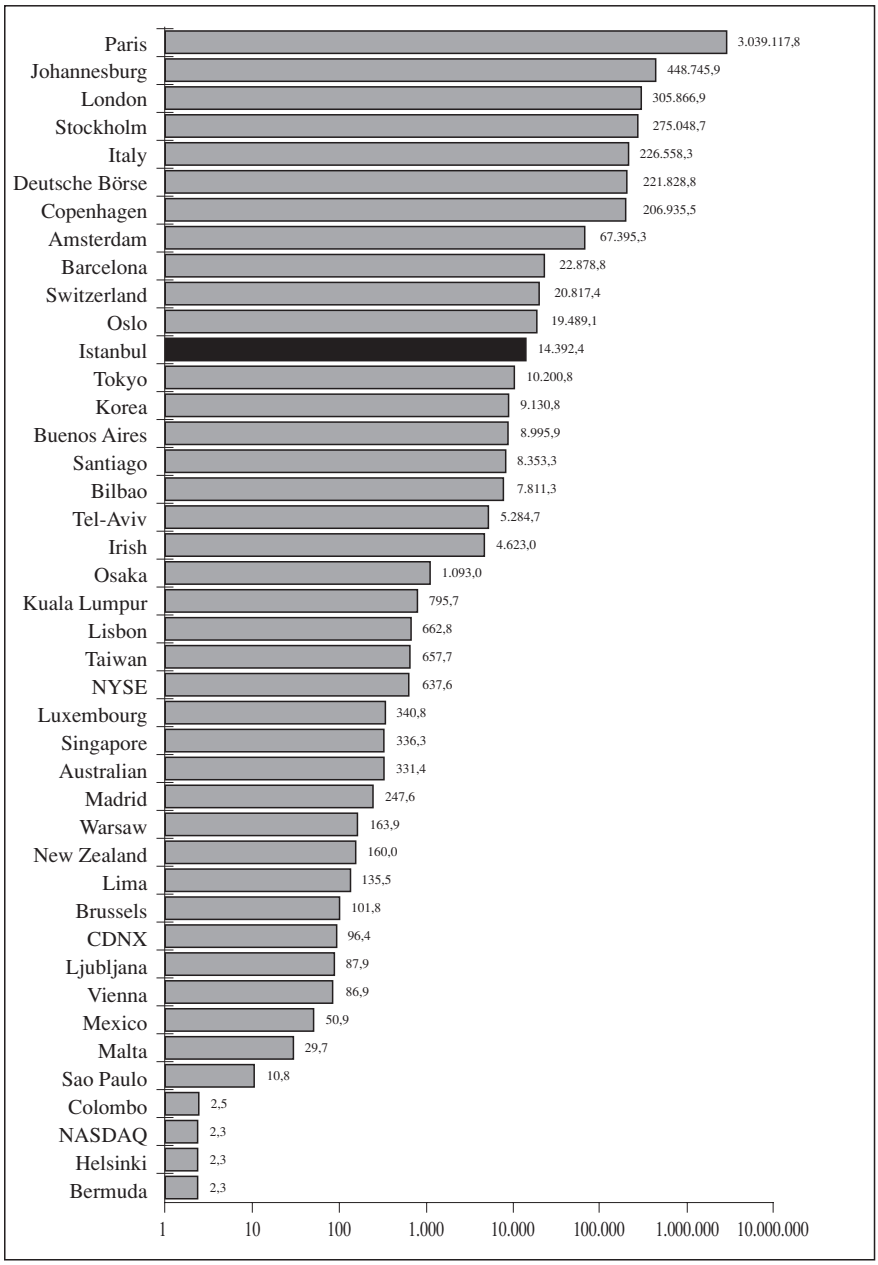
Source: The Economist, April 2000.

Market Vaule/Book Vaule Ratios (1993-2000/3)

	1993	1994	1995	1996	1997	1998	1999	2000/3
Turkey	7.2	6.3	2.7	4.0	9.2	2.7	8.8	8.0
Greece	1.9	1.9	1.8	2.0	2.9	4.9	9.4	6.0
Hungary	1.6	1.7	1.2	2.0	3.7	3.2	3.6	4.4
Taiwan. China	3.9	4.4	2.7	3.3	3.8	2.6	3.3	3.7
India	4.9	4.2	2.3	2.1	2.7	1.9	3.1	3.1
Indonesia	3.1	2.4	2.3	2.7	1.5	1.6	2.9	2.3
Malaysia	5.4	3.8	3.3	3.8	1.8	1.3	1.9	2.3
S. Africa	1.8	2.6	2.5	2.3	1.9	1.5	2.7	2.2
Thailand	4.7	3.7	3.3	1.8	0.8	1.2	2.6	2.2
Mexico	2.6	2.2	1.7	1.7	2.5	1.4	2.2	2.2
Poland	5.7	2.3	1.3	2.6	1.6	1.5	2.0	2.2
Korea	1.4	1.6	1.3	0.8	0.6	0.9	2.0	1.8
Chile	2.1	2.5	2.1	1.6	1.6	1.1	1.8	1.8
Argentina	1.9	1.4	1.3	1.6	1.8	1.3	1.5	1.6
Czech Rep.	1.3	1.0	0.9	0.9	0.8	0.7	1.2	1.6
Brazil	0.5	1.6	0.5	0.7	1.1	0.6	1.6	1.5
Jordan	2.0	1.7	1.9	1.7	1.6	1.8	1.5	1.4
Philippines	5.2	4.5	3.2	3.1	1.7	1.3	1.5	1.2

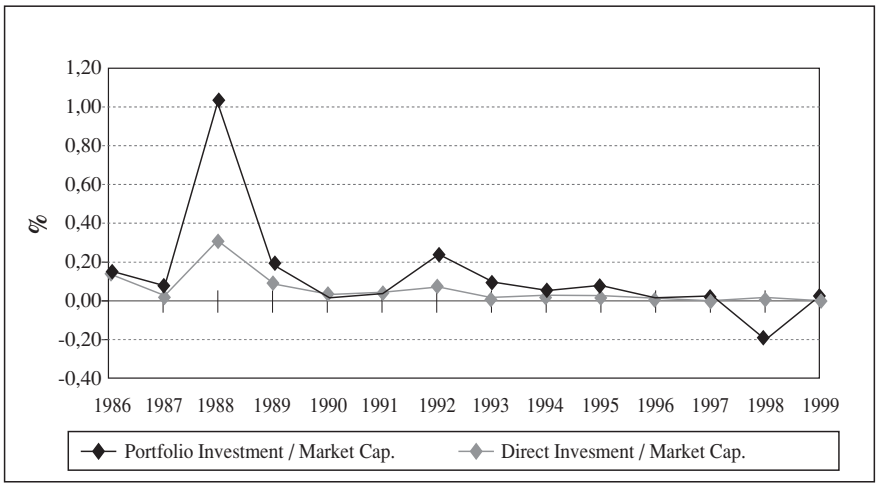
Source: IFC Factbook 1996-1999; IFC Monthly Review, March 2000.

Market Value of Bonds (Million USD, January - March 2000)



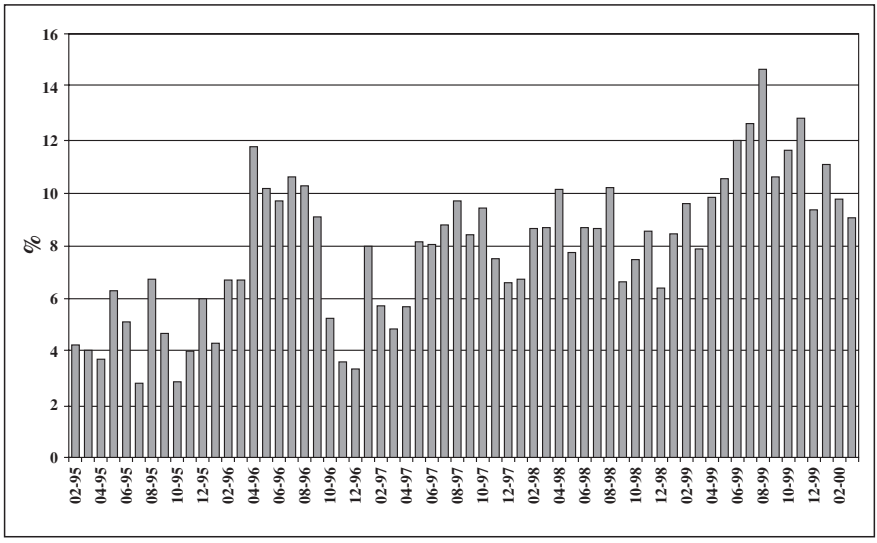
Source: FIBV, Monthly Statistics, April 2000.

Foreign Invesments as a Percentage of Market Capitalization in Turkey (1986-1999)



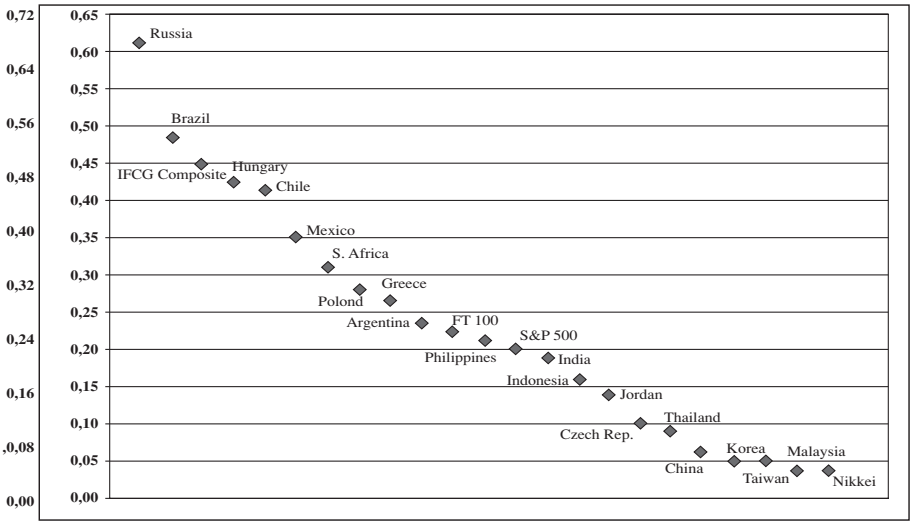
Source: ISE Data; CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE (Jan. 95-March 2000)



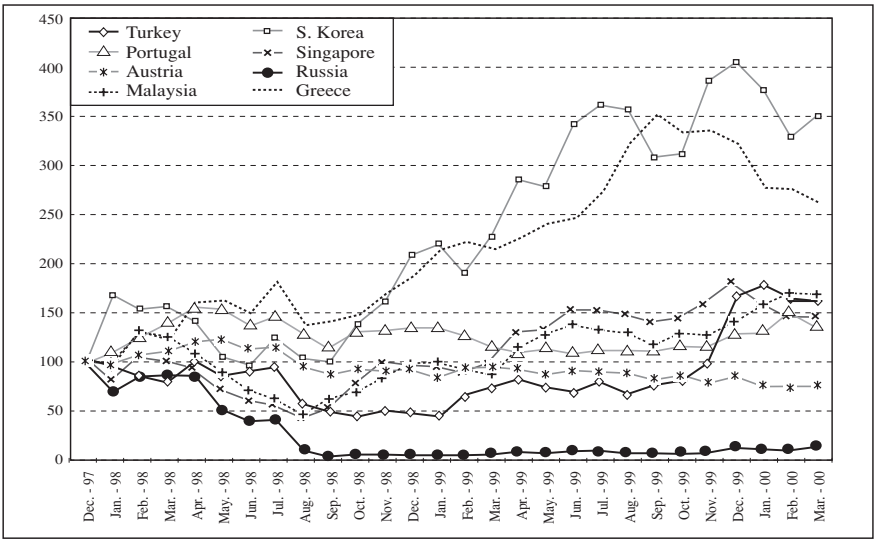
Sdurce: ISE Data

Price Correlations of the ISE (March 1995 - March 2000)



Source : IFC Monthly Review, March 2000.
Notes : The correlation coefficient is between -1 and +1. If it is zero, for the given period, it is implied that there is no relation between two serious of returns. For monthly return index correlations (IFCI) see. IFC, Monthly Review, Oct. 1999.

Comparison of Market Indices (Dec 1997=100)



Source : Reuters
Note : Comparisons are in US$.

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ISE
Market Indicators

STOCK MARKET

	Number of Companies	Total 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	89	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	298	35,003,411	62,647	603,507	1,080	64,197,681	109,197	0.91	30.27	29.92	22.59
2000/Q1	298	35,003,411	62,647	603,507	1,080	64,197,681	109,197	0.91	30.27	29.92	22.59

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 profits.

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)
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	1,045.91	914.47
1997	3,451.26	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	15,920.10	11,183.62	13,690.36	21,813.72
2000/Q1	15,920.10	11,183.62	13,690.36	21,813.72

	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-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	982.—	757.—	1,022.—	1,287.—	—-
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	1,575.77	1,106.96	1,355.07	2,159.12	1,936.52
2000/Q1	1,575.77	1,106.96	1,355.07	2,159.12	1,936.52

Q : Quarter

*The first quarter figures are as of March 31, 2000.

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	16,908,559	29,769	277,189	488
2000/Q1	16,908,559	29,769	277,189	488

Repo-Reverse Repo Market

	Total		Daily Average	
	(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)
1993	59,009	4,794	276	22
1994	756,683	23,704	2,991	94
1995	5,781,776	123,254	22,944	489
1996	18,340,459	221,405	72,780	879
1997	58,192,071	374,384	230,921	1,486
1998	97,278,476	372,201	389,114	1,489
1999	250,723,656	589,267	1,010,982	2,376
2000	120,833,056	214,855	1,980,870	3,522
2000/Q1	120,833,056	214,855	1,980,870	3,522

Q : Quarter

ISE 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	106.05	120.72	147.92	117.39
2000/Q1	106.05	120.72	147.92	117.39

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

	TL Based		
	30 Days	**91 Days**	**182 Days**
1996	222.52	240.92	262.20
1997	441.25	474.75	525.17
1998	812.81	897.19	983.16
1999	1,372.71	1,576.80	1,928.63
2000	1,457.73	1,673.39	2,113.26
2000/Q1	1,457.73	1,673.39	2,113.26
	US $ Based		
1996	122.84	132.99	144.74
1997	127.67	137.36	151.95
1998	153.97	169.96	186.24
1999	151.02	173.47	212.18
2000	146.71	168.41	212.68
2000/Q1	146.71	168.41	212.68

Q: Quarter

(*) The first quarter figures are as of March 31, 2000.

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Book Reviews

The euro, Ed. Paul Temperton, The Independent Economic Research Company, (TIER), John Wiley and Sons, 1998, pp. ix-3-389.

The first section of the book "the background to the euro" discusses some of the most basic questions relating to the euro that are raised frequently. The explanations to those questions rest on political and economic factors and many of the themes raised are repeated throughout the book. The following chapters of the first section describe the "Euroland" in relation to North America and Asia. The last chapter of the section describes how the euro was created from the ECU and its relation to the currencies of the participating currencies.

The economics of the euro are given in section II in more detail. A 'cost-benefit' analysis is conducted where the costs associated with preparing for the euro- in particular, the fiscal tightening seen in all countries in recent years- will be rewarded with a boost to economic growth once the euro is launched. Chapter 6 discusses the fundamental economic aspects of the euro. 'Can Europe work with one interest rate?' is the question addressed in chapter 7. Will the 'one size fits all' approach to interest rates lead to greater regional disparities and even greater problems with European unemployment? Whether the UK is right to stay "out" and the approaches the government could take to the euro are discussed in chapter 8. The interesting arrangements in the Nordic area-with Finland taking part in EMU, Sweden and Denmark out and Norway not even in the EU, are discussed in Chapter 9.

Section III looks at the institutions of the euro. The key institution, the European Central Bank's operations form the subject of Chapter 10. The primary objective of the ESCB shall be to maintain price stability and without prejudice to the objective of price stability. The institution that will manage fiscal policy has been described as 'Euro-X' which is a sub-group of Ecofin (the Council of Economic and Finance Ministers). Chapter 11 looks at the role of the Euro-X. Although Euro-X could exert control over euro-area fiscal policy, national governments will retain control over their own country's fiscal policy. Euro-X's will be limited by the operation of the Stability and Growth Pact, the general need to reduce budget de-

ficits further; and the views and actions of the ECB.

Section IV is based on legal issues discussing not only the features of the legislation which introduces the euro but also the more difficult issues such as 'break up risk' of the economic and monetary union or the withdrawal of a participating country.

Section V deals with the problems that might be faced in relation to EMU. Chapter 13 examines the potential for a break up of EMU while in chapter 14 Tim Congdon assesses whether monetary union is feasible without political union.

Section VI looks at the foreign exchange market, where the euro's presence was initially felt. In chapter 15, how the new currency will trade relative to the two other main world currencies- the US dollar and the yen is discussed. Emphasis is given to the arguments for the euro being a relatively strong currency. Chapter 16 examines the impact of the euro on Eastern European currencies.

Section VII looks at three key areas of the financial market. Chapter 17 looks at the impact of the euro on the functioning of the money market in Europe. In particular, the new operating environment for setting euro-area interest rates, a comparison of EURIBOR, a new reference interest rate, and euro LIBOR, and the new benchmark overnight rate, EONIA are examined.

Chapters 18 and 19 discuss the transitional issues regarding bond and equity markets. With the euro's introduction some benefits will arise from the more efficient operation of the bond and equity markets. However, prior to establishment of a fully functioning pan-European market in either of the markets, some transitional problems need to be overcome. The impact of the euro on the pensions is discussed in Chapter 20.

The last Section VIII examines the impact of the euro on companies and consumers. Many companies face substantial costs as a result of adapting to the new environment, namely the changes to their accounting practices, their systems, treasury operations, staff training etc. These issues are discussed in chapter 21. Chapters 22 and 23 deal with financial institutions and retailers. The financial institutions are already into a process of dramatic transition. The euro will simply accelerate and intensify the transition process as a result of the combined driving forces, EMU demographics and technology.

Monetary Policy Rules, Ed. John B. TAYLOR, National Bureau of Economic Research, 1999, The University of Chicago Press, p. ix + 443.

The aim of this book is to present an econometric evidence on efficiency and strength of monetary policies. Another aim is to settle several current monetary policy issues-such as the effects of the uncertainty about potential GDP growth or the role of the exchange rate in the setting of interest rates. The economists who are conducting research in order to investigate various monetary policy rules came together at a conference in the Florida Keys to discuss their results with policymakers and other economists. This book contains papers, comments and discussion from the conference.

Models represented by economists differ in size as well as in degree of openness. Some are closed economy models, some are small open economy models and some are large open economy models. Some models are estimated with formal econometric methods and fit the historical data tightly while others are calibrated using rules of thumb or information from other studies, and they give rough approximations to historical data.

Woodford, and by Robert King and Alex Wolman have a microfoundation built around a "representative agent framework" in which a household maximizes utility over time. These models tend to be smaller than many of the other models in the volume, and they give rough approximation of the quarterly time series in the united States.

The model used by Nicoletta Batini and Andrew Haldane and the four models used by Andrew Levin, Volker Wieland, and John Williams are constructed under "the rational expectation assumption". The micro economic foundations for these models are separate decision rules for household's consumption or for a firm's investment and production, rather than explicit dynamic optimization of a representative agent.

Laurence Ball, Glenn Rudebusch and Lars Svensson, and Arturo Estrella and Frederic Mishkin used non-rational expectations models in their analysis. In order to achieve better empirical accuracy or to focus on other issues such as exchange rates or measurement error, these models do not build in agents' responses to future policy decisions as the rational expectations models do. These non-rational expectations models make the simplifying assumptions that the parameters will not change when policy changes.

In contrast to these model-based policy evaluation models, the editor of this book- John B. Taylor - uses historical methodology to evaluate po-

licy rules. Rather than testing policy rule in a structural model, this paper looks at different historical periods to see whether different policy rules result in different macroeconomic outcomes. Moreover, the paper uses general monetary theory rather than a specified model to interpret the historical data.

There are some similarities in methodologies used by economists related to monetary policy evaluation research in papers. First, each of the models are a dynamic, stochastic, general equilibrium model. Second, each of the models incorporates some form of temporary nominal rigidity usually a variant of staggered wage or price setting which results in a short-run trade-off between the inflation and output or unemployment. Third, for each model the variance can be computed directly or through stochastic simulation and the measure of economic performance depends on the variance of inflation around the target inflation rate, the variance of real output around the measure of potential or full-employment output.

In the first paper, Bennett McCallum and Edward Nelson try to measure performance of operational policy rules in an estimated semiclassical structural model. It implies that a variety of macroeconomic models rather than optimal performance in a single model. The objective of the paper is to study the performance of simple monetary rules within a small model of the U.S. economy.

In the second paper, Julio J. Rotemberg and Michael Woodford seeks to evaluate interest rate rules in an estimated sticky price model. The paper seeks to evaluate monetary policy rules that generalize the rule proposed by Taylor (1993). In particular, the authors consider rules in which the Fed sets the federal funds rate as a function of the history of inflation, output, and the federal funds rate itself. The feature of optimal policy is also considered, that is, the policy that maximizes the utility of the representative agent, assuming unlimited information about the exogenous disturbances to the economy.

Third paper by Laurence Ball, analyzes policy rules for open economies. What policy rules should Central Banks follow? A growing number of economists and policymakers advocate targets for the level of inflation. Many analysis of policy rules assume a closed economy. This paper extends the Svensson-Ball model to an open economy and asks how the optimal policies change. In open economies different rules are required because monetary policy affects the economy through exchange rate as well as interest rate channels.

In the fourth paper, Nicoletta Batini and Andrew Haldane shows im-

pact of forecast rules for inflation targeting. Economic policy in general, the monetary policy in particular needs a forward-looking dimension. Monetary policy in the G-7 countries appears in recent years to have been driven more by anticipated future than by lagged actual outcomes. Batini and Haldane embodied transmission lags (lag encompassing); they potentially embody all information useful for predicting future inflation (information encompassing); and suitably designed, they can achieve a degree of output smoothing (output encompassing). Their study has evaluated quantitatively these features of an inflation-forecast-based rule using simulation techniques.

In the fifth paper, Glenn Rudebusch and Lars Svensson concentrates on policy rules for inflation targeting. In this paper, the authors use a small empirical model of the US economy to examine the performance of policy rules that are consistent with a monetary policy regime of inflation targeting.

Andrew Levin, Volker Wieland, and John Williams's studies are on robustness of simple monetary policy rules under monetary uncertainty. In this paper, the authors investigate the characteristic of policy rules that yield low output and inflation volatility across four different structural macroeconometric models of the US economy.

In the next paper, John Taylor looks at historical background of monetary policy rules. This paper examines several eras and episodes of US monetary history from the perspective of recent research on monetary policy rules. The paper also defines, using current information and the vantage point of history, a quantitative measure of the size of past mistakes in monetary policy. And it examines the effects that these mistakes may have had on the economy.

In the eighth paper, Robert G. King and Alexandar L. Wolman gives an answer to the question which is "What should the monetary authority do when Prices are Sticky?". Practical macroeconomics gives a simple and direct answer to this question: monetary policy should regulate aggregate demand to stabilize output and inflation. Stabilizing output is presumed to eliminate the "Okun gaps" that arise from changes in aggregate demand when prices are sticky. Low and stable inflation is widely viewed as important policy goal: high and variable inflation is taken to increase relative price variability as well as increasing other costs of production and exchange.

In the final paper, Arturo Estrella and Frederic S. Mishkin examines role of NAIRU (nonaccelerating inflation rate of unemployment). The

NAIRU concept has come under quite serious attack in recent years. Because the effects of monetary policy on the aggregate economy have long lags, monetary policy must necessarily be preemptive; that is , it must act well before inflation starts to rise. In order to act preemptively, monetary policymakers must have signals that help them forecast future changes in inflation. One such signal that has received substantial attention is the gap between unemployment and NAIRU. In other words, NAIRU is the unemployment rate at which inflation is expected to neither increase or decrease.

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