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MULTISCALE SYSTEMATIC RISK: AN APPLICATION ON THE ISE-30

Atilla ÇİFTER*
Alper ÖZÜN**

Abstract

In this study, variance changing to the scale and multi-scale Capital Asset Pricing Model (CAPM) is tested by Wavelets as a new analysis method in finance and economics. It introduces a new approach to the variance changing to the scale as a general risk indicator, and to multi-scale CAPM portfolio theory as a systematic risk indicator. In the study, variance changes to scale and systematic risk changes to scale of 10 stocks in the ISE-30 have been determined. The ability of the investors to conduct risk based analysis up to 128 days allows them to determine the risk level to the scale (stock holding period).

According to the study results; it is determined that the variances of 10 stocks from the ISE 30 change according to the scale and variance differentiation as an expression of general risk level increase starting from the 1st scale (1 to 4 days). In multi-scale CAPM, it is determined that systematic risk of all stocks is changed to frequency (scale) and increased at higher scales. The finding as to beta and return at the high levels shall be in stronger form evidenced by Gencay et al (2005) is determined as not applicable to the ISE 30. The risk and return for the ISE-30 are close to the positive in the 3rd scale (32 days), but they are in the same direction for the other scales. This finding shows that the risk-return maximization of a portfolio of 10 stocks from the ISE may be achieved at a level of 32 days and the risk will be higher than the return in the portfolios established at those levels different than 32 days.

I. Introduction

According to CAPM, the factors affecting the return of the stocks are; i)market risk premium; ii) return from market movements; iii) unexpected changes in the company specific factors. The stock return (R_i) for a period is calculated by

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using the equation:

$$R_i = R_f + \beta_i \ (R_m - R_f)$$

where

R_i= the return for stock i
R_f= the return of treasury note
β_i= systematic risk (Beta coefficient) for stock i
Rm= The market return (in balance)

R_f used in the equation represents the indicative treasury bill (of which its duration is less than 1 year) interest rate prevailing the market.

In addition to this, with the questioned validity of CAPM by the test results of the advanced measurement methods in the financial markets which are developing and being more complex gradually, alternative asset valuation models have been developed. Roll (1977) posted the first serious criticism by asserting the linear relation between risk and return arises from the effectiveness of market portfolio average variance and the return explanation by one factor (beta coefficient) is, indeed, not applicable in the reality. Upon the cited criticism of Roll, researchers have agreed that financial markets are being more complex and accordingly the complexity reflecting on the stock returns can not be explained by a single factor.

Ang and Chen (2002), revealed that many factors are related to each other and a multi-beta model can be reduced to single-beta CAPM if the appropriate transformation can be performed in a study conducted. However, attempts to bring the data to a specified form without theoretical formation may be fallacious econometrically.

Owing to erroneous and/or different reflection of the data, variables will collide with and overlap each other. Besides since the results of multi factor pricing models would change pertinent to the chosen variables and market, it will not establish a base. After the cited findings and comments, the studies concerning to improvement of single factor (beta coefficient) CAPM have come to the agenda again. Brailsford and Faff (1997), Brailsfordand

Josev(1977), Cohen and et al (1986), Frankfurter and et al (1994), Hawawini (1983, Handa and et al (1989, 1993) stated that beta as the systematic risk coefficient would change according to the time slice; and those studies become base articles related to that multi-scale systematic risk shall lead to more appropriate results.

Financial markets being more complex and mathematical techniques have contributed to the formation of alternative single factor models. In this scope, Wavelet Analysis as a product of Chaos Theory is started to be used in the modelling phase of financial data. Applying Wavelet Analysis in stock pricing which has been used in Electric-electronic communication, earth sciences, microbiology and finance and economics is a new but promising subject from the modelling perspective. Although Wavelet analysis applied in all sciences after 1980, its application in finance and economics has commenced after 1995. As for application of Wavelet on portfolio management and risk management, it has been started only since 2005. Multiscale variance provides information about general risk level, and multiscale SVFM provides information about the change according to the holding period of systematic risk level or frequency. The findings showing that systematic risk may change through time support the views defending that risk may change to the scale.

This article aims to establish variance changing according to the scale and multi-scale Capital Asset Pricing Model (CAPM) by applying Wavelet Analysis using data from ten stocks in the ISE-30. In the model providing opportunity multiscale risk analysis up to 128 days, it is possible to determine the risk level of the investors according to the stock holding period.

In the next part of the study, the methodology of Wavelet Analysis shall be presented to readers in detail after a short literature scan part. Especially, it is thought that the discussion to be executed on modelling of strengths and scaling introduced by the model in the frame of financial data analysis shall contribute in the progression of existing models and development of alternative computer based methods. After the presentation of the data used in the analysis phase, empirical findings will be evaluated in terms of both finance and chaos theory and practical investor behaviours. The article will be ended with a part containing the recommendations on the future studies.

II. Literature Review

There are not many studies for the application of Wavelet Analysis to the financial variables in the literature since it is a very new method. This article has a particular importance for which it is the first analysis conducted with the data from Turkish financial markets.

Although there are limited studies available in which Wavelet Analysis is applied, many studies can be seen with this method in electronic-electric, earth sciences, biomedical and other sciences. Özün and Çifter (2006) tested Wavelet Analysis in assessing the impact of change in the interest rates on stock prices by Multiscale Causality Analysis. The authors have shown that the impact of interest rate changes on stock prices changes according to the scale and evidenced that Wavelet Analysis can be used in establishment of portfolio position. Albora and et al (2002) applied Wavelet Transform Technique in archeo- geophysics field. Çetin and Kuçur (2003a) and Çetin and Kuçur (2003b) has used wavelet transform method for determining the phase incoming time in earthquake indicators. The authors have determined that the features of the indicator in characteristic functions established for the different scales of earthquake indicators can be observed separately in each scale. Dirgenali and Kara (2005) used Wavelet Transform technique in the diagnosis of Arteriosclerosis and evidenced that wavelet transform and artificial nerve net methods provided better results in the diagnosis of Arteriosclerosis compare to other methods. Kara and et al (2005), applied Wavelet Transform in determining of abnormal stomach rhythm of Diabetics. The authors concluded that rhythm differences between diabetics and healthy individuals can be determined better by using wavelet transform. Okkesim et al (2006), used wavelet transform in modelling of the movements of jaw muscles of the patients using pre-orthodontic apparatus. The authors showed that the pressure level of pre-orthodontic apparatus on jaw muscles may be evaluated by wavelet transform.

Multiscale variance was developed by Percival (1995) and used in finance field firstly by Ramsey and Lampart (1998). Ramsey and Lampart (1998) determined causality relation between consumption, GDP, income and money by means of Wavelet Analysis. The authors have shown that the

relations between macroeconomic data are changing according to the scale. Lee (2004) used wavelet analysis to test international transmission mechanism in stock markets. The author has determined that the impact of multiscale price and volatility is from advanced countries to the emerging countries. Kim and In (2005a) tested Fisher Hypothesis with Wavelet Analysis. The authors determined that scale based inflation and stock return in short and long term move in the positive direction while in the mid-term moves in negative direction. Gallegati (2005a) has determined that stock return variance and correlation in MENA (Mid, East and North Africa Countries) change according to the scale. Gallegati and Gallegati (2005) analyzed production index volatility of G7 countries and found that no country has a direct effect on the production index of any other country. Gallegati (2005b) studied DJIA (Dow Jones Industrial Average) and economic output based on multiscale. Gallegati (2005b) has determined that, only in high scales, stock returns affect economy and economic activity multiscale variance is different. Kim and In (2007) tested the relation between stock prices and bond returns. The authors found that stock and bond returns also change according to the scale as well as they change from country to country.

Multiscale CAPM was applied by Gençay et al (2003), Fernandez (2005, 2006) and Gençay et al (2005). Gençay et al (2003) has determined that CAPM changes according to the scale and the relation between return and systematic risk (Beta) is higher at higher scales. Fernandez (2005) tested international CAPM and determined that systematic risk changes according to the scale for the stock portfolio from emerging countries. Fernandez (2006) applied multiscale CAPM in Chilean Stock Market and determined that CAPM model is applicable in the mid term. Gençay et al (2005) applied multiscale CAPM on the S&P 500, DAX30 and FTSE100 indices and concluded that systematic risk should be calculated as multiscale in the risk and return calculations. In the next part, wavelet analysis and its application methods in financial markets shall be presented in detail after stating basic features of CAPM.

Lin and Stevenson (2001) has studied the relation between the future market and spot market by using wavelet analysis. Wavelet analysis is used

by Kim and In (2003) in multiscale causality test between financial data and economic activity, and by Kim and In (2005b) in calculation of multiscale Sharp ratio. Almasri and Shukur (2003) analyzed multiscale causality relationship between public expenditures and incomes. Zang and Farley (2004) used wavelet analysis in the multiscale causality analysis of the international stock market. Dalkır (2004) analyzed the causality relationship between money supply and income. In and Kim (2006) used wavelet analysis in the determination of causality relationship between stock prices and future market prices.

III. Methodology

Capital Asset Pricing Model (CAPM) is based on the studies of Sharpe (1964), Lintner (1965) and Mossin (1966). CAPM is model pricing an asset considering the relationship between risk and expected return. In CAPM, risk is divided into two parts as systematic risk and non-systematic risk. Systematic risk (Beta) shows how a stock acts in relation to the market.

CAPM is the expression of expected return according to the systematic risk as in the Equation (1).

$$E(R_Y) = R_f + \beta_i E(R_m - R_f) \tag{1}$$

where

R_i= return of the asset
R_f= Risk free rate
R_m= Marketwide risk

Overnight repo (O/N) rates are preferred instead of treasury bill rates for R_f. Beta (β_i) as the systematic risk coefficient is also stated in the Equation (2) (Gençay et al, 2005).

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)} \tag{2}$$

$E(R_m - R_f)$ is called market risk premium. Equation (1) can be written as:

$$E(R_Y) - R_f = \beta_i E(R_m - R_f) \quad (3)$$

In the application, equations (1) and (2) are tested by Equation (4) (Gençay et al, 2005).

$$R_Y - R_f = \alpha + \beta_i (R_m - R_f) \quad (4)$$

Multiscale CAPM consists of separation of risk free stock and portfolio returns ($R_m - R_f$ and $R_i - R_f$) according to the 6th scale (1-4 Days, 8 Days, 16 Days, 32 Days, 64 Days and 128 Days) obtained by wavelet analysis and being test by the Equation (4). For purpose of comparison, standard CAPM is also tested.

The foundation of wavelet analysis goes through non-linear transformers. Sophisticate functions can be expressed with more than one linear function and this is called "function transformer". The foundation of such transformers goes to "The Analytical Theory of Heat" published by Joseph Fourier in 1822. In this book, Fourier showed that any irregular periodic function can be expressed as the total of the other functions (-Sin and Cos of signals) fluctuating regularly Selçuk, 2005).

Mallat (1989) and Daubechies (1988) also developed application-oriented different wavelet types. Mallat (1989) developed a limited wavelet of which its derivative is not continuous, having limited intensity support. Daubechies (1988) developed a wavelet function of which each wavelet can be re-formed at each step and this wavelet was preferred in analysis of chaotic irregularity.

Figure 1: Self-Identity of Daubechies Wavelet

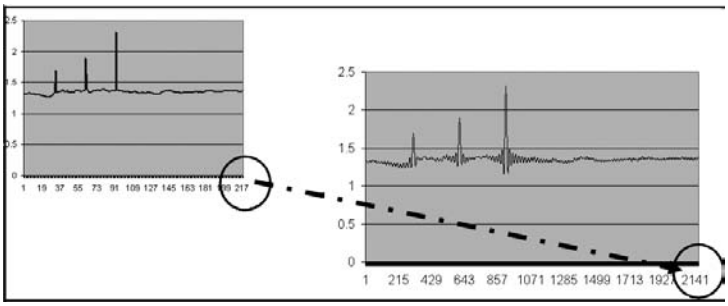
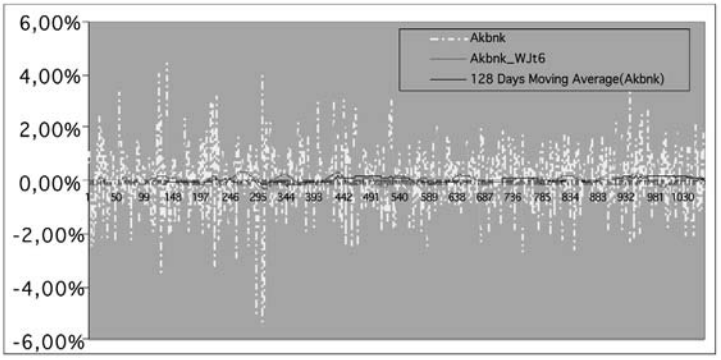


Figure (2) shows the comparison of 128-day daily wavelet analysis and 128-day moving average for AKBNK stock. The moving average can not get the average shock period where as wavelet analysis can do it.

Figure 2: 128 Days Time-Scale (Light Line) and 128 Days Moving Average (Dark Line) of AKBNK Stock



Fourier series regulated by Sinus and Cosine functions is expressed by Equation (5) mathematically (Tkacz, 2001).

$$f(x) = b_0 + \sum_{k=1}^{\infty} (b_k \cos 2\pi kx + a_k \sin 2\pi kx) \tag{5}$$

$$b_0 = \frac{1}{2\pi}\int_0^{2\pi} f(x)dx \quad , \quad b_k = \frac{1}{\pi}\int_0^{2\pi} f(x)Cos(kx)dx \quad ,$$

$$a_k = \frac{1}{\pi}\int_0^{2\pi} f(x)Sin(kx)dx$$

$a_{0,}\, a_k$ *and* b_k parameters can be solved by using the smallest squares methods.

$$f(x) = c_0 + \sum_{j=0}^{\infty}\sum_{k=0}^{2^j-1} c_{jk}\psi(2^j\chi - k) \tag{6}$$

$\psi(x)$ is called as the base wavelet and it is the foundation of all of ψ 's, from Equation 7, expansion and transform (Tkacz, 2001).

$$\Psi(x) = \begin{cases} 1 & : 0 \le x < \frac{1}{2} \\ -1 & : \frac{1}{2} \le x < 1 \\ 0 & : \text{others} \end{cases} \tag{7}$$

Maximal overlap discrete wavelet transform-MODWT is used in the high frequency financial time series. MODWT can be applied to any of N data set, however, wavelet variance carry asymptotic feature. This feature of MODWT allows it to be used in any given N-data set. MODWT is expressed by the matrixes (Gençay et al, 2002 and Percival and Walden, 2000). MODWT is expressed as scaled wavelet and scaling filter coefficient according to Equations (8) and (9).

$$\widetilde{W}_{j,t} = \sum_{t=L_j}^{N} \widetilde{w}_{j,t}^{X} f(t-1) \tag{8}$$

$$\widetilde{V}_{j,t} = \sum_{t=L_j}^{N} \widetilde{v}_{j,t}^{Y} f(t-1) \tag{9}$$

Wavelet variance of λ_j measurement determined by MODWT is expressed in Equations (10) and (11) (In and Kim, 2006).

$$\widetilde{v}_X(\lambda_j) = \frac{1}{\widetilde{N}} \sum_{t=L_j}^{N} \left[\widetilde{W}_{j,t}^{X}\right]^2 \tag{10}$$

$$\widetilde{v}(\lambda_j)_Y = \frac{1}{\widetilde{N}} \sum_{t=L_j}^{N} \left[\widetilde{V}_{j,t}^{Y}\right]^2 \tag{11}$$

IV. Data and Empirical Findings

4.1. Data

Study data consist of 10 stocks from the ISE-30 namely AKBNK, AEFES, AKGRT, ARCLK, EREGL, KCHOL, KRDMD, TCELL, TUPRS and YKBNK. 10 stocks are selected randomly with their data set starting from 2002 and the sample rate is 33% (10/30). The volatility changed to the scale, systematic risk and long term memory parameter were determined by wavelet theory. Data sets are obtained from the web site, www.analiz.com. The statistical characteristic of the level data of the chosen stocks can be seen in Table 1. The flatness and distortion features of all stock returns are different from each other; and it can be considered that stocks are in normal distribution according to the normality test - Jarque-Bera Test.

Table 1: Main Statistical Features (Level Series)

Stock exchange	Min.	Maks.	Std. Deviation	Skewness	Kurtosis	Jarque-Bera
AKBNK	14786	135103	29218.5	1.08972	3.49509	221.864
AEFES	93607	497321	97053.8	0.975298	2.94809	169.117
AKGRT	14680	145396	26896.7	1.64071	5.84979	838.987
ARCLK	21185	130137	23953.9	0.371356	2.7581	27.1002
EREGL	12199	97200	24496.7	0.708779	2.30727	110.568
KCHOL	25991	82246	13387.7	0.307466	2.16677	47.6328
KRDMD	0.0299	0.7452	0.225812	0.352008	1.44914	128.845
TCELL	16126	102214	23572.3	0.534852	1.84816	109.754
TUPRS	44665	303477	66169	1.05593	2.81388	199.636
YKBNK	10195	79864	17992.2	0.394087	2.1502	59.6686
ISE100	8627.42	47728.5	10039.8	1.01437	3.1919	184.445
ISE30	10880.5	60772.1	12882.6	0.978913	3.11851	170.877

In determination of both volatility and long term memory effect parameter, the first degree logarithmic differences of the series are taken. It is a common application in literature that 1st degree logarithmic differences are used. In the study 1st degree logarithmic differences of all series are taken.

In Table 2, there are stability values of stock returns at the level (I(0)) according to KPSS test (Kwiatkowski et al, 1992), Phillips-Peron test (Phillips and Peron, 1988) and Augmented Dickey Fuller test (Dickey and Fuller, 1981). Series are not stable at I(0) and they are stabilized when the logarithmic differences are taken according to the unit-root tests (Table 3).

Table 2: Unit Root Test (Level Series)

Stock exchange	KPSS test I(0)	Phillips- Peron test I(1)	Augmented D-F test I(1)
AKBNK	20.0126	0.638136	0.504895
AEFES	20.456	0.389534	0.563084
AKGRT	17.512	-1.44333	-1.46362
ARCLK	20.4979	-0.218052	-0.393636
EREGL	21.6616	-0.000165	-0.0483108
KCHOL	18.6793	-0.686503	-0.838449
KRDMD	20.7315	0.047202	0.0981312
TCELL	21.8022	-0.096907	-0.0878089
TUPRS	19.7428	1.52696	1.60709
YKBNK	16.8746	0.231628	0.0857086
ISE100	20.2774	1.57173	1.63275
ISE30	20.3486	1.35768	1.39816

Table 3: Unit Root Test (Log Differenced Series)

Stock exchange	KPSS test I(0)	Phillips- Peron test I(1)	Augmented D-F test I(1)
AKBNK	0.0653892*	-26.694*	-26.8563*
AEFES	0.2068*	-27.7824*	-27.9301*
AKGRT	0.0795931*	-30.0199*	-30.011*
ARCLK	0.0331696*	-25.5729*	-25.7272*
EREGL	0.0941811*	-25.8769*	-25.9482*
KCHOL	0.0866762*	-25.528*	-25.6102*
KRDMD	0.123164*	-26.8404*	-23.9578*
TCELL	0.144187*	-26.0658*	-22.2537*
TUPRS	0.333554*	-28.6147*	-28.6611*
YKBNK	0.37495*	-24.2236*	-21.792*
ISE100	0.330153*	-32.9528*	-32.9307*
ISE30	0.309776*	-33.038*	-33.0119*

* represents %1 C.I. statistically significance

4.2. Empirical Findings

CAPM and multiscale CAPM have been tested for 10 stocks from the ISE-30. In the study, firstly, multiscale variance difference was determined.

In Table 4, you can see linear correlation of 10 stocks covered in the study from the ISE-30. The correlation between the stocks and the ISE-30 and the ISE-100 is in the range of 91.4% 98.8%

Table 4: Linear Correlation

	akbnk	aefes	akgrt	arclk	eregl	kchol	krdmd	tcell	tuprs	ykbnk	ISE 100	ISE 30
AKBNK	100%	97.3%	94.9%	93.8%	96.3%	90.9%	81.5%	93.6%	95.2%	84.9%	98.8%	98.8%
AEFES	97.3%	100%	92.5%	89.2%	96.9%	88.6%	84.5%	95.4%	96.8%	90.1%	98.4%	98.4%
AKGRT	94.9%	92.5%	100%	88.0%	92.7%	85.5%	74.8%	89.2%	91.0%	82.4%	94.4%	94.5%
ARCLK	93.8%	89.2%	88.0%	100%	90.9%	94.7%	85.1%	89.9%	85.2%	75.4%	92.4%	92.5%
EREGL	96.3%	96.9%	92.7%	90.9%	100%	90.4%	87.4%	96.4%	95.8%	87.6%	97.3%	97.5%
KCHOL	90.9%	88.6%	85.5%	94.7%	90.4%	100%	85.3%	90.0%	81.9%	79.2%	91.1%	91.4%
KRDMD	81.5%	84.5%	74.8%	85.1%	87.4%	85.3%	100%	92.1%	78.4%	80.6%	84.5%	84.5%
TCELL	93.6%	95.4%	89.2%	89.9%	96.4%	90.0%	92.1%	100%	91.7%	89.3%	95.9%	95.9%
TUPRS	95.2%	96.8%	91.0%	85.2%	95.8%	81.9%	78.4%	91.7%	100%	85.9%	96.1%	96.0%
YKBNK	84.9%	90.1%	82.4%	75.4%	87.6%	79.2%	80.6%	89.3%	85.9%	100%	90.8%	90.9%
ISE100	98.8%	98.4%	94.4%	92.4%	97.3%	91.1%	84.5%	95.9%	96.1%	90.8%	100%	99.9%
ISE30	98.8%	98.4%	94.5%	92.5%	97.5%	91.4%	84.5%	95.9%	96.0%	90.9%	99.9%	100%

In table 5, there are multiscale variance data for 10 stocks and the ISE indices. Average multiscale variance shows the risk situation at short, mid and long term.

According to the test results, KRDMD has the highest multiscale average variance value with 29.55% while EREGL has the smallest one with 9.68%.

Table 5: Variance Analysis With Wavelets

	Lower Border (L)	Variance (wavelet)	Upper Border(U)
AKBNK	0.115	0.1047	0.1252
AEFES	0.0972	0.0888	0.1057
AKGRT	0.1115	0.1016	0.1214
ARCLK	0.1084	0.0987	0.1182
EREGL	0.0968	0.0881	0.1055
KCHOL	0.0932	0.0849	0.1016
KRDMD	0.2955	0.2696	0.3214
TCELL	0.1228	0.1121	0.1336
TUPRS	0.1039	0.0948	0.1131
YKBNK	0.2105	0.1918	0.2291
ISE100	0.916	0.8383	0.9936
ISE30	0.101	0.0924	0.1095

In Table 6 and Figure 3, multiscale variance distribution is available instead of average scale of variance. According to test results which are parallel to expectation, variance is increasing for all stocks as the scale increased. However it is seen that multiscale variance of YKBNK has higher multiscale variance at all scales. YKBNK has the smallest multiscale variance whereas TUPRS has the highest one at the 1st (1-4 days) scale. In the 6th scale (128 days), as the highest scale chosen, AKBNK has the smallest variance and YKBNK has the highest one. These results show that YKBNK stock has the lowest level of risk at holding periods of 1 to 4 days, while for 128 days of holding period AKBNK has the smallest risk level.

It is determined that, for the stocks chosen from the ISE-30, risk levels are changing according to the multiscale variance analysis (according to stock holding periods). This finding supports the argument of "variance should be calculated multiscale (according to the stock holding period) systematic risk coefficient instead of fixed interval systematic risk coefficient (beta or value subject to variance-risk etc)."

Table 6: Distribution of Variance Based on Scale

Stock exchange	1. Scale	2. Scale	3. Scale	4. Scale	5. Scale	6. Scale	Total
AKBNK	38.08%	30.78%	18.73%	7.80%	3.26%	1.35%	100%
AEFES	40.34%	30.31%	16.89%	7.32%	3.45%	1.70%	100%
AKGRT	37.13%	30.82%	18.13%	8.21%	3.52%	2.19%	100%
ARCLK	36.24%	29.59%	20.05%	8.06%	3.66%	2.38%	100%
EREGL	36.95%	28.94%	16.69%	7.48%	7.31%	2.62%	100%
KCHOL	36.29%	28.76%	18.95%	8.35%	4.92%	2.72%	100%
KRDMD	38.71%	33.24%	18.06%	5.05%	3.01%	1.94%	100%
TCELL	37.35%	29.98%	18.18%	7.60%	4.82%	2.07%	100%
TUPRS	42.46%	28.26%	15.73%	6.36%	4.04%	3.15%	100%
YKBNK	33.56%	32.14%	17.54%	7.09%	6.45%	3.23%	100%
ISE100	51.18%	25.44%	13.58%	4.93%	2.93%	1.94%	100%
ISE30	51.35%	25.49%	13.64%	4.89%	2.82%	1.80%	100%

* 1.scale is 4 days, 2.scale is 8 days, 3.scale 16 days, 4. scale 32 days, 5. scale is 64 days, 6. scale is 128 days.

Figure 3: Variance Based on Scale

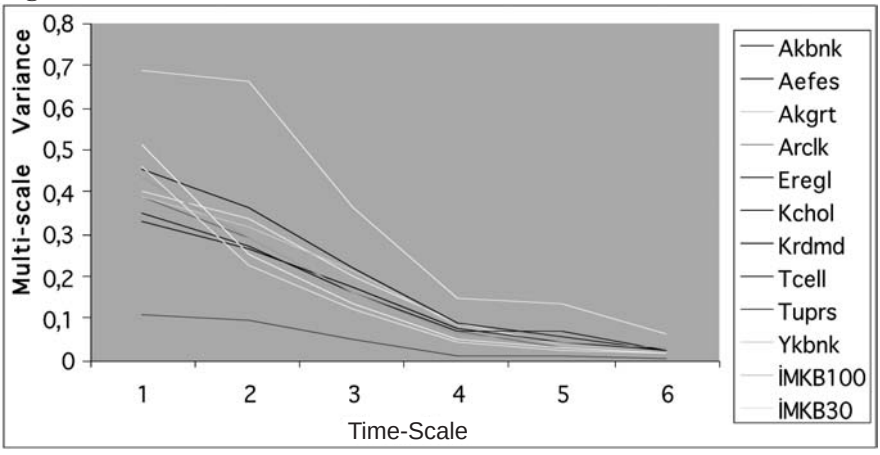
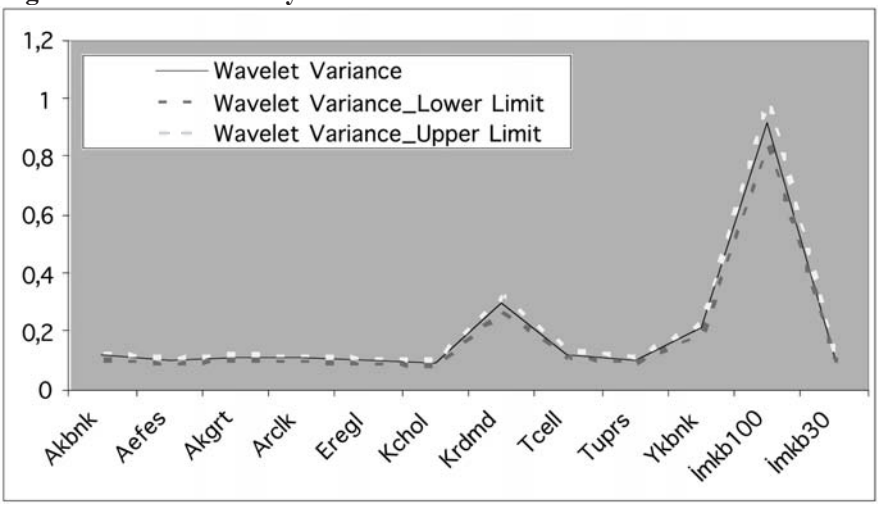


Figure 4: Variance Analysis With Wavelets



In Table 7, multiscale CAPM test results are available on average values for the 10 stocks. Systematic risk (beta) changes according to the scale. Beta averages of stocks: 0.44 in the 1st scale, 0.85 in the 2nd scale, 1.01 in the 3rd scale, 1.02 in the 4th scale, 1.09 in the 5th scale and 1.02 in the 6th scale. YKBNK and KRDM differentiate from other stocks due to their higher beta values in higher scales*. As seen in Figure 6, beta values of all stock are closing each other at the 1st scale. This situation indicates that multiscale analysis for 1 to 4 days may not be adequate. The approaching to "1" of systematic risk after the 3rd scale (8 to 16 days) supports the argument "CAPM should be tested at the scales later than 8 to 16 days."

Table 7: Multiscale CAPM

	Alpha	Beta	R^2
CAPM	0.000182	0.707044	0.37676
1. Scale (4 Days)	4.06E-06	0.443118	0.25994
2. Scale (8 Days)	0.0232	0.856786	0.47105
3. Scale (16 Days)	4.47E-05	1.0126	0.55994
4. Scale (32 Days)	-6.9E-07	1.021196	0.49827
5. Scale (64 Days)	3.37E-05	1.09919	0.55995
6. Scale (128 Days)	0.00023	1.021967	0.59142

Figure 5: Multiscale CAPM

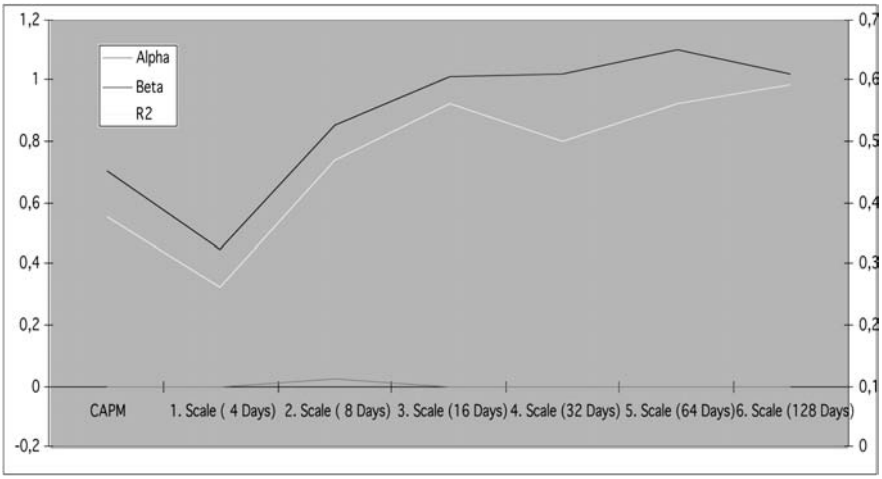
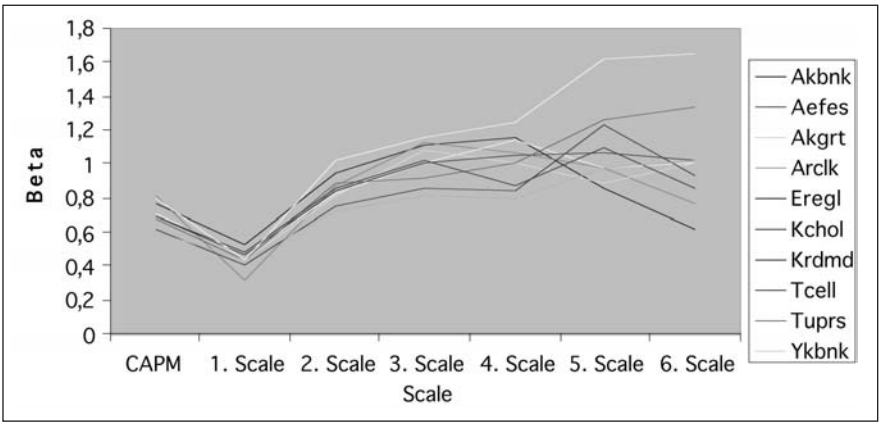
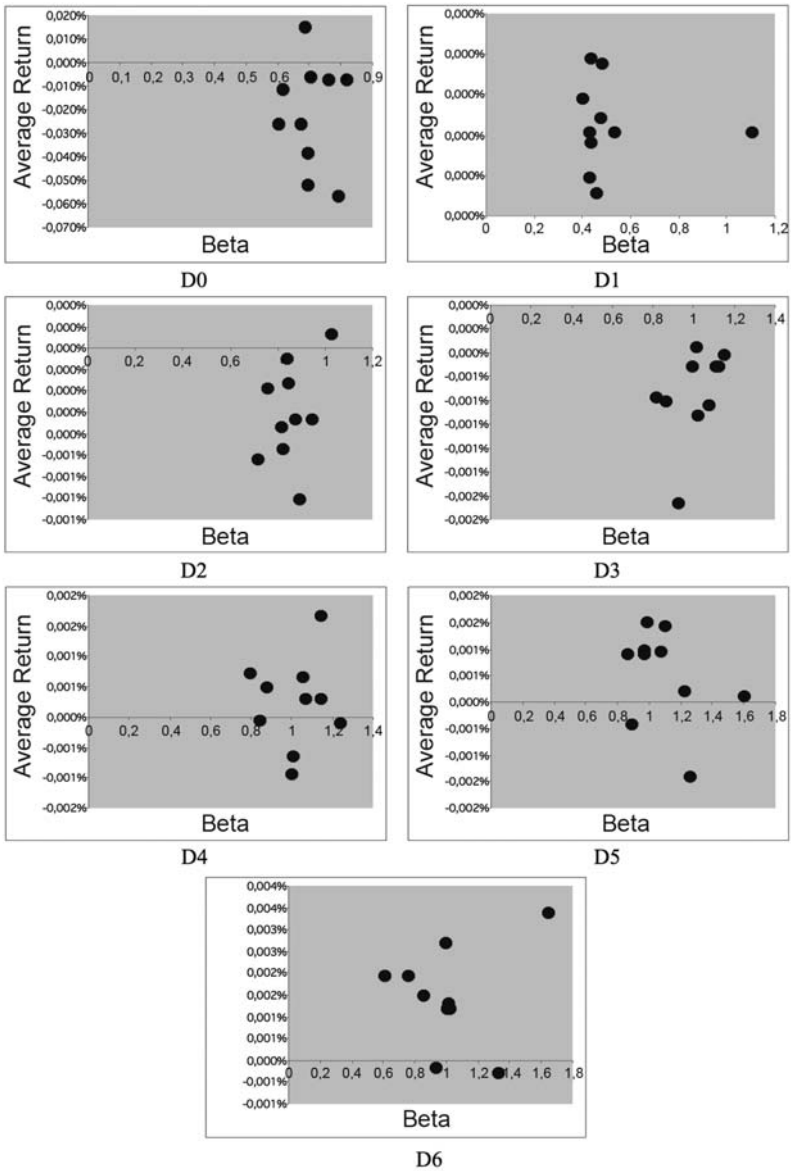


Figure 6: Systematic Risk Based on Scale



In Figure 7, there is a relationship between multiscale return and systematic risk coefficients (beta). The finding related to beta and return to be in better form determined by Gençay et al (2005) in a study conducted in International indices are not applicable for the ISE-30. Risk and return is close to positive in the 3rd scale (32 days). This finding shows that the risk-return maximization of a portfolio of 10 stocks from the ISE may be achieved at a level of 32 days and the risk will be higher than the return in the portfolios established at those scales different than 32 days.

Figure 7: Average Return and Beta Based on Scale



* D1: 1.scale(1-4 days), D2: 2.scale(5-8 days), D3: 3.scale(9-16 days), D4: 4.scale(17-32 days), D5: 5.scale(33-64 days), D6: 6.scale(65-128 days)

V. Conclusion and Recommendations

In this study, Wavelets method, as a new analysis method in finance and economics, and multiscale variance and multiscale Capital Asset Pricing Model (CAPM) were tested. Multiscale variance as a general risk indicator and multiscale CAPM as a systematic risk indicator brought a new approach to portfolio theory. In this study, variance and systematic risk change according to the scale have been determined for 10 stocks from the ISE 30. The ability of the investors to conduct risk based analysis up to 128 days allows them to determine the risk level to the scale (stock holding period).

According to the study results; it is determined that the variances of 10 stocks from the ISE-30 change according to the scale and variance differentiation as an expression of general risk level increase starting from the 1st scale (1 to 4 days).

In multi-scale CAPM, it is determined that systematic risk of all stocks is changed to frequency (scale) and increased at higher scales. The finding as to beta and return at the high levels to be in stronger form evidenced by Gençay et al (2005) is determined as not applicable to the ISE-30. The risk and return for the ISE-30 are close to the positive in the 3rd scale (32 days), but they are in the same direction for the other scales. This finding shows that the risk-return maximization of a portfolio of 10 stocks from the ISE may be achieved at a level of 32 days and the risk will be higher than the return in the portfolios established at those levels different than 32 days.

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EXCHANGE RATE EXPOSURE: A FIRM AND INDUSTRY LEVEL INVESTIGATION

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Abstract
Exchange rate exposure has become one of the most important subjects in international finance area after collapsing fixed exchange rate system. Several studies have been devoted to explore the relationship between exchange rate changes and the value of the firm. This study aims to investigate this relationship in the Istanbul Stock Exchange Market. The results of univariate model and multivariate models indicate that 30 % of the firms are affected negatively against exchange rate changes. The results are very sensitive to the chosen model and sub-period test results imply that exposure has a time-varying character.

I. Introduction

Exchange rate exposure has become one of the most serious source of risk for countries, industries, and companies since the beginning of the 1970s after collapse of the fixed exchange rate regime. The risk is not just the movement of the exchange rates but also limited knowledge about the effect of the movements on the value of the firm. Therefore, it is a risk which is difficult to measure and hedge.

The studies about the exposure are mainly concentrated on the developed economies and little attention is paid to the emerging markets. Investigations of the exposure on the emerging markets will be useful because of several reasons. For example, it is possible to hedge exposure in developed countries whereas there are not enough financial instruments in order to hedge exposure in emerging markets. Again, there is no big difference between nominal and real exchange rates in developed countries due to low inflation. However, a big difference may exist between real and nominal exchange rates because of high inflation figures in emerging markets and that makes the exposure a more complicated issue. Furthermore, developing countries are usually in a big trade deficit and hence

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exchange rates will be one of the most important economical variables. With these motivations, this study aims to investigate the exchange rate exposure of the Turkish companies that are quoted on the Istanbul Stock Exchange Market (ISEM). This study differs from the previous studies at least for two reasons. First reason is the selection of the time period.[1] The second one, this study employs three methods that have been used to measure exposure at the same time. This will enable us to see the effect of the chosen methods on the results.

II. Exchange Rate and Exchange Rate Exposure

Exchange rate is the price of one unit foreign currency in terms of the domestic currency. This price is important as the prices of goods are set in the domestic currency. If the price of goods are constant both in domestic and foreign country in terms of home currencies, a change of foreign currency price in terms of domestic currency will alter the goods prices relatively and hence demand and supply relationship will also change. The relationship between exchange rates and commodity prices are expressed as the Purchasing Power Parity (PPP) and assumes that inflation rate differentials should create a proportionate change in exchange rates. If PPP holds, then the real exchange rate[2] (RER) will be constant. Therefore, PPP and RER are in a very close relationship. That is if the PPP is not valid then the RER will move. Previous works agree that PPP is not valid in the short term but may be valid only in the long-run. Thus RER will move in the short-run. What does a change in RER mean? Edwards (1991) says that a devaluation of RER increases the competitiveness of the country in international trade since this country's products will be relatively cheaper in the eyes of the foreign customers and the demand for this country's commodities will rise. Oppositely a revaluation of the RER makes the exports expensive and imports cheaper and a decline of the competitiveness in international trade.

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[1] We have chosen 1991-2004 time period. We are able to see the effect of financial crises of 1994 and 2001. Moreover, it is also possible to discover the effect of the floating exchange rate system adopted in 2001.

[2] RER is defined as: $RER=s.(P^*/P)$ where s is the nominal exchange rate and P^* and P denote the price indices of foreign and domestic countries,respectively. It is obvious that if the inflation rate differentials are reflected into the exchange rates then RER will be constant.

2.1. Exchange Rate Exposure

Exchange rate exposures are classified as translation, transaction, and economic (operational) exposures. Translation exposure arises when a company operates in foreign currency regions. Financial statements are consolidated in parent company at the end of fiscal year. If exchange rates move between two of the consolidation dates, the value of assets and liabilities will differ in terms of parent company's currency. It is commonly accepted that this is the paper risk and brings no change of the fundamental variables that determine the value of the firm. This means that translation exposure does not affect the value of the company. Transaction exposure is a risk that arises when a company enters a contract that will be exercised in the future. If a movement of exchange rates exists between the contract date and the exercise date, final payment will be affected. Choi (1986) argues that this risk affects the value of the firm since it changes the cash flow of the company. On the other hand, Martin and Mauer (2003) assert that this type of risk is relatively definite and can be hedged and hence no effect of transaction exposure exists on the value of the firm.

2.1.1. Economic Exposure

Unexpected movements of the exchange rates may cause a change in value of the firm. This relationship is known as foreign exchange exposure. The firm value effect of exposure comes from the cash-flow concept. If the cash-flow of the company changes, inevitably the value of the company will also change as the value of the company is equal to the expected discounted future cash-flow. As a result of the movements of exchange rates, firm's fundamental variables such as cost, profit margin, sales volume, and competitiveness may change dramatically and firms are vulnerable against these changes in the short-run.[3] Assume that a movement of RER occurs and the cost increases as a result of this

[3] If the movement of RER is the long-lasting, firms may decide to apply strategic approaches such as plant location, different raw sources, new markets. But these are long-term decisions and firms are not able to much about dealing with the exposure.

change. The firm may keep the prices constant if the effect of exchange rate changes is not incorporated into the selling prices to avoid a decrease in sales volume. Obviously, it will cause a decline of profit margin that is existed because the RER changes. Alternatively, firms may transfer all of the exchange rate effect into the prices which means keeping the profit margin constant. On this case, firms may face to a decrease in sales volume as Srinivasulu (1983) presents.

As we have mentioned before, a change in RER causes exposure. In other words, if there is no change in the RER, then it seems to be there is no exposure at all. However, this expression may be wrong most of the times. That is because if PPP holds and no change in RER in terms of producer prices do not necessarily mean that PPP holds for every commodity and hence every industry. If so, some industries and firms may have exposure even when PPP holds aggregately.

Exposure may not exist directly. For example, If PPP holds at the aggregate and disaggregate levels between two countries, say Turkey and Germany, a third country, say China, and if there is a change in RER among three countries, then exposure may exist if the Chinese company produces the same product. This effect is known as the third country effect and causes an indirect exposure. Obviously, the measurement and evaluation of indirect exposure will be more difficult than the direct one.

Another point is to determine the lasting period of exposure. If exchange rate backs to the original level, does the exposure end? Milberg and Gray (1992) state that if the currency movement is long-lasting, the companies or industries will suffer because of competitors that are positively affected by the movement of the exchange rates may develop new strategies such as reducing prices. This policy will expand the competitors' market share. Or they may keep prices constant and invests extra profit for long-term purposes. If the currency moves back to the original level, the company will still suffer because competitors are stronger. In other words, the exposure will be still lasting.

III. Literature Survey

The studies about exposure started at the beginning of the 1970's but 1990s have witnessed a significant increase in the number of papers in this field. We will present a short review of the literature in grouped form instead of focusing on single studies.

The results of the empirical works report a limited exposure effect.[5] The limited exposure effect is explained as the hedging policies of the firms[6] and the inadequacy of the selected explanatory variables.[7] Some authors[8] assert that investors need time to evaluate the true effect of the RER movements and report significant lagged effect. However, some empirical results do not support the lagged effect.[9] Another disagreement in literature is about the characteristics of the exposure. Jorion (1990), He and Ng (1998), Harris, Marr and Spivey (1991) advocate that exposure is positively related with the foreign operations. On the other hand, Chow, Lee and Solt (1997), Dominguez and Tesar (2005) claim that exposure is not related with the foreign involvement but related with the firm size.

There is no through investigation of exposure in Turkish market, at least to the best of our knowledge. Önal, Doğanlar and Canbaş (2002) reported an investigation of the exposure effect Turkish banking industry by using a cointegration technique. They found that only two banks out of 11 had exposure effect in the long-run. Kıymaz (2003) investigated exposure effect for 109 companies quoted on the ISEM by using the weighted[10] nominal exchange rates as an explanatory variable. The results of the one-factor and multi-factor model indicate that 51 and 67 firms are negatively affected by the exchange rate movements during the 1991-1998 period, respectively. The author reports significant differences among the industries. Textile, Financial, Paper and

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[5] Khoo (1994), AlDaib, Zoubi and Thornton (1994), Ma and Kao (1990), Jorion (1990), Choi and Prasad (1995).

[6] Amihud (1994), He and Ng (1998), Pritamani, Shome and Singal (2004).

[7] Fraser and Pantzalis (2004), Dominguez and Tesar (2001), Tai (2005).

[8] Bartov and Bodnar (1994), Chow, Lee and Solt (1997), Frazer and Pantzalis (2004).

[9] He and Ng (1998), Soenen and Hennigar (1988).

[10] 1 Dollar+0,77 ECU.

Chemical industries are the most affected industries. Little exposure effect is reported for the Food and Services industries. He divided the study period into pre- and post-crisis periods. The pre-crisis period spans from January 1991 to February 1994, and post-crisis period ranges from May 1994 to December 1998. The sub-period results imply that exposure tends to decline significantly in the second sub-period. The author explains this decrease as the fall of the exchange rate volatility and firms' hedging policies by using derivative instruments after 1994 crisis.

IV. Method and Data

4.1. Method

Three models have been generally accepted for testing exposure effect.[11] The first one is the single-factor model developed by Adler and Dumas (1984). This model assumes that the relationship between the firm value and exchange rate can be stated as follows:

$$R_{it} = \alpha + \beta_1 R_{st} + \varepsilon_{it} \qquad \text{(Model 1)}$$

where R_{it} denotes the return of *i*th company's common stock in period *t.* R_{st} is the rate of change in a trade weighted real exchange rate. α is constant and ε_{it} stands for the error term. β_1 coefficient shows the sensitivity of the firm value against the changes of exchange rates. If the exchange rate is expressed as the price of one unit foreign currency in terms of the domestic currency, TL in our case, then a positive value of R_{st} will indicate a TL depreciation. If $\beta 1$ is positive, this means that firms are benefiting from the exchange rate depreciation. Oppositely, if negative value occurs, this implies that firms suffer because of the exchange rate depreciation.

Jorion (1990) assumes that exposure coefficient can be obtained from the following time series regression,

[11] Cointegration analysis are rarely used for this kind of analysis.

$$R_{it} = \alpha + \beta_3 R_{st} + \beta_2 R_{mt} + \varepsilon_{it} \qquad \text{(Model 2)}$$

where R_{mt} is the return of the stock market index, ISEM-100 in our case, and other variables are the same as in model 1. The statistically significant relationship between explanatory variables causes problems[12] and Choi and Prasad (1995) propose a modification of the Jorion model in order to overcome this problem. That is the residual market factor is orthogonal to the exchange rate and can be added to the model as follows:

$$R_{it} = \alpha + \beta_3 R_{st} + \beta_2 (U) R_{mt} + \varepsilon_{it} \qquad \text{(Model 3)}$$

where $(U)R_{mt}$ is the residual market return and is calculated by regressing exchange rate changes against stock market index. Clearly, it means that the regression relationship between exchange rate changes and the stock market index by employing model 1.

4.2. Data

We have selected all of the companies that quoted on the ISEM before December 1990 and have continuous available data. 77 companies meet our criteria. The prices are adjusted prices and taken from the ISEM's web site. ISEM-100 is chosen for the market index and this data are obtained from the Central Bank of Turkey's (CBRT) Electronic Data Distribution System (EDDS). All of the data are transformed into the natural logarithmic forms and monthly percentage changes are calculated. We have preferred to use trade weighted real effective exchange rates (TWREER).[13] The TWREER presented in graph 1 is then converted into the natural logarithmic form and monthly percentage changes are calculated.

Our time period ranges from January 1991 to December 2004. The number of the date is above the average number of the previous studies' data. We have also divided the time periods to the following sub-periods:

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[12] Multicollinerity

[13] See appendix 1 for construction of TWREER.

1991.01- 1994.02
1994.05- 2001.02
2001.04- 2004.12

As it can be noticed from graph 1, the first sub-period TWREER tends to rise, second sub-period seems to be constant and the last sub-period exhibits a decline of TWREER. We expect a different reaction of the firm values against exchange rate changes as the TWREER tends to have a time-varying character.

V. Empirical Findings

The empirical findings are presented in Tables 1, 2, and 3. The results of Model 1 exhibit that 28 % of the companies have significant negative exposure coefficients. When we test the exposure by using Model 2, the results tend to change. That is only 10 % of the companies are exposed and the number of positively affected companies are more than negatively affected companies. Model 3 results show that 35 % of the firms are exposed negatively. The overall evaluation of the results reported exhibit the general characteristics of these models. That is Model 1 and Model 3 tend to show nearly the same results. Model 2, on the other hand, exhibits a positive effect rather than a negative one. The reason for this can be the relationship between the market index changes and exchange rate changes. Glaum, Brunner, and Himmel (2000) point out this subject and assert that insignificant exchange rate coefficient may not necessarily mean that firms are not exposed. This clearly implies that firms' individual exchange rate sensitivity is not higher than the market. If there is no statistically significant relationship between two of explanatory variables, they advocate that the results of Model 2 and Model 3 will be similar. We carry out the regression between market index and TWREER and results are presented in Table 4. The findings of regression analysis indicate that there is a statistically significant negative relationship between two of them except the second sub-period. Interestingly, the results of the second sub-periods report a heavily negative exposure for all of the methods.

The first sub-period covers the time before the 1994 financial crisis. TWREER tends to rise in this period and test results imply that the number of exposed companies is relatively low in all of the models. The effect is usually

negative and Model 2 almost indicates no exposure while Model 3 indicates the highest exposure effect. The second sub-period findings demonstrate the highest exposure effects. Model 1 shows that 45 % of the companies are negatively affected. Model 2 also indicates a 33 % of significant exposure coefficients, and model 3 implies that 61 % of the companies are negatively exposed. The highest exposure effect on this period may be due to the insignificant relationship between the market index and TWREER. But it is difficult to explain these high levels of exposure for an economy which experiences a severe economical crisis in 1994. Kıymaz (2003) claims that exposure tends to decline after the crisis. The author explains the decline of the exposure as a result of hedging policies of the firms against the exchange rate movements. We are not able to reach a similar conclusion as the exposure effect is quite high for the same term in our study. If the exposure is measured in nominal terms rather than real terms, firms will be able to manage the transaction exposure. The results of the banking industry supports our prediction as the exposure tends to increase in every sector but banking sector. We may assume that this high level of exposure may be due to investors' awareness of exchange rate effect after the 1994 crisis. On the other hand,

Table 1: Summarized Results of Single-Factor Model (Model 1)

Industry	# of Firms	1991-2004		1991-1994		1994-2001		2001-2004	
		Neg.	Poz.	Neg.	Poz.	Neg.	Poz.	Neg.	Poz.
Food	4	-	-	-	-	-	-	-	-
Textile	4	2	-	-	-	3	-	-	-
Chemical	14	6	-	5	-	5	-	1	-
Non-matal/Cement	13	1	-	1	-	8	-	1	-
Basic Metal	6	1	-	1	-	2	-	-	1
Metal Products	12	3	-	1	-	5	-	-	-
Paper and Wood	5	1	-	1	-	3	-	-	-
Tourism	4	1	-	1	-	1	-	-	-
Banking	8	6	-	4	-	3	-	-	-
Holding	5	1	-	-	-	4	-	-	-
Other	2	-	-	1	-	1	-	-	-
Total	77	**22**		**15**		**35**		**2**	**1**
%		**28,5**		**19,5**		**45,4**		**2,59**	**1,29**

Table 2: Summarized Results of Multi-Factor Model (Model 2)

Industry	# of Firms	1991-2004		1991-1994		1994-2001		2001-2004	
		Neg.	Poz.	Neg.	Poz.	Neg.	Poz.	Neg.	Poz.
Food	4	-	1	-	-	-	-	-	2
Textile	4	-	-	-	-	2	-	-	3
Chemical	14	2	1	-	-	7	1	-	7
Non-matal/Cement	13	1	2	-	-	3	-	-	11
Basic Metal	6	-	-	-	-	2	-	-	6
Metal Products	12	1	-	-	-	3	-	-	8
Paper and Wood	5	-	1	1	-	1	1	-	3
Tourism	4	-	-	-	-	1	-	-	1
Banking	8	-	-	1	-	3	-	-	5
Holding	5	-	-	-	-	1	-	-	5
Other	2	-	-	-	-	1	-	-	2
Total %	**77**	**4 5,19**	**5 6,49**	**2 2,59**		**24 31,2**	**2 2,59**		**53 68,8**

Table 3: Summarized Results of Multi-Factor Model (Model 3)

Industry	# of Firms	1991-2004		1991-1994		1994-2001		2001-2004	
		Neg.	Poz.	Neg.	Poz.	Neg.	Poz.	Neg.	Poz.
Food	4	-	-	-	-	-	-	-	-
Textile	4	2	-	1	-	4	-	-	-
Chemical	14	8	-	7	-	10	-	2	-
Non-matal/Cement	13	1	-	2	-	9	-	1	1
Basic Metal	6	1	-	1	-	3	-	1	1
Metal Products	12	4	-	4	-	7	-	-	-
Paper and Wood	5	2	-	3	-	4	-	-	-
Tourism	4	2	-	1	-	2	-	-	-
Banking	8	6	-	5	-	3	-	1	-
Holding	5	1	-	1	-	4	-	-	-
Other	2	-	-	1	-	1	-	-	-
Total %	**77**	**27 35,0**		**26 33,7**		**47 61,0**		**5 6,49**	**2 2,59**

the level of TWREER is around 130 which is nearly 30 % above the starting value for the second period. This means that there is no advantage for the companies that use imported materials. It is expected that exporter firms should benefit from the advantages of high level of TWREER and we can not capture this expected positive effect. Pritamani, Shome and Singal (2004) assert that exposure of the exporter companies can not be captured. This finding is similar with Amihud (1994) which reports no significant exposure effect for the exporter companies. The third sub-period is quite different from the other sub-periods. This is because Turkey has adopted freely floating exchange rate regime after the 2001 financial crisis. As it can be seen from graph 1, the TWREER tends to decline which is unusual for the Turkish economy. If this opposite behavior of exchange rate exists comparing to previous sub-periods, then it is logical to expect that firms' exposure effect will be different in this case. The results support this point and model 1 and 3 report no exposure effect while model 2 indicates that 68 % of the companies are positively affected. In summary, it is possible to say that firms benefited from the TWREER changes or at least are not affected negatively.

Tablo 4: The Regression Results Between TWREER and ISEM-100

$$\Delta ISEM = \alpha + \beta_1 \Delta TWREER + \varepsilon_{it}$$

Period	α	β[16]
1991.01–2004.12	0.54 (3.83*)	-0.52 (-2.50*)
1991.01–1994.02	1.12 (2.43*)	-2.07 (-2.15*)
1994.05–2001.02	0.57 (3.19*)	-0.67 (-1.36)
2001.04–2004.12	0.11 (0.86)	-0.57 (-3.97*)

We have grouped the firms based on the industries which they belong and evaluated the results at the industry level in order to understand whether there

is a difference among the industries against TWREER changes. Food industry shows no significant exposure at all. The highest exposed industries are Chemical, Banking and Metal products industries. However, Banking industry differs from the other industries especially in the second sub-period. That is the exposure effect tends to rise in every industry except banking industry in this term. This can be a result of exchange rate management policies of the banks after the 1994 crisis. These findings lead us to conclude that there are some differences among the industries against the TWREER changes but it is very difficult to reach a definite conclusion of that exposure effect is related with the industry.

VI. Conclusions

This study investigated exposure effect the firms quoted on the ISEM. Exposure is defined as the change of the firm value when the TWREER changes. We have used three models that are generally accepted in the literature for testing exposure. Our time period ranges from January 1991 to December 2004. We have divided this range into three sub-periods to see the time-varying characteristics of the exposure. The results indicate that exposure is quite important for Turkish companies as around 30 % of the companies are affected negatively. However, the results are very sensitive to the chosen model. Jorion (1990) model tends to show the highest positive exposure effect while Choi and Prasad (1995) model tends to imply the highest negative effect. The results also show that exposure has a time-varying character. That is the second sub-period results indicate the highest negative effect and third sub-period findings show no exposure or the highest positive exposure depending on the chosen model. Another finding is that there are some differences among industries but we are not able to say that industry characters are very sensitive to the TWREER

changes. In summary, the results of this study reveal a relative success about discovering exposure comparing to the previous studies.

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Appendix:

The Calculation of the Trade Weighted Real Effective Exchange Rates (TWREER)

The first step of of the TWREER is to determine the biggest trade partners of Turkey. To do so, we have investigated the foreign trade figures of Turkey between 2000 and 2004 and determine the first 8 major trading partners of Turkey. These are Germany, U.S.A, France, Italy, England, Netherland, Spain and Belgium, in order of decreasing trade volume. We have used the CBRT's buying rate of U.S. Dollar and British Pound for U.S.A and U.K. We have used ECU buying rates for the rest of the countries until the year 1999 and Euro after this date since they started to use a common currency. The Exchange rate series are indexed to 100 in December, 1990. The next step is to construct weighted price indices. We have decided to use Producer Price Indices and the data for this variable are taken from the DataStream International and CBRT' EDDS for Turkey. We set TWREER as follows:

$$TWREER = EER.(P^*/P)$$

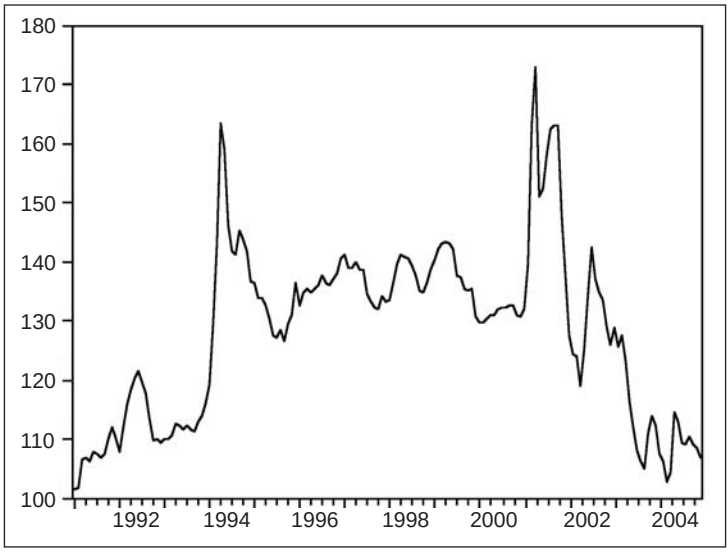
EER stands for nominal effective exchange rate and P is the PPI of Turkey. To calculate the EER we need to use the weights and these weights are derived from the foreign trade volumes. We assume that Turkey uses Euro with European Community (EC) and British Pound for U.K and US Dollar for the rest of the world. The weights are as follows:

Pound	5,99 %
Euro	44,35 %
Dollar	49,66 %

By using the weights we calculate the EER which equals to 100 in December 1990. We need to use the same weights for calculating trade weighted foreign price indices (P^*). To do so, we need to create an average PPI for EC

countries as they use the same currency. We again searched the trade volumes of these countries within the group and determined the weights.[14] We create a trade weighted PPI by using above weights. Then TWREER is calculated according to the equation defined above. Now, we have a TWREER which is equal to 100 in December 1990 and it is presented in Graph 1.

Graph 1: Trade Weighted Real Effective Exchange Rate (1990.12=100)



T values are shown in parantheses and * stands for significant coefficient at 5 % confidence level.

[14] Germany 40 %, Italy 21 %, France 17 %, Spain 8 %, Netherland 8 %, Belgium 6 %.

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INFLATION TARGETING ACCORDING TO OIL AND EXCHANGE RATE SHOCKS

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Abstract

Unless current output is not equal to potential output in an economy, inflation targeting cannot be zero. The minimum rate of inflation target is determined by the level of economic distortion rate. Briefly, economic distortion can be defined as all kind of events and regulations that reduces the efficiency of price mechanism. While shocks are included to the analysis of inflation targeting with distortions, the central bank is compelled to make a choice between inflation and output stability. If the shocks are permanent, they cause serious economic distortions. Under these circumstances, central bank has to revise its inflation target. The main purpose of this work is to analyze how exchange rate and oil shocks affect inflation and how these shocks affect the inflation targeting in the Turkish economy. The econometric determinations of this work emphasize that exchange rate shocks affect inflation target positively in the long run. On the other hand, petrol shocks will lead The Central Bank of the Republic of Turkey to revise its inflation targets.

I. Introduction

Increases in the price of oil in Turkey during the first quarter of 2006 and important fluctuations in exchange rates occurred from May 2006 caused discussions among the public on whether Central Bank of the Republic of Turkey (CBRT) should revise its inflation target. Recently, the oil prices that divert CBRT's inflation targeting policy increased significantly (CBRT, 2006-I, 2006-II). Furthermore the changes in the exchange rates also caused similar effects on the oil prices. In theory such sudden and unexpected price changes are named as shocks. (Blanchard & Fischer, 2000). Accordingly changes in the oil prices-considering oil is an important input- and exchange rate appreciations accelerates inflation both primarily (input prices) and secondarily (expectations). CBRT revised its inflation target for 2006 and increased the interest rates in order to avoid break down of expectations. Furthermore it declared to the public that it keeps its inflation targets in the middle term (CBRT, 2006-III).

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If the central bank targets an inflation rate numerically, for a specific term, declaring it to the public and it designs its whole monetary policy targets according to this specified inflation rate, this is named as inflation targeting. As it is stated in the definition, inflation targeting is a dynamic and flexible process (Carare, Stone, 2003). Generally inflation targeting is applied by three-year programs (Miskin, 1998; Süslü, 2005). Except inflation target, central bank does not undertake any commitments and it uses whole monetary policy tools according to inflation target (Walsh, 1995). This means that inflation targeting is a flexible monetary policy approach (Baydur, Süslü, Bekmez, 2005).

Although the definition is correct, it is insufficient. Because, the aim of inflation targeting is the expectations of economic actors. Parallel to its targets, the central bank uses its basic policy tool -short term interests- in order to divert the inflation expectations of economic actors. Inflation targeting is also a mid-level monetary policy target. The central bank can not control prices/wages directly (Sevennson, 2005). However, it controls the prices -namely the inflation- as much as it affects the expectations of economic actors.

According to the works on inflation targeting, successful inflation stability requires credibility. Credibility means that the central bank keeps its promises. If a central bank has enough credibility, with inflation targeting it can provide stability both in output and inflation. (Flood & Isard, 1989). Inflation targeting plays a major role to decline inflation. In inflation targeting, the cost of declining the inflation –defined as the deviation from the potential output level- is low (Blinder, 1999). During the process of declining the inflation, there occur a natural harmony between the price stability and output stability. This harmony gives an important responsibility to the central in declining inflation. In other words, a central bank that has an inflation target should consider the possible fluctuations in inflation and in output together. Especially while the shocks are included to the inflation targeting, the central bank should make a choice between inflation and output stability. If the shocks are permanent and causing serious economic distortion, the central bank has to revise its inflation target. If the central bank does not act in this way, the economy faces a very serious output cost. Under a social aspect, as it is

not possible to sustain such high output costs for a long time, the central bank has to finally revise its inflation target (Schaechter, 2002).

The main aim of this work is to demonstrate when and why a central bank, having an inflation target, should change its target according to oil and exchange rate shocks. Another aim of this article is to evaluate whether CBRT's monetary policy according to oil and exchange rate shocks is correct or not. For this purpose, first of all, a theoretical framework based on Blanchard's (2003) work on inflation targeting will be given. Lastly, by drawing on this theoretical base, probable affects of oil/exchange rate shocks on CBRT's inflation target and monetary policy.

II. Theoretical Model

Today, it is emphasized that the main objective of the central banks is to achieve price stability. Because, from the central banks point of view price stability makes it easier to implement whole other economic targets. One of the most common policies of central banks to achieve price stability is inflation targeting. The main reason of this commonness is its ability to accomplish output and price stability together/at the same time (natural harmony). Under specific circumstances, stability of price and potential output level are consistent. Blanchard's model will be used to demonstrate this statement. In the model prices and wages are defined as follows (Blanchard & Fisher, 2000):

$$p = w + \alpha y + e_p \tag{1}$$

$$w = Ep + \beta y + e_w \tag{2}$$

p, w and y indicate the logarithm of general price level, nominal wages and output in turn. e_p is an increasing function of general price levels, nominal wages, output and error term. Term e_p indicates mark-up rate of relative prices and

technological changes (Barro, 1997; Taylor,1983). Also, wages are an increasing function of expected inflation, *Ep,* output and error term, e_w . Variable e_w depends on bargaining power and unemployment rate (Barro, 1997).

Assuming inflation expectations are adaptive, π indicates inflation rate and the terms shown in brackets indicate length of lag. Notation E defines the expectations.

$$Ep = p(-1) + \pi(-1) \tag{3}$$

The output level in an economy without distortions and where price expectations come to be true is named as potential output level (Blanchard & Fischer, 2000). Potential output level is shown as y* and derived by equations (1) and (2) as follows:

$$p = Ep + \beta y + e_w + \alpha y + e_p \tag{3.1}$$

$$p - Ep = \beta y + e_w + \alpha y + e_p \tag{3.2}$$

As the expectations come to be true at the level of potential outcome and $p - Ep = 0$. Having equations given above, we can show potential output level as follows:

$$y^* = -\frac{1}{(\alpha + \beta)}(e_p + e_w) \tag{4}$$

Summing up equations (1), (2), (3) and (4), we get equation (5) that defines the relation between inflation and output:

$$p = Ep + \beta y + e_w + \alpha y + e_p \tag{4.1}$$

$$p = p(-1) + \pi(-1) + \beta y + e_w + \alpha y + e_p \tag{4.2}$$

$$p = p(-1) + \pi(-1) + (\beta + \alpha) y + (e_w + e_p) \tag{4.3}$$

$$y^* = -\frac{1}{(\alpha + \beta)}(e_p + e_w) \tag{4.4}$$

$$-(\alpha + \beta) y^* = (e_p + e_w) \tag{4.5}$$

$$p = p(-1) + \pi(-1) + (\beta + \alpha) y - (\alpha + \beta) y^* \tag{4.6}$$

$$p - p(-1) = \pi(-1) + (\beta + \alpha) y - (\alpha + \beta) y^* \tag{4.7}$$

$$p - p(-1) = \pi \tag{4.8}$$

$$\pi = \pi(-1) + (\beta + \alpha)(y - y^*) \tag{4.9}$$

$$\pi - \pi(-1) = (\beta + \alpha)(y - y^*) \tag{5}$$

Equation (5) includes two results about price stability. Firstly, according to equation (5) changes of inflation is a function of output gap. Secondly, in equation

(5) the confusing terms (e_p, e_w) which indicate shocks are excluded from the analysis. Equation relates the changes in inflation only to output gap. The reason for why shocks (e_p, e_w) are excluded from equation (5) is that the affects of e_p, e_w are analyzed through output growth (see the analysis process given above). Such a way of analysis shows that output gap is both a sufficient term and a sufficient statistical measure to evaluate the relation between inflation and shocks.

We can develop the models arguments on inflation for rational expectations. In such a model with such expectations, inflation is not determined according to previous inflation rates. It is determined by using the whole data in the economy and by predicting the inflation expectations together with output gap, assuming the expectations are rational. However, the result we get is similar to the result of equation (5) (Blanchard, 2003).

Excluding the terms of shock from equation (5) has direct and indirect affects. To clarify these affects, we need to expand the analysis stated above. We can start this extension by defining inflation stability. Inflation stability means that inflation fixes upon a specific level: $\pi = \pi(-1) = \overline{\pi}$. According to equation (5) output fluctuations, namely output gap, must be zero for price stability. In other words, potential output level must be equal to current output level: $y_t = y_t^*$. This is what we called natural harmony between inflation and output, at the very beginning of this work. This harmony has significant effects on monetary policy and inflation targeting policy of the central bank. Under the natural harmony, there is only one inflation target for the central bank. This target is zero inflation. If there are distortions in the economy because of several different reasons, zero inflation cannot be a target[1]. Under these circumstances the inflation target declared by the central bank is a function of deviation from potential output level. Current output level in the economy may be different from the potential output level because of several reasons (such as contention of mark-up ratios and wages, adoption speed of prices being not infinitive (Akyüz, 1977)). In an economy with distortions, we cannot consider potential output level as the first best one. If the output gap is different from zero because of the economic distortions, the central bank targets a

[1] See Fischer (1996), Walsh (2000).

positive inflation and inflation target will not be zero. In order to see this mathematically, we can analyze the relation between the potential output growth rate and first best output growth rate as follows:

$$y^* = y^f - a + \eta \tag{6}$$

y^f indicates the first best output growth rate. a is a constant. η indicates the error term of which the average is zero and variance is constant. It shows how potential output growth rate departs from the best growth rate, because of the distortions in the economy. We sum up equations (6) and (5) and get equation (7) that shows the relation between output gap, shocks and inflation.

$$\pi = \pi(-1) + (\beta + \alpha)(y - y^*) \tag{6.1}$$

$$\pi = \pi(-1) + (\beta + \alpha)(y - (y^f - a + \eta)) \tag{6.2}$$

$$\pi = \pi(-1) + (\beta + \alpha)(y - y^f + a) - (\beta + \alpha)\eta \tag{7}$$

Assuming that the central bank achieved its previous term inflation target ($\pi(-1) = \pi^T = \bar{\pi}$), we rewrite equation (7) to analyze oil and exchange rate shocks and get equation (8).

$$\pi - \bar{\pi} = (\beta + \alpha)(y - y^f + a) - (\beta + \alpha)\eta \tag{8}$$

Equation (8) can be used for evaluation the effects of shocks on inflation and output gap. According to its attribution, variance η in equation (8) that symbolizes the shocks faces an exchange between price stability of the central bank

and output stability. When the shocks occur, harmony between inflation and output gap -that we named as natural harmony at this work- is not proper anymore. Under these circumstances shocks are distributed between inflation and output gap (inflation gap: $\pi - \overline{\pi}$, output gap: $y - y^f$). Including shocks to the analysis, natural harmony process of central banks inflation targeting varies according to the types of shocks. If the shocks, η, is temporary and it does not affect the gap between current output and first best output growth rate that are defined according to $y - y^f + a$, remaining the inflation target steady is the optimum policy for the central bank. Accordingly, the right policy is concerning deviation of inflation as periodically/temporary and declaring to the public the reason for why the shock is temporary. If the shock, η, is permanent and it affects the current output-first best output growth ratio defined by $y - y^f + a$, in other words, shocks are permanent and change the level of distortions, the central bank either changes its inflation target or undertake the risk of a significant recession and wait for the improvement (re-adoption of prices and wages) of economic distortions (Blanhard & Fischer, 2000)[2].

Decision making process in modern monetary policy has two parts: rule based policy practices and discretionary policy practices. Discretionary (assessment based) policy may change periodically and it is determined by valid economic conditions, having inflationary tendency. Recently, central banks prefer rule based policies during their struggles with inflation and inflationary expectations (Rogoff, 1985). Monetary policy rule means that central bank undertakes several commitments by means of its objective and tools. In rule based policy, central bank takes some responsibilities in order to gain credibility. If the central bank is credible, it reduces the costs of achieving it targets. Similar to whole policy practices, rule based policy practices have some advantages and disadvantages. As these practices are not flexible, it may cause some negative affects when unexpected conditions occur (Kansu, 2006; Bernanke & Mishkin, 1999). So, in order to avoid negative effects of rule based/inflexible policy and instability caused by discretionary policy

[2] Shocks are divided into two groups: Permanent and temporary shocks. Temporary shocks do not have any effect on long run output growth rate. Controversially, permanent shocks do.

"constrained discretion" is offered (Kansu, 2006; Bernanke & Mishkin, 1999). In case of constrained discretion provides possibility to eliminate economic shocks, financial disorder and other unforeseen conditions occurred, by inflation targeting. Also, this kind of discretion can help the central bank achieve successful results on inflation and unemployment, without giving up its commitment on low and stable inflation. (Bernanke & Mishkin 1999; Kansu, 2006, Lohman, 1982). For a central bank with constrained discretion, inflation target is flexible –generally inside a band of fluctuations- in short term. In the middle term inflation target is binding for the central bank. Even so the central bank uses its constrained discretion power, significant and permanent shocks that can affect economic distortions may force central bank to target the right inflation rate and change its inflation target. Similar to shocks, some practices of economic authorities that empower the distortions may cause a similar effect. If wrong policies or instabilities kept hidden appear for a reason and this has a reflection on prices, central bank prefers to either revise the inflation target or face a serious decline of credibility by insisting on this policy and burdening serious costs to the public. In such a case, the right choice for the central bank is to determine a higher inflation target that is more suitable for the basic balances of the economy. Because, a central bank which uses a policy far from the base of the economy and insist on its targets despite the economic distortions cannot be fair and credible anymore.

As long as there are distortions in the economy, costs of such tight monetary policies are not distributed to the society equally. Considering the practicing possibility of recession policy is low (because of chambers, unions, regulations, politics etc.), we can say that, if the shocks are permanent, optimal monetary policy for the central bank is to revise the inflation target (Kansu, 2005). If the shocks are not permanent, then the fluctuations in the inflation should be taken as temporal and the central bank should not intervene the deviation.

For evaluating possible effects of oil/exchange rate appreciations on Turkish economy by the help of theoretical framework developed above, first of all, it is necessary to calculate the output gap. With the Hodrick-Presscot (HP) filtering method, output gap can be calculated for Turkey. In general, calculated

gap for Turkey also indicates the lack of compatibility and flexibility of markets in Turkey. According to positive or negative relation between calculated output and oil/exchange rate shock, it can be debated whether CBRT's revision of inflation target for 2006 and exchange rate policy it sustained is true or not.

III. Changes in Exchange Rate, Oil Prices, Consumer and Producer Prices in Turkey

Oil is a strategic product for all economies as it's a basic input for production. So, oil price changes are significant for economies. During the first quarter of 2006, international prices of crude oil increased 30% - 50% annually (Table 3.1). These changes expectedly increased both consumer and producer prices in two ways. Primary effects are the ones that directly affect oil prices. Secondary effects are indirect effects and divided into two parts. First one is oils' price increasing effect as it is an important input of production. Second one is its' causing changes in expectations. Oil and exchange rate shocks increases the prices of other products through expectations.

Table 3.1: Annual Percentage Change in Prices of Crude Oil ($/barrel), CPI, PPI and Exchange Rate

	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Agu-05
Basket	32.67	40.73	52.92	45.16	29.51	50.36	46.40	43.58
Dubai	30.59	35.97	48.20	44.15	31.83	52.98	52.10	47.96
Brent	30.90	46.39	56.08	51.25	29.67	55.44	49.93	49.43
CPI	9.24	8.69	7.94	8.18	8.70	8.95	7.82	7.91
PPI	10.70	10.58	11.33	10.17	5.59	4.25	4.26	4.38
Foreign Currency ($)	5.22	-0.74	4.51	0	-6.71	-6.76	-6.16	-8.67
	Sep-05	Oct-05	Nov-05	Dec-05	jan-06	Feb-06	Mar-06	Apr-06
Basket	43.41	47.48	31.65	20.41	44.86	36.11	18.06	37.22
Dubai	58.81	55.80	48.06	44.11	54.66	46.40	26.80	40.41
Brent	44.49	44.61	29.46	18.11	53.28	33.99	18.02	43.87
CPI	7.99	7.52	7.61	7.72	8.15	8.16	8.83	9.86
PPI	2.57	1.60	2.66	5.11	5.26	4.21	4.96	7.66
Foreign Currency ($)	-.9.40	-6.80	-3.52	-2.16	-0.75	0	-2.88	5.04

Resource: OPEC, TCMB.

Amount of indirect and direct effects of shocks on prices is measured by indexes. Although there are several special inflation indicators in Turkey, two of them are the most significant: Consumer Price Index (CPI) and Producer Price Index (PPI). Besides, some changes increased the effectiveness of oil prices and exchange rates on CPI and PPI significantly. Taking 2003 as a base, new price index definitions are being used. The new definition of CPI is made, as new products are added to index due to the increasing foreign trade. For PPI, prices out of tax are being used and these definitions increased index sensitivity to exchange rate and imported goods (oil prices). Instead of gross mass data in Table 3.1, correlation of variables is given in Table 3.2. While correlation between the changes in crude oil and CPI came out to be negative, this correlation is positive with PPI that is in conformity with our expectations. We can say that oil prices affect CPI negatively because CPI items are not dependent to oil as much as PPI does and (TL) YTL appreciated since 2002. If we take 2005 as a base instead of 2002, we see that effects of oil prices on CPI become positive. Works done by CBTR shows that increases in oil prices raised 2005 inflation rate 1.56% (TCMB, 2005 Monetary Policy Report-II).

Table 3.2: Correlation Between Exchange Rate, Oil Prices and Price Indexes

	BRENT	FOREIGN CURRENCY	CPI	PPI
BRENT	1.000000	-0.049323	-0.069993	0.185367
FROIGN CURRENCY	-0.049323	1.000000	0.468614	0.760330
CPI	-0.069993	0.468614	1.000000	0.444015
PPI	0.185367	0.760330	0.444015	1.000000

Changes occurred in exchange rate also has a parallel effect on oil prices, affecting prices and expectations. In literature, this is named as "pass-through effect" (Swamy & Thurman, 1994). For Turkish economy, this is a significant effect. There is a positive correlation between exchange rate and CPI/PPI. Accordingly, exchange rate appreciations meanwhile increase inflation. It is stated that pass-through effect of exchange rates in Turkey on inflation is around 40-60% (Baydur & Baldemir, 2004). It is known that, appreciation of YTL has both direct and indirect effects that lead to a significant decline in inflation. However, in May 2006, exchange rate

fluctuations showed that exchange rates have a significant pass-through effect on prices/inflation.

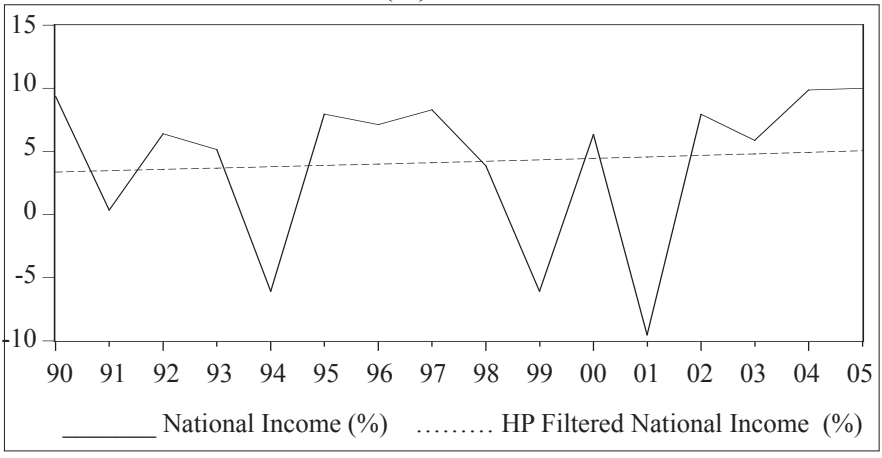
By May 2006, depression of foreign business cycle, USA and Japan's increasing/expectations to increase interest rates declined Turkey's attraction. Besides, increases in raw material prices made CBRT's struggle with inflation harder. After negative expectations on Turkish economy came to body on May 2006, outflow of capital occurred and YTL significantly depreciated (30%). Such depreciation appreciates inflation and inflationary expectations in economies such as Turkey that are dependent to foreign input. Inflation expectations occurred much above the 5% target and reached 10% (2006 Inflation Report-III). As a result of increasing inflation and corrupted expectations, CBRT appreciated real O/N interest rates from 13% to 26%. With its interest rate increasing policy according to these corrupted expectations, CBRT plans in mid-term to achieve its 5% inflation target (CBRT finds this target 70% probable) (2006 Inflation Report-III). Many factors out of CBRT make the fight against inflation and achieving the inflation target harder. Despite the flexible exchange rate regime, it is hard to gain credibility under the conditions in Turkey. From the point of inflation targeting, flexible exchange rate regime does not solve the whole problems.

Theoretically, flexible exchange rate regime is suitable for inflation targeting. However, in practice, it may not succeed in its duty. For instance, flexible regimes may cause exchange rates to appreciate because of interest rate policies used during the struggle with inflation. From the point of inflation targeting, there is no ideal exchange rate regime. Under two circumstances, monetary authorities can prefer a flexible regime. If the exchange rates change quickly or the rates fluctuate significantly, a mid-regime which is more flexible than fixed regime can be preferred. Secondly, in an economy with incompatible achievements, it is better to select more than one anchor for inflation targeting. For inflation targeting, an interventionist exchange regime is more effective than flexible exchange rate regime in countries that have a declining inflation together with appreciated currency (Truman, 2003). There is not such a tool in economics that can be used to achieve whole targets simultaneously. This is named as Tinbergen Rule in

economics. Hence, while interest rate policy and inflation is controlled in Turkey, some negative developments may occur such as appreciation of money owing to the flow of foreign capital. Such developments may harm the economy and the inflation target, as it happened during May 2006 turbulence.

Shocks more or less affect price indexes in Turkey, yet what determines the permanency of the shocks is output gap. We should evaluate CBRT's interest rate increasing policy due to how oil and exchange rate shocks change. Therefore, determining permanency of the shocks occurred and level of distortions in economy -whether it deepened or not- is a significant empirical problem to be solved for responding discussions on CBRT's inflation target revising. According to the model, for claiming that CBRT should revise its inflation target for 2006, one should prove that there is a positive relationship between oil price, exchange rate changes and output gap, namely, the shocks are permanent. So that, we took 1990-2005 periods as a base to test the relations of crude oil price and exchange rate with output gap in Turkish economy. To figure output gap, we use a simple filtering method, HP filter, and calculated long term output growth rate. For Turkey, we reached the output gap by subtracting adjusted growth rates and effective growth rates. The results of this calculation are given in Figure 3.1.

Figure 3.1: National Income Growth Rate, HP Filter and Adjusted National Income Growth Rate (%)



Regression results between annual changes in oil prices -taken from OPEC- and output gap is given in Table 3.3. According to data's in Table 3.3, there is 10% significance level and statistically positive relation between output gap and oil prices. Therefore, oil shocks increases output gap (the lack of compatibility and flexibility of markets) and forces CBRT to revise inflation targets (CBRT, 2006 Inflation report -II). Likewise, CBRT declared that position of CBRT will be revising inflation target if there occurs a significant oil shock. Hence, according to the shock, the central bank increased the interest rates and revised its inflation targets for 2006. CBRT claimed that by the help of interest rate and other economic policies, it will achieve its inflation target in mid-term and by the end of 2007. Interest rate appreciation policy is seen as a policy that both avoids the corruption of expectations and reduces aggregate demand. However in foreign resource dependent economies such as Turkey, this can be seen as an effort for creating new flows of hot money to decline the inflation (Baydur, 2006-a, Baydur 2006-b; Berksoy, 2001, Kansu, 2005). Right policy to prepare an inflation targeting program considering oil shocks' negative effect on output gap in Turkey is to start with a higher inflation (Ito & Hayati, 2003) target and keep the interest rates stabile in spite of the shocks. Because CBRT did not determine such a policy, it had to revise its inflation target in 2006. This means a loss of credibility for the central bank. (Baydur, Süslü, Bekmez, 2005).

Table 3.3: Output Gap and Oil Prices

Dependent Variable: Output Gap				
Method: Least Squares				
Period: 1990-2005				
Number of Observations: 15				
Output Gap =C(1)+ C(2)*Oil Prices				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-9.778116	5.878477	-1.663376	0.1201
C(2)	0.374774	0.217876	1.720127	0.1091
R-squared	0.185404	Mean dependent var		-7.85E-13
Adjusted R-squared	0.122743	S.D. dependent var		6.192404
S.E. of regression	5.799929	Akaike info criterion		6.477134
Sum squared resid	437.3092	Schwarz criterion		6.571541
Log likelihood	-46.57851	F-statistic		2.958838
Durbin-Watson stat	2.489015	Prob(F-statistic)		0.109109

Table 3.4: Regression Between Output Gap and Exchange Rate

Dependent Variable: Output Gap				
Method: Least Squares				
Period: 1990-2005				
Number of Observations: 14				
DOutput Gap =C(1)+C(2)*Dexchange Rate (TL-Dollar)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.678270	1.418355	-0.478209	0.6411
C(2)	-0.132830	0.022667	-5.860064	0.0001
R-squared	0.741046	Mean dependent var		0.065196
Adjusted R-squared	0.719467	S.D. dependent var		9.979584
S.E. of regression	5.285724	Akaike info criterion		6.299460
Sum squared resid	335.2665	Schwarz criterion		6.390754
Log likelihood	-42.09622	F-statistic		34.34035
Durbin-Watson stat	2.253874	Prob(F-statistic)		0.000077

D= First Difference

Analyzing of Table 3.4 is significant. We found autocorrelation at level of output gap equation then we took first difference and we run regression again. The equation achieved can define % 74 of the relationship between output gap and exchange rates. The regression equation chosen according to F value is suitable statistically and there is no autocorrelation. The interesting point about the regression occurred is that there is an inverse relationship between output gap (lack of compatibility and flexibility of markets in Turkey) and exchange rate. If this result is interpreted according to the theoretical model, shocks occurred in exchange rates decline output gap (distortion) and reduce deviation between inflation targeted by CBRT and effective inflation. Accordingly, exchange rate shocks serve declining of output gap in Turkey. Exchange rate shocks are advantageous for the central bank by means of reducing inflation. Hence, as exchange rate shocks decline output gap, it helps to reduce the inflation target in Turkey. The exchange rate shocks in Turkey are a factor which serves the stability in inflation. Even if exchange rate shocks affect the inflation negatively because of the pass-through effect in short term, it serves to decline inflation by reducing output gap in long term.

We can explain how exchange rate shocks decline inflation as: increasing completion efficiency due to the Turkish currency depreciation has two effects. In one hand it improves export; on the other hand it leads to reduce import by

increasing usage of domestic import. This contributes significantly to improvements of balance of payment, usage of more domestic resource in economy, increasing employment and also positive changes in expectations about Turkish economy. The factors such as balance of payment that improved, increasing completion efficiency and employment increases potential output growth rate and this increase effects prices and expectations positively. To sum up, this provides lower inflation rates.

IV. Conclusion

The issues on revising of inflation target are determined whether shocks' effects on output gap (lack of compatibility and flexibility of markets) are permanent or not. In the light of this information, oil and exchange shocks' effects on output gap were tested in this work for Turkish economy, based on years of 1990-2005. According to test results, since both oil shock and exchange shock effect output gap, it was determined that the shocks in question were permanent shocks. CBRT both revised inflation target and increased interest rates according to oil shocks that widened output gap. According to test results, exchange rate shocks are also permanent. But it reduces output gap. CBRT has chosen the policy of increasing interest rates according to exchange rate and oil shocks, while it pressurized the exchange rate appreciation. According to CBRT, it is the right choice to apply high interest policy and revise inflation target for 2006. According to CBRT, with the high interest policy followed, it will again reach the %5 of inflation, targeted by the end of 2007.

The monetary policies followed by CBRT can be criticized in two ways. Firstly, in economies where occurs fluctuations or instability, aims and targets should not be determined as points but as tendencies or wide bands. In order to be flexible, a central bank targeting inflation should determine inflation not as a point but inside a band. Width of these bands depends on economy's level of effect from shocks. 2006 May turbulence could not absorb the target of CBRT which has a band of +,-% 2 above and below the target. Due to the fact that inflation and its expectations exceeded the band, CBRT revised its inflation target. In some terms, the inflation target may be missed and can be revised. The main condition

for avoiding the loss of credibility is not to repeat these revisions continuously. In order not to meet with a loss of credibility, CBRT needs to design higher inflation target and wider bands by taking into account Turkish economy's sensitiveness according to shocks.

Secondly, Turkish Lira TL (YTL) appreciated significantly during 2003-2006. Although appreciation of TL (YTL) affected the inflation positively, it had a negative effect on competitiveness. We can say that, protecting competitiveness of Turkish economy and applicability of inflation targeting regime requires a more realistic inflation target. Although a high inflation target and a wider band implementation require high cost in short run due to the transition effect of exchange rates, in long run it assists achieving the inflation target. Such an approach is more suitable for Turkish economy. However, policies followed by the central bank could not decline the output gap (lack of compatibility and flexibility of markets) because of the circumstances occurred in 2006 May. Contrarily it has an appreciation effect. CBRT, hesitating from transition affect of exchange rate, increased the interest rates. Also CBRT sold foreign currency and bought YTL by repurchased stock in order to increase its foreign resource revenue, in other words, to guarantee the flow of foreign resource. To sum up, high interest rate policy followed by CBRT, on the one hand declined inflation. On the other hand, by this policy CBRT tried to sustain economic growth. We can say that, by 2006 May, CBRT implemented its interest rate policy in order to create suitable conditions for short term capitals and survive inflation targeting program. Besides, the decline in oil prices in the following months of 2006 made it easier for CBRT to fight against inflation. But current monetary and exchange rate policy makes this fight complicated by increasing output gap in the long term. On the other hand, these policies cause problems such as increasing imbalances of payment. Increasing imbalances of payment is significant for Turkey as a deficit above a specific rate may cause a crisis in Turkey. Concerning the past of Turkish economy, we can say that monetary and exchange rate policies, namely inflation targeting that covers the other needs of the economy (balance of payments, output growth and unemployment) will be the right choice in the long run.

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GLOBAL CAPITAL MARKETS

The global economy continued to expand in the first half of 2007. Although growth in the US slowed in the first quarter, the economy rebounded strongly in the second quarter. In the Euro area economy has been expanding at about 3 percent year on year since the middle of 2006. Growth has been driven by a broad-based acceleration in investment spending, especially in Germany. The Japanese economy contracted slightly in the second quarter of 2007, following two quarters of strong gains. The decline in real GDP in the second quarter was driven largely by declines in investment and weaker consumption growth. Emerging market countries have continued to expand robustly led by rapid growth in China, India and Russia.

Following some volatility experienced in the equity markets in the first quarter of 2007, the emerging equity markets rallied with record highs in mid—2007. However, influenced by global developments, due to concerns over the housing market and their implications for U.S. growth, the Asian equity markets declined by 10-20 percent by mid-August.

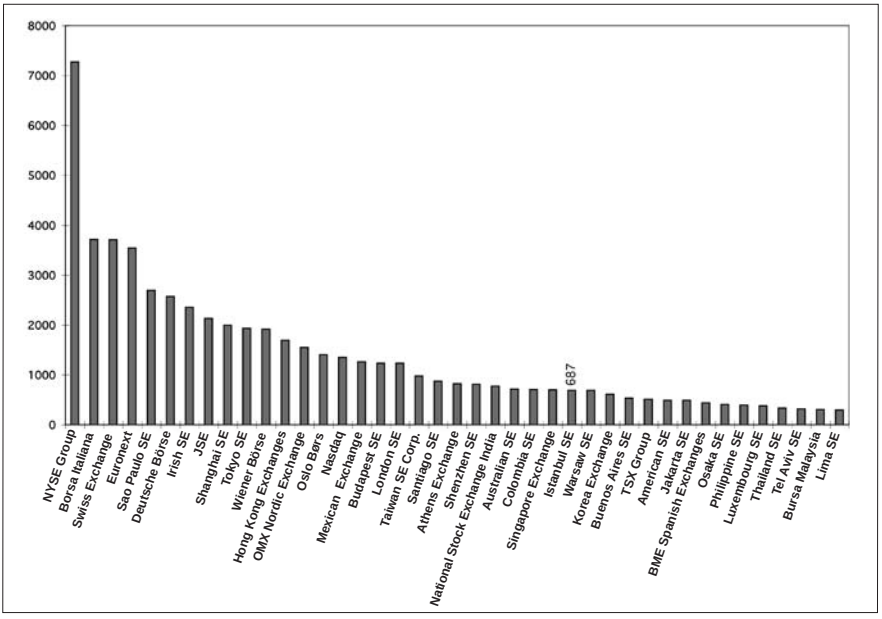
The performances of some developed stock markets with respect to indices indicated that DJIA, FTSE-100, Nikkei-225 and DAX changed by 8.9%, 10.5%, 2.5% and 26.5% respectively at July 4th, 2007 in comparison with the December 29, 2006. When US $ based returns of some emerging markets are compared in the same period, the best performer markets were: China (46.2 %), Poland (39.9 %), Brazil (39.9 %), Pakistan (39.3 %) and Turkey (38.7 %). In the same period, the lowest return markets were: Saudi Arabia (-9.6 %), Russia (1.1 %), Argentina (6.9 %), and Colombia (9.1 %). The performances of emerging markets with respect to P/E ratios as of end-June 2007 indicated that the highest rates were obtained in China (34.6), Taiwan (28.6), Chile (24.2), Czech Rep. (23.6) and Indonesia (23.0) and the lowest rates in Thailand (10.1), Brazil (13.6), Argentina (14.5), Korea (15.2), Hungary (15.6).

Market Capitalization (USD Million, 1986-2006)

	Global	Developed Markets	Emerging Markets	ISE
1986	6.514.199	6.275.582	238.617	938
1987	7.830.778	7.511.072	319.706	3.125
1988	9.728.493	9.245.358	483.135	1.128
1989	11.712.673	10.967.395	745.278	6.756
1990	9.398.391	8.784.770	613.621	18.737
1991	11.342.089	10.434.218	907.871	15.564
1992	10.923.343	9.923.024	1.000.319	9.922
1993	14.016.023	12.327.242	1.688.781	37.824
1994	15.124.051	13.210.778	1.913.273	21.785
1995	17.788.071	15.859.021	1.929.050	20.782
1996	20.412.135	17.982.088	2.272.184	30.797
1997	23.087.006	20.923.911	2.163.095	61.348
1998	26.964.463	25.065.373	1.899.090	33.473
1999	36.030.810	32.956.939	3.073.871	112.276
2000	32.260.433	29.520.707	2.691.452	69.659
2001	27.818.618	25.246.554	2.572.064	47.689
2002	23.391.914	20.955.876	2.436.038	33.958
2003	31.947.703	28.290.981	3.656.722	68.379
2004	38.904.018	34.173.600	4.730.418	98.299
2005	43.642.048	36.538.248	7.103.800	161.537
2006	54.194.991	43.736.409	10.458.582	162.399

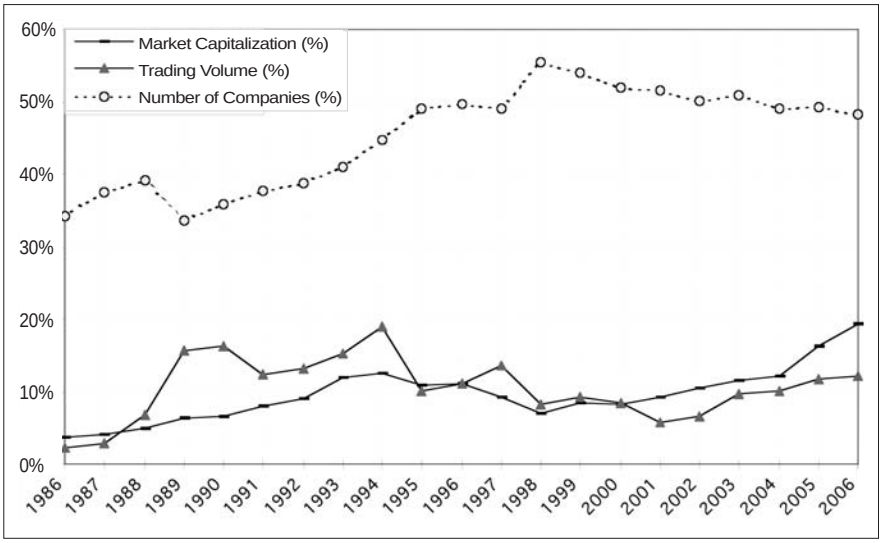
Source: Standard & Poor's Global Stock Markets Factbook, 2007.

Comparison of Average Market Capitalization Per Company (USD Million, June 2007)



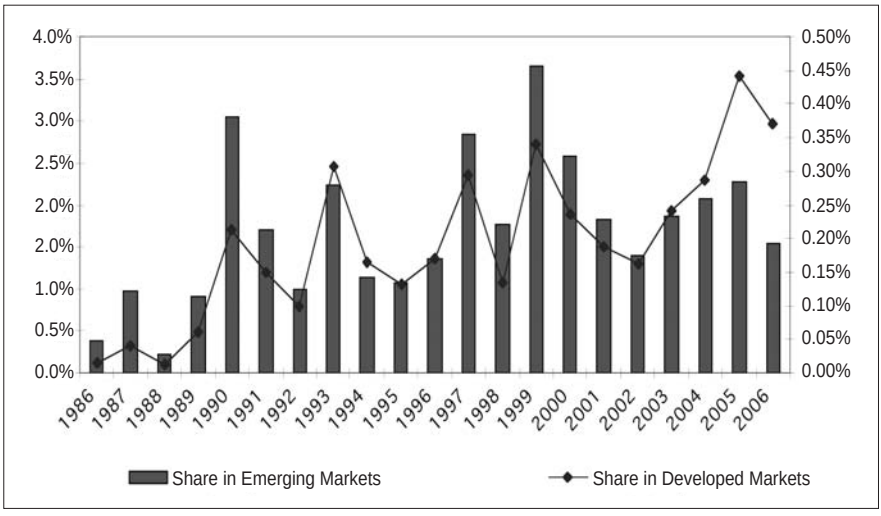
Source: FIBV, Monthly Statistics, June 2007.

Worldwide Share of Emerging Capital Markets (1986-2006)



Source: Standard & Poor's Global Stock Markets Factbook, 2007.

Share of ISE's Market Capitalization World Markets (1986-2006)



Source: Standard & Poor's Global Stock Markets Factbook, 2007

Main Indicators of Capital Markets (June 2007)

	Market	Monthly Turnover Velocity (June 2007) (%)	Market	Value of Share Trading (millions, US$) Up to Year Total (2006/1-2007/6)	Market	Market Cap. of Share of Domestic Companies (millions US$) June 2007
1	Shenzhen SE	373,3%	NYSE Group	13.110.920	NYSE Group	16.603.601,2
2	NASDAQ	269,3%	NASDAQ	6.856.640	Tokyo SE	4.681.045,7
3	Shanghai SE	206,6%	London SE	5.556.848	Euronext	4.240.062,1
4	(BME) Spanish Exc	190,1%	Tokyo SE	3.255.246	NASDAQ	4.182.155,2
5	Deutsche Börse	187,6%	Euronext	2.701.580	London SE	4.036.985,8
6	Borsa Italiana	179,1%	Deutsche Börse	2.124.083	Hong Kong Exch	2.027.997,7
7	Korea Exchange	163,8%	Shanghai SE	2.060.972	TSX Group	1.980.838,5
8	NYSE	141,9%	(BME) Spanish Exc	1.488.404	Deutsche Börse	1.956.078,6
9	Oslo Børs	141,1%	Borsa Italiana	1.198.862	Shanghai SE	1.693.017,3
10	London SE	135,2%	Shenzhen SE	1.076.703	(BME) Spanish Exc	1.519.587,6
11	OMX Nordic Exchange	133,4%	Swiss Exchange	945.418	Australian SE	1.355.556,1
12	Taiwan SE Corp	130,3%	OMX Nordic Exch	936.240	Swiss Exchange	1.290.048,0
13	Tokyo SE	126,2%	Korea Exchange	844.475	OMX Nordic Exch	1.289.738,3
14	Istanbul SE	124,5%	TSX Group	752.757	Borsa Italiana	1.099.723,3
15	Swiss Exchange	118,4%	Hong Kong Exch	730.301	Korea Exchange	1.042.158,6
16	Euronext	117,9%	Australian SE	627.151	Bombay SE	1.023.454,0
17	Budapest SE	95,8%	Taiwan SE Corp	410.120	Sao Paulo SE	1.007.839,9
18	Australian SE	92,4%	American SE	283.206	National Stock Exchange India	976.829,1
19	TSX Group	78,1%	Oslo Børs	259.417	JSE	795.970,1
20	Hong Kong Exchanges	68,6%	National Stock Exchange India	258.623	Taiwan SE Corp	668.969,8
21	Irish SE	68,2%	Sao Paulo SE	236.463	Singapore Exch	505.588,6
22	Singapore Exch	64,1%	JSE	187.170	Shenzhen SE	490.463,9
23	Thailand SE	62,2%	Singapore Exchange 2	170.471	Mexican Exchange	422.300,6
24	National Stock Exchange India	59,4%	Bombay SE	124.789	Oslo Børs	339.723,5
25	Osaka SE	58,5%	Istanbul SE	124.115	Bursa Malaysia	306.960,0
26	Athens Exchange	55,1%	Osaka SE	110.173	American SE	284.582,0
27	Jakarta SE	51,9%	Bursa Malaysia	93.960	Athens Exchange	232.665,5
28	Bursa Malaysia	51,2%	Athens Exchange	74.770	Wiener Börse	224.034,3
29	Wiener Börse	50,7%	Irish SE	67.897	İstanbul SE	221.282,4
30	Cairo & Alexandria SEs	50,3%	Wiener Börse	63.968	Santiago SE	214.515,4
31	Sao Paulo SE	49,6%	Mexican Exchange	58.625	Warsaw SE	211.936,2
32	Tel-Aviv SE	48,5%	Tel Aviv SE	48.709	Tel Aviv SE	202.742,4
33	New Zealand Exchange	46,8%	Jakarta SE	46.772	Osaka SE	191.644,2
34	JSE	45,6%	Thailand SE	45.058	Irish SE	174.357,6
35	Warsaw SE	44,2%	Warsaw SE	44.023	Thailand SE	172.652,0
36	Cyprus SE	34,3%	Budapest SE	23.769	Jakarta SE	166.685,1
37	Colombia SE	28,7%	Cairo & Alexandria	23.228	Cairo & Alexandria	105.722,6
38	Mexican Exchange	28,6%	Santiago SE	21.954	Luxembourg SE	96.863,2
39	Philippine SE	27,7%	Philippine SE	13.829	Philippine SE	94.117,3
40	Bombay SE	27,5%	New Zealand	11.755	Colombia SE	65.011,2
41	Santiago SE	21,1%	Colombia SE	8.585	Lima SE	64.810,9
42	Ljubljana SE	17,8%	Lima SE	5.853	Buenos Aires SE	56.800,8
43	Tehran SE	16,9%	Tehran SE	3.513	New Zealand	51.991,1
44	Lima SE	16,8%	Cyprus SE	3.040	Budapest SE	50.626,6
45	Colombo SE	14,8%	Buenos Aires SE	2.988	Tehran SE	38.272,6

Source: FIBV, Monthly Statistics, June 2007.

Trading Volume (USD millions, 1986-2006)

	Global	Developed	Emerging	ISE	Emerging/ Global (%)	ISE/ Emerging (%)
1986	3.573.570	3.490.718	82.852	13	2,32	0,02
1987	5.846.864	5.682.143	164.721	118	2,82	0,07
1988	5.997.321	5.588.694	408.627	115	6,81	0,03
1989	7.467.997	6.298.778	1.169.219	773	15,66	0,07
1990	5.514.706	4.614.786	899.920	5.854	16,32	0,65
1991	5.019.596	4.403.631	615.965	8.502	12,27	1,38
1992	4.782.850	4.151.662	631.188	8.567	13,20	1,36
1993	7.194.675	6.090.929	1.103.746	21.770	15,34	1,97
1994	8.821.845	7.156.704	1.665.141	23.203	18,88	1,39
1995	10.218.748	9.176.451	1.042.297	52.357	10,20	5,02
1996	13.616.070	12.105.541	1.510.529	37.737	11,09	2,50
1997	19.484.814	16.818.167	2.666.647	59.105	13,69	2,18
1998	22.874.320	20.917.462	1.909.510	68.646	8,55	3,60
1999	31.021.065	28.154.198	2.866.867	81.277	9,24	2,86
2000	47.869.886	43.817.893	4.051.905	179.209	8,46	4,42
2001	42.076.862	39.676.018	2.400.844	77.937	5,71	3,25
2002	38.645.472	36.098.731	2.546.742	70.667	6,59	2,77
2003	29.639.297	26.743.153	2.896.144	99.611	9,77	3,44
2004	39.309.589	35.341.782	3.967.806	147.426	10,09	3,72
2005	47.319.584	41.715.492	5.604.092	201.258	11,84	3,59
2006	67.912.153	59.685.209	8.226.944	227.615	12,11	2,77

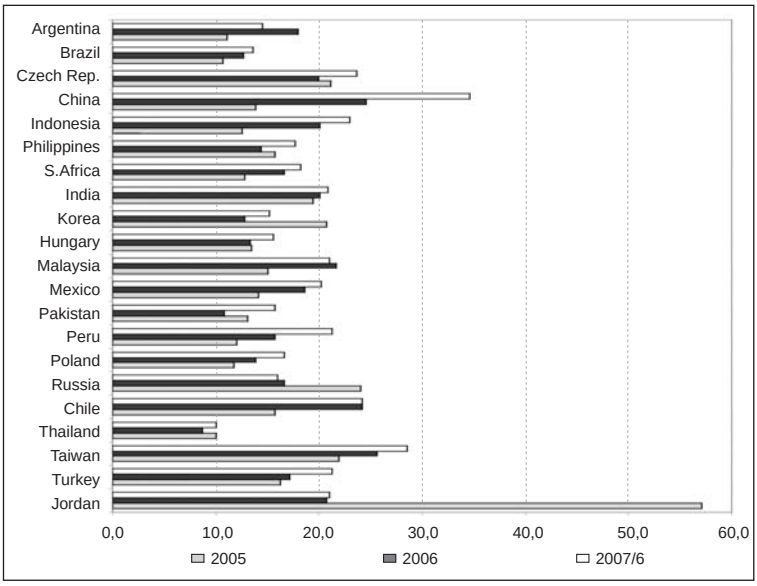
Source: Standard & Poor's Global Stock Markets Factbook, 2007.

Number of Trading Companies (1986-2006)

	Global	Developed Markets	Emerging Markets	ISE	Emerging/ Global (%)	ISE/Emerging (%)
1986	28.173	18.555	9.618	80	34,14	0,83
1987	29.278	18.265	11.013	82	37,62	0,74
1988	29.270	17.805	11.465	79	39,17	0,69
1989	25.925	17.216	8.709	76	33,59	0,87
1990	25.424	16.323	9.101	110	35,80	1,21
1991	26.093	16.239	9.854	134	37,76	1,36
1992	27.706	16.976	10.730	145	38,73	1,35
1993	28.895	17.012	11.883	160	41,12	1,35
1994	33.473	18.505	14.968	176	44,72	1,18
1995	36.602	18.648	17.954	205	49,05	1,14
1996	40.191	20.242	19.949	228	49,64	1,14
1997	40.880	20.805	20.075	258	49,11	1,29
1998	47.465	21.111	26.354	277	55,52	1,05
1999	48.557	22.277	26.280	285	54,12	1,08
2000	49.933	23.996	25.937	315	51,94	1,21
2001	48.220	23.340	24.880	310	51,60	1,25
2002	48.375	24.099	24.276	288	50,18	1,19
2003	49.855	24.414	25.441	284	51,03	1,12
2004	48.806	24.824	23.982	296	49,14	1,23
2005	49.946	25.337	24.609	302	49,27	1,23
2006	50.212	25.954	24.258	314	48,31	1,29

Source: Standard & Poor's Global Stock Markets Factbook, 2007.

Comparison of P/E Ratios Performances



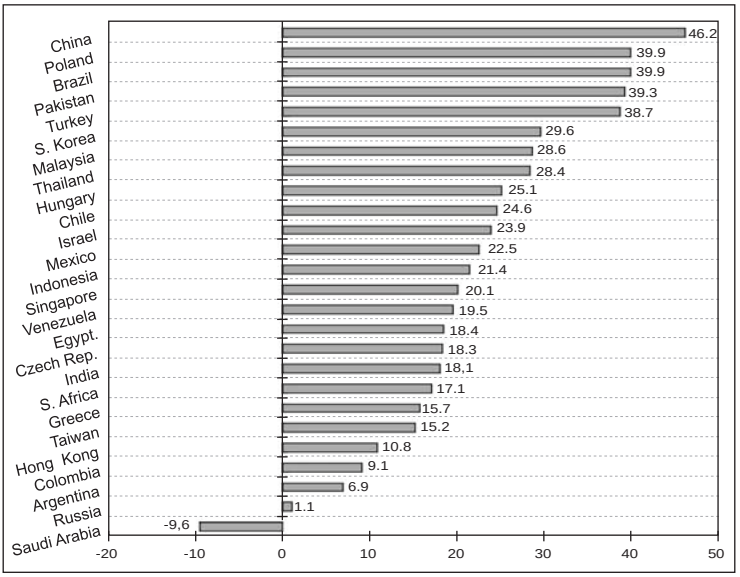
Source: IFC Factbook 2001. Standard & Poor's, Emerging Stock Markets Review, June 2007.

Price-Earnings Ratios in Emerging Markets

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007/6
Argentina	13,4	39,4	-889,9	32,6	-1,4	21,1	27,7	11,1	18,0	14,5
Brazil	7,0	23,5	11,5	8,8	13,5	10,0	10,6	10,7	12,7	13,6
Chile	15,1	35,0	24,9	16,2	16,3	24,8	17,2	15,7	24,2	24,2
China	23,8	47,8	50,0	22,2	21,6	28,6	19,1	13,9	24,6	34,6
Czech Rep.	-11,3	-14,9	-16,4	5,8	11,2	10,8	25,0	21,1	20,0	23,6
Hungary	17,0	18,1	14,3	13,4	14,6	12,3	16,6	13,5	13,4	15,6
India	13,5	25,5	16,8	12,8	15,0	20,9	18,1	19,4	20,1	20,9
Indonesia	-106,2	-7,4	-5,4	-7,7	22,0	39,5	13,3	12,6	20,1	23,0
Jordan	15,9	14,1	13,9	18,8	11,4	20,7	30,4	6,2	20,8	21,0
Korea	-47,1	-33,5	17,7	28,7	21,6	30,2	13,5	20,8	12,8	15,2
Malaysia	21,1	-18,0	91,5	50,6	21,3	30,1	22,4	15	21,7	21,0
Mexico	23,9	14,1	13,0	13,7	15,4	17,6	15,9	14,2	18,6	20,2
Pakistan	7,6	13,2	-117,4	7,5	10,0	9,5	9,9	13,1	10,8	15,7
Peru	21,1	25,7	11,6	21,3	12,8	13,7	10,7	12,0	15,7	21,3
Philippines	15,0	22,2	26,2	45,9	21,8	21,1	14,6	15,7	14,4	17,7
Poland	10,7	22,0	19,4	6,1	88,6	-353,0	39,9	11,7	13,9	16,7
Russia	3,7	-71,2	3,8	5,6	12,4	19,9	10,8	24,1	16,6	16,0
S. Africa	10,1	17,4	10,7	11,7	10,1	11,5	16,2	12,8	16,6	18,2
Taiwan	21,7	52,5	13,9	29,4	20,0	55,7	21,2	21,9	25,6	28,6
Thailand	-3,6	-12,2	-6,9	163,8	16,4	16,6	12,8	10,0	8,7	10,1
Turkey	7,8	34,6	15,4	72,5	37,9	14,9	12,5	16,2	17,2	21,3

Source: IFC Factbook, 2004; Standard&Poor's, Emerging Stock Markets Review, June 2007
Note: Figures are taken from S&P/IFCG Index Profile.

Comparison of Market Returns in USD (29/12/2006-04/07/2007)



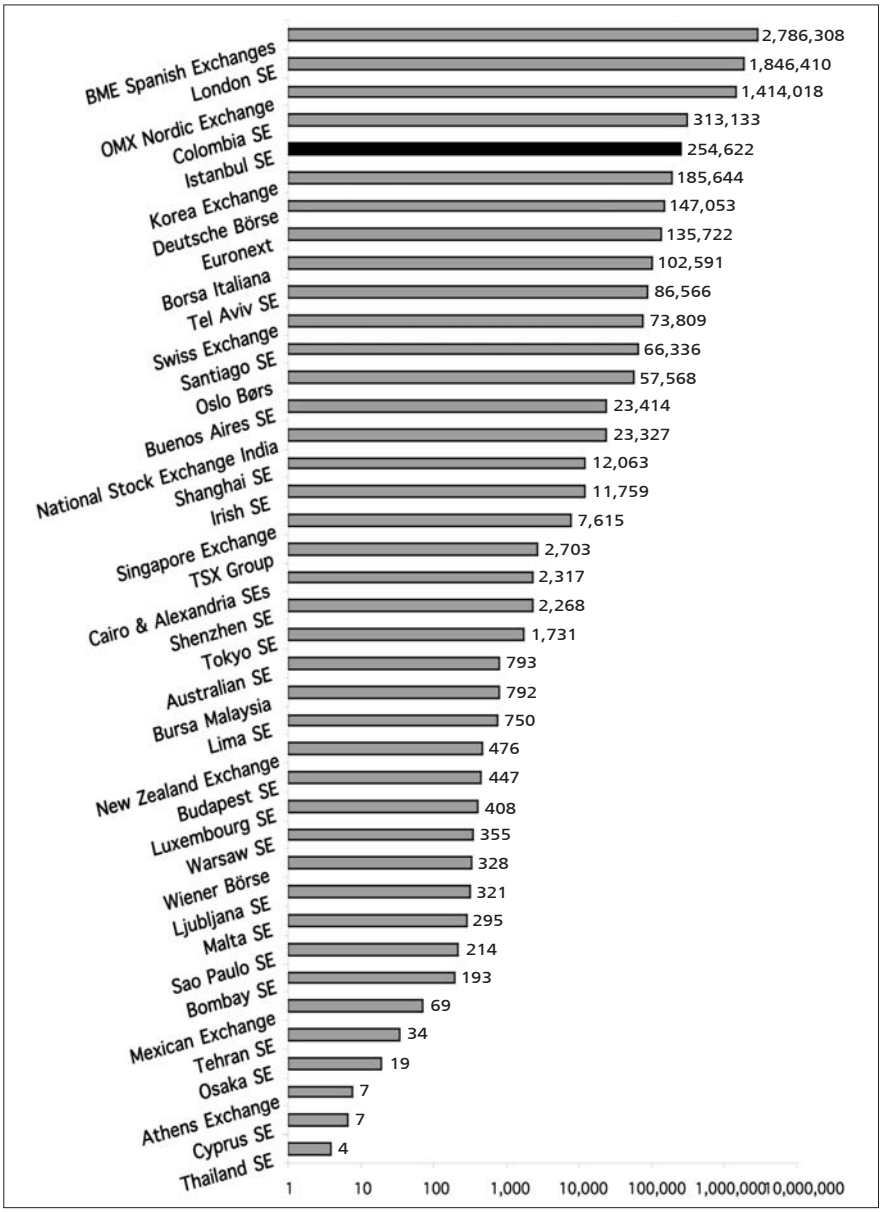
Source: The Economist, Jul 7th 2007.

Market Value/Book Value Ratios

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007/6
Argentina	1,3	1,5	0,9	0,6	0,8	2,0	2,2	2,5	4,1	3,4
Brazil	0,6	1,6	1,4	1,2	1,3	1,8	1,9	2,2	2,7	2,7
Chile	1,1	1,7	1,4	1,4	1,3	1,9	0,6	1,9	2,4	2,7
China	2,1	3,0	3,6	2,3	1,9	2,6	2,0	1,8	3,1	4,4
Czech Rep.	0,7	0,9	1,0	0,8	0,8	1,0	1,6	2,4	2,4	2,8
Hungary	3,2	3,6	2,4	1,8	1,8	2,0	2,8	3,1	3,1	3,6
India	1,8	3,3	2,6	1,9	2,0	3,5	3,3	5,2	4,9	5,3
Indonesia	1,5	3,0	1,7	1,7	1,0	1,6	2,8	2,5	3,4	3,9
Jordan	1,8	1,5	1,2	1,5	1,3	2,1	3,0	2,2	3,3	3,3
Korea	0,9	2,0	0,8	1,2	1,1	1,6	1,3	2,0	1,7	2,1
Malaysia	1,3	1,9	1,5	1,2	1,3	1,7	1,9	1,7	2,1	2,4
Mexico	1,4	2,2	1,7	1,5	1,5	2,0	2,5	2,9	3,8	4,0
Pakistan	0,9	1,4	1,4	0,9	1,9	2,3	2,6	3,5	3,2	4,6
Peru	1,6	1,5	1,1	1,4	1,2	1,8	1,6	2,2	3,5	6,2
Philippines	1,3	1,4	1,0	0,9	0,8	1,1	1,4	1,7	1,9	2,7
Poland	1,5	2,0	2,2	1,4	1,3	1,8	2,0	2,5	2,5	3,0
Russia	0,3	1,2	0,6	1,1	0,9	1,2	1,2	2,2	2,5	2,4
S.Africa	1,5	2,7	2,1	2,1	1,9	2,1	2,5	3,0	3,8	4,2
Taiwan	2,6	3,4	1,7	2,1	1,6	2,2	1,9	1,9	2,4	2,7
Thailand	1,2	2,1	1,3	1,3	1,5	2,8	2,0	2,1	1,9	2,2
Turkey	2,7	8,9	3,1	3,8	2,8	2,6	1,7	2,1	2,0	2,3

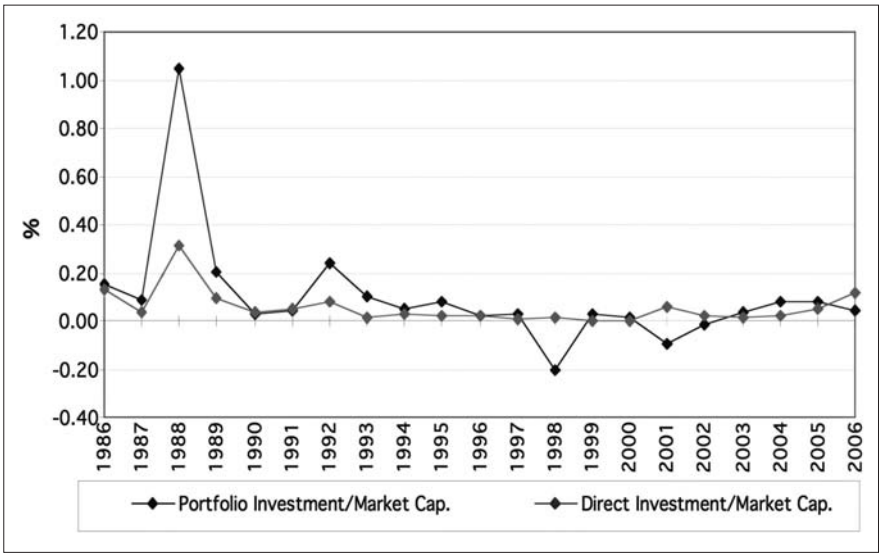
Source: IFC Factbook, 2004; Standard & Poor's, Emerging Stock Markets Review, June 2007.
Note: Figures are taken from S&P/IFCG Index Profile.

Value of Bond Trading (Milyon USD, Jan. 2007-June 2007)



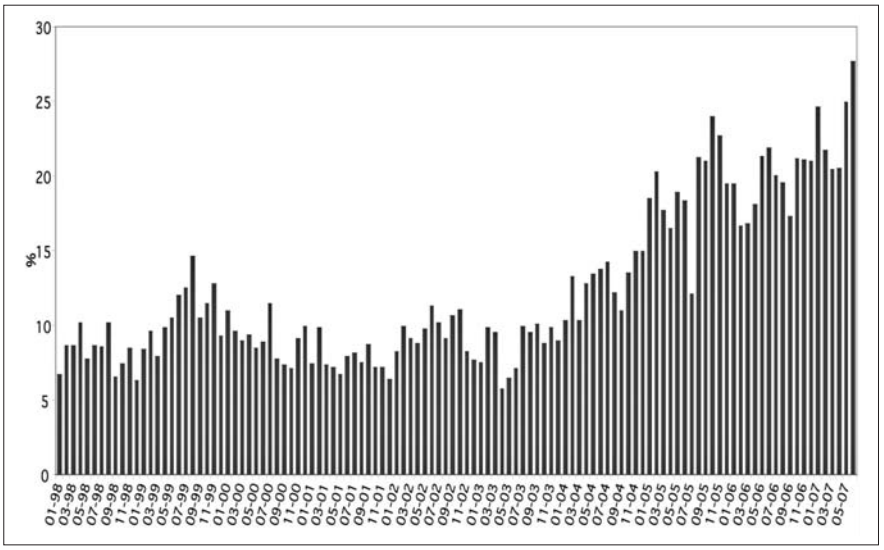
Source: FIBV, Monthly Statistics, June 2007.

Foreign Investments as a Percentage of Market Capitalization in Turkey (1986-2006)



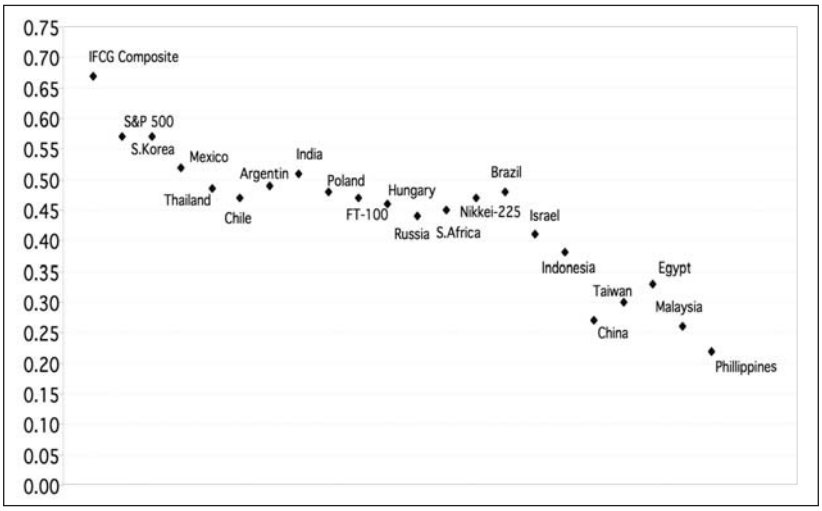
Source: ISE Data.CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE (Jan. 1998-June 2007)



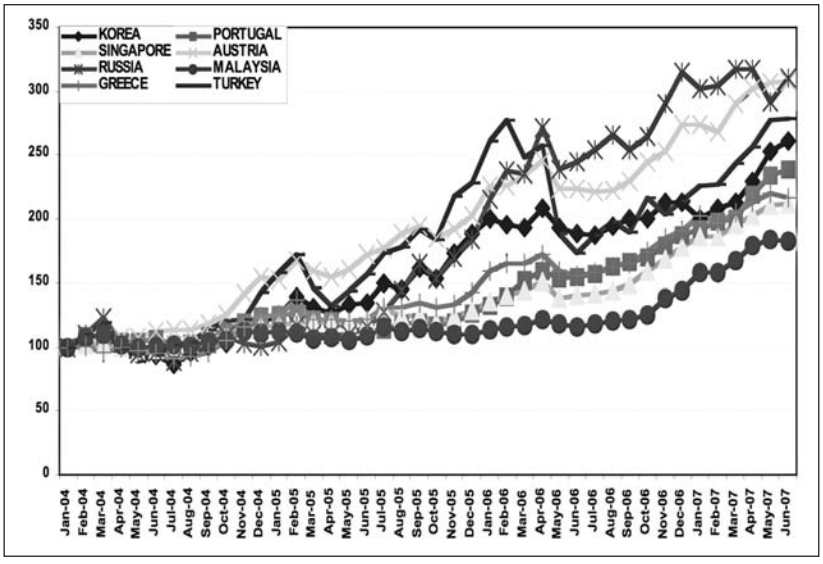
Source: ISE Data.

Price Correlations of the ISE (June 2002-June 2007)



Source: Standard & Poor's, Emerging Stock Markets Review, June 2007.
Notes : The correlation coefficient is between -1 and +1. If it is zero for the given period it is implied that there is no relation between two serious of returns.

Comparison of Market Indices (31 Jan. 2004 =100)



Source: Bloomberg
Note: Comparisons are in US$.

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ISE
Market Indicators

	STOCK MARKET										
	Number of Companies	Traded Value				Market Value		Dividend Yield	P/E Ratios		
		Total		Daily Averaga							
		YTL Million	US$ Million	YTL Million	US$ Million	YTL Million	US$ Million	(%)	YTL(1)	YTL(2)	US$
1986	80	0,01	13	---	---	0,71	938	9,15	5,07	---	---
1987	82	0,10	118	---	---	3	3.125	2,82	15,86	---	---
1988	79	0,15	115	---	---	2	1.128	10,48	4,97	---	---
1989	76	2	773	0,01	3	16	6.756	3,44	15,74	---	---
1990	110	15	5.854	0,06	24	55	18.737	2,62	23,97	---	---
1991	134	35	8.502	0,14	34	79	15.564	3,95	15,88	---	---
1992	145	56	8.567	0,22	34	85	9.922	6,43	11,39	---	---
1993	160	255	21.770	1	88	546	37.824	1,65	25,75	20,72	14,86
1994	176	651	23.203	3	92	836	21.785	2,78	24,83	16,70	10,97
1995	205	2.374	52.357	9	209	1.265	20.782	3,56	9,23	7,67	5,48
1996	228	3.031	37.737	12	153	3.275	30.797	2,87	12,15	10,86	7,72
1997	258	9.049	58.104	36	231	12.654	61.879	1,56	24,39	19,45	13,28
1998	277	18.030	70.396	73	284	10.612	33.975	3,37	8,84	8,11	6,36
1999	285	36.877	84.034	156	356	61.137	114.271	0,72	37,52	34,08	24,95
2000	315	111.165	181.934	452	740	46.692	69.507	1,29	16,82	16,11	14,05
2001	310	93.119	80.400	375	324	68.603	47.689	0,95	108,33	824,42	411,64
2002	288	106.302	70.756	422	281	56.370	34.402	1,20	195,92	26,98	23,78
2003	285	146.645	100.165	596	407	96.073	69.003	0,94	14,54	12,29	13,19
2004	297	208.423	147.755	837	593	132.556	98.073	1,37	14,18	13,27	13,96
2005	304	269.931	201.763	1.063	794	218.318	162.814	1,71	17,19	19,38	19,33
2006	316	325.131	229.642	1.301	919	230.038	163.775	2,10	22,02	14,86	15,32
2007	306	172.363	126.037	1.368	1.000	289.017	221.689	2,06	15,05	13,57	15,09
2007/Ç1	306	87.531	62.427	1.412	1.007	257.193	186.493	1,98	15,44	14,60	15,35
2007/Ç2	307	84.831	63.610	1.325	994	289.017	221.689	2,06	15,05	13,57	15,09

Q: Quarter

Note:

- Between 1986-1922, 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
  T(2)= Total Market Capitalization / Sum of Last four three-month profits.
  US$= US$ based Total Market Capitalization / Sum of Last four US$ based three-month profits.
- Companies which are temporarily de-listed and will be traded off the Exchange under the decision of ISE's Executive Council are not included in the calculations.
- ETF's data are taken into account only in the calculation of Traded Value.

Closing Values of the ISE Price Indices

YTL Based

	NATIONAL-100 (Jan. 1986=1)	NATIONAL-INDUSTRIALS (Dec. 31.90=33)	NATIONAL-SERVICES (Dec. 27,96 =1046)	NATIONAL-FINANCIALS (Dec. 31.90=33)	NATIONAL-TECHNOLOGY (Jun. 30,2000 =14,466,12)	INVESTMENT TRUSTS (Dec 27, 1996=976)	SECOND NATIONAL (Dec 27, 1996=976)	NEW ECONOMY (Sept 02,2004 =20525,92)
1986	1,71	---	---	---	---	---	---	---
1987	6,73	---	---	---	---	---	---	---
1988	3,74	---	---	---	---	---	---	---
1989	22,18	---	---	---	---	---	---	---
1990	32,56	---	---	---	---	---	---	---
1991	43,69	49,63	---	33,55	---	---	---	---
1992	40,04	49,15	---	24,34	---	---	---	---
1993	206,83	222,88	---	191,90	---	---	---	---
1994	272,57	304,74	---	229,64	---	---	---	---
1995	400,25	462,47	---	300,04	---	---	---	---
1996	975,89	1.045.91	---	914,47	---	---	---	---
1997	3.451,--	2.660,--	3,593.--	4.522,--	---	2.934,--	2.761,--	---
1998	2.597,91	1.943,67	3,697.10	3.269,58	---	1.579,24	5.390,43	---
1999	15.208,78	9.945,75	13,194.40	21.180,77	---	6.812,65	13.450,36	---
2000	9.437,21	6.954,99	7,224.01	12.837,92	10.586,58	6.219,00	15.718,65	---
2001	13.782,76	11.413,44	9,261.82	18.234,65	9.236,16	7.943,60	20.664,11	---
2002	10.369,92	9.888,71	6,897.30	12.902,34	7.260,84	5.452,10	28.305,78	---
2003	18.625,02	16.299,23	9,923.02	25.594,77	8.368,72	10.897,76	32.521,26	---
2004	24.971,68	20.885,47	13,914.12	35.487,77	7.539,16	17.114,91	23.415,86	39.240,73
2005	39.777,70	31.140,59	18,085.71	62.800,64	13.669,97	23.037,86	28.474,96	29.820,90
2006	39.117,46	30.896,67	22,211.77	60.168,41	10.341,85	16.910,76	23.969,99	20.395,84
2007	47.093,67	38.096,88	27,573.48	69.512,16	10.457,25	15.722,98	26.925,66	24.195,67
2007/Ç1	43.661,12	35.689,19	23,243.99	66.140,71	10.561,42	16.767,50	24.957,08	20.383,97
2007/Ç2	47.093,67	38.096,88	27,573.48	69.512,16	10.457,25	15.722,98	26.925,66	24.195,67

US $ Based

EURO Based

	NATIONAL-100 (Jan. 1986=100)	NATIONAL-INDUSTRIALS (Dec. 31.90=643)	NATIONAL-SERVICES (Dec. 27,96 =572)	NATIONAL-FINANCIALS (Dec.31.90=643)	NATIONAL-TECHNOLOGy (Jun. 30,2000 =1.360,92)	INVESTMENT TRUSTS (Dec 27, 96=534)	SECOND NATIONAL (Dec 27, 96=534)	NEW ECONOMY (Sept 02,2004 =796,46)	NATIONAL-100 (Dec.31,98=484)
1986	131,53	---	---	---	---	---	---	---	---
1987	384,57	---	---	---	---	---	---	---	---
1988	119,82	---	---	---	---	---	---	---	---
1989	560,57	---	---	---	---	---	---	---	---
1990	642,63	---	---	---	---	---	---	---	---
1991	501,50	569,63	---	385,14	---	---	---	---	---
1992	272,61	334,59	---	165,68	---	---	---	---	---
1993	833,28	897,96	---	773,13	---	---	---	---	---
1994	413,27	462,03	---	348,18	---	---	---	---	---
1995	382,62	442,11	---	286,83	---	---	---	---	---
1996	534,01	572,33	---	500,40	---	---	---	---	---
1997	982,--	757,--	1,022,--	1.287,--	---	835,--	786,--	---	---
1998	484,01	362,12	688,79	609,14	---	294,22	1.004,27	---	---
1999	1.654,17	1.081,74	1.435,08	2.303,71	---	740,97	1.462,92	---	1.912,46
2000	817,49	602,47	625,78	1.112,08	917,06	538,72	1.361,62	---	1.045,57
2001	557,52	461,68	374,65	737,61	373,61	321,33	835,88	---	741,24
2002	368,26	351,17	244,94	458,20	257,85	193,62	1.005,21	---	411,72
2003	778,43	681,22	414,73	1.069,73	349,77	455,47	1.359,22	---	723,25
2004	1.075,12	899,19	599,05	1.527,87	324,59	736,86	1.008,13	1.689,45	924,87
2005	1.726,23	1.351,41	784,87	2.725,36	593,24	999,77	1.235,73	1.294,14	1.710,04
2006	1.620,59	1.280,01	920,21	2.492,71	428,45	700,59	993,05	844,98	1.441,89
2007	2.102,04	1.700,46	1.230,75	3.102,69	466,76	701,80	1.201,83	1.079,98	1.827,67
2007/Ç1	1.842,28	1.505,90	980,78	2.790,80	445,64	707,50	1.053,06	860,10	1.620,94
2007/Ç2	2.102,04	1.700,46	1.230,75	3.102,69	466,76	701,80	1.201,83	1.079,98	1.827,67

Q: Quarter

BONS AND BILLS MARKET

Traded Value

Outright Purchases and Sales Market

	Total		Daily Average	
	(YTL Million)	(US $ Million)	(YTL Million)	(US $ Million)
1991	1	312	0,01	2
1992	18	2.406	0,07	10
1993	123	10.728	0,50	44
1994	270	8.832	1	35
1995	740	16.509	3	66
1996	2.711	32.737	11	130
1997	5.504	35.472	22	141
1998	17.996	68.399	72	274
1999	35.430	83.842	143	338
2000	166.336	262.941	663	1.048
2001	39.777	37.297	158	149
2002	102.095	67.256	404	266
2003	213.098	144.422	852	578
2004	372.670	262.596	1.479	1.042
2005	480.723	359.371	1.893	1.415
2006	381.772	270.183	1.521	1.076
2007	201.503	147.119	790	577
2007/Ç1	108.250	77.054	1.746	1.243
2007/Ç2	93.254	70.064	1.457	1.095

Repo-Reverse Repo Market

Repo-Reverse Repo Market

	Total		Daily Average	
	(YTL Million)	(US $ Million)	(YTL Million)	(US $ Million)
1993	59	4.794	0.28	22
1994	757	23.704	3	94
1995	5.782	123.254	23	489
1996	18.340	221.405	73	879
1997	58.192	374.384	231	1.486
1998	97.278	372.201	389	1.489
1999	250.724	589.267	1.011	2.376
2000	554.121	886.732	2.208	3.533
2001	696.339	627.244	2.774	2.499
2002	736.426	480.725	2.911	1.900
2003	1.040.533	701.545	4.162	2.806
2004	1.551.410	1.090.477	6.156	4.327
2005	1.859.714	1.387.221	7.322	5.461
2006	2.538.802	1.770.337	10.115	7.053
2007	2.497.864	1.843.415	9.796	7.229
2007/Ç1	592.940	422.711	9.564	6.818
2007/Ç2	631.064	474.036	9.860	7.407

Q: Quarter

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

	YTL Based					
	3 Months (91 Days)	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)	General
2001	102,87	101,49	97,37	91,61	85,16	101,49
2002	105,69	106,91	104,87	100,57	95,00	104,62
2003	110,42	118,04	123,22	126,33	127,63	121,77
2004	112,03	121,24	127,86	132,22	134,48	122,70
2005	113,14	123,96	132,67	139,50	144,47	129,14
2006	111,97	121,14	127,77	132,16	134,48	121,17
2007	112,41	122,17	129,53	134,76	137,96	123,89
2007/Ç1	112,12	121,52	128,44	133,19	135,91	121,25
2007/Ç2	112,41	122,17	129,53	134,76	137,96	123,89

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

	YTL Based				
	3 Months (91 Days)	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)
2001	195,18	179,24	190,48	159,05	150,00
2002	314,24	305,57	347,66	276,59	255,90
2003	450,50	457,60	558,19	438,13	464,98
2004	555,45	574,60	712,26	552,85	610,42
2005	644,37	670,54	839,82	665,76	735,10
2006	751,03	771,08	956,21	760,07	829,61
2007	818,89	843,54	1,053,97	844,39	919,51
2007/Ç1	784,73	808,35	1,005,88	802,47	866,84
2007/Ç2	818,89	843,54	1,053,97	844,39	919,51

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

	YTL Based						
	Equal Weighted Indices (YTL Based)			Market Value Weighted Indices			
	EQ 180-	EQ 180-	EQ COMPOSİTE	MV 180-	MV 180+	MV COMPOSİTE	REPO
2004	125,81	130,40	128,11	125,91	130,25	128,09	118,86
2005	147,29	160,29	153,55	147,51	160,36	154,25	133,63
2006	171,02	180,05	175,39	170,84	179,00	174,82	152,90
2007	187,17	201,51	193,66	186,46	200,92	193,49	164,56
2007/Ç1	178,94	190,53	184,34	178,46	189,77	183,92	158,52
2007/Ç2	187,17	201,51	193,66	186,46	200,92	193,49	164,56

Q: Quarter

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