ISE Review
Istanbul Stock Exchange

ISSN 1301-1642 Volume: 6 No: 24 October/November/December 2003

Examining Systematic and Nonsystematic Risks the
ISE Financial Sector Companies

Hatice Doğukanlı & Songül Kakilli & Serkan Yılmaz Kandır

An Investigation of Beta Instability in the Istanbul Stock Exchange

Atilla Odabaşı

Finance and Growth in Turkey: Causality Issue

Ensar Yılmaz & Özgür Kayalıca

Now Online Access:

ISE REVIEW, Quarterly Economics and Finance Review published by the Istanbul Stock Exchange.

Starting with Volume 3 No: 10 issue (year 1999), full-text articles published in the ISE Review are now available through the Internet in pdf-format. Access to the printed version of the ISE Review for users with a fully paid subscription will be via an assigned password.

Abstracts:
Abstracts of all articles published in the ISE Review are available through the ISE website. The database covers all abstracts of refereed journal articles published since 1997. Astracts df published articles are provided every three months, free of change, following the publication of the ISE Review.

Access:
(1) http://www.ise.org/publictn.htm
(2) select: ISE Review

For further information, comments and suggestions please contact:
Tel: (90.212) 298 21 71   E-Mail: arastir@imkb.gov.tr

The ISE Review Subscription Order Form

Please check appropriate box for one year subscription.

- [ ] US$ 30 for hard copy (4 issues no.22, 23, 24, 25) (US$ 7.5 per copy)
- [ ] US$ 15 via E-Mail (4 issues no.22, 23, 24, 25) (US$ 3.75 per issue)

Name ....

Title ....

Company ....

Address ....

City .... State .... Zip ....

Phone .... Fax ....

E-Mail ....

- [ ] Payment enclosed
- [ ] Wire transfer to Türkiye İş Bankas› Borsa Branch Account no: 1125 30103 4599

Please write the name of the publication and send us a copy
Please do not send cash

The ISE Review

Volume 6   No 24   October/November/December 2002

CONTENTS

Examining Systematic and Nonsystematic Risks of the ISE Financial Sector Companies
Hatice Doğukanl› & Songül Kakilli Acaravc› & Serkan Yılmaz Kandır 1

An Investigation of Beta Instability in the Istanbul Stock Exchange
Atilla Odabaşı 15

Finance and Growth in Turkey: Causality Issue
Ensar Yılmaz & Özgür Kayalıca 33

Global Capital Markets 49

ISE Market Indicators 59

ISE Book Review 65

ISE Publication List 67

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

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642 © ISE 1997

EXAMINING SYSTEMATIC AND NONSYSTEMATIC RISKS OF THE ISE FINANCIAL SECTOR COMPANIES

Hatice DOĞUKANLI *
Songül Kakilli ACARAVCI **
Serkan Yılmaz KANDIR ***

Abstract
The recent crises in Turkey again indicated the importance of systematic risk. Transfer of many banks into "Savings Deposit Insurance Fund" in the last period is a result of these events. It is believed that systematic risk has an important place in these risks. Basic systematic risk sources, growth rate in GNP, inflation rate, interest rate and exchange rate risk influence all of the companies. Effect of these risks over financial companies is more important. Because interest rate and exchange rate risks concern financial companies and especially banks more than any other sector companies. In this study, systematic and nonsystematic risks of 32 financial sector stocks are decomposed by using single index model. The time period of 72 months between January 1996 and December 2001 is covered in the study. As a result it can be stated that nonsystematic risk is more important than systematic risk for financial sector companies. Nevertheless this is not the case for all of the financial companies. There are differences in both total risks and composition of risk between financial companies.

I. Introduction

When making stock investment decision, investor, who wants to maximize his expected utility, needs two factors, that are risk and return. As soon as the

* Prof. Dr. Hatice Doğukanlı, Çukurova University, Department of Finance and Accounting, Balcalı, Adana 01330, Turkey.
Tel: +90 322 3387254 Fax: +90 322 3387283 E-posta: hatdog@mail.cu.edu.tr
** Research Assistant Songül Kakilli Acaravcı, Çukurova University, Department of Finance and Accounting, Balcalı, Adana 01330, Turkey.
Tel: +90 322 3387254 Fax: +90 322 3387283 E-posta: skakilli@mail.cu.edu.tr
*** Research Assistant Serkan Yılmaz Kandır, Çukurova University, Department of Finance and Accounting, Balcalı, Adana 01330, Turkey.
Tel: +90 322 3387254 Fax: +90 322 3387283 E-posta: skandir@mail.cu.edu.tr

probability distribution of returns is known and historical data are used, average return replaces expected return. Variance and standard deviation are generally accepted measures of risk. A part of risk is market risk and another part is firm-specific risk. According to Markowitz, since the measurement of portfolio risk is related to covariances of securities in the portfolio, it is becoming more difficult to make such measurements as the number of the stocks in the portfolio increases. Single index (market) model is developed in order to explain stock returns, depending on the high correlation between market index and stock returns. Market model explains stock returns by relating stock returns to a sole factor, market index. The result of this is to calculate variance and covariance again by depending on the relation between stock returns and market index. Calculating variance by using single index model is both easy and useful in indicating the risk sources.

In some studies on decomposing risk, β is accepted as the measure of systematic risk. Although β is an indicator of systematic risk, it is insufficient to measure systematic risk. In this study, considering these drawbacks, systematic risk is measured as "$\beta_i^2\sigma_{ei}^2$". In this study, systematic and nonsystematic risks of financial sector companies are decomposed.

In the following section of the study, related literature is reviewed; in the third and fourth sections the data and methodology are explained, respectively. In the fifth section, risk is decomposed as systematic risk and nonsystematic risk. Sixth section presents the conclusion.

II. Studies Concerning Systematic and Nonsystematic Risk

There are a number of empirical studies concerning systematic and nonsystematic risk. Important ones are summarized below.

Beaver, Ketler and Scholes (1970) examined the relation between variables and stock beta. These variables are: dividend growth (dividend/earnings, asset growth (annually change in total assets), leverage (securities/total assets, liquidity (current assets/short-term liabilities), asset volume (total assets), variability of earnings (standard deviation of earnings/price ratio and calculated beta (earnings beta). In the study, negative relation between dividend payment and beta; positive relation between growth and beta are expected. High growth firms are accepted to be more risky than low growth firms. Leverage increases earnings volatility. Risk and beta increases with leverage. Liquidity is reversely related with beta. High liquidity firms are said to be less risky than low liquidity firms. Big firms are less risky than small firms. Beaver, Ketler and Scholes (1970) confirmed the expectations stated above.

Elton and Gruber (1971), examined risk-return relationship and found that adding extra indices to single index model explains risk better, but underestimate the performance Correlation matrix is interpreted better by adding more indices. However, future correlation matrix is weakly estimated and portfolios which provide less return are selected. Blume (1971) intensed on systematic risk in his study that covers January 1926–June 1968 period. Blume separated the period into seven-year subperiods and examined consistency of beta over time. Beta is found to be changing in time. Beta follows an increasing trend in low beta portfolios and follows a decreasing trend in high beta portfolios. Historical data are insufficient in estimating future data. However, a methodology is developed to overcome this biased estimate problem. According to this methodology, adjusted beta is obtained by regressing beta of the each period over previous beta. These adjusted betas are used in estimating future beta. Results obtained by this method provides a better estimate of the future. In other words, using adjusted betas provides better results.

Jacob (1971), covering December 1945–December 1965 period, and 593 securities, separated the period into 4 subperiods. 240 monthly data are used in the study and monthly return is calculated by dividing the difference between last month's price and previous month's price by previous month's price. He maintained an equally weighted index by using security prices and used this index as the market index. Portfolio returns are not harmonious with betas. The causes of this inconsistency are: (1) Length of time period, (2) Market return, (3) Length of owning period, (4) Number of the securities in the portfolio, (5) Security selection method used.

Rosenberg and McKibben (1973) determined 32 variables for calculating beta. The study covers 1950-1971 period and 5788 stocks. These variables are classified as accounting based, market based and market value related. Both historical and accounting based data are used in the study. Data are related to beta by using regression analysis. Using accounting based data improved the estimating power of future.

Blume (1975), covering the same 1926-1968 period, obtained similar results. Extreme beta values move to normal values in time. In other words, extreme betas move to average values. The results of this normalization are management's limiting risky projects and risky project's becoming less risky.

Thompson II (1976), by using monthly data and covering January 1949–June 1966 period, aimed to explain the size of stock betas. In this context, he explained beta as company risk, by using accounting data. He used 43 risk factors in order to explain beta. Covering 290 firms, research period is separated into 2 subperiods in order to determine the consistency of effects of factors over beta. Relation between beta and risk factors is determined by conducting

regression analysis and correlation analysis. Results reveal that most of the factors examined in the study do not have effect over beta. Also, consistency of the relation between beta and risk factors is examined and it is found that the relation mentioned above indicates great volatility in time.

Aydoğan (1989) examined the risk-return relation of stocks traded in the ISE for the 1978-1986 period. Stocks are classified in two groups. In the first group, there are stocks whose betas are greater than one. All of the stocks are included in the second group. Risk premiums of the two groups are different. Results of the study suggest a positive relationship between average returns and systematic risks of the stocks.

Pettengill, Sundaram and Mathur (1995) examined the relationship between stock betas and returns. Covering 1926-1990 period and using monthly returns, they estimated this relationship by using multiple regression analysis. When the regression coefficients are examined, a systematic but conditional relationship is observed between beta and return. Whether the relationship between risk and return is periodical or not is examined, it is found that there is a negative relationship between risk and return in six of the twelve months. In other words, there is a different relationship from the one expected. However, general result reveal that there is a positive relationship between beta and return.

Ugan (1997) examined the application of forward index operations as systematic risk management tool in developing stock markets. First, a risk-return analysis is carried out in order to determine systematic risk level in developing markets. Systematic risk of the markets are calculated by variation coefficient over weekly returns of these markets. Results of the analysis suggest that developing markets are two times more risky than developed markets. Risk of the developing markets is examined by comparing the market structure and financial-economic indicators with the ones of developed markets. Applicability of forward index operations can be determined by the risk degree of the market.

Karabıyık (1998), suggested that investments in developing countries provide more return than the ones in developed countries. As an example of developing markets, the number of international investors is increased in the ISE. The ISE is a diversification alternative for security investors in developed countries. Cumulative trading volume of EU exchanges increased 6 folds between 1986-1994, whereas the ISE trading volume increased 1800 folds. Investors in developing countries want to take advantage of risk-return opportunities of developing countries by investing in these countries. However, it should be considered that risk is high level in developing countries and risk-return move in the same direction.

Balaban (1999), covering the January 1987-December 1997 period and studying the ISE, examined the existence of meaningful relation between risk and return. Analysis results suggest that by taking the whole period and the period which T+1 rule applies, there is a meaningful and positive relation between risk and return. This situation indicates the risk-avoiding characteristic of exchange investors. However, when T+2 period is examined, risk-return relation continues to be positive, but not meaningful anymore. This result would suggest the decrease in risk-avoiding degree of investors or a need to replace standard deviation or variance by another risk measure such as semi-variance.

Y›lgör (2001) examined the effects of November and February crises in Turkey over systematic risk. In the analysis, weekly data of ISE-30 stocks, manufacturing, service, finance and technology sectors covering the 12/28/1999 - 09/14/2001 period are used. High level of beta indicates the high sensitivity of stocks to changes in the ISE-30 index. Although most of the risk was systematic risk before the crises, this type of risk increased after the crises. In other words, crises caused an increase in both total risk and systematic risk.

III. Measurement of Systematic and Nonsystematic Risks

According to the portfolio theory, stock risk is measured by variance of stock returns. However, variance measures total risk of the stock. Risk of a stock is decomposed in two parts as systematic risk and nonsystematic risk. The risk cannot be explained by the market is known as diversifiable or nonsystematic risk. The risk related to market influences on all of the stocks and so it can neither be diversified nor be eliminated. This kind of risk can be called systematic risk. In the calculation of systematic risk, beta, sensitivity of the stock to the market, is used.

In Turkey, risk plays an important role in directing investments. Risk is in a high level because of both variability of investment tools and macroeconomic variables. Volatility of financial instruments and others that are important for Turkey are summarized in Table 1.

Table 1: Volatility of Financial Instruments in Turkey

Financial Instruments and Others	Frequency of Data	Period of Data	Volatility (Standard Deviation)
Deposits Interest Rates	Monthly	April 1984 - April 2003	0,0025
ISE-100 Index	Daily	January 1986 - April 2003	0,0352
Foreign Exchange Rate ($)	Yearly	1923 - 2002	0,339
Gold (Bullion)	Monthly	1950 - 2002	0,0904
Gold (Republic)	Monthly	1950 - 2002	0,0916
GNP	Yearly	1968 - 2001	0,2562
Inflation (WPI)	Yearly	1923 - 2002	0,3057

As seen in Table 1, variability of both investment tools and macroeconomic variables is high. All of these variations are sources of systematic risk and it cannot be eliminated by investors and companies. Exchange rate risk has the first place in systematic risk sources, followed by inflation risk and growth rate risk. Nonsystematic risk is the only risk that can be eliminated by investors and companies. In this context, it is important to know how much of the total risk is systematic risk and how much is nonsystematic risk.

Generally, beta is calculated by two methods. In the first method, beta is obtained by running a regression analysis between stock returns and market returns. This regression model can be formulated as below (Klemkosky and Martin, 1975):

$$R_i = \alpha_i + \beta_i R_m + e_i$$

R_i = return of stock i,
α_i = return of stock i other than the market,
β_i = sensitivity of stock i to market index,
R_m = market index return,
e_i = error term.

According to this equation, the most important factor that determines the price of the stock or the portfolio is the beta of the stock or the portfolio. However, total risks or specific risks of the securities may be needed to be known. When this happens, total risk can be calculated by the equation below depending on beta (Ben, Horim and Levy, 1980):

$$\sigma_i^2 = \beta^{i2}\,\sigma_m^2 + \sigma_{ei}^2$$

Specific risk for securities can be calculated from this equation as below:

$$\sigma_{ei}^2 = \sigma_i^2 - (\,\beta_i^2\,\sigma_m^2)$$

σ_i^2 = variance of security returns (total risk),
σ_m^2 = variance of market returns,
β_i^2 = square of security beta,
σ_{ei}^2 = specific risk of the equity.

In the second calculation method, beta is calculated by dividing the covariance between stock returns and market returns by variance of stock returns. This calculation method can be formulated as below (Chen, 2001):

$$\beta_i = Cov_{i,m}\ /\ \sigma_m^2$$

$Cov_{i,m}$ = covariance between stock returns and market returns.

IV. Data and Methodology

a) 32 financial sector companies which operated for 72 months between January 1996 and December 2001.
b) In the study, stock returns over 72 months are calculated. Returns are calculated by using stock prices. Stock prices are obtained from the internet site[1]. Stock prices obtained are adjusted for capital increases, so there is no need for any adjustment in the study. Monthly return is calculated by dividing the difference between last month's price and previous month's price by previous month's price. Calculation of monthly return can be formulated as below:

$$r_i = (F_t\ - F_{t-1}\,)\ /\ F_{t-1}$$

r_i = monthly stock return,
F_t = last month's stock price,
F_{t-1} = previous month's stock price.

1 "http: www.analiz.com/isapi/hisse_anket.asp?url = / isapi / AT01 / FIYATout.asp".

c) One of the indices used in calculating systematic risk and nonsystematic risks is the ISE-100 index. In the study, calculated values of the ISE-100 are obtained from the internet site[2]. The ISE-100 returns are calculated by the same method as stock returns are calculated:

$$r_i = (E_t\ - E_{t-1}\,)\ /\ E_{t-1}$$

r_i = ISE-100 index return,
E_t = last month's ISE-100 index level,
E_{t-1} = previous month's ISE-100 index level.

In the empirical section of the study, risks of 32 Turkish financial company stocks are decomposed into systematic and nonsystematic risks.
In the first step, monthly returns of 32 stocks and the ISE-100 index are calculated.
In the second step, variances of the returns stocks and the ISE-100 index are calculated.
In the third step, risks of stocks and the ISE-100 index are decomposed into systematic risk and nonsystematic risk. As stated in third section of the study, risk of a security can be decomposed into two as below:

$$\sigma_i^2 = \beta_i^2\,\sigma_m^2 + \sigma_{ei}^2$$

In this equation, nonsystematic risk of security is σ_{ei}^2 and systematic risk is $\beta_i^2\,\sigma_m^2$.
Beta of each stock is obtained by dividing covariance between stock return and market return by variance of market return. This calculation method can be formulated as indicated in the third section:

$$\beta_i = Cov_{i,m}\ /\ \sigma_m^2$$

V. Empirical Results

Variances, systematic risks and nonsystematic risks belonging to financial companies, banks, leasing and factoring companies, insurance companies and investment trusts are indicated in Table 2.

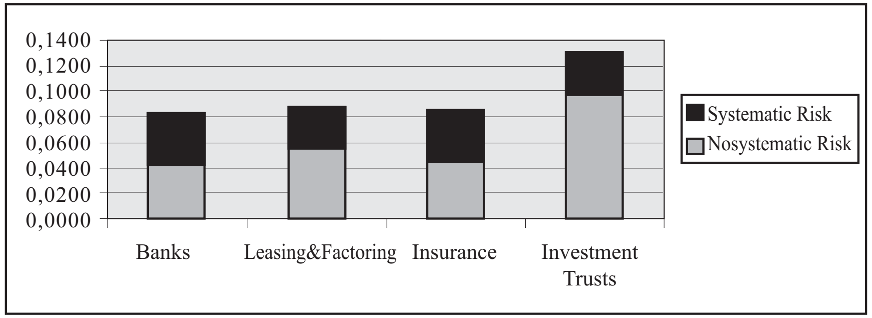
1 "http: tcmbf40.gov.tr/cgi-bin/famecgi".

Table 2: Decomposition of Risks of Financial Sector Companies

Months	Variance	Nonsystematic Risk	Systematic Risk
Bank 1	0,0587	0,0192	0,0395
Bank 2	0,1397	0,1053	0,0345
Bank 3	0,0597	0,0181	0,0416
Bank 4	0,0629	0,0173	0,0456
Bank 5	0,0673	0,0288	0,0385
Bank 6	0,0587	0,0387	0,0200
Bank 7	0,0720	0,0222	0,0498
Bank 8	0,0497	0,0285	0,0211
Bank 9	0,0639	0,0151	0,0488
Bank 10	0,0428	0,0259	0,0169
Bank 11	0,2154	0,1452	0,0701
Average of Banking Sector	0,0810	0,0422	0,0388
Leasing&Factoring Company 1	0,0788	0,0680	0,0108
Leasing&Factoring Company 2	0,1314	0,0835	0,0479
Leasing&Factoring Company 3	0,0502	0,0198	0,0305
Leasing&Factoring Company 4	0,1019	0,0492	0,0527
Leasing&Factoring Company 5	0,0545	0,0375	0,0170
Leasing&Factoring Company 6	0,0850	0,0646	0,0204
Leasing&Factoring Company 7	0,1018	0,0616	0,0402
Average of Leasing&Factoring Sector	0,0862	0,0549	0,0314
Insurance Company 1	0,0712	0,0215	0,0498
Insurance Company 2	0,0683	0,0255	0,0428
Insurance Company 3	0,0881	0,0421	0,0460
Insurance Company 4	0,1201	0,1051	0,0150
Insurance Company 5	0,0711	0,0345	0,0366
Average of Insurance Sector	0,0838	0,0457	0,0380
Investment Trust Company 1	0,0684	0,0263	0,0421
Investment Trust Company 2	0,0862	0,0406	0,0457
Investment Trust Company 3	0,1172	0,0967	0,0205
Investment Trust Company 4	0,4451	0,4311	0,0139
Investment Trust Company 5	0,0986	0,0497	0,0489
Investment Trust Company 6	0,1004	0,0620	0,0385
Investment Trust Company 7	0,0615	0,0390	0,0226
Investment Trust Company 8	0,1258	0,1001	0,0256
Investment Trust Company 9	0,0580	0,0301	0,0279
Average of Investment Trusts	0,1290	0,0973	0,0317

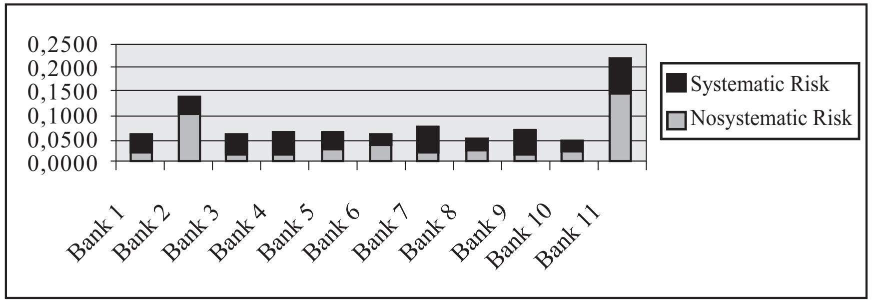
Systematic and nonsystematic risk structure of subsectors of the finance sector can be seen in Graphic 1. For all subsectors, nonsystematic risk prevails more than systematic risk. For banks and insurance companies, systematic and nonsystematic risks are in equilibrium. For the investment trusts and leasing and factoring companies the dispersion is not balanced. Dispersion of risk of investment trust companies is not in line with expectations. Since investment trusts invest in diversified security portfolios, their systematic risk is expected to be in low level. However, their systematic risk is found to be in high level. This result can be interpreted as an indicator of investment trusts' failure in diversifying.

Graphic 1: Risk Structure of Subsectors of the Finance Sector



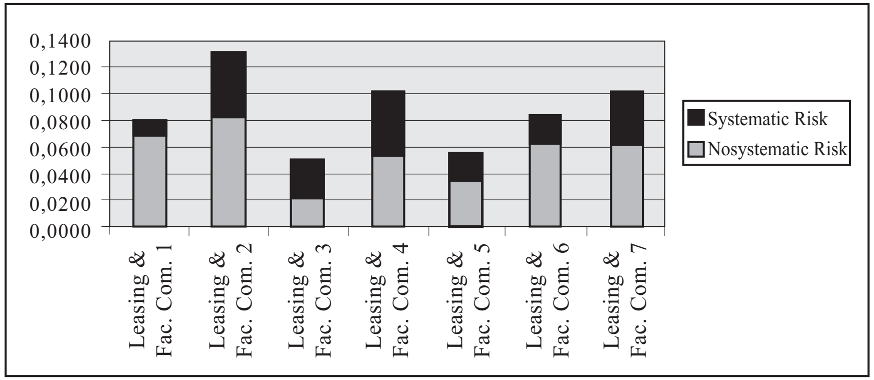
When each sector is examined, difference is found in both risk levels and risk dispersion for firms.

Graphic 2: Risk Structure of the Banking Sector



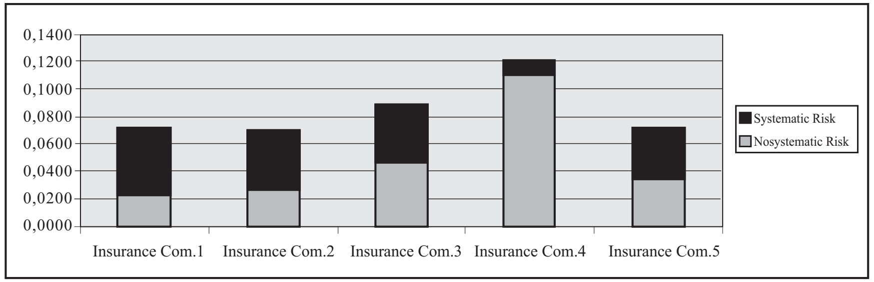
As seen in Graphic 2, stock returns of Bank 11 and Bank 2 has the most total risk. On the contrary, the least risky bank is Bank 10. For Bank 1, Bank 3, Bank 4, Bank 5, Bank 7 and Bank 9, systematic risks are higher than nonsystematic risks. For other banks, nonsystematic risk is higher.

Graphic 3: Risk Structure of Leasing and Factoring Companies



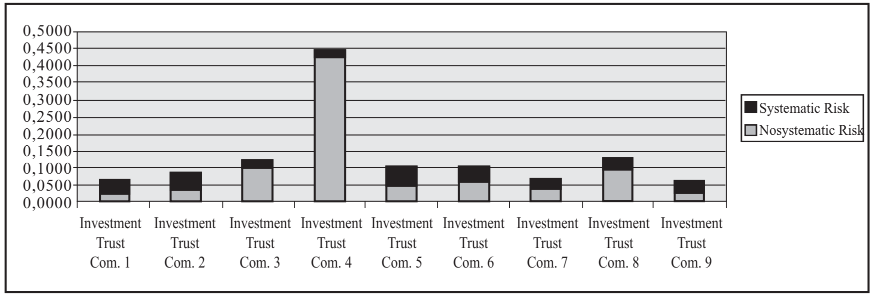
As seen in Graphic 3, stocks of leasing and factoring company 2, leasing and factoring company 4 and leasing and factoring company 7 has the highest risk. On the contrary, leasing and factoring company 3 and leasing and factoring company 5 has less risk. Except leasing and factoring company 3, all leasing and factoring companies has more nonsystematic risk than systematic risk.

Graphic 4 : Risk Structure of Insurance Sector



As seen in Graphic 4, insurance companies can generally be said to have high risk. Nevertheless, insurance company 1 and insurance company 2 has more systematic risk. Insurance company 3 and insurance company 5 has risk in equilibrium. Other Insurance companies has more nonsystematic risk.

Graphic 5: Risk Structure of Investment Trusts



As seen in Graphic 5, investment trust 4 has the most total risk. Other investment trusts have similar risk levels. In addition to this, investment trust 4 has much more nonsystematic risk than systematic risk. On the contrary, investment trust 1 and investment trust 5 has more systematic risk than nonsystematic risk.

VI. Conclusion

Risk is an important criterion in security evaluation. In this context, there are a number of studies including risk-return relationship. In these studies, generally properties of beta and beta-return relationship are examined. Results of these studies reveal a positive relationship between risk and return. However, in some of the studies, average returns of portfolios are not found to be suitable with their betas. Moreover, risk-return relationship shows volatility over time.

In this study, 32 Turkish financial sector companies' risks are decomposed into systematic and nonsystematic risk. The study covers the 72-month period between January 1996 and December 2001. The study consists of three steps. In the first step, monthly returns of 32 stocks and the ISE-100 index are calculated. In the second step, variances of stocks and the ISE-100 index are calculated. In the third step, risks of stocks and the ISE-100 index are decomposed into systematic and nonsystematic risk in the context of single index model.

When variance, systematic and nonsystematic risk structure of subsectors of the finance sector are evaluated it is found that nonsystematic risk is bigger than systematic risk for all of the subsectors. Systematic and nonsystematic risk are in equilibrium for banking and insurance companies; however it is not the case for investment trusts and leasing and factoring companies.

As a consequence, nonsystematic risk can be said to be more important than systematic risk for financial sector companies. Systematic risk is in the control of the company itself and can either be decreased or be eliminated.

Since these risks are high for the financial institutions examined, a question arises about whether these institutions are successful in risk management. However, this is not the case for all of the companies. Both total risks and risk compositions of financial sector companies indicate differences. Capital Asset Pricing Model maintains that market prices only systematic risk and it does not give a premium for nonsystematic risk. As a result, two suggestions can be made to the investors considering to invest in the financial sector stocks. Since nonsystematic risks can be eliminated by diversification; portfolio risk can be decreased by taking stocks that are negatively or slightly correlated and has a high level of nonsystematic risk into the portfolio. Moreover, it should not be forgotten that not the total risk but the systematic risk is priced.

References

Aydoğan, Kürşat, Portföy Teorisi, SPK Araştırma Raporu, SPK Yayınları, Ankara, 1989.

Balaban, Ercan, "Borsada Takas Kuralları ve Zamana Bağlı Risk ve Getiri ilişkisi: Türkiye Örneği", iktisat, işletme ve Finans Dergisi, No.164, 1999, p.30-47.

Beaver, W., and others, "The Association Between Market Determined and Accounting Determined Risk Measures", The Accounting Review, Vol.45, 1970, p.654-682.

Ben-Horim, Moshe, Haim, Levy, "Total Risk, Diversifiable Risk and Nondiversifiable Risk: A Pedagogic Note", Journal of Financial and Quantitative Analysis, Vol.15, No.2, 1980, p.289-297.

Blume, Marshall E., "On the Assessment of Risk", The Journal of Finance, Vol.26, No.1, 1971, p.1-10.

Blume, Marshall E., "Betas and Their Regression Tendencies", The Journal of Finance, Vol.30, No.3, 1975, p.785-795.

Chen, Ming-Hsiang, "Risk and Return: CAPM and CCAPM", The Quarterly Review of Economics and Finance, Vol.43, 2003, p.369-393.

Elton, Edwin J., Gruber, Martin J., "Improved Forecasting Through the Design of Homogenous Groups", The Journal of Business, Vol.44, No.4, 1971, p.408-431.

Farrell, James L., Portfolio Management, Second Edition, McGraw-Hill, Singapore, 1997.

http://www.analiz.com/isapi/hisse_anket.asp?url=/isapi/AT01/FIYAT01out.asp

http://tcmbf40.tcmb.gov.tr/cgi-bin/famecgi

Jacob, Nancy L., "The Measurement of Systematic Risk for Securities and Portfolios: Some Empirical Results", The Journal of Financial and Quantitative Analysis, Vol.6, No.2, 1971, p.815-833.

Karabıyık, Lale, "Yabancı Yatırımcıların Yatırım Portföyleri için IMKB Alternatifi", Uludağ Üniversitesi İİBF Dergisi, Vol.16, No.1, 1998.

Klemkosky, Robert C., John D. Martin, "The Adjustment of Beta Forecasts", The Journal of Finance, Vol.30, No.4, 1975, p.1123-1128.

Pettengill, Glenn N., and others, "The Conditional Relation Between Beta and Returns", The Journal of Financial and Quantitative Analysis, Vol.30, No.1, 1995, p.101-116.

Rosenberg, Barr, Walt, McKibben, "The Prediction of Systematic and Specific Risk in Common Stocks", The Journal of Financial and Quantitative Analysis, Vol.8, No.2, 1973, p.317-333.

Thompson II, Donald J., "Sources of Systematic Risk in Common Stocks", Journal of Business, Vol.49, No.2, 1976, p.173-188.

Ugan, Gökhan, "Gelişmekte Olan Hisse Senedi Piyasalarında Sistematik Risk Yönetimi", IMKB Dergisi, Yıl 1, No.2, 1997, p.51-61.

Yılgör, Ayşe Gül, "Kasım ve Şubat Krizlerinin Sistematik Risk Üzerindeki Etkisi", V.Türkiye Finans Eğitimi Sempozyumu, 2001.

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642

AN INVESTIGATION OF BETA INSTABILITY IN THE ISTANBUL STOCK EXCHANGE

Atilla ODABAŞI *

Abstract
The estimation of systematic risk, or beta, is important to many applications in finance. The Capital Asset Pricing Model assumes that the beta coefficient is constant through time. However, many studies on developed equity markets and some on emerging markets have found evidence that individual stock betas are time varying. The purpose of this study is to investigate the issue of beta stability in the Istanbul Stock Exchange from 1992 to 1999. The tests are conducted on individual stocks over the full sample period and his subintervals. It seems that Betas are highly time varying over four- and eight-year estimation periods in the ISE. In addition, the incidence of instability gets lower as the estimation sub-period shortens from eight-year to a year. This finding can be explained by fast changes in companies and the market in Turkey. It also questions the existence of an estimation length effect on beta estimates.

I. Introduction

The estimation of systematic risk, or beta, is important to many applications in finance. Practitioners rely on beta estimates when estimating costs of capital, applying various valuation models and determining portfolio strategies. Researchers also rely on beta estimates for many applications such as determining relative risk, testing asset pricing models, testing trading strategies and conducting event studies.

The Capital Asset Pricing Model (CAPM) hypothesis states that the relevant risk measure in holding a given security is the systematic risk or beta, because all other risk measures can be diversified away through portfolio diversification.

* Dr. Atilla Odabaşı, Faculty of Economics & Administrative Sciences, Bo¤azici University, Bebek, Istanbul, 34342.
Tel: (90) 212 358 1540 Fax: (90) 212 263 7379 E-Mail: odabasi@boun.edu.tr
The author wishes to thank an anonymous referee for helpful comments which have significantly improved the paper.
Keywords: Emerging markets; Beta stability; Lagrange multiplier tests

Traditionally betas are estimated by an OLS regression of asset returns on market returns. The CAPM also assumes that the beta is constant through time. However, empirical research has shown that true betas appear to be time varying. Blume (1971), in a pioneering effort, showed that portfolio betas tend to regress toward one over time and used this finding to produce better beta estimates. Vasicek (1973) argued that better beta estimates could be obtained through a Bayesian approach. Vasicek and Blume betas have been empirically tested for their ability to predict future period-unadjusted betas (Klemkosky and Martin, 1975; Dimson and Marsh, 1983 to name a few). These studies marginally favor Blume method for its accuracy in forecasting future OLS estimates. In a recent theoretical paper, however, Lally (1998) examines Vasicek and Blume methods for correcting OLS betas and suggests that when the firms are partitioned into industries Vasicek method can not be inferior and may be superior to the Blume method. In addition, Lally (1998) points out that controlling for the degree of financial leverage may improve beta forecasting. Dimson (1977), on the other hand, suggested that beta estimates should be controlled against thin trading and hence against downward bias.

The pursuit for obtaining better beta estimates has continued over the years. Some other estimation issues that have been investigated include the method of estimation (Chan and Lanonishok, 1992); the effect of the length of estimation period (Levy 1971; Baesel 1974; Altman, et al. 1974; Roenfeldt, 1978; Kim, 1993); the effect of return interval (Frankfurter, 1994, Brailsford and Josev, 1997) and the effect of outliers (Shalit and Yitzhaki, 2002). The latter presents evidence that OLS betas are highly sensitive to observations of extremes in market index returns.

Stochastic properties of beta estimates have been extensively investigated. The empirical work of Fabozzi and Francis (1978), Sunder (1980), Alexander and Benson (1982), Lee and Chen (1982), Ohlson and Rosenberg (1982), Bos and Newbold (1984), and Collins et al. (1987) provides strong evidence that the beta of securities is not stable but is best described by some type of stochastic parameter model. They are, however, in disagreement as to whether the variation in beta is purely random or exhibits autocorrelation in time. While many advocate the use of time varying betas hence conditional CAPM's instead of constant beta models, the success of conditional CAPM's is dependent on capturing the dynamics of beta risk. Ghysels (1998) investigates the possibility to commit serious pricing errors due to misspecification of these dynamics. According to Ghysels (1998) pricing errors with constant beta models are

1 We use the terms instable, non-stationary and time-varying interchangeably throughout the text.

smaller than with conditional CAPM's.

The following are detailed findings indicating the extend that beta is time-varying. The hypothesis that equity betas are constant has been empirically rejected many times on the US market. Fabozzi and Francis (1978) analysed six years of data from 1966 to 1971 and found that 8% of stocks had varying betas. Sunder (1980) analysed a range of sub-periods on data from 1926 to 1975. The sub-periods varied from seven years to fifty years. In the seven-year sub-periods the proportion of stocks with varying betas ranged from 2% to 47%. Over the fifty years 99% of stocks had varying betas. Alexander and Benson (1982) analysed two six-year sub-periods over the period 1960 to 1971 and found that 5 to 6% of stocks had varying betas. Bos and Newbold (1984) analysed ten years of data from 1970 to 1979 and found that 58% of stocks had varying betas. Collins et al. (1987) analysed various sub-periods from 1962 to 1981 on weekly data. When they analysed five-year sub-periods they found that 34% of stocks had varying betas. With ten-year sub-periods they found that 65% of stocks had varying betas.

A number of studies on the Australian equity market have also found evidence of individual stock beta instability. Faff et al. (1992) analysed ten years of data from 1978 to 1987. When they analysed five-year sub-periods they found that from 11% to 13% had varying betas. Faff and Brooks (1997) analysed a range of sub-periods on data over the period 1974 to 1992. When they analysed five-year sub-periods they found that the degree of beta instability ranged from 23% to 41%. In seven-year sub-periods they found the degree of beta instability to range from 29% to 51%. In ten-year sub-periods the degree of stock beta instability varied from 28% to 61%. Finally, for the full nineteen years of data they found 67% of stocks to have varying betas.

If beta instability raises problems in these developed markets then it is likely to be even more significant in emerging markets. However, research on beta instability in emerging markets is rare in the literature. Bos and Fetherson (1992) studied the Korean market from 1980 to 1988 and found that 61% of stocks had varying betas. Brooks et al. (1998) investigated the Singapore stock market on data from 1986 to 1993. On the full sample of eight years they found that at about 40% of the stocks had varying betas. They also analysed four-year overlapping sub-periods and found an incidence of beta instability at about 20% lower level than that observed for the eight-year sample.

This paper reports on an investigation of beta stability in the Istanbul Stock Exchange. While contributing to the research on beta stability in emerging markets, the study also displays the extent that beta is time varying in the ISE. There are significant differences between our study and the previous studies

mentioned earlier. First, the previous studies used monthly data except one. As in Collins et al. (1987) this study used weekly data. Second, the sub-periods analysed in the previous studies varied from four-year sub-periods to longer sub-periods. In our study, besides four- and eight-year periods we also analysed shorter, namely one- and two-year periods. Therefore, a direct comparison of the level of time-varying in betas found in this paper and in the empirical work cited in the literature review may not be dependable. At first glance, however, we can conclude that the incidence of beta instability of individual stocks in the ISE is as prominent as that found in developed and other emerging markets. Additionally, the observation of time-varying in betas over short estimation periods (eg. one and two years) is a characteristic found in emerging markets.

The organization of the paper is as follows. Section II describes the test employed to assess the stability of beta in the ISE, the research sample and some characteristics of the sample data. Section III provides empirical evidence and Section IV concludes the paper.

II. Empirical Framework and Data

Empirically, the systematic risk is often estimated by applying ordinary least squares (OLS) to the market model. For a given stock,

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it}$$

where R_{it}, R_{mt} represent the returns of the stock and of the market in period t; u_t is the error term, a white noise random variable. Beta of the stock, β_i, is the regression coefficient and α_i is the intercept. The coefficients α_i and β_i are estimated as constants rather than as time-varying variables. The simplest model of beta behavior assumes $\beta_{it} = \overline{\beta}$ for all t that yield the familiar constant parameter market model.

One of the key issues to be resolved in testing for time-varying beta is how the instability in beta is to be modeled. A popular alternative to the constant parameter model is the random coefficients model first proposed by Hildreth and Houck (1968)[2]. In this model beta coefficients vary according to

$$\beta_{it} = \overline{\beta} + e_t ,$$

where e_t's are serially uncorrelated random variables with mean zero and variance σ^2. The effect of beta being time varying on the market model is to

2 This model has been used in studies by Fabozzi and Francis (1978), Alexander and Benson (1982), and Lee and Chen (1982), Brooks et al. (1992, 1994) and Brooks and Faff (1995), among others.

alter the properties of the disturbance term, u_{it}. In the case of beta following the Hildreth and Houck (1968) model the disturbances become heteroscadastic if there are some independent variables $z_1, z_2, ..., z_r$ that influence the error variance and the form of heteroscadasticity is given by

$$\sigma_t^2 = \sigma^2 f(\alpha_0 + \alpha_1 z_{1t} + \alpha_2 z_{2t} + ... + \alpha_r z_{rt})$$

A large number of econometric tests exists for this type of heteroscadacticity. One of the most computationally simple test available is the Lagrange Multiplier (LM) test devised by Breusch and Pagan (1979)[3]. In this setting, the Breusch and Pagan (1979) test is a test of the null hypothesis (homoscedastic model):

$$H_0: \alpha_1 = \alpha_2 = ... = \alpha_r = 0$$

The function f(.) can be any functional form. The Breusch and Pagan test does not depend on the functional form. The test can be carried out with a simple regression (Greene, 1997). For a given stock we let the sample variance of the disturbance terms $\hat{\sigma}^2 \Sigma \hat{u}_t^2 / N$, then we run the regression of $\hat{u}_t^2 / \hat{\sigma}^2$ on z_{rt}.

If the error term u in the market model is normally distributed and under the null hypothesis of homoscedasticity one-half of the regression sum of squares, ESS/2, provides a suitable test statistic. Specifically, ESS/2 is asymptotically distributed as chi-squared with degrees of freedom equal to the number of independent variables, z_r. The analysis of beta instability conducted in this paper employs this testing framework.

The data for this study is drawn from the database of Center for Applied Research in Finance (CARF). Capitalisation and dividend adjusted daily prices relative to all the firms listed on the ISE are kept in the database. The weekly stock returns are computed using the closing value for Friday of each week. Similarly, monthly stock returns would be computed using the closing value for the last working day of each month. At the present, the ISE lists around 300 stocks but a large number of these stocks have only been listed in recent years. The study uses a sample of those firms which have been continually listed and for which we have complete data over the period of 1992 to 1999.

3 Brooks et al. (1998) state that other techniques used to investigate beta stability in the literature are the locally best invariant test (Faff et al., 1992) and the point optimal invariant test (Brooks et al., 1994). The advantage of LM test over these tests is that it can accommodate complications arising due to thin trading in a market.

This gives us a sample of 100 stocks, which are detailed at the bottom of Table 1. The study uses the value-weighted ISE-100 index series to assess the market performance.

Throughout the study, rates of return were calculated as follows:

$$R_{it} = (P_{it} - P_{t-1})/P_{t-1}$$

Here P_{it} reflects the price of the security i at time t. Beta coefficients, β_i, were then calculated using the market repeated below:

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it}$$

Here R_{mt} denotes the rate of return on the ISE-100 and α_i and β_i are the regression parameters to be estimated. Damodaran (2002) argues that in many emerging markets, both the companies being analyzed and the market itself change significantly over short periods of time. Using five year data, as usually done, for a regression may yield a beta estimate for an equity that bears little resemblance to the company as it exists today. Consequently, we started to estimate betas over sub-periods as short as a year. For the 8-year sample period, beta coefficients were calculated for consecutive annual estimation intervals, resulting in 8 betas per security. The procedure was repeated to produce four betas for two-year estimation intervals, and two betas for four-year estimation intervals per security.

Table 1, summarizes the distributions of beta estimates in terms of the means, standard deviations, medians, maximum and minimum values over the whole sample period and its subintervals. In general, the average betas are less than one. Possible explanations for the “less than one beta” are (1) measurement errors, (2) stocks excluded from the sample, and (3) capitalization bias. For instance, the average beta estimates displayed in Table 1 give equal weight to each security while the ISE-100 index is weighted to give greater influence to the higher capitalized firms. In addition, a few discontinued stocks and the stocks that were introduced to the market after 1992 were excluded from the sample. The above mentioned factors, therefore, might have influenced the content of Table 1. However, the beta instability through time is the main subject of interest in this paper, therefore, the level of estimated betas is of less concern.

It is seen in Table 1 that the average annual beta is observed to be around 0.9 consistently. Fluctuations in periodical betas do get larger as the estimation period gets shorter as statistically expected.

Table 1: Distribution of Betas Estimated Over Various Estimation Periods

Descriptive statistics for the beta estimates computed over a sample of 100 Turkish stocks*. The sample covers the period from 1992 to 1999.

Period	Average Beta	Standard Deviation	Median	Kurtosis	Skewness	Minimum	Maximum
1992	0.792	0.428	0.858	-0,385	-0,267	-0.459	1.665
1993	0.894	0.327	0.924	0,809	-0,577	-0.080	1.661
1994	0.939	0.268	0.987	0,889	-0,777	-0.068	1.384
1995	1.054	0.310	1.100	1,286	-0,876	-0.111	1.646
1996	0.962	0.336	0.960	0,586	-0,040	0.027	1.899
1997	0.807	0.251	0.782	1,731	-0,143	-0.097	1.490
1998	0.850	0.237	0.869	1,935	-0,589	-0.060	1.521
1999	0.743	0.278	0.724	0,016	0,161	0.064	1.531
92-93	0,880	0,283	0,915	1,435	-0,983	-0,159	1,340
94-95	0,965	0,234	1,022	2,922	-1,257	-0,076	1,296
96-97	0,850	0,228	0,830	2,151	-0,364	-0,058	1,461
98-99	0,809	0,213	0,794	0,818	-0,586	0,045	1,169
92-95	0,941	0,216	0,974	4,706	-1,509	-0,099	1,278
96-99	0,825	0,195	0,818	1,992	-0,618	0,004	1,197
92-99	0,889	0,177	0,890	7,105	-1,577	-0,055	1,223

* The stocks included in the sample are:

				adana	adnac	afyon	akalt
akbnk	aksa	alark	alrsa	altin	anacm	arclk	asels
aslan	aygaz	bagfs	boluc	brisa	celha	cimsa	cukel
devah	disba	dokts	ecilc	eczyt	egbra	egeen	eggub
enka	ercys	eregl	fenis	finbn	garan	gents	goody
gubrf	guney	hurgz	hekts	iktfn	intem	isctr	istmp
izmdc	izocm	kartn	kavor	kchol	kepez	klmbo	konya
kords	kutpo	maalt	maktk	maret	metas	migrs	mmart
mrdin	mrshl	nthol	okant	olmks	otosn	parsn	pegpr
petkm	pimas	pinsu	pkent	pnet	pnsut	pnun	ptofs
sabah	sarky	smens	tborg	tekst	telts	thyao	tirek
tkbnk	toaso	tofas	trkcm	tsise	tskbn	tuddf	tuprs
tutun	unyec	usak	vakfn	vestl	yasas	ykbnk	yunsa

III. Empirical Results

It is widely accepted that the OLS beta estimates of one period are not good predictors of the corresponding betas in the subsequent period. Attempts have been made to correct for inefficiency in beta forecasts by adjusting computed

OLS betas. Vasicek (1973) has suggested a Bayesian approach to adjust the OLS beta estimates. This procedure makes use of the prior or historical distribution of OLS beta coefficients to provide posterior estimates of model parameters. The mean of the posterior distribution of beta for a security is a weighted average of the OLS estimator and the mean cross-sectional beta, where the weights are inversely proportional to the respective variances. We, therefore, can calculate Vasicek (1973) betas using the following equation,

$$\hat{B}'_{j1} = \left(\bar{B}_1 / S^2_{\bar{B}1} + B_{j1} / S^2_{B1} \right) / \left(1 / S^2_{\bar{B}1} + 1 / S^2_{B1} \right)$$

where $\hat{B}'_{j1}$ is the mean of the posterior distribution of beta for security j, $\bar{B}_1$ is the mean of the cross sectional distribution of security betas for period 1, $S^2_{\bar{B}1}$ is the variance of cross sectional betas in period 1, B_{j1} is the estimated beta coefficient for security j in period 1, and S^2_{B1} is the variance in the estimate of B_{j1}.

As it is stated in Dimson (1979), when shares are thinly traded, their beta estimates are biased downwards. If thin trading persists over time, these systematic biases are expected to be serially correlated and the OLS beta estimates would look like more stable than they actually are. In response to the possibility of thin trading in the ISE, we also estimated betas using Dimson's (1979) lead-lag method. The Dimson betas are obtained by regressing the stock returns on the contemporaneous market return and two leads and two lags of the market return. Accordingly, the multiple regression form of the Dimson model is

$$R_{it} = a_i + b_{1i}R_{mt-2} + b_{2i}R_{mt-1} + b_{3i}R_{mt} + b_{4i}R_{mt+1} + b_{5i}R_{mt+2} + u_{it}$$

and thus, the Dimson beta is given as

$$\beta_i^D = \sum_j^5 bji.$$

We computed Vasicek and Dimson betas in addition to OLS betas to control against the inefficiency in OLS beta forecasts. All of the beta estimates for various estimation periods are presented in Table 2. In the table, stocks are also classified into three risk categories according to the point estimates of systematic risk. Stocks are classified as low risk if their beta is less than 0.8, medium risk if their beta is between 0.8 and 1.2, and high risk if their beta is greater than 1.2. It is seen that there is not much difference between OLS and Vasicek betas. However, Dimson betas are significantly higher than OLS and Vasicek betas as expected in a sample characterized by thin trading. There are more high risk stocks according to Dimson betas and more medium risk stocks according to Vasicek betas.

Table 2: The Beta Characteristics for the Sample of 100 Turkish Stocks, Over Various Sub-Periods

	1992	1993	1994	1995	1996	1997	1998	1999	92-93	94-95	96-97	98-99	92-95	96-99	92-99
OLS															
Low	48	32	30	19	30	52	37	58	31	24	44	52	20	46	28
Medium	36	57	51	45	50	41	58	35	56	62	50	48	75	54	71
High	16	11	19	36	20	7	5	7	13	14	6	0	5	0	1
Average	0,792	0,894	0,939	1,054	0,962	0,807	0,850	0,743	0,880	0,965	0,850	0,809	0,941	0,825	0,889
Dimson															
Low	35	33	23	25	31	38	23	21	19	18	28	20	17	21	10
Medium	34	32	22	33	37	43	56	54	47	31	55	69	40	69	71
High	31	35	55	42	32	19	21	25	34	51	17	11	43	10	19
Average	0,956	1,077	1,265	1,099	1,045	0,929	0,963	1,053	1,073	1,200	0,976	0,976	1,136	0,963	1,039
Vasicek															
Low	48	26	26	11	20	52	33	66	27	18	41	51	16	46	22
Medium	39	70	65	60	68	45	67	33	71	76	57	49	80	54	78
High	13	4	9	29	12	3	0	1	2	6	2	0	4	0	0
Average	0,801	0,895	0,943	1,059	0,956	0,809	0,851	0,742	0,883	0,969	0,851	0,812	0,944	0,826	0,890

Results are presented for OLS, Dimson (1979), and Vasicek (1973) betas. Results are also classified into stocks with low betas ($\beta < 0.8$), stocks with medium betas ($0.8 - \beta - 1.2$) and stocks with high betas ($\beta > 1.2$).

A formal comparison of the betas obtained using different estimators is treated by the Wilcoxen test. In comparing two matched samples the Wilcoxen test takes account of the sign and the size of the difference between each pair. This test also has very high power efficiency compared to other methods designed specifically for the matched pair situation (Hays, 1973). The mechanics of the test are very simple. The signed difference between each pair of observations is found. Then these differences are rank-ordered in terms of their absolute size. Finally, the sign of the difference is attached to the rank for that difference. The test statistic, T, is the sum of the ranks with the less frequent sign. The hypothesis tested by the Wilcoxen test is that the two populations represented by the respective members of matched pairs are identical. For large N (number of pairs), the sampling distribution is approximately normal with:

$$E(T) = N(N+1)/4 \text{ and } \sigma^2_r = N(N+1)(2N+1)/24$$

Since we are interested in no directional difference between the two populations, a two tailed test has been applied.

Table 3 reports Wilcoxen signed rank tests. The differences between Dimson betas and OLS and Vasicek betas are formally supported by the significantly negative Wilcoxen signed rank tests for the full sample and the most of the sub-periods. The difference between OLS and Vasicek betas, however, is not significative. Therefore, the Vasicek betas are not included in ensuing tests in the study.

Table 3: The Wilcoxon Signed Rank Tests

	1992	1993	1994	1995	1996	1997	1998	1999	92-93	94-95	96-97	98-99	92-95	96-99	92-99
β_{OLS} versus β_D	-4,631	-3,799	-5,058	-1,038	-1,850	-3,435	-4,398	-7,155	-6,131	-4,972	-3,621	-6,375	-6,021	-5,859	-6,963
β_{OLS} versus β_V	0,313	-0,987	-0,519	-0,791	0,038	-0,124	-0,364	-0,416	-0,873	-0,502	0,021	-0,134	-0,633	0,076	-0,399
β_V versus β_D	-4,521	-3,679	-5,061	-0,866	-1,795	-4,796	-4,398	-7,337	-6,234	-5,006	-3,614	-6,608	-6,096	-6,031	-7,104

* The alternative hypothesis is set to proclaim the existence of a nondirectional difference between two populations. Hence a two-tailed test has been applied. Consequently, the critical t value is ±1.96.

The Wilcoxon signed rank tests comparing (a) OLS and Dimson (1979) betas (βOLS versus βD); (b) OLS and Vasicek (1973) betas (βOLS versus βV); (c) Vasicek (1973) and Dimson (1979) betas (βV versus βD). Results are presented for the sample of 100 Turkish stocks, over various sub-periods. The Wilcoxon test statistic, T, has an asymptotic normal distribution under the null hypothesis. Significant test statistics are indicated with bold-italic characters*.

To initiate the question of time-varying beta we ran Blume (1971) regressions to examine if there was a regression tendency in the betas. For this purpose, a cross sectional regression is run on the security betas computed for two adjacent periods. The equation of simple linear regression accordingly run for a sub-period is

$$\beta_{jt} = a_0 + a_1 B_{jt-1} + e_j \qquad \text{for } j = 1, 2, \ldots, 100$$

Where a_0 and a_1 are least square regression coefficients and e is a random disturbance term. B_{jt} and B_{jt-1} are the beta estimates for security j in sub-periods t and t-1. We tested through t-statistics whether the intercept coefficients, a_0, are zero and the slope coefficients, a_1, are unity.

Blume regressions were run for each of the sub-period groups and estimators. The regression results reported in Table 4 demonstrate that the intercept coefficients are significantly different from zero. Most of the slope coefficients are significantly different from unity. These findings suggest the presence of a regression tendency and inter-period beta instability. However, this provides no evidence on intra-period beta instability.

Table 4: Blume Regression Results

OLS Betas	Intercept Coeff.		Slope Coeff.		Dimson Betas	Intercept Coeff.		Slope Coeff.	
β_{93}^{OLS} =	0,696 (10,617)	+	0,249 (3,414)	β_{92}^{OLS}	β_{93}^{D} =	1,075 (9,190)	+	0,003 (0,023)	β_{92}^{D}
β_{94}^{OLS} =	0,634 (8,854)	+	0,341 (4,526)	β_{93}^{OLS}	β_{94}^{D} =	0,986 (6,818)	+	0,260 (2,135)	β_{93}^{D}
β_{95}^{OLS} =	0,807 (7,26)	+	0,262 (2,306)	β_{94}^{OLS}	β_{95}^{D} =	0,909 (8,611)	+	0,151 (2,013)	β_{94}^{D}
β_{96}^{OLS} =	0,686 (0,262)	+	5,878 (2,468)	β_{95}^{OLS}	β_{96}^{D} =	0,919 (7,043)	+	0,114 (1,048)	β_{95}^{D}
β_{97}^{OLS} =	0,686 (5,878)	+	0,262 (2,468)	β_{96}^{OLS}	β_{97}^{D} =	0,862 (10,675)	+	0,065 (0,935)	β_{96}^{D}
β_{98}^{OLS} =	0,463 (6,679)	+	0,479 (5,831)	β_{97}^{OLS}	β_{98}^{D} =	0,932 (11,116)	+	0,034 (0,402)	β_{97}^{D}
β_{99}^{OLS} =	0,200 (2,284)	+	0,639 (6,430)	β_{98}^{OLS}	β_{99}^{D} =	0,939 (6,641)	+	0,118 (0,841)	β_{98}^{D}
β_{9495}^{OLS} =	0,630 (9,216)	+	0,380 (5,131)	β_{9293}^{OLS}	β_{9495}^{D} =	0,909 (5,887)	+	0,271 (1,965)	β_{9293}^{D}
β_{9697}^{OLS} =	0,472 (5,288)	+	0,392 (4,351)	β_{9495}^{OLS}	β_{9697}^{D} =	0,906 (10,765)	+	0,036 (0,547	β_{9495}^{D}
β_{9899}^{OLS} =	0,351 (5,155)	+	0,539 (6,972)	β_{9697}^{OLS}	β_{9899}^{D} =	0,642 (9,164)	+	0,352 (4,987)	β_{9697}^{D}
β_{9699}^{OLS} =	0,444 (5,625)	+	0,405 (4,958)	β_{9295}^{OLS}	β_{9699}^{D} =	0,966 (11,327)	+	-0,002 (-0,034)	β_{9295}^{D}

The Blume (1971) regression results examining the regression tendency in betas.

The regressions are performed for each of the estimators. β^{OLS} is the beta estimated by OLS and β^{D} is the beta estimated by Dimson method. For the intercept coefficient t-statistics are reported in parantheses testing whether the coefficient is zero. For the slope coefficient the t-statistics are reported in parantheses testing whether the coefficient is unity. Significant test statistics are indicated in bold italics.

Table 5: The Number of Rejections of Beta Stability for the Sample of Turkish Stocks

	1992		1992		1993		1995		1996		1997		1998		1999		92-93		94-95		96-97		98-99		92-95		96-99		92-99	
	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%	n	5%
OLS Betas																														
All	100	25	100	46	100	23	100	46	100	21	100	20	100	17	100	46	100	69	100	50	100	45	100	48	100	71	100	65	100	83
%		0,25		0,46		0,23		0,46		0,21		0,20		0,17		0,46		0,69		0,50		0,45		0,48		0,71		0,65		0,83
High	48	11	32	7	30	8	19	2	30	2	52	14	37	6	58	19	31	14	24	9	44	16	52	20	20	12	46	22	28	19
%		0,23		0,22		0,27		0,11		0,07		0,27		0,16		0,33		0,45		0,38		0,36		0,38		0,60		0,48		0,68
Med	36	6	57	33	51	11	45	17	50	11	41	5	58	8	35	21	56	43	62	34	50	24	48	28	75	54	54	43	71	63
%		0,17		0,58		0,22		0,38		0,22		0,12		0,14		0,60		0,77		0,55		0,48		0,58		0,72		0,80		0,89
Low	16	8	11	6	19	4	36	27	20	8	7	1	5	3	7	6	13	12	14	7	6	5	0	0	5	5	0	0	1	1
%		0,50		0,55		0,21		0,75		0,40		0,14		0,60		0,86		0,92		0,50		0,83		0,00		1,00		0,00		1,00
Dimson Betas																														
All	100	18	100	39	100	26	100	40	100	25	100	23	100	14	100	40	100	68	100	47	100	43	100	45	100	70	100	64	100	84
%		0,18		0,39		0,26		0,40		0,25		0,23		0,14		0,40		0,68		0,47		0,43		0,45		0,70		0,64		0,84
High	35	9	33	7	23	7	25	7	31	7	38	8	23	2	21	3	19	7	18	9	28	11	20	5	17	9	21	9	10	7
%		0,26		0,21		0,30		0,28		0,23		0,21		0,09		0,14		0,37		0,50		0,39		0,25		0,53		0,43		0,70
Med	34	6	32	14	22	4	33	11	37	5	43	10	56	10	54	24	47	30	31	14	55	22	69	31	40	26	69	45	71	58
%		0,18		0,44		0,18		0,33		0,14		0,23		0,18		0,44		0,64		0,45		0,40		0,45		0,65		0,65		0,82
Low	31	3	35	18	55	15	42	22	32	13	19	5	21	2	25	13	34	31	51	24	17	10	11	9	43	35	10	10	19	19
%		0,10		0,51		0,27		0,52		0,41		0,26		0,10		0,52		0,91		0,47		0,59		0,82		0,81		1,00		1,00

The percentages of the sample with unstable betas are shown in italics. Results are presented for both OLS and Dimson (1979) betas. Rejections are assessed according to the LM test at the 5% significance level. Results are presented for the sample of all stocks, stocks with high betas ($\beta > 1.2$), stocks with medium betas (0.8 - β - 1.2) and stocks with low betas ($\beta < 0.8$).

The Breusch and Pagan (1979) LM test was applied to assess the intra-period instability of the stocks in the full sample and all sub-periods. The LM test was applied in both the OLS and Dimson (1979) beta settings. The results are presented in Table 5. For the full eight-year sample (1992 to 1999) we find that from 83 to 84% of our sample have time-varying betas at the 5% level of significance for the OLS and Dimson (1979) betas. The level of instability is almost the same in Dimson and OLS betas. These results suggest that findings of beta instability are not caused by the failure to make thin trading adjustments. We also observe that high beta stocks exhibit greater instability. For Dimson (1979) betas, 19 of the hundred stocks are assigned to high risk group and all of them have time-varying betas. In case of OLS betas, however, one should note that there is only one high risk beta.

There are some significant differences in the results when we consider the four-year sub-periods against the full sample period. First, the degree of beta instability across four-year periods is reduced relative to the full eight-year period. This suggests that in the eight-year sample the high occurrence of beta instability may be due to a sample length effect. Second, for both OLS and Dimson betas, the stocks in the 1992 to 1995 period are more unstable.

We also observe significant differences when we consider the two-year sub-periods against the four-year and the full sample period. The average degree of beta instability for two-year periods is significantly reduced relative to the four-year periods and the full eight-year period. For both OLS and Dimson betas, the highest degree of beta instability occurs for the 1992 to 1993 sub-period. Beta instability is reduced in the succeeding two-year sub-periods. The percentage of time-varying betas varies from 17% to 46% for one-year periods. However, we do not observe a consistent decrease in beta instability when we move from 1992 to 1999.

IV. Conclusion and Suggestions for Future Research

This paper has explored the issue of beta instability in the Turkish stock market over the period from 1992 to 1999. Given the differences in sample period, sample size and the length of sub-periods used in this study and in the studies cited earlier, one-to-one type of comparisons would be inappropriate. However, the findings of the study permit us to make couple of points. First, it seems that the Turkish market is not different than other emerging and developed markets in terms of beta stationarity. Betas are time varying in the ISE. Second, the incidence of beta instability at about 80% for the full eight-year interval is a high score compared to the scores for similar length periods in the studies cited earlier. Similar statement can be put forward for the score of about %65

in case of four-year sub-periods. Third, the incidence of instability gets lower as the estimation sub-period shortens. Hence, a sample length effect may exist. This finding reminds us Damodaran's (2002) statement about how fast companies change their nature and/or economy changes in the emerging markets. Lastly, our results are largely insensitive to one factor. The results are insensitive to whether betas are estimated by OLS or the Dimson (1979) technique.

Of course, the findings of this study are sample specific, due to the short period covered and smaller number of companies included in the sample. Therefore, further replications of this study should be conducted as new data become available. Yet, other estimation issues such as the effect of the return interval, the effect of diversification, the "right" length of estimation period as well as the stochastic properties of betas in the Turkish market would be worthy of future research.

References

Alexander, G. J., Benson, P. G., "More on Beta as a Random Coefficient", Journal of Financial and Quantitative Analysis, 17, 1982, p. 27-36.

Altman, E. I.., Jacquillat, B., Levasseur, M., "Comparative Analysis of Risk Measures: France and the United States", Journal of Finance, 29, 1974, p. 1495-1511.

Baesel, J. B., "On the Assessment of Risk: Some Further Considerations", Journal of Finance, 29, 1975, p. 1491-1494.

Blume, M., "On the Assessment of Risk", Journal of Finance, 26, 1971, p. 1-10.

Blume, M., "Betas and Their Regression Tendencies", Journal of Finance, 30, 1975, p. 785-95.

Bos, T., Fetherston, T. A., "Market Model Nonstationarity in the Korean Stock Market", Pacific Basin Capital Markets Research, 3, 1992, p. 287-302.

Bos T., Newbold, P., "An Emprical Investigation of the Possibility of Stochastic Systematic Risk in the Market Model", Journal of Business, 57, 1984, p. 35-41.

Brailsford, T. J., Josev, T., "The Impact of the Return Interval on the Estimation of Systematic Risk", Pacific-Basin Finance Journal, 5, 1997, p. 357-376.

Breusch, T. S., Pagan, A. R., "A Simple Test for Heteroscadasticity and Random Coefficient Variation", Econometrica, 47, 1979, p. 1287-1294.

Brooks, R. D., Faff, R. W., "Financial Market Deregulation and Bank Risk: Testing for Beta Instability", Australian Economic Papers, 34, 1995, p. 180-199.

Brooks, R. D., Faff, R. W., Ariff, M., "An Investigation into the Extent of Beta Instability in the Singapore Stock Market", Pacific-Basin Finance Journal, 6, 1998, p. 87-101.

Brooks, R. D., Faff, R. W., Lee, J. H. H., "The Form of Time Variation of Systematic Risk: Testing for Beta Instability", Pacific-Basin Finance Journal, 2, 1992, p. 191-198.

Brooks, R. D., Faff, R. W., Lee, J. H. H., "Beta Stability and Portfolio Formation", Pacific-Basin Finance Journal, 4, 1994, p. 463-479.

Chan, L., Lakonishok, J., "Robust Measurement of Beta Risk", Journal of Financial and Quantitative Analysis, 27, 1992, p. 265-282.

Cohen, K., Hawawini, G., Mayer, S., Schwartz, R., Whitcomb, D., "Implications of Microstructure Theory for Emprical Research on Stock Price Behavior", Journal

of Finance, 35, 1980, p. 249-257.
Collins, D.W., Ledolter, J., Rayburn, J., "Some Further Evidence on the Stochastic Properties of Systematic Risk", Journal of Business, 60, 1987, p. 425-448.
Damodaran, A., Investment Valuation. 2nd Ed. John Wiley, 2002.
Dimson, E., "Risk Management When Shares are Subject to Infrequent Trading", Journal of Financial Economics, 7, 1979, p. 197-226.
Dimson, E., Marsh, P., "The Stability of U.K. Risk Measures and the Problem of Thin Trading", Journal of Finance, 38, 1983, p. 753-783.
Fabozzi, F. J., Francis, J. C., "Stability Tests fro Alphas and Betas Over Bull and Bear Market Conditions", Journal of Finance, 32, 1977, p. 1093-1099.
Fabozzi, F. J., Francis, J. C., "Beta as a Random Coefficient", Journal of Financial and Quantitative Analysts, March 1978, p. 101-116.
Faff, R., Brooks, R. D., "Further Evidence on the Relationship Between Beta Stability and the Length of the Estimation Period", Advances in Investment Analysis and Portfolio Management, 4, 1997, p. 97-113.
Faff R., R. W., Lee, J.H.H., Fry, T. R. L., "Timte Stationarity of Systematic Risk: Some Australian Evidence", Journal of Business Finance and Accounting 19, 1992, p. 253-270.
Frankfurter, G., Leung, W., Brockman, P., "Compounding Period Length and the Market Model", Journal of Economics and Business, 46, 1994, p. 179-193.
Ghysels, E., "On Stable Factor Structures in the Pricing of Risk: Do Time-Varying Betas Help or Hurt?", Journal of Finance, 53, 1998, p. 549-573.
Greene, W., "Econometric Analysis", 3rd Ed., Prentice-Hall Inc., 1997, p. 550-553.
Hays, W. L., Statistics. Holt Rinehart and Winston, 1975.
Hildreth, C., Houck, J. P., "Some Estimators for a Linear Model with Random Coefficients", Journal of American Statistical Association, 63, 1968,p. 584-595.
Kim, D., "The Extent of Non-Stationarity of Beta", Review of Quantitative Finance and Accounting, 3, 1993, p. 241-254.
Klemkosky, R. C., Martin, J. D., "The Adjustment of Beta Forecasts", Journal of Finance 30, 1975, p. 1123-1128.
Lee, C. F., Chen, C. R., Beta Stability and Tendency: An Application of a Variable Mean Response Regression Model", Journal of Economics and Business 34, 1982, p. 210-206.
Levy, R. A., "On the Short-Term Stationarity of Beta Coefficients", Financial Analysts Journal, 27, 1971, p. 55-62.
Ohlson, J., Rosenberg, B., "Systematic Risk of the CRSP Equal-Weighted Common Stock Index: A History Estimated by Stochastic Parameter Regression", Journal of Business 55, 1982, p. 121-145.
Roenfeldt, R., "Further Evidence on the Stationarity of Beta Coefficients", Journal of Financial and Quantitative Analysis, March, 1978, p. 11-21.
Shalit, H., Yitzaki, S., "Estimating Beta", Working Paper, Department of Economics and Finance, Ben Gurion University, 2001.
Sunder, S., "Stationarity of Market Risks: Random Coefficient Tests for Individual Stock", Journal of Finance, 35, 1980, p. 883-896.
Vasicek, O., "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas", Journal of Finance 28, 1973, p. 1233-1239.

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642 © ISE 1997

FINANCE AND GROWTH IN TURKEY: CAUSALITY ISSUE

Ensar YILMAZ *
Özgür KAYALICA **

Abstract
There has been a renewed interest in the nature of the links between the development of financial systems and economic growth. Many theoretical models have been proposed to show how financial markets and intermediary activity promote growth. We use a multivariate Granger causality tests within an error-correction framework for Turkey to analyze the causality between the financial sector development and growth for the period 1960-2001. We find that the relationship between financial development and economic growth is in the nature of 'supply-leading' if the sum of the M2Y/GNP ratio and market capitalization is taken as the measure of financial development, but when the variable representing the financial development becomes the ratio of private sector credit to total domestic credit, there is no causal relationship. However, in spite of this conflicting result, it seems that there is no any supportive evidence for the demand-lead causality hypothesis.

I. Introduction

The role of financial sector development in economic growth has become a major topic of empirical research in the last ten years. A standard approach to explaining growth has emerged and the literature has examined the role of the aggregate amount of financial intermediation, bank lending and the influence of equity market development. Numerous studies have dealt with different aspects of this relationship at both the theoretical and empirical levels. Many of them have attempted to establish whether financial deepening leads to improved growth performance, and have endeavored to analyze the strength of this relationship. Other studies have focused on identifying the channels of

* Asst. Prof., Ensar Yılmaz, Faculty of Economics and Administrative Sciences, Department of Economics, Yıldız Technical University, Beşiktaş, Istanbul.
Tel: 212-259 7070 E-mail: enyilmaz2000@yahoo.com.
** Asst. Prof. Özgür Kayalıca, Istanbul Technical University, Faculty of Management.
E-mail: kayalica@itu.edu.tr

transmission from financial intermediation to growth.

The purpose of this paper is to analyze the theoretical arguments in this debate and provide some empirical testing of the relationship between the financial development and economic growth in Turkey during the 1960-2001 period. The empirical analysis uses the recent cointegration and error-correction methodology. We explore the channels through which the financial sector played an enabling role in Turkey's economic development using vector autoregressive (VAR) and error correction models (ECMs).

The choice of the study country is driven by two considerations. First, an individual economy has a unique relationship between finance and growth. This is valid for Turkey too. Second, cross-sectional analysis on the growth-finance relationship and the direct effect of financial repression has long been criticized by its homogeneous assumption on all economy's characteristics, policy implementations, and institutional efficiency.

The paper is structured as follows. Section 2 examines the links between financial development and economic growth theoretically and reviews the empirical studies on this subject and also argues that a time series approach is more fruitful than the cross-section approach which has been quite popular in recent studies. In section 3, we construct a simple theoretical model to observe the interaction between the finance and growth. Section 4 provides an account of the empirical methodology to test the theoretical model. Section 5 reports and analyzes the results of the empirical tests carried out. Finally, section 6 concludes the paper and discuses some policy implications.

II. Finance and Growth

The conventional view that financial deepening is a necessary pre-condition for economic growth rests on many premises. This hypothesis contends that well-functioning financial institutions can promote overall economic efficiency, create and expand liquidity, mobilize savings, enhance capital accumulation, transfer resources from traditional (non-growth) sectors to the more modern growth-inducing sectors, and also promote a competent entrepreneur response in these modern sectors of the economy. This hypothesis is usually labeled "supply leading" since it postulates that the presence of efficient financial markets increases the supply of financial services in advance of the demand for them in the real sector of the economy. The "supply-leading" hypothesis has been advanced by many prominent economists like Gurley and Shaw (1955), Goldsmith (1969), McKinnon (1973), Shaw (1973), and Fry (1978). Recent empirical work by King and Levine (1993 a, b), DeGregorio and Giudotti (1995), and Levine and Zervos (1996) have all lent support to the supply-leading hypothesis in the case of many developing (and developed) countries. The statistical basis of this apparent support is that, almost without exceptions, the empirical results reveal positive and statistically significant coefficients on the proxies of financial deepening in the real economic growth equations.

Although plausible, this supply-leading hypothesis is not of course the only possible description of reality. Indeed, many well-known scholars including Robinson (1952) and Patrick (1966) have long rejected this hypothesis on purely theoretical grounds. They argue that financial deepening is merely a by-product or an outcome of growth in the real side of the economy, a contention recently revived by Ireland (1994) and Demetriades and Hussein (1996). According to this alternative view, any evolution in financial markets is simply a passive response to a growing economy. As the real sector expands and grows (due, say, to technological advancement or improvement in labor productivity), the growing real sector will generate increased and new demands for financial services. This in turn will exert and intensify pressures to establish larger and more sophisticated financial institutions to satisfy the new demand for their services. This alternative view is often called the "demand-following" hypothesis since financial markets develop and progress following the increased demand for their services from the growing real economy.

Interestingly, there is still another group of well-known economists who maintain that financial deepening is almost totally irrelevant for economic growth. Some prominent economists [e.g., Lucas (1988), Stern (1989)] have long rejected any causal role for financial deepening in the growth process. In a study describing the dynamics of economic development, Lucas (1988) argued that economists have generally exaggerated the importance of financial markets in economic development and that these markets at best play only a very minor role in the economic growth process. If valid, this Stern-Lucas proposition denies any reliable causal relationship between financial deepening and real economic growth. Thus, a third pattern emerges implying that the two variables are causally independent.

Besides the above three distinct causal hypotheses, a fourth proposition can be inferred which is a combination of the supply-leading and demand-following hypotheses. That is, both hypotheses are jointly valid, making financial deepening and real economic growth mutually causal (bidirectional causality). This type of causality pattern seems likely especially over the long-run. Greenwood and Smith (1997) have also advanced a similar view in their recent survey.

In addition to all of these propositions, theory also shows that financial

development can hurt growth. Specifically, by enhancing resource allocation and the returns to saving, financial sector development could lower saving rates through well-known income and substitution effects. Also, greater risk diversification in some models lowers precautionary savings and therefore may lower aggregate saving rates. If there are externalities associated with capital accumulation, this drop in savings could slow growth and reduce welfare. Thus, theory provides ambiguous predictions about the growth effects of financial development. Theory also provides conflicting predictions about whether stock markets and banks are substitutes, compliments, or whether one is more conducive to growth than the other. For instance, Boyd and Prescott (1986) model the critical role that banks play in easing information frictions and therefore in improving resource allocation, while Stiglitz (1985) and Bhide (1993) stress that stock markets will not produce the same benefits as banks.

Use of the cross-sectional regression has become a near-tradition in the empirical analysis of growth and its possible determinants in the years since Barro (1991) isolated key variables, such as education and political stability, as members of a benchmark set of robust correlates. Given that most existing studies of financial factors in growth are extensions of this framework (e.g., King and Levine, 1993a, b; Levine and Zervos, 1996, 1998, Atje and Jovanovic (1993), Demirgüç-Kunt and Maksimovich (1998), Rajan and Zingales (1998), Neusser and Kugler (1998), Rousseau and Wachtel (1998), and Beck, Levine and Loayza (2000)),

However, a great deal of skepticism in relation to cross-country regressions is shared by many investigators. In relation to King and Levine (1993a, b), Arestis and Demetriades (1997) argue that their causal interpretation is based on a fragile statistical basis, while they do not disagree with King and Levine that financial development and growth are robustly correlated, they do not think that the question of causality can satisfactorily be addressed in a cross-section framework.

To Arestis and Demetriades (1997), the cross-country regressions approach has a further limitation. It can only refer to the "average effect" of a variable across countries. In the context of causality testing this limitation is particularly severe as the possibility of differences in causality patterns across countries is likely. Such differences are, in fact, detected by time-series studies. For example, Arestis and Demetriades (1997), which utilizes data for 12 countries, provides evidence which suggests that the causal link between finance and growth is crucially determined by the nature and operation of the financial institutions and policies pursued in each country. They conclude that "not only is possible that the long-run causality may vary across countries but it is also possible, indeed likely, that the long-run relationships themselves exhibit substantial variation. They argue that a time series analysis may yield deeper insights into the relationship between financial development and real output than cross-country regressions.

Although not many, there are some time-series studies to search the causality relationships between finance and growth. Jung (1986), and Demetriades and Hussein (1996) carried out causality tests for 16 developing countries, suggesting that causality between financial development and growth varies across countries. An investigation of finance and growth in Sweden from 1834 to 1991 by Hansson and Jonung (1997) revealed no stable and conclusive finance-led growth relationship in the long run. Arestis, Demetriades and Luintel (2000) use quarterly data and apply time series methods to five developed economies and show that while both banking sector and stock market development explain subsequent growth. Darrat (1999) investigates empirically the role of financial deepening in economic growth in three middle-eastern countries (Saudi Arabia, Turkey, and the United Arab Emirates). The results generally support the view that financial deepening is a necessary causal factor of economic growth, although the strength of the evidence varies across countries and across the proxies used to measure financial deepening. Levine and Carkovic (2001) find that the empirical results emphasize the growth-enhancing role of stock markets and banks for Chile. Thornton (1995) analyzes 22 developing economies with mixed results although for some countries there was evidence that financial deepening promoted growth. Spears (1991) reports that in the early stages of development financial intermediation induced economic growth in Sub-Saharan Africa, while Ahmed and Ansari (1998) report similar results for three major South-Asian economies. Neusser and Kugler (1998) report that financial sector GDP Granger-caused manufacturing sector GDP in a sample of thirteen OECD countries. In time series studies of industrialized countries over the past century, Rousseau and Wachtel (1998) present evidence that the dominant causal link runs from the intensity of intermediary activity to economic performance.

III. The Theoretical Model

In order to establish the theoretical link between financial deepening and growth, we assume that we have a closed economy featured by an aggregate production function where output Y(t) is produced during period t by capital factor, K(t):

$$Y(t)=F(K(t)) \qquad (1)$$

K(t) is the aggregate capital stock including physical and human capital. Total differentiation of equation (1) gives

$$dY(t) = \frac{\partial F}{\partial K(t)}\, dK(t) \qquad (2)$$

Dividing the two terms of (2) by Y(t) gives the growth rate of the economy $g = dY(t)/Y(t)$ as follows:

$$\frac{dY(t)}{Y(t)} = g = \frac{\partial F}{\partial K(t)} \frac{dK(t)}{Y(t)} \qquad (3)$$

The growth rate g appears then as a product of the marginal productivity of capital $\partial F / \partial K(t)$ and the investment rate $dK(t) / Y(t)$. In this closed economy without government, the financial market equilibrium supposes the equality between savings and investment. However, we could envisage the hypotheses of a loss of resources during the intermediation process such that in equilibrium only a fraction of saved resources S(t) is channeled to investment I(t) as follows:

$$\theta\, S(t) = I(t) \qquad (4)$$

The amount of savings absorbed by the financial system is then $(1-\theta)\, S(t)$ and the higher it is, the lesser is capital accumulation in the economy. Combining this latter equation with the growth rate of the economy, we have:

$$g = F'(K(t))\theta \left[\frac{S(t)}{Y(t)}\right] \qquad (5)$$

It appears then from this simple model that the development of financial market may affect the growth process through: (i) First, the improvement of capital productivity with better resource allocation toward their most productive use. In equation (5), this corresponds to an increase in F' (K(t)). (ii) Second, the channeling of more savings to investment by avoiding the loss of funds during the intermediation process through a rise in the fraction θ. (iii) Finally, through an increase of the saving rate S(t) / Y(t) (or also the investment rate) by using economic policies affecting directly the determinants of private saving behavior.

IV. The Empirical Methodology and Data

After defining the channels of financial development to affect the growth theoretically, now we can analyze empirically whether these channels in total are effective at the growth rate in Turkey.

4.1. Indicators of Financial Development

In order to assess the efficiency with which financial intermediaries and markets assess new projects and firms, we need appropriate indicators of financial deepening and economic growth in Turkey. For economic growth, we follow the common practice and use the growth rate (percentage changes) of real GNP for Turkey, denoted by G. While the perfect measures certainly do not exist, the recent literature has developed indicators that proxy relatively well for financial intermediary and stock market development across countries. While many studies have focused on either financial intermediary or stock market development, one of indicators used in this paper combine the development of banks and stock markets into one proxy. Omitting stock market development makes it difficult to assess whether (a) the positive relationship between bank development and growth holds when controlling for stock market development, (b) banks and markets each have an independent impact on economic growth, or (c) overall financial development matters for growth but it is difficult to identify the separate impact of stock markets and banks on economic success. While this does not control for the fact that banks and stock markets might impact economic growth through different channels, as found by Levine and Zervos (1998), it helps us distinguish more clearly between the effects of financial development as opposed to financial structure.

There are some measures of the level of financial development which are closely linked to the functioning of the financial system. These variables have been used in the growth regressions to study the impact of financial sector development on growth. These measures show the size of financial intermediaries and equal liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries). One of them is the currency ratio, denoted by C, and calculated by the ratio of currency to the narrow money stock (M1). The second proxy of the degree of financial deepening is the inverse of the broad-money velocity, that is, the ratio of broad money stock (M2) to nominal GDP. This measure, suggested by McKinnon (1973) and Shaw (1973), and recently used by King and Levine (1993a, b) is often called the monetization variable, which could measure the size of the financial market or "financial depth." However, we use the more comprehensive proxy, which is M2Y. The variable M2Y includes all of the

components of M2 plus foreign exchange deposits. Due to high level of dollarization (currency substitution) in Turkey, it seems that the ratio of (M2Y) to nominal GDP will capture the notion of financial depth[1]. Then, in order to measure the total extent of financial system, we add the market capitalization (the value of listed shares divided by GDP) as a measure of stock market development to the ratio of (M2Y) to nominal GDP[2]. This sum of ratios of financial intermediaries and stock exchange market is represented by the variable F.

The second proxy used in this paper is the ratio of credit allocated to private enterprises to total domestic credit (excluding credit to banks), which is denoted by K. The variable K addresses the allocation of credit. The assumption behind using this measure is that financial systems that allocate more credit to private firms are more engaged in researching firms, exerting corporate control, providing risk management services, mobilizing savings, and facilitating transactions than financial systems that simply give credit to the government or state owned enterprises. Thus, the proxy K is used due to taking into account the impact of financial intermediation on productivity. Recent work shows that this measure exerts a large, positive, robust influence on economic growth (Beck, Levine, and Loayza 2000).

We use annual data over 1960-2001 on the components of the three measures (G, F, and K) for Turkey, and the data came from the various issues of the IMF, International Financial Statistics and the State Planning Organization (SPO).

4.2. Empirical Methodology

In order to empirically test the causality issue it is common to apply the Granger causality test (Granger, 1969, Sims, 1972). A time series {Xt} is said to Granger-cause another time series {Yt} if the prediction error from regressing Y on X declines by using past values of X in addition to past values of Y. Tests of Granger-causality require stationary time series. Granger (1986) shows that any nonstationary time series {Y} can achieve stationarity if differenced

---

1 In the aftermath of the capital account liberalization in 1989, M2Y, which includes foreign exchange deposits, displayed an upward trend (Central Bank of Turkey, 2002).

2 Since financial liberalization in the 1980s, Turkey's securities markets have grown tremendously in size and in sophistication, though the dominance of the government debt securities in the market has remained unchanged. Stock market capitalization has increased from from 1% of GNP in 1988 to 38% of GNP in 2001. This tremendous growth induces us to add it to the variable M in order to find the total extent of financial system.

appropriately. To determine the proper order of differencing for any variable, we employ the Augmented Dickey-Fuller (ADF) test. The proper lag structures in the unit root tests are determined by the Akaike Information Criterion (AIC) and autocorrelation.

This paper uses the traditional methodology that the VAR will take first-differencing for I(1) series before carrying out Granger causality tests. The causality relationship is determined by whether the present and lagged values of a variable affect another variable. However, if variables are non-stationary and cointegrated of order 1, I(1), the causation may come from another source, which is the deviation from the long-run equilibrium relationship. The causality tests, therefore, are preceded by cointegration testing in order to identity whether there is any long run relationship among variables. We use the Engle-Granger (1987) and the Johansen-Juselius (1990) tests for the presence of cointegrating vectors.

Note that the standard Granger-causality tests between X and Y are valid only if the two variables are not cointegrated (i.e., lacking a long-run relationship). Otherwise, Hendry (1986), and Engle and Granger (1987) have demonstrated that it will be biased because they overlook valuable long-run (low-frequency) information. Under cointegration, a better approach is to use Granger's (1986) Representation Theorem to construct Error Correction models (ECMs) to analyze the causal relationships between the two variables. To test for cointegration, Engle and Granger (1987) have outlined a two-step procedure.

If the two variables are found to be cointegrated, then the final stage of the empirical methodology is to construct dynamic error correction models (ECMs) that take into account the underlying cointegration properties of the two variables. The ECMs differ from the standard Granger-causality models in that they add another regressor in each equation; namely, the estimated residuals (called the error correction, EC, terms) that are obtained from the associated cointegrating equations. Blind applications of "standard" Granger-causality tests that overlook the cointegratedness of the variables would have yielded incorrect causality inferences. Granger Causality in a cointegrated system in an ECM form:

$$\Delta y_t = \alpha_{01}\,\gamma_1\,(y_{t-1} - b_0 - b_1 x_{t-1}) + \sum_{i=1}^{k_1} \alpha_{i1}\,\Delta y_{t-i} + \sum_{i=1}^{k_2} \beta_{i1}\,\Delta x_{t-i} + u_{1t} \qquad (1)$$

and

$$\Delta x_t = \alpha_{02}\,\gamma_2\,(y_{t-1} - b_0 - b_1 x_{t-1}) + \sum_{i=1}^{k_1} \alpha_{i2}\Delta y_{t-i} + \sum_{i=1}^{k_2} \beta_{i2}\,\Delta x_{t-i} + u_{t2} \qquad (2)$$

This two-variable error correction model is a bivariate VAR in first differences augmented by the error-correction terms γ_1 and γ_2. Notice that γ_1 and γ_2 are speed of adjustment parameters. The larger γ_1 is, the greater the response of y_t to the previous period's deviation from long-run equilibrium. At the opposite extreme, very small values γ_1 imply that y_t is unresponsive to last period's equilibrium error. For the $\{\Delta y_t\}$ sequence to be unaffected by the sequence y_t and all the coefficients of $\{\Delta x_t\}$ must be equal to zero. Thus, the absence of Granger causality for cointegrated variables requires the additional condition that the speed of adjustment coefficient be equal to zero. Of course, at least one of the speed of adjustment terms in (1) and (2) must be nonzero. If both γ_1 and γ_2 are equal to zero, the long-run equilibrium relationship does not appear and the model is not one of error correction or cointegration.

V. Empirical Results

Before proceeding to a discussion of the empirical results, we should note that causality inferences from bivariate models could be biased due to omitted variables. Therefore, the inflation rate, which seems relevant for the case at hand was incorporated in order to mitigate the potential for biases, making our models multivariate in nature. The variable of inflation rate also seems to represent the changes in interest rate, which is extremely important to understand what is happening in Turkey in this context.

The support for the supply-leading hypothesis is inferred if the degree of financial deepening (F and/or K) unidirectionally Granger-causes real economic growth (G). If, however, the reverse is true, then support is instead found for the demand-following hypothesis.

Table 1 reports the results from the unit roots (nonstationarity) tests for all the variables, all of which are in logarithmic form. The ADF-test results indicate that the null hypothesis of nonstationarity is not consistently rejected for all variables if the variables are expressed in levels. But the real economic growth (G) gives conflicting results, depending on how many differenced variables are included on the right-hand side of the ADF regression. However, closer study of the ADF regressions for the G indicates that AIC statistics improves as the differenced lags are added. Therefore, we decide that G is nonstationary in levels. On the other hand, the ADF-test results indicate that the null hypothesis of nonstationarity is consistently rejected for all variables if the variables are expressed in first-differences. Thus, the variables can be considered integrated of order one [~I (1)] and may thus be cointegrated (a reliable long-run (equilibrium) relationship).

Next, we test for possible cointegration among the proxy variables of the degree of financial deepening and economic growth. To that end, we use the Engle-Granger and the Johansen-Juselius approach. But, only the results from the latter test are reported to conserve

Table 1: Unit Roots Test Results
Null Hypothesis: The Variable is Nonstationary in the Tested Form

(A) Variables in Levels	ADF(L)
Real economic growth, G	-2.04(2)
Financial Development Indicator, F	1.94 (2)
Credit Ratio, K	-1.15 (2)
Inflation, INF	-1.17(2)
(B) Variables in First-Difference	**ADF(L)**
ΔG	-4.20(2)*
ΔF	-3.61(2)*
ΔK	-3.26(1)*
ΔINF	-5.91(2)*

Notes: L is the proper (AIC-based) lag length measured in years. An * indicates rejection of the null hypothesis of nonstationarity at the 5 percent level of significance.

space. Table 2 and Table 3 display the cointegration test results. We introduce lags in the testing equations that are sufficiently long to induce white-noise residuals. When cointegrating vectors are (G, F, INF) and (G, K, INF) (Table 2), the likelihood ratio rejects any cointegration at 5% significance level. But when INF is excluded, (G and F) and (G and K) are cointegrated, specifically supporting the presence of one non-zero cointegrating vector (Table 3)[3]. This implies that inflation does not possess a reliable long-run relationship with financial deepening and real economic growth. Therefore, to enhance statistical efficiency, the inflation variable was excluded from the cointegrating vectors prior to constructing the ECM. But we include the inflation (in difference) as an independent variable in the ECM because while inflation may not exhibit a long-run relationship with the remaining two variables, it may still be related to them over the short-run horizon within the ECM framework.

[3] The Engle-Granger procedure also give the same result as the Johansen-Juselius procedure that the variables G and F and G and K are cointegrated at the proper lags.

Table 2: Multivariate Cointegration Test Results:
The Johansen-Juselius Approach
Cointegrating Vector (G, F, INF)

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.300675	21.32055	29.68	35.65	None
0.152141	7.372602	15.41	20.04	At most 1
0.023715	0.936013	3.76	6.65	At most 2

Cointegrating Vector (G, K, INF)

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.231649	16.88782	29.68	35.65	None
0.106086	6.610978	15.41	20.04	At most 1
0.055752	2.237295	3.76	6.65	At most 2

Notes: L.R. rejects any cointegration at 5% significance level. Results are based on 2 lags.

Table 3: Bivariate Cointegration Test Results: The Johansen-Juselius Approach

Cointegrating Vector (G and F)

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.371946	19.25386	15.41	20.04	None*
0.016087	0.648709	3.76	6.65	At most 1

*denotes rejection of the hypothesis at 5% significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level at lag 1.

Cointegrating Vector (G and K)				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.326165	16.92741	15.41	20.04	None*
0.049426	1.926178	3.76	6.65	At most 1

* denotes rejection of the hypothesis at 5% significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level at lag 3.

The empirical results from the ECMs are assembled in Table 4. In these results, it seems that there is a supportive evidence of the supply-leading hypothesis when the degree of financial deepening is measured by F. However, the variable K (as the ratio of credit allocated to private enterprises to total domestic credit) does not Granger-cause growth or vice versa. This result suggests that financial development leads to economic growth but this is not mainly through an increase of the efficiency of investment induced by the allocation of credits to private enterprises. This shows that the allocation of credits by banks is either not enough to spur growth or not effectively used by the real sector. Especially high interest rates as of the mid-1980s appear to be one of fundamental causes for this. The increased interest rates during this period have urged banks not to make loans to real sector but rather make them lend to the government which has to offer high interest rates to finance the budget deficit. Thus, the private sector has been crowded out of the credit markets, but this situation needs to be explored in more detail and give an opportunity for many possible extensions for future research.

On the other hand, adjustment parameters (γ_1 and γ_2) are not zero in both in the ECM model of G and F, and in the ECM model of G and K according to the t-tests applied, this verifies the cointegration results that there is a long-run relationship between these variables.

Table 4: Granger-Causality Test Results From Trivariate Error-Correction Models

Null Hypothesis	F-statistics
F does not Granger-cause G	5.03*
G does not Granger-cause F	1.89
K does not Granger-cause G	1.52
G does not Granger-cause K	1.88

Notes: Proper Lags are based on AIC. An * indicates rejection of the null hypothesis of noncausality at the 5 percent level of significance.

VI. Conclusions and Policy Implications

This paper investigates empirically the relationship between the development of an economy's financial sector and its real economic growth in Turkey. The empirical analysis is based on multivariate Granger-causality tests within an error-correction framework. in addition to the well-known problems associated with the Granger concept of causality, the results of this paper are only suggestive and should thus be interpreted cautiously.

The direction of causality between financial development and economic growth in Turkey is searched for the period 1960-2001. In order to see the impact of different aspects of financial development, we have chosen two proxies for financial development, one of which represents the extent of financial development, including both the development of banking and stock markets. On the other hand, we need another proxy to elaborate the channel of financial development to growth. However, as there is no causal relationship between the ratio of private sector credit to total domestic credit and growth, the relationship between financial development and economic growth is only in the nature of 'supply-leading' if the sum of M2Y/GNP and market capitalization is taken as the measure of financial development. However, there is no supportive evidence for the demand-lead causality hypothesis. It is, therefore, clear that expanding and refining the financial sector in Turkey should prove beneficial to her economic growth process, particularly by improving the credit allocation mechanism.

It is worth emphasizing that the modeling effort in this paper is mainly exploratory, revealing many possible extensions for future research. In particular, some consideration for sectoral disaggregation could provide interesting results. For example, financial deepening may influence only some but not all sectors of the economy, and certainly not in the same degree or manner. Therefore, it may be important for policymakers to identify those sectors that are most sensitive to financial development. Furthermore, it appears useful to examine the underlying mechanism through which financial deepening impacts economic growth.

References

Ahmed, S. N., Ansari, M. I., “Financial Sector Development and Economic Growth: The South-Asian Experience,” Journal of Asian Economics, 9, 1998, pp. 503-17.

Arestis, P., Demetriades, P., “Financial Develpment and Economic Gowth: Assessing the Evidence”, The Economic Journal, 107, 1997, pp. 783-799.

Arestis, P., Demetriades, P, Luintel, K. B., “Financial Development and Economic Growth: The Role of Stock Markets,” Journal of Money, Credit, and Banking, Vol.33, No.1, 2001, pp. 16-41.

Atje, Raymond, Jovanovic, B., “Stock Markets and Development,” European Economic Review, 37 (2/3), 1993, pp. 632-40.

Barro, R. J., “Economic Growth in a Cross Section of Countries”, Quarterly Journal of Economics, 106(May), 1991, pp. 407-443.

Beck, T., Levine, R., N. Loayza, N., “Finance and the Sources of Growth”, Journal of Financial Economics, 58, 2000, pp. 261-300.

Bhide, A., "The Hidden Costs of Stock Market Liquidity," Journal of Financial Economics, 34(2), 1993, pp. 31-51.

Central Bank of the Republic of Turkey (CBRT), The Impact of Globalization on the Turkish Economy, CBRT, Ankara 2002.

De Gregorio, J., Guidotti, P., “Financial Development and Economic Growth”, World Development, 23(Mar.), 1995, pp. 433 - 438.

Demetriades, P. O., Hussein, K., “Financial Development and Economic Growth: Cointegration and Causality Tests for 16 Countries”, Journal of Development Economics, Vol. 51, 1996, pp. 387-411.

Engle, R. F., Granger, C. J., “Co-Integration and Error-Correction: Representation, Estimation, and Testing,” Econometrica, 1987, pp. 251-276.

Goldsmith, R. W., Financial Structure and Development, Yale University Press, New Haven 1969.

Granger, C. J., “Investigating Causal Relationships by Econometrics Models and Cross Spectral Methods,” Econometrica, 37, 1969, pp. 425-35.

Granger, C. J., “Developments in the Study of Cointegrated Economic Variables,” Oxford Bulletin of Economics and Statistics, 1986, pp. 213-228.

Granger, C. J., Newbold, P., “Spurious Regressions in Econometrics,” Journal of Econometrics, 1974, pp. 111-120.

Greenwood, J., Smith, B. D., “Financial Markets in Development and the Development of Financial Market,” Journal of Economic Dynamics and Control, January, 1997, pp. 145-181.

Gurley, J. G., Shaw, E. S., "Financial Aspects of Economic Development," American Economic Review, 45 (4), 1955, pp. 515-38.

Fry, M. J., “Money and Capital or Financial Deepening in Economic Development?,” Journal of Money, Credit and Banking, November, 1978, pp. 464-475.

Hansson, P., Jonung, L., “Finance and Economic Growth: The Case of Sweden 1834-1991,” Research in Economics, 51, 1997, pp. 275-301.

Hendry, D. F., “Econometric Modeling with Cointegrated Variables: An Overview.” Oxford Bulletin of Economics and Statistics, August, 1986, pp. 201-212.

IMF, International Financial Statistics, several issues, Washington D.C.

Ireland, P. N., “Money and Growth: An Alternative Approach,” American Economic Review, March 1994, pp. 47-65.

Johansen, S., Juselius, K., “Maximum Likelihood Estimation and Inference on Cointegration-with Application to the Demand for Money,” Oxford Bulletin of Economics and Statistics, May, 1990, pp. 169-210.

Jung, W. S., (1986) "Financial Development and Economic Growth: International Evidence," Economic Development and Cultural Change, Jan. 1989, 34 (2), pp. 333-46.

King, R. G., Levine, R., "Finance Entrepreneurship and Growth: Theory and Evidence," Journal of Monetary Economics, 32(3), 1993a, pp. 513-42.

King, R., R. Levine, “Finance and Growth: Schumpeter Might be Right”, Quarterly Journal of Economics, Vol.198, 1993b, pp.713-37.

Levine, R., Carkovic, M., Finance and Growth: New Evidence and Policy Analyses for Chile, University of Minnesota mimeo 2001.

Levine, R., Zervos, S., “Stock Market Development and Long-run Growth”, World Economic Review, Vol.10, No.2, 1996, pp. 323-39.

Levine, R., Zervos, S., "Stock Markets, Banks, and Economic Growth," American Economic Review, 88(3), 1998, pp. 537-558.

Lucas, R. E., “On the Mechanics of Economic Development,” Journal of Monetary Economics, July 1988, pp. 3-42.

McKinnon, R. I., Money and Capital in Economic Development (Borookings Institute, Washington, DC), 1973.

Neusser, K., Kugler, M., “Manufacturing Growth and Financial Development: Evidence from OECD Countries”, Review of Economics and Statistics, 80, 1998, pp. 638-646.

Patrick, H. T., “Financial Development and Economic Growth in Underdeveloped Countries,” Economic Development and Cultural Change, January, 1966, pp. 174-189.

Rajan, R.G., L. Zingales, L., “Financial Dependence and Growth", American Economic Review, 88(3), 1998, pp. 559-86.

Robinson, J., “The Generalization of the General Theory,” in The Rate of Interest and Other Essays, London, MacMillan Publishing Co. 1952.

Rousseau, P., Wachtel, P., “Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries”, Journal of Money, Credit and Banking 30 (4), 1998, pp. 657-678.

Shaw, E. S., Financial Deepening in Economic Development New York: Oxford University Press, 1973.

Sims, C. A., “Money Income and Causality”, American Economic Review, 62, 1972, pp. 540-552.

Spears, A., “Financial Development and Economic Growth-Causality Tests,” Atlantic Economic Journal, 19, 1991, pp. 66.

State of Planning Organization (SPO), Main Indicators of Turkey, 1950-2001, Ankara 2002.

Stiglitz, J., “The Role of the State in Financial Markets,” Proceedings of the Annual World Bank Conference on Development Economics, Washington, D.C., The World Bank, 1994.

Stern, N., “The Economics of Development: A Survey,” Economic Journal, September 1989, pp. 597-685.

Thornton, J., “Financial Deepening and Economic Growth in Developing Countries,” Economia Internazionale, 48(3), 1995, pp. 423-30.

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642 © ISE 1997

GLOBAL CAPITAL MARKETS

After a strong economic activity in the third quarter of 2002, concerns increased about the pace and sustainability of a recovery. Equity prices in the mature markets edged down in early October 2002 due to dissapointing news about the economic recovery. In addition to uncertainty about the strength of the U.S. recovery , due to financial implications of a low interest rate environment, the international value of the dollar weakened significantly as of the end of the third quarter of 2002. In the euro area, domestic demand growth is likely to increase slower than previously expected. In Latin America, the outlook has deteriorated and output is expected to decline in 2002. In emerging markets in Asia, the recovery has so far proved stronger than expected, driven by the rebound in global trade. In the Middle East, while the outlook for oil prices is somewhat stronger, the forecast has remained broadly unchanged. The global growth is projected at 3 percent in 2002.

Emerging financial markets were influenced by the external financial market developments. Due to falling prices in the major equity markets, financial flows to emerging markets fell, however, emerging markets ended last year on a positive note.

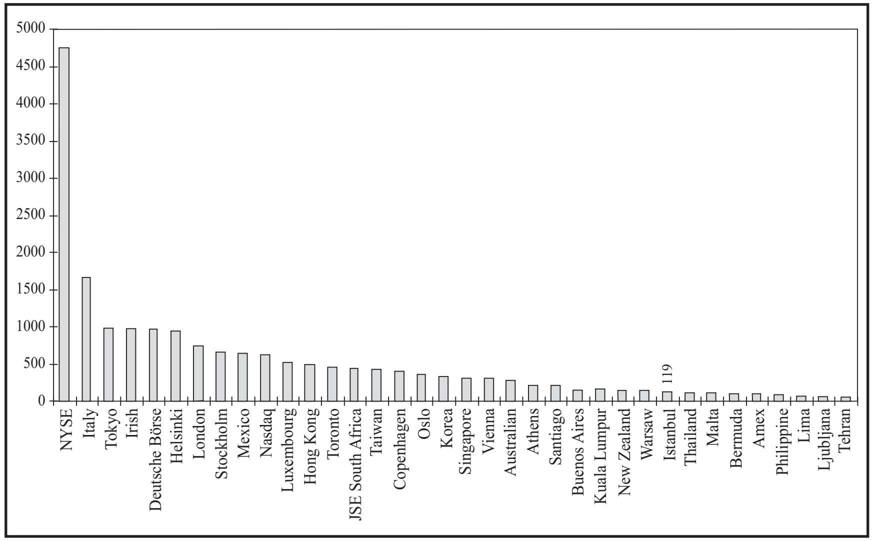
The performances of some developed stock markets with respect to indices indicated that DJI, FTSE-100, Nikkei-225 and Xetra DAX decreased by –14,2%, –17,3%, –11,7 % and –32,3% respectively at the end of December 2002 in comparison with the beginning of 2002. When US$ based returns of some emerging markets are compared in the same period, the best performer markets were: Russia (38,1%), Czech Rep. (38,0%), Hungary (33,8%), Indonesia (26,0%), S.Africa (24,3%) and Thailand (20,3%). In the same period, the lowest return markets were: Argentina (-47,2 %), Brazil (-45,8%), Turkey (-34,1%), Venezuela (-33,5%) and Israel(-31,7%). The performances of emerging markets with respect to P/E ratios as of end-December 2002 indicated that the highest rates were obtained in Poland (103,0), Turkey (39,1), Philippines (30,6), Korea (22,7), Taiwan (20,9), Indonesia (19,8) and Malaysia (19,6) and the lowest rates in Argentina (-1,7), S.Africa (10,2), Czech Rep. (11,1) and Brazil (13,7).

Market Capitalization (USD Million, 1986-2002)

	Global	Developed Markets	Emerging Markets	ISE
1986	6,514,199	6,275,582	238,617	938
1987	7,830,778	7,511,072	319,706	3,125
1988	9,728,493	9,245,358	483,135	1,128
1989	11,712,673	10,967,395	745,278	6,756
1990	9,398,391	8,784,770	613,621	18,737
1991	11,342,089	10,434,218	907,871	15,564
1992	10,923,343	9,923,024	1,000,319	9,922
1993	14,016,023	12,327,242	1,688,781	37,824
1994	15,124,051	13,210,778	1,913,273	21,785
1995	17,788,071	15,859,021	1,929,050	20,782
1996	20,412,135	17,982,088	2,272,184	30,797
1997	23,087,006	20,923,911	2,163,095	61,348
1998	26,964,463	25,065,373	1,899,090	33,473
1999	36,030,810	32,956,939	3,073,871	112,276
2000	32,260,433	29,520,707	2,691,452	69,659
2001	27,818,618	25,246,554	2,572,064	47,689
2002	23,391,914	20,955,876	2,436,038	33,958

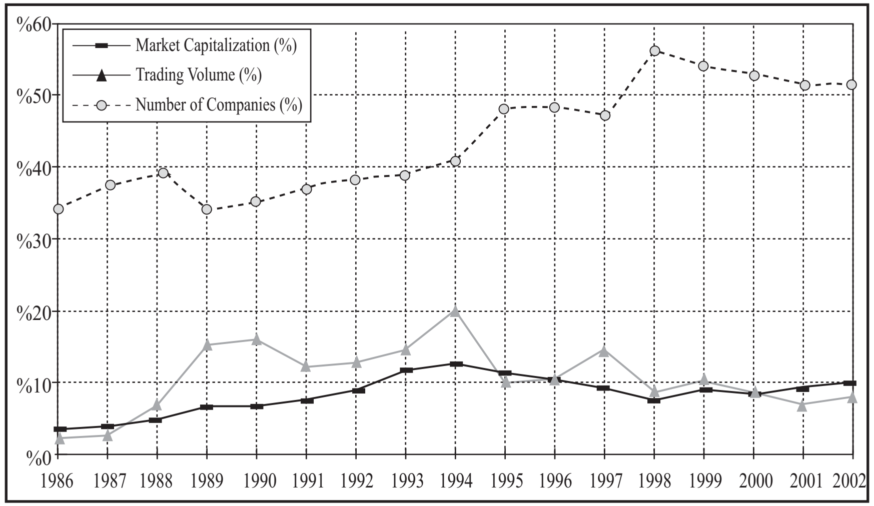
Source: Standard&Poor's Global Stock Markets Factbook, 2003.

Comparison of Average Market Capitalization Per Company (USD Million, December 2002)



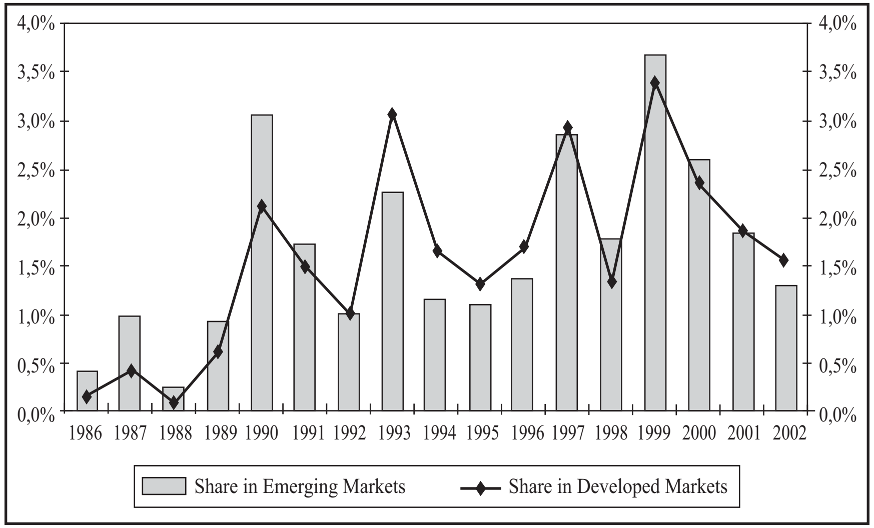
Source: FIBV, Monthly Statistics, December 2002.

Worldwide Share of Emerging Capital Markets (1986-2002)



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

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



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

Main Indicators of Capital Markets (December 2002)

	Market	Value of Share Trading (Millions, US$) Up to Year Total (2002/12)	Market	Market Cap. of Share of Domestic Companies (Millions, US$) December 2002
1	NYSE	10,311,156	NYSE	9,015,167
2	Nasdaq	7,254,595	Tokyo	2,069,299
3	London	3,998,462	Nasdaq	1,994,494
4	Euronext	1,987,199	London	1,785,199
5	Tokyo	1,565,824	Euronext	1,538,654
6	Deutsche Börse	1,207,977	Deutsche Börse	686,014
7	Spanish Exchange	654,743	Swiss Exchange	612,667
8	Amex	642,181	Toronto	573,403
9	Italy	636,821	Italy	477,075
10	Taiwan	632,666	Hong Kong	463,055
11	Swiss Exchange	600,067	Spanish Exchange	461,560
12	Korea	592,838	Australian	380,087
13	Chicago	532,040	Taiwan	261,211
14	Bermuda	413,744	Korea	215,894
15	Toronto	406,041	JSE South Africa	181,998
16	Australian	295,649	Stockholm	179,117
17	Stockholm	277,495	Helsinki	138,833
18	Hong Kong	194,003	Brazil	126,761
19	Helsinki	178,596	Kuala Lumpur	125,778
20	Osaka	124,111	Mexico	103,941
21	JSE South Africa	79,000	Singapore	99,807
22	Istanbul	70,767	Copenhagen	76,750
23	Singapore	62,770	Athens	67,062
24	Oslo	56,058	Oslo	64,170
25	Copenhagen	53,101	Irish	59,938
26	Sao Paulo	48,153	Santiago	48,044
27	Thailand	41,292	Thailand	45,504
28	Irish	33,532	Amex	44,769
29	Kuala Lumpur	33,109	Tel-Aviv	42,131
30	Mexico	32,724	Istanbul	34,217
31	Athens	23,512	Vienna	33,578
32	Jakarta	13,050	Jakarta	30,067
33	Tel-Aviv	12,703	Warsaw	28,380
34	New Zeland	8,936	Luxembourg	24,551
35	Warsaw	7,801	New Zeland	21,762
36	Vienna	6,142	Philippines	18,507
37	Budapest	5,943	Buenos Aires	16,571
38	Philippine	3,107	Budapest	12,989
39	Santiago	3,018	Tehran	11,761
40	Tehran	2,070	Lima	11,441
41	Ljubljana	1,539	Ljubljana	5,578
42	Buenos Aires	1,366	Bermuda	2,153
43	Lima	1,191	Colombo	1,680
44	Luxembourg	491	Malta	1,375
45	Colombo	318	Chicago	122

Source: FIBV, Monthly Statistics, December 2002.

Trading Volume (USD millions, 1986-2002)

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

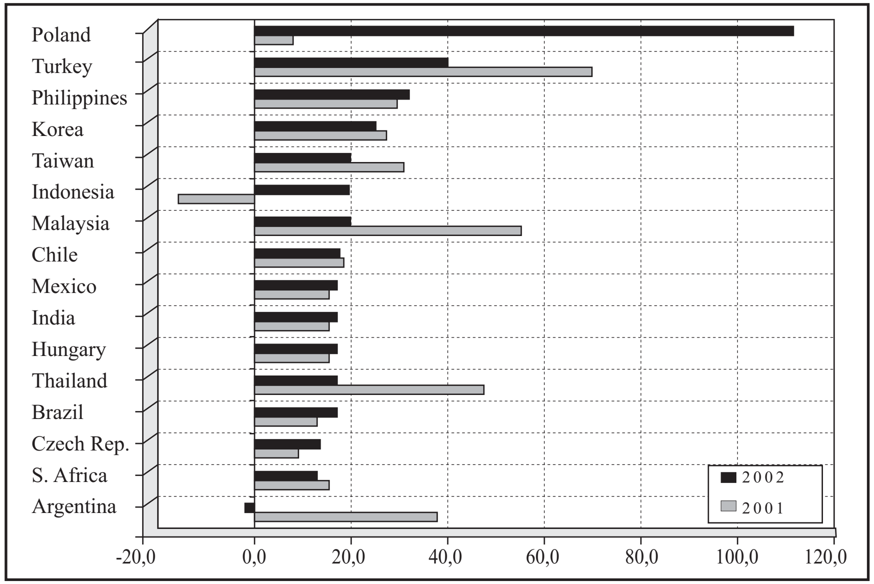
Source: Standard&Poor's Global Stock Markets Factbook, 2003.

Number of Trading Companies (1986-2002)

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

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

Comparison of P/E Ratios Performances



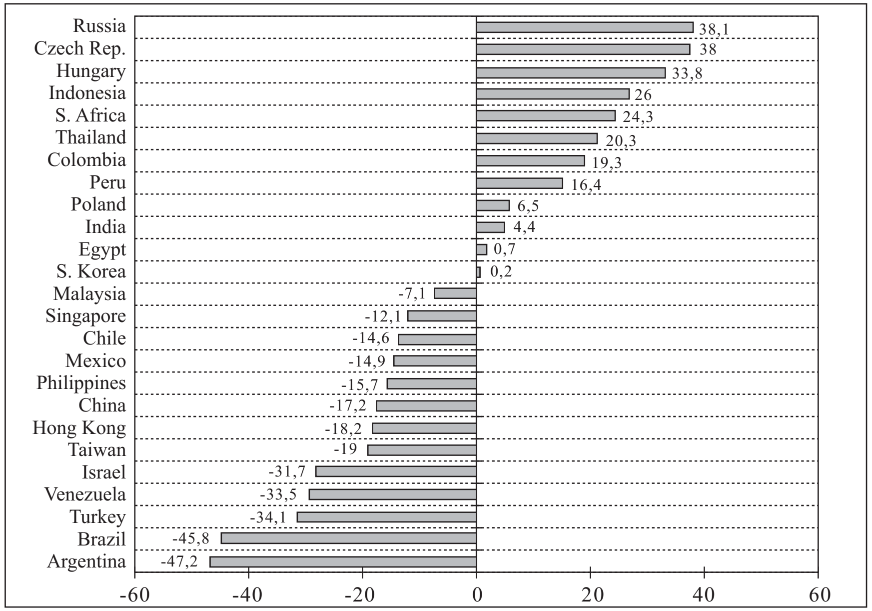
Source: IFC Factbook 2001. IFC, Monthly Review, December 2002.

Price-Earnings Ratios in Emerging Markets

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	41.9	17.7	15.0	38.2	17.1	13.4	39.0	293.3	38.4	-1.7
Brazil	12.6	13.1	36.3	14.5	15.4	7.0	25.1	11.7	8.9	13.7
Chile	20.0	21.4	17.1	27.8	15.9	15.1	37.7	31.8	17.1	16.8
Czech Rep.	18.8	16.3	11.2	17.6	8.8	-11.3	-14.8	21.0	5.6	11.1
Hungary	52.4	-55.3	12.0	17.5	25.2	17.0	18.2	14.3	13.3	15.0
India	39.7	26.7	14.2	12.3	16.8	13.5	22.0	14.8	12.3	15.4
Indonesia	28.9	20.2	19.8	21.6	11.2	-106.2	-10.5	-6.5	-14.1	19.8
Korea	25.1	34.5	19.8	11.7	11.6	-47.1	-27.7	19.3	24.9	22.7
Malaysia	43.5	29.0	25.1	27.1	13.5	21.1	-19.1	71.7	53.2	19.6
Mexico	19.4	17.1	28.4	16.8	22.2	23.9	14.1	12.5	13.2	15.6
Philippines	38.8	30.8	19.0	20.0	12.5	15.0	24.0	28.2	28.4	30.6
Poland	31.5	12.9	7.0	14.3	10.3	10.7	22.0	19.4	6.0	103.0
S.Africa	17.3	21.3	18.8	16.3	12.1	10.1	17.4	10.7	11.7	10.2
Taiwan, China	34.7	36.8	21.4	28.2	32.4	21.7	49.2	13.7	28.5	20.9
Thailand	27.5	21.2	21.7	13.1	4.8	-3.7	-14.5	-12.4	47.3	14.5
Turkey	36.3	31.0	8.4	10.7	18.9	7.8	33.8	15.2	69.5	39.1

Source: IFC Factbook 2001; IFC, Monthly Review, December 2002.
Note: Figures are taken from IFC Investable Index Profile.

Comparison of Market Returns In USD (31/12/2001-1/1/2003)



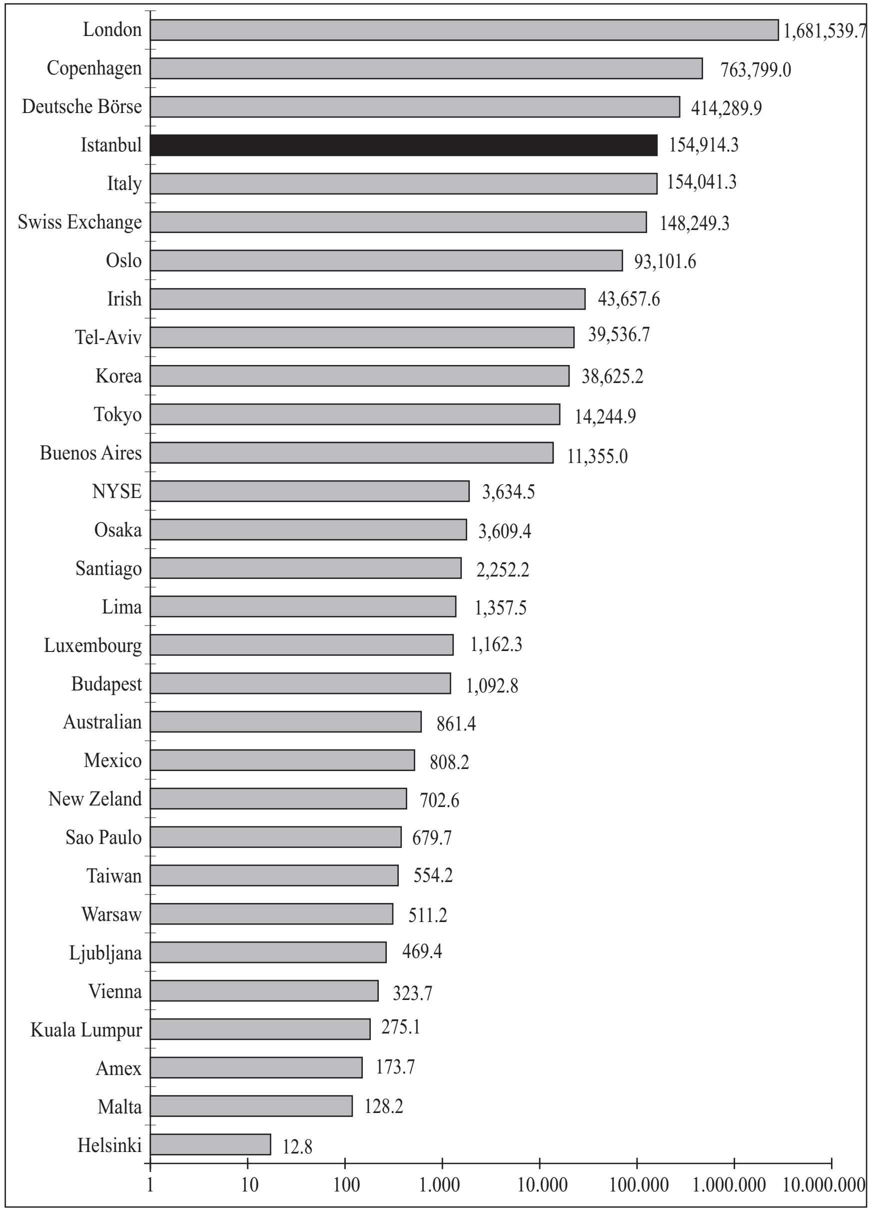
Source: The Economist, January 4th-10th 2003.

Market Value/Book Value Ratios (1993-2002)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	1.9	1.4	1.3	1.6	1.8	1.3	1.5	1.0	0.6	0.9
Brazil	0.5	0.6	0.5	0.7	1.1	0.6	1.6	1.4	1.2	1.3
Chile	2.1	2.5	2.1	1.6	1.6	1.1	1.8	1.5	1.4	1.4
Czech Rep.	1.3	1.0	0.9	0.9	0.8	0.7	1.2	1.2	0.8	0.8
Hungary	1.6	1.7	1.2	2.0	3.7	3.2	3.6	2.5	1.8	2.0
India	4.9	4.2	2.3	2.1	2.7	1.9	3.1	2.5	2.0	2.6
Indonesia	3.1	2.4	2.3	2.7	1.5	1.6	2.9	1.6	1.9	1.0
Korea	1.4	1.6	1.3	0.8	0.6	0.9	2.0	0.8	1.3	1.1
Malaysia	5.4	3.8	3.3	3.8	1.8	1.3	1.9	1.5	1.3	1.4
Mexico	2.6	2.2	1.7	1.7	2.5	1.4	2.2	1.7	1.7	1.6
Philippines	5.2	4.5	3.2	3.1	1.7	1.3	1.5	1.2	1.1	0.9
Poland	5.7	2.3	1.3	2.6	1.6	1.5	2.0	2.2	1.4	1.3
S.Africa	1.8	2.6	2.5	2.3	1.9	1.5	2.7	2.1	2.1	1.9
Taiwan, China	3.9	4.4	2.7	3.3	3.8	2.6	3.3	1.7	2.1	1.7
Thailand	4.7	3.7	3.3	1.8	0.8	1.2	2.6	1.6	1.6	1.7
Turkey	7.2	6.3	2.7	4.0	9.2	2.7	8.8	3.1	3.8	2.8

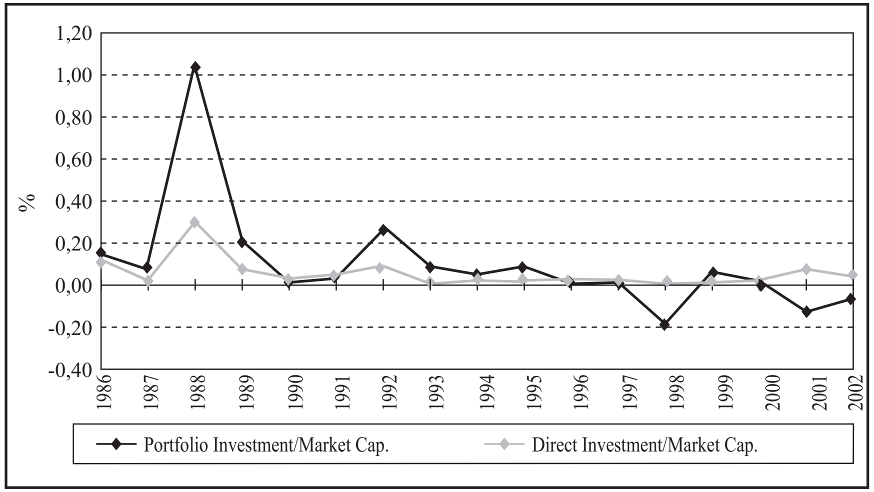
Source: IFC Factbook 1996-2001; IFC, Monthly Review, December 2002.
Note: Figures are taken from IFC Investable Index Profile.

Value of Bond Trading
(Million USD. January 2002-December 2002)



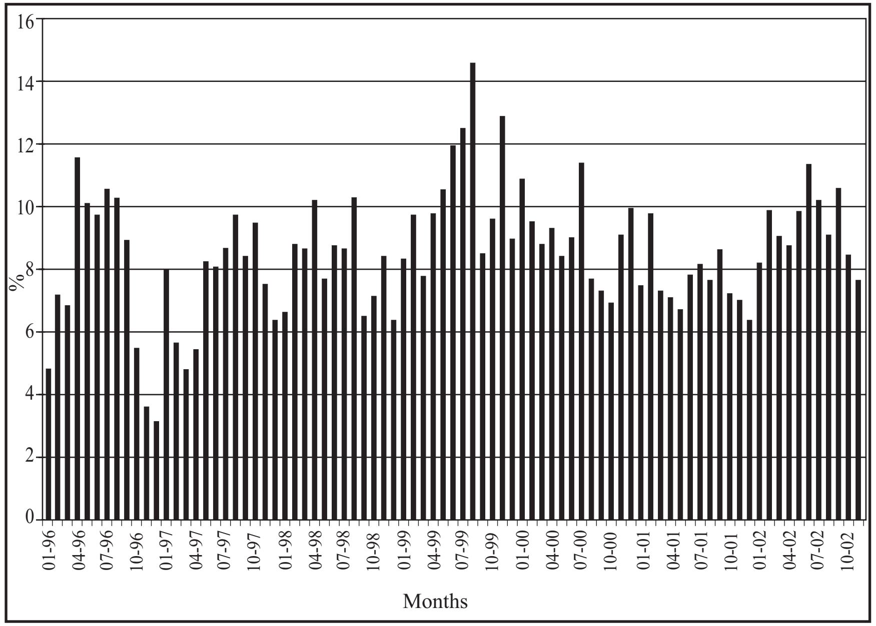
Source: FIBV, Monthly Statistics, December 2002.

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



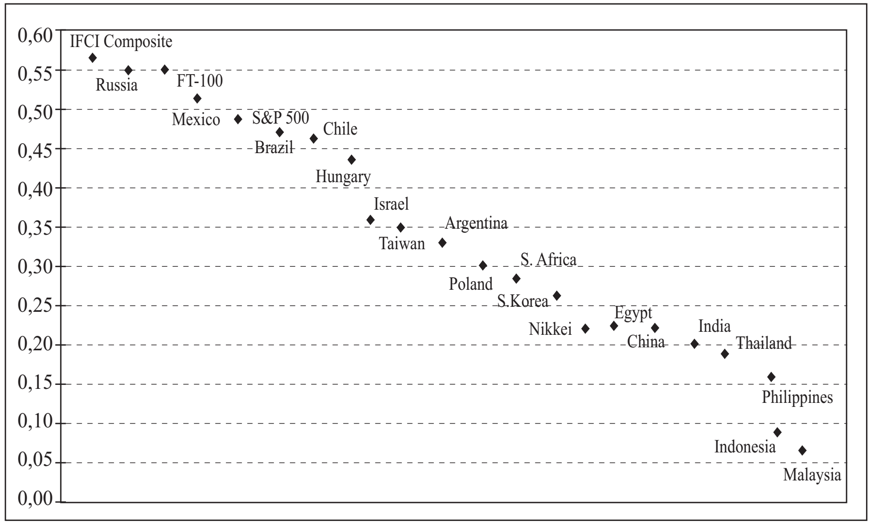
Source: ISE Data. CBTR Databank.

Foreigners' Share in the Trading Volume of the ISE
(Jan. 95-Dec. 2002)



Source: ISE Data.

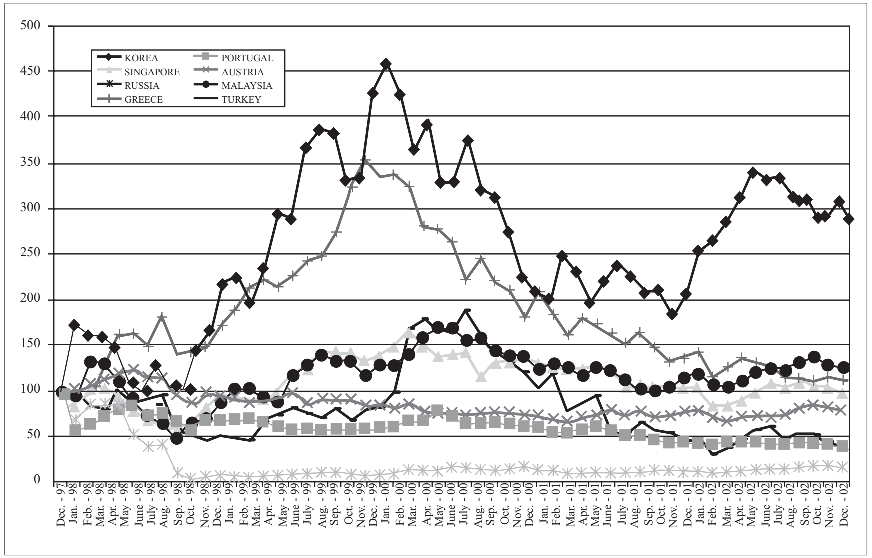
Price Correlations of the ISE
(Dec. 1997- Dec. 2002)



Source : IFC Monthly Review, December 2002.

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 series of returns.

Comparison of Market Indices
(31 Dec 97=100)



Source: Reuters.

Note: Comparisons are in US$.

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642 © ISE 1997

ISE
Market Indicators

STOCK MARKET

	Number of Companies	Traded Value				Market Value		Dividend Yield	P/E Ratios		
		Total		Daily Average							
		(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)	(%)	TL (1)	TL (2)	US$
1986		9	13	—		709	938	9,15	5,07	—	—
1987	82	105	118	—	—	3.182	3.125	2,82	15,86	—	—
1988	79	149	115	1	—	2.048	1.128	10,48	4,97	—	—
1989	76	1.736	773	7	3	15.553	6.756	3,44	15,74	—	—
1990	110	15.313	5.854	62	24	55.238	18.737	2,62	23,97	—	—
1991	134	35.487	8.502	144	34	78.907	15.564	3,95	15,88	—	—
1992	145	56.339	8.567	224	34	84.809	9.922	6,43	11,39	—	—
1993	180	255.222	21.770	1.037	88	546.316	37.824	1,65	25,75	20,72	14,86
1994	176	650.864	23.203	2.573	92	836.118	21.785	2,78	24,83	16,70	10,97
1995	205	2.374.055	52.357	9.458	209	1.264.998	20.782	3,56	9,23	7,67	5,48
1996	228	3.031.185	37.737	12.272	153	3.275.038	30.797	2,87	12,15	10,86	7,72
1997	258	9.048.721	58.104	35.908	231	12.654.308	61.879	1,56	24,39	19,45	13,28
1998	277	18.029.967	70.396	72.701	284	10.611.820	33.975	3,37	8,84	8,11	6,36
1999	285	36.877.335	84.034	156.260	356	61.137.073	114.271	0,72	37,52	34,08	24,95
2000	315	111.165.396	181.934	451.892	740	46.692.373	69.507	1,29	16,82	16,11	14,05
2001	310	93.118.834	80.400	375.479	324	68.603.041	47.689	0,95	108,33	824,42	411,64
2002	288	106.302.343	□70.756	421.835	281	56.370.247	34.402	1,20	195,92	26,98	23,78
2002/Q1	309	25.283.320	18.670	421.389	311	57.824.887	43.254	1,26	93,13	108,29	100,57
2002/Q2	306	18.501.225	13.432	289.082	210	49.293.803	31.436	1,27	—	—	—
2002/Q3	289	20.456.347	12.436	314.713	191	48.003.961	29.106	1,41	207,83	215,07	110,16
2002/Q4	288	42.061.451	26.219	667.642	416	56.370.247	34.402	1,20	195,92	26,98	23,78

Q: Quarter

Note:

* Between 1986-1992, the price earnings ratios were calculated on the basis of the companies' previous year-end net profits. As from 1993.
  TL(1) = Total market capitalization / Sum of last two six-month profits
  TL(12) = 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 decison of ISE's Board of Directions are not included in the calculations.

Closing Values of the ISE Price Indices

TL Based

	NATIONAL - 100 (Jan. 1986=1)	NATIONAL - INDUSTRIALS (Dec. 31.90=33)	NATIONAL - SERVICES (Dec. 27,90=1046)	NATIONAL - FINANCIALS (Dec.31.90=33)	NATIONAL - TECHNOLOGY (Jun. 30.90=14.466,12)
1986	1.71	—	—	—	—
1987	6,73	—	—	—	—
1988	3,74	—	—	—	—
1989	22,18	—	—	—	—
1990	32,56	32,56	—	32,56	—
1991	43,69	49,63	—	33,55	—
1992	40,04	49,15	—	24,34	—
1993	206,83	222,88	—	191,90	—
1994	272,57	304,74	—	229,64	—
1995	400,25	462,47	—	300,04	—
1996	975,89	1.045,91	1.046,00	914,47	—
1997	3.451,–	2.660,—	3.593,—	4.522,—	—
1998	2.597,91	1.943,67	3.697,10	3.269,58	—
1999	15.208,78	9.945,75	13.194,40	21.180,77	—
2000	9.437,21	6.954,99	7.224,01	12.837,92	10.586,58
2001	13.782,76	11.413,44	9.261,82	18.234,65	9.236,16
2002	10.369,92	9.888,71	6.897,30	12.902,34	7.260,84
2002/Q1	11.679,43	9.427,08	7.165,25	16.370,98	6.972,81
2002/Q2	9.379,92	8.850,68	5.668,98	12.065,92	5.145,49
2002/Q2	8.842,24	8.831,86	6.221,22	10.650,94	6.427,05
2002/Q4	10.369,92	9.888,71	6.897,30	12.902,34	7.260,84

US $ Based / EURO Based

	US $ Based					EURO Based
	NATIONAL - 100 (Jan. 1986=100)	NATIONAL - INDUSTRIALS (Dec. 31, 90=643)	NATIONAL - SERVICES (Dec. 27, 90=572)	NATIONAL - FINANCIALS (Dec.31, 90=643)	NATIONAL - TECHNOLOGY (Jun. 30,00=1.360.92)	NATIONAL - 100 (Dec. 31, 98=484)
1986	131,53	—	—	—	—	—
1987	384,57	—	—	—	—	—
1988	119,82	—	—	—	—	—
1989	560,57	—	—	—	—	—
1990	642,63	642,63	—	642,63	—	—
1991	501,50	569,63	—	385,14	—	—
1992	272,61	334,59	—	165,68	—	—
1993	833,28	897,96	—	773,13	—	—
1994	413,27	462,03	—	348,18	—	—
1995	382,62	442,11	—	286,83	—	—
1996	534,01	572,33	572,00	500,40	—	—
1997	982,—	757,—	1022,—	1.287,—	—	—
1998	484,01	362,12	688,79	609,14	—	484.01
1999	1.654,17	1.081,74	1.435,08	2.303,71	—	1.912,48
2000	817,49	602,47	625,78	1.112,08	917,06	1.045,57
2001	557,52	461,68	374,65	737,61	373,61	741,24
2002	368,26	351,17	244,94	458,20	257,85	411,72
2002/Ç1	508,38	410,34	311,89	712,60	303,51	683,05
2002/Ç2	348,09	328,45	210,38	447,77	190,95	410,26
2002/Ç3	311,97	301,02	219,50	375,79	226,76	371,39
2002/Ç4	368,26	351,17	244,94	458,20	257,85	411,72

Q: Quarter

BONDS AND BILLS MARKET

Traded Value

Outright Purchases and Sales Market

	Total		Daily Average	
	(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)
	1.476	312	11	2
1992	17.977	2.406	72	10
1993	122.858	10.728	499	44
1994	269.992	8.832	1.067	35
1995	739.942	16.509	2.936	66
1996	2.710.973	32.737	10.758	130
1997	5.503.632	35.472	21.840	141
1998	17.995.993	68.399	71.984	274
1999	35.430.078	83.842	142.863	338
2000	166.336.480	262.941	662.695	1.048
2001	39.776.813	37.297	159.107	149
2002	102.094.613	67.256	403.536	266
2002/Ç1	14.192.919	10.478	232.671	172
2002/Ç2	25.634.521	18.409	400.539	288
2002/Ç3	23.749.797	14.457	365.381	222
2002/Ç4	38.517.376	23.912	611.387	380

Repo-Reverse Repo Market

Repo-Reverse Repo Market

	Total		Daily Average	
	(TL Billion)	(US$ Million)	(TL Billion)	(US$ Million)
1993	59.009	4.794	276	22
1994	756.683	23.704	2.991	94
1995	5.781.776	123.254	22.944	489
1996	18.340.459	221.405	72.780	879
1997	58.192.071	374.384	230.921	1.486
1998	97.278.476	372.201	389.114	1.489
1999	250.723.656	589.267	1.010.982	2.376
2000	554.121.078	886.732	2.207.654	3.533
2001	696.338.553	627.244	2.774.257	2.499
2002	736.425.706	480.725	2.910.774	1.900
2002/Ç1	112.784.853	83.282	1.848.932	1.365
2002/Ç2	156.721.973	110.194	2.448.781	1.722
2002/Ç2	232.492.188	141.514	3.576.803	2.177
2002/Ç2	234.426.692	145.735	3.721.059	2.313

Q: Quarter

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

TL Based

	30 Days	91 Days	182 Days	General
1996	103,41	110,73	121,71	110,52
1997	102,68	108,76	118,48	110,77
1998	103,57	110,54	119,64	110,26
1999	107,70	123,26	144,12	125,47
2000	104,84	117,12	140,81	126,95
2001	106,32	119,29	137,51	116,37
2002	107,18	122,57	145,86	121,87
2002/Ç1	106,60	120,76	142,23	124,04
2002/Ç2	107,05	120,83	138,19	123,99
2002/Ç3	106,98	120,88	139,09	122,48
2002/Ç4	107,18	122,57	145,86	121,87

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

TL Based

	30 Days	91 Days	182 Days
1996	222,52	240,92	262,20
1997	441,25	474,75	525,17
1998	812,81	897,19	983,16
1999	1.372,71	1.576,80	1.928,63
2000	1.835,26	2.020,94	2.538,65
2001	2.877,36	3.317,33	3.985,20
2002	3.718,40	4.667,82	6.241,47
2002/Ç1	3.076,72	3.632,78	4.576,96
2002/Ç2	3.281,30	3.944,90	4.970,20
2002/Ç3	3.499,50	4.297,58	5.746,42
2002/Ç4	3.718,40	4.667,82	6.241,47

USD $ Based

	30 Days	91 Days	182 Days
1996	122.84	132.99	144.74
1997	127.67	137.36	151.95
1998	153.97	169.96	186.24
1999	151.03	173.47	212.18
2000	148.86	169.79	231.28
2001	118.09	136.14	163.55
2002	134.27	168.55	225.37
2002/Ç1	136.17	160.78	202.57
2002/Ç2	123.81	148.85	187.54
2002/Ç3	125.46	154.07	205.47
2002/Ç4	134.27	168.55	225.37

Q: Quarter

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

	TL Based				
	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)	General
2001	101,49	97,37	91,61	85,16	101,49
2002	106,91	104,87	100,57	95,00	104,62
2002/Ç1	104,35	101,69	97,16	91,62	103,58
2002/Ç2	101,77	94,97	86,19	77,10	98,81
2002/Ç3	102,21	96,36	88,49	80,11	101,70
2002/Ç4	106,91	104,87	100,57	95,00	104,62

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

	TL Based			
	6 Months (182 Days)	9 Months (273 Days)	12 Months (365 Days)	15 Months (456 Days)
2001	179,24	190,48	159,05	150,00
2002	305,57	347,66	276,59	255,90
2002/Ç1	207,48	220,50	190,80	169,85
2002/Ç2	232,97	247,59	210,88	170,71
2002/Ç3	271,74	296,44	245,97	208,23
2002/Ç4	305,57	347,66	276,59	255,90
	US $ Based			
2001	7.34	7.79	6.62	6.14
2002	11.03	12.55	9.99	9.24
2002/Ç1	9.18	9.76	8.44	7.52
2002/Ç2	8.79	9.34	7.96	6.44
2002/Ç3	9.72	10.61	8.80	7.46
2002/Ç4	11.03	12.55	9.99	9.24

Q: Quarter

The ISE Review Volume: 6 No: 24 October/November/December 2002
ISSN 1301-1642 © ISE 1997

Book Review

"Swaps and Other Derivatives", Richard Flavell, John Wiley and Sons, Ltd., U.K., 2002, pp.ix-451.

The book provides a detailed and practical approach to the pricing of a wide range of swap structures, including non-generic interest rate and cross currency swaps.

Following an introduction on swaps and methods on their application in Chapter 1, Chapter 2 explains short term interest rate swaps. It first discusses the derivation of discount factors from cash rates and concentrates on the range of alternative approaches that may be used. It then looks at the derivation of forward interest rates and how FRA's may be priced using cash and futures.

Chapter 3 discusses generic interest rate swaps. The chapter concentrates initially on the relationship between the bond and swap markets and how generic swap prices may be implied. It concludes by developing various techniques for the estimation of discount factors from a generic swap curve.

Chapter 4 describes a range of simple non-generic swaps, and discusses various techniques for pricing them, including one that requires no discounting.

Chapter 5, covers the pricing and hedging of some of the more complex and popular swaps. These include asset packages, credit swap, mismatch swaps of various types including yield curve and overnight average.

Chapter 6 starts with a fundamental cross-currency swaps and explores its characteristics, uses, pricing and hedging while chapter 7 reviews a range of different option structures and touches on briefly on option pricing. Volatility plays a crucial role, and various techniques for estimation are described in detail. The chapter concludes with two sections on FX options. These options are mainly trade OTC. The chapter concentrates on the pricing of these options, and how it may be varied depending on the method of quoting the underlying currencies.

Chapter 8 describes the traditional market risk management. The chapter then extends the risk management to interest rate options. Finally the chapter shows how the same techniques can be used to create an inflation hedge for a portfolio of inflation swaps.

Chapter 9, concentrates on imperfect risk management and describes the major approaches used to estimate VaR; delta, historic and Monte-Carlo simulations as well as second order delta-gamma approaches.