CROSS-SECTION OF STOCK RETURNS ON THE ISTANBUL STOCK EXCHANGE

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DECEMBER 2003

CROSS-SECTION OF STOCK RETURNS ON THE ISTANBUL STOCK EXCHANGE:

A THESIS SUBMITTED TO

THE GRADUATE SCHOOL OF SOCIAL SCIENCES

OF

MIDDLE EAST TECHNICAL UNIVERSITY

BY

NURİ VOLKAN KAYAÇETİN

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

DECEMBER 2003

Approval of the Graduate School of Social Sciences

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ABSTRACT

CROSS-SECTION OF STOCK RETURNS ON THE ISTANBUL STOCK EXCHANGE:

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December 2003, 96 Pages

The aim of this master thesis is to examine the explanatory power of some popular company-specific factors for the cross-section of average stock returns in the Istanbul Stock Exchange (ISE) for a period from 1992 to 2001. Factors tested in this thesis are firm size (*MVE*), book-to-market value of equity (*BMR*), debt-to-equity ratio (*DER*), sales-to-price ratio (*SPR*), gross profit-price ratio (*GPPR*) and dividend yield (*DY*).

Keywords: Asset Pricing, Company-Specific Variables, Empirical Tests

ÖZ

İSTANBUL MENKUL KIYMETLER BORSASI HİSSE GETİRİLERİ

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MBA, İşletme Bölümü

Tez Yöneticisi: Doç. Dr. Zehra Nuray Güner

Aralık 2003, 96 Sayfa

Bu yüksek lisans tezinin amacı şirketten şirkete değişen bazı finansal değerlerin, 1992'den 2001'e uzanan bir zaman aralığında, İstanbul Menkul Kıymetler Borsası (İMKB) hisse getirileri üzerindeki açıklayıcılığını incelemektir. Bu çalışmada denenen faktörler şirket büyüklüğü (*MVE*), defter-piyasa değeri (*BMR*), borç-öz kaynak oranı (*DER*), satış-fiyat oranı (*SPR*), brüt kar-fiyat oranı (*GPPR*) ve temettü-fiyat oranıdır (*DY*).

Anahtar Kelimeler: Hisse Değerlemesi, Şirket-Özel Değişkenler, Ampirik Testler

ACKNOWLEDGEMENTS

I would like to express great appreciation to Associate Prof. Dr. Nuray Güner, for her continuous suggestions and supervisions that helped me cope with the various difficulties I faced during the course of this study.

I acknowledge my co-supervisors, Assistant Professor Dr. Seza Danışoğlu and Assistant Professor Dr. Zeynep Önder for their valuable interpretations, recommendations and contributions.

I am thankful to my friends, Özlem, Hande, İlkay, and Boğaç for motivating and supporting me when I was overwhelmed about what life may bring.

Finally, I would like send the greatest of my gratitudes to my beloved family, for they are the ones whom I owe the most of what I have so far been able to achieve.

“I hereby declare that all information in this document has been obtained and presented according with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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CHAPTER 1

INTRODUCTION

When we take a look at the evolution of the asset pricing models, it was first in 1960s that the finance world met an extensive theory on the issue, the single-period, mean-variance (MV) efficient capital asset pricing model (the CAPM), proposed by Treynor (1961), Sharpe (1964), Lintner (1965), Mossin (1966) and Black (1972). The model proposed a simple, yet elegant linear relation between the cross-section of returns and the sensitivity of individual stock returns to changes in the market portfolio return, beta. The simplicity and theoretical appeal of the model proposed by CAPM is yet unmatched; however, many simplifying assumptions were made in the derivation of CAPM. One of the basic premises of the model, that the market betas were the only measure of risk needed to explain the cross-section of expected stock returns, has been rejected by a good number of empirical tests. (E.g. Banz [1981], Basu [1977], Bhandari [1988], Fama and French [1992, 1993, 1995])

An important theory that followed the CAPM is the Arbitrage Pricing Theory (APT) of Ross (1976). The notion of arbitrage pricing filled the absence of the long sought for theoretical basis for multi-factor return generating models. Some of the studies in this school have taken macroeconomic factors like consumption growth, investment growth as explanatory variables (Ferson and Harvey [1997], Hamao [1988], Geske and Roll [1983], Fama [1981]), while others examined company-specific variables like book-to-market ratio, debt-equity ratio, earnings-price ratio, firm size, sales-to-price ratio (E.g. Basu [1977], Reinganum [1981], Banz [1981], Bhandari [1988], Fama and French [1992, 1993, 1995]).

In this master's thesis we study the cross-section of returns on the Istanbul Stock Exchange (ISE) in a multi-factor model framework. Our field of study, the ISE, is an emerging market with characteristics different from those of established markets such as the New York Stock Exchange, or Tokyo Stock Exchange where the bulk of the empirical tests on asset pricing are conducted. Emerging markets offer higher yields and demonstrate higher volatility of returns. Returns are often auto-correlated and not integrated to global markets (Muradoğlu, Taşkın and Bigan [2000]). The crisis-prone nature of the Turkish market[1], characterized by high degrees of political and, effectively, economic instability, might have a remarkable effect on the set of variables that proxy for equity risk.

We test the explanatory powers of several company-specific variables, including firm size, book-to-market ratio, sales-to-price ratio, gross profit-to-price ratio,

[1] In the last decade, Turkish economy suffered from financial crises in years 1994, 1997, 2000 and 2001.

debt-to-equity ratio, and dividend yield is tested for the cross-section of returns on the ISE securities in the period from July 1993 to November 2002. In doing so, three different analysis techniques, namely, univariate portfolio analysis, bivariate portfolio analysis, and Fama-MacBeth cross-sectional regressions are used. Our study may, with a larger set of company-specific variables and a longer time period, expand on a previous study by Akdeniz et al. (2000) in which book-to-market ratio and firm size are shown to have significant explanatory power for the cross-section of returns for the Turkish stocks. Also, the fact that sales-to-price, gross profit-to-price and debt-to-equity ratios, to the best of our knowledge, have not yet been tested for the ISE may also make this study worthwhile.

Our results indicate that each of these variables except dividend yield commands a significant return premium when included in a simple regression model. The highest premium is associated with sales-to-price ratio. Sales-to-price ratio and debt-to-equity ratio display a higher explanatory power on the cross-sectional variability in returns on the ISE compared to firm size, book-to-market ratio, and gross profit-to-price ratio; however, when debt-to-equity ratio and sales-to-price ratio are included in a single regression equation, the explanatory power of debt-to-equity ratio is also subsumed by the sales-to-price ratio.

In the Literature Review Chapter, a summary of related research selected from the extensive literature on asset pricing theories and empirical tests is provided. Data

Chapter points at the sources of data used in this thesis, and then illustrates how raw data are converted to the form they are going to be used in the empirical tests. The test methodologies used and the hypotheses tested in this thesis are discussed in the Methodology Chapter. In the Results and Discussion Chapter, empirical findings of this study are presented. Interpretations pertaining to these results are made, where seen appropriate. Finally, in the Conclusions Chapter, the conclusions based on the findings of this thesis, and further research opportunities are stated.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

An investment can be defined as an initial outlay of funds to a set of return-generating assets that will be possessed over some future time period. These assets can be real assets (e.g. commercial goods, real estate, gold), or financial assets (e.g. stocks, bonds, derivatives, mutual funds). Financial assets are paper or electronic claims on the earnings of the issuer, be it a corporation or a federal government. Capital assets [stocks and bonds] are one of the oldest, and, the most important elements of the market for financial assets.

Pricing of capital assets is at the heart of finance and investments. Two important theories on how capital assets are priced in the market currently coexist. Mean-variance analysis approach of Markowitz (1952) led to the introduction of the single period mean-variance Capital Asset Pricing Model (CAPM) (Treynor [1961], Sharpe [1964], Lintner [1965], Mossin [1966] and Black [1972]). On the other hand, Arbitrage Pricing Theory of Ross (1977) has formed the theoretical basis for the use of multi-factor models in capital asset pricing and shifted the momentum of research remarkably.

In the following two sections of this chapter, main notions of the mean-variance approach to portfolio selection and the single period mean-variance CAPM are reviewed. Next, we supply a brief introduction to Factor Models, and discuss the essentials of Arbitrage Pricing Theory, a theory that is testable by means of Factor Models. In the final two sections, a summary of the empirical evidence on asset pricing models that relate to the context of this master thesis is given.

2.2 Mean-Variance Theorem

For a portfolio of n assets, mean return is given by:

$$E\,(R_P) = w_1\,E\,(R_1) + w_2\,E\,(R_2) + \ldots + w_n\,E\,(R_n)$$

E(.) is the expectation operator, R_P is the portfolio return, R_i is the return on asset i, and w_i is the weight of assets i in the portfolio, where $i = 1, 2, \ldots, n$

The variance of the rate of return on such a portfolio is:

$$\sigma_P^2 = \Sigma\, w_i\, w_j\, \sigma_{ij}$$

σ_{ij} is the covariance of asset i with asset j, where $i, j = 1, 2, \ldots, n$.. Variance of returns on a portfolio may, partly, be eliminated through the addition of more assets [a process referred to as *diversification*], provided that the returns to these assets are not in perfect positive correlation with each other. This can be shown using mathematical equations, with a little help from three simplifying assumptions: (i) $w_i = 1/n$ for all assets i = 1, 2, ..., n; (ii) variance, $\sigma^2_i = \sigma^2$ for all assets i = 1, 2, ..., n; and (iii) covariance, $\sigma_{ij} = a\sigma^2$ for all assets i, j = 1, 2, ..., n where $i \neq j$. Under these conditions:

$$\sigma_P^2 = \Sigma\, w_i\, w_j\, \sigma_{ij} = 1/n^2\,(n\sigma^2 \;\; + [n^2 - n]\; a\; \sigma^2) \quad \text{where } a \in [-1, 1]$$

$$\sigma_P^2 = \sigma^2/n + a\sigma^2\,(n-1)/n$$

$$\sigma_P^2 = \sigma^2\,(1-a)/\,n + a\sigma^2 \tag{1}$$

Equation (1) shows that for each portfolio, there is some portion of risk, $a\sigma^2$ that cannot be diversified away by increasing *n,* number of assets in the portfolio. This portion of risk is called the *systematic* [*market*] *risk. Non-systematic* [*company*] *risk,* the other component of portfolio variance [$\sigma^2\ (1-a)/n$], can obviously be reduced down to zero by increasing *n,* the number of assets in the portfolio. This process is referred to as *diversification.*

Minimizing risk without considering the returns would be a meaningless practice. Decreases in portfolio risk [portfolio variance] imply relative decreases in portfolio return [mean return]. The process of diversification enables the reduction of risk with comparably lower reductions in return. It is this notion of the trade-off between mean and variance that the general mean-variance approach of Markowitz (1952) tries to make explicit.

Markowitz posits that, in making portfolio choice, investors are concerned with two parameters, risk and return, and that these two parameters should be measured for the portfolio as a whole. Assuming portfolio variance to be an appropriate measure of risk, he concludes that the investors choose portfolios from the set of Pareto optimal expected return-variance combinations, referred to as the *efficient frontier*. It would be proper to remark that Markowitz' theory is concerned mainly with how a risk-return optimizing investor would behave. It was the subsequent studies by Treynor, Sharpe, Lintner, Mossin and Black that characterized the implications of the mean-variance approach on portfolio choice, and universally, on the stock market equilibrium.

2.3 The Capital Asset Pricing Model

Sequential studies by Treynor (1961), Sharpe (1964), Lintner (1965), Mossin (1966) and Black (1972) opened an era in the modern finance literature, and introduced to the world of finance the Capital Asset Pricing Model (CAPM). The CAPM remained a dominant paradigm of the theory of asset valuation for decades until today.

The model builds on Markowitz' (1952) mean-variance approach to portfolio selection. Following from the portfolio optimality conditions, the model suggests a positive and linear relationship between expected rate of return and systematic risk (β) measured relative to the portfolio of all marketable securities. The CAPM relationship between the systematic risk (β) and the expected return (E [R_i]) of security *i* can be expressed as:

$$E\,(R_i) = R_f + \beta_i\,(R_m - R_f) \qquad (2)$$

In equation (2), R_f is the risk-free rate, and R_m is the return on the market portfolio of all marketable securities, which is presumed to be mean-variance efficient. In an empirical setting, equation (2) could be written as:

$$E\,(R_i) = a_0 + a_1\beta_i$$

If the CAPM holds, a_0 would approximate the risk free rate, which is generally taken as the rate of return on long-term government bonds, and a_1 would approximate the market risk premium.

In following studies, Black, Jensen, and Scholes (1972), Fama and MacBeth (1973), and Blume and Friend (1973) have all verified a significant linear relation between average stock returns and estimated betas. Yet, according to the results of these studies, the estimated intercept, a_0, was higher, and the estimated slope, a_1, was lower than that predicted by the CAPM. This flatter relation was then attributed to the absence of a risk-free security in the market, and deemed consistent with the Black's (1972) version of CAPM.[2]

The CAPM is built on a good number of simplifying assumptions. The model assumes that: (1) there are many investors each with a wealth that is small compared to the total wealth of all investors and these investors act as though security prices are unaffected by their own trades; (2) all investors plan for one identical time period and ignore everything that might happen after the end of single-period horizon; (3) investments are limited to a universe of publicly traded financial assets, such as stocks and bonds, and to risk-free borrowing or lending arrangements; (4) investors pay no taxes on returns and no transaction costs on trades in securities; (5) all investors are rational mean-variance optimizers, meaning that they all use the Markowitz portfolio selection model; (6) all investors analyze securities in the same way and share the same economic view of

[2] In his work, Black shows, under the condition in which a risk-free security does not exist, that the risk-free asset is simply replaced by the zero-beta portfolio and the linear relationship between betas and average stock returns gets flatter, yet remains robust.

the world, and make identical estimates of the probability distribution of future cash flows from investing in the available securities (Bodie, Kane, and Markus [2002]).

In equilibrium, these assumptions imply: (1) all investors choose to hold a combination of the risk-free asset and the tangency portfolio. The weights of the risk free asset and the tangency portfolio are determined by the investor's risk preference; (2) the tangency portfolio is the market portfolio, which is the portfolio of all traded assets; (3) there is a linear relationship between stock betas and expected returns; (4) market betas suffice to explain the cross-sectional variation in expected stock returns.

Of these implications, the empirical tests of CAPM so far centered on the third and fourth, namely, linearity of the relationship between betas and returns, and the sufficiency of betas in explaining the cross-sectional variation in stock returns.

2.4 Factor Models

The determination of the parameter values that mean-variance approach to portfolio selection requires, namely mean expected asset returns and covariances among each asset in the market, poses a major difficulty in the application of the theory. Hence, alternative approaches are proposed, some of which have appealed the finance academia almost as strongly as mean-variance theorem did.

The appeal of the factor analysis comes from the fact that it requires much less information compared to mean-variance analysis. Factor models suggest that the randomness displayed by the returns on *n* assets can be traced back to *k* underlying factors, and that *k* is considerably smaller than *n*. A factor model that relates these factors to individual stock returns leads to a greatly simplified covariance matrix, and therefore, to a less problematic estimation of the parameter values required by the models.

Factor models are generally represented in the form:

$$r_i = a_i + \Sigma\ (b_{k,i}\, f_k) + e_i \qquad (3)$$

In equation (3), constant a_i is the *intercept*, $b_{k,i}$ are *factor loadings* of security *i* for the chosen set of *k* explanatory factors, f_k are random variables which are hypothesized to explain the variation in expected stock returns, and, finally, e_i is the error term. It is assumed that the expected value of the error term is zero, and that the error is correlated with neither the factors under study, nor the errors of other assets.

One important aspect in the construction of factor models is the selection of factors. Luenberger (1998) classifies factors used in these models in three main groups: extracted factors, external factors, and firm characteristics. Extracted factors are factors derived using the known information about security returns (e.g. return on market portfolio). External factors are, as the name implies, variables that are external to the securities being explicitly considered in the model (e.g. inflation, exchange rates, consumption-growth etc.). Firm characteristics relate to the characteristics of individual firms, and are mostly expressed in terms of certain accounting figures and financial ratios (e.g. earnings-to-price ratio).

Arbitrage Pricing Theory (APT) served as an important milestone in the current status of factor models in asset pricing by supplying a sound theoretical basis for how the stock market might work under the assumption of a multi-factor arbitrage-based return-generating model.

2.5 Arbitrage Pricing Theory

An important theory that competes with CAPM is the Arbitrage Pricing Theory (APT) of Ross (1976). The APT model begins with the assumption that individuals homogeneously believe that a k-factor linear return-generating model explains the randomness displayed by the returns on n assets that constitute the market, where n is significantly greater than k. This model is of the form:

$$\mathrm{R}_i = E_i + b_{i1} f_1 + b_{i2} f_2 + \ldots + b_{ik} f_k + e_i , \qquad i = 1, 2, \ldots, k \tag{4}$$

In equation (4), E_i is the expected return on asset; b_{ik} are the *factor loadings* for asset *i;* and f_k are the *common factors* that are hypothesized to govern the returns on the assets. These factors capture the systematic risk component of the assets. Finally, e_i is the *error term*, the risk component idiosyncratic to asset *i,* or simply the unsystematic risk of asset *i,* which is ideally uncorrelated with e_j for all i and j, given $i \neq j$. A high correlation between error terms would signal for the existence of additional factors.

If these k factors account for all the risk associated with asset *i*, E_i will reduce to the expected rate of return for that particular asset. Then, it would be possible to represent the expected rate of return on individual securities and the *k* common risk factors as linear combinations of $k+1$ individual returns, $R_1, R_2, \ldots, R_{k+1}$. This seemingly simple statement implies that portfolios of $k+1$ assets may be so designed that they serve as perfect substitutes to the remaining $n–k+1$ assets that constitute the market; and perfect substitutes, in the absence of arbitrage, must be priced equally. This is at the core of the APT: there are only a few systematic components of risk existing in nature. As a consequence, many portfolios are close substitutes and as such, they must have the same value.[3]

Roll and Ross (1979) suggest, as a result of empirical tests on returns from 1962 to 1972, that at least three [and probably four] factors govern the assumed linear return generating process. However, the theory does not shed a light on what these few systematic risk factors that are common to all the assets in the market might be. On the downside, this eventually may result in multi-factor models that make use of *ad-hoc* variables that are not backed up theoretically. Still, the APT is an appealing model in that: (i) it allows the use of multi-factor models that bring a richness to the risk-return relationship; (ii) utility assumptions made in the derivation of the model, monotonicity and concavity, are much less constraining than the quadratic utility function assumption of the mean-variance framework; (iii) it does not require a mean-variance efficient market portfolio to operate; (iv) it holds both in single-period and multi-period. As a natural consequence of such plausible characteristics, research has shifted, to an extent, on the multi-factor models based on arbitrage-pricing theory.

Reinganum (1981) finds, after testing for three-, four-, and five- factor models he derived using 30x30 matrices of annual returns, that APT fails to account for size effect. Yet, he also realizes that such contradictory results may also stem from a possible poor definition of the stochastic process governing returns, or the inability to diversify idiosyncratic variances, or even the existence of arbitrage opportunities in the U.S. stocks between 1963 and 1978. Chen (1983) on the other hand uses larger covariance matrices (180x180) to define five factors and their loadings, and come up with the result that APT cannot be rejected in favor of

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[3] See Roll and Ross (1980)

any alternative hypothesis and the APT performs very well against CAPM. Another important finding of this study is that variables such as own variance and firm size do not contribute additional explanatory power to that of the factor loadings.

In a criticism of Roll and Ross methodology, Dhrymes, Friend, and Gültekin (1984) arrive to striking conclusions: (i) analyzing small groups of securities lead to flawed results; (ii) it is not possible to test whether a given factor is priced due to the rotation-of-factors problem, i.e. the t-tests on individual factor significances are meaningless; and most importantly, (iii) the number of factors depends on the size of the group under study. The retribution to this paper by Roll and Ross (1984) has been swift. Roll and Ross argue in their reply that t-tests are perfectly valid and that it is natural that the number of factors to depend on group size as larger groups would have more chance to capture factors that are missed by smaller groups.

Cho et al (1984) state that although the Roll and Ross methodology tends to overstate the number of factors, this tendency cannot be held accountable for the large number of factors found in their original article. Chen et al (1984) perform an interesting research on APT in which the three factors reported significant by their factor analysis are linked to the overall economic activity, energy costs, and interest rates. Lehmann and David (1988) conduct yet another empirical test of

APT and find that an APT model does a better job in explaining the premia related to own variance and dividend yield than the CAPM. Both models, however, fail to account for the size premium.

The most severe criticisms to APT models have come from Shanken (1985, 1992) and Reisman (1992). In these papers, it was mathematically shown that, as long as there exists an approximate factor structure, almost any set of factors could serve as the benchmark in an approximate APT expected return relation.

2.6 Empirical Evidence on Company Specific Variables

The dominant paradigm of modern finance, the CAPM, has been called into question by many studies, which have documented that several macroeconomic and company specific variables had significant explanatory power over that of beta. These findings were in sharp contrast with one of the main premises of the CAPM.

On one hand, macroeconomic variables such as inflation (Fama and Schwert [1977], Geske and Roll [1983]), exchange rate (Geske and Roll [1983]), nominal interest rate (Chen, Roll, and Ross [1986]) and the level of real economic activity (Fama, [1990]) were shown to have significant explanatory power on the cross-section of stock returns. Depreciation of the home country currency increases returns to common stocks indirectly through augmenting the export sales levels of home country firms. The relation between stock returns and inflation rate as well as the nominal interest rate, debatably, is negative, provided that the cash flows to a given firm would not increase in pace with the changes in the discount rate to neutralize the negative effect caused by the increase of the risk-free rate. Intuitively, an increase in the level of economic activity will, on the average, increase earnings of the firms, and hence the stock returns (Fama [1990]).

On the other hand, company specific variables such as firm size (Banz [1981], Reinganum [1981], Fama and French [1992, 1993, 1995]), earnings-price ratio (Basu [1977]), debt-equity ratio (Bhandari [1988], Barbee, Mukherji and Reines [1996]) book-to-market value of equity (Fama and French [1992, 1993, 1995]) and sales-to-price ratio (Barbee, Mukherji and Reines [1996]) were all cited to have significant explanatory powers in excess of beta.

The main objective for a good number of researchers, then, was to reveal those variables that best explained the cross-sectional variation in average stock returns. The following paragraphs, in line with the context of this master thesis, briefly focuses on the company specific variables that are found to have significant explanatory power over that of beta.

2.6.1 Size Effect

One relation that has been rigorously researched in studies on cross-sectional predictability of stock returns is that between size and average stock returns. This relation was initially put forward by Banz (1981). In this study, the relation between average returns and market values in the period between 1936 and 1975 is examined for the U.S. market. Banz assumes a linear relationship of the form:

$$E(R_i) = \gamma_0 + \gamma_1 \beta_i + \gamma_2 [(\phi_i - \phi_m) / \phi_m)]$$

where $E(R_i)$ is the expected return on security *i;* γ_0 is the expected return on minimum variance zero-beta portfolio; γ_1 is the expected market risk premium; ϕ_i is the market value of security *i*; ϕ_m is the average market value; and γ_2 is the premium associated with the relative market capitalization for security *i*.

Obviously, if size effect is not statistically significant, the model will reduce to the Black's version of CAPM. However, the results of Banz's analysis indicate that the common stock of small firms had, on average, higher risk adjusted returns than the common stocks of large firms. Reinganum (1982) tests Roll's conjecture that a bias in beta estimation might be accountable for firm size effect, and concluded that, although the direction of this bias is consistent with Roll's conjecture, its magnitude is too small to explain firm size effect. Blume and Stambaugh (1983) posit that estimates of size effect based on daily return data are potentially biased and use annual returns on buy-and-hold portfolios in their tests. Premium associated with size is found to be only half as large as previously reported, and on the average, observed mostly in January. Chan (1985) finds that size premium drops from 20 percent to a mere 2 percent when returns are adjusted for risk measured by the difference between returns to low grade bonds and returns to long term government bonds. Zivney and Thompson (1987) adjust daily returns on stocks listed on the National Association of Securities Dealers Automatic Quotations (NASDAQ) and the over-the-counter (OTC) for differences in relative stock prices (*PR*)[4] and demonstrate that the size effect disappears when controlled for *PR*.

Handa, Kothari, and Wasley (1989) test the relation between return intervals and betas and find that beta changes with return interval because an assets covariance with market and market's variance do not change proportionately as the return interval changes. Their results show that size effect becomes statistically insignificant when betas are estimated using annual returns. Jegadeesh (1992) attributes Handa et al's results to the high degree of correlation between firm size and beta, and constructs test portfolios so that the correlation between betas and firm sizes are small. Based on his findings, Jegadeesh concludes that betas explain virtually none of the cross-sectional differences in returns and that size

[4] PR = Current Price / (Max (Price) – Min (Price)) where maximum and minimum price values are of the values observed during a 5 year evaluation period.

effect cannot be accounted for by betas. Two later studies by Chan, Hamao, and Lakonishok (1991), and Fama and French (1992) verify that there is a significant size premium in both the U.S. and Japanese markets. Yet, both of these studies conclude that the significance of firm size is subsumed by the addition of book-to-market ratio to the regressions.

Knez and Ready (1997) argue, however, that the premium on size estimated by Fama and French (1992) completely disappears when 1 percent of the most extreme observations on size are trimmed. This study demonstrates that the significant negative average of monthly size coefficients disappears when 16 months of most extreme coefficients on size are excluded from the calculations.

2.6.2 Earnings Yield Effect

Earnings yield, or earnings-price ratio (*EPR*), has long been a popular figure for financial analysts and investors. Its first appearance in finance academia dates back to as early as the first half of twentieth century. In their book on Security Analysis, Graham and Dodd (1940) claim that a prudent investor should never pay more than 20 times earnings, and that a suitable multiplier should be less than or equal to 12.

Nicholson (1960) tests the relation between price-earnings ratio (*PER*), the reciprocal of *EPR*, and subsequent stock returns to find low *PER* stocks consistently performed better than the average stock. Basu (1977) finds a significant negative relation between *PER* and subsequent stock returns, and interprets this as an evidence of market inefficiency, assuming the capital asset pricing model is valid. Reinganum (1981) verifies the existence of an *EPR* effect, and posits that high EPR portfolios systematically outperform low *EPR* portfolios, even after beta risk adjustment.

Basu (1983) tests the relationship between earnings yield, market value, and returns and concludes that the premium of earnings yield is significant even when the differences in size are controlled for. Jaffe, Keim, and Westerfield (1989) also study earnings yield effect along with size effect and show that the premium for earnings yield is positive significant both in January and in other months, while the premium for size is significant only in January. Aggarwal, Rao, and Hiraki (1990) and Chan et al (1991) find significant premium for earnings yield in Tokyo Stock Exchange (TSE). Yet, Chan et al also report that this significance disappears when book-to-market ratio is added to the regression. Fama and French (1992) also report an earnings yield effect, which loses its statistical significance when used together with factors such as book-to-market ratio or firm size. On the other hand, Davis (1994) shows that earnings yield displays explanatory power in both two-parameter (*EPR* and negative earnings dummy) regressions and in multiple regressions that include various combinations of beta, size, and price. Finally, Omesh (2001) reaches to the joint conclusion that the systematic risk estimates for *EPR*-ranked portfolios are not sensitive to measurement interval; results are robust to experimental control on firm size; and that mismeasurement of systematic risk cannot explain the abnormal profitability of EPR strategy.

Akdeniz et al. (2000) test a sample period from 1992 to 1998 and find evidence confirming the results of Fama and French (1992) for stocks listed on the ISE: that is book-to-market ratio and firm size explain the cross-sectional variability in stock returns best, while market beta and earnings yield virtually do not possess significant explanatory powers. In this study, betas are calculated from monthly returns; market capitalization is taken as a proxy for firm size, and is updated monthly as share prices change; and accounting figures are taken from the annual reports of the companies.

2.6.3 Descendants of Earnings-to-Price Effect: Cash Flow-to-Price and Sales-to-Price Ratios

EPR has two weaknesses that can easily inhibit its effectiveness as a predictor of cross-sectional variation in stock returns. One of these weaknesses relates to the abundance of manipulation opportunities in earnings figures by the management.

Accounting procedures that are used in calculating the bottom-line earnings figure can be so modified [...within boundaries of generally accepted accounting principles] that it ceases to be a dependable estimate of future prospects of a company. The other weakness is that, more than rarely, one can observe negative earnings figures. Such data are often omitted from statistical analyses that aim to test the relation between EPR and subsequent stock returns, resulting in a smaller sample.

Cash flow-to-price ratio (*CFPR*) and sales-to-price ratio (*SPR*) are two alternative measures that are less prone to the problems with *EPR*. *CFPR* simply equals to the ratio of earnings plus depreciation to market capitalization. As depreciation is probably the one account on which much of the manipulation is done, the chances that cash flow-to-price ratio would provide a biased estimate of future prospects of a company is much less than that of the earnings figure. Moreover, the probability of a firm reporting a negative cash flow figure is definitely less than the probability associated with a negative earnings figure. For the Japanese Stock Market, cash flow-to-price ratio is tested and found to be significant in explaining the cross-sectional variation in average returns (Chan, Hamao, and Lakonishok [1991]). Davis (1994) also reports for U.S. market that, controlling for differences in book-to-market ratio, cash flow yield has predictive ability with respect to subsequent realized returns.

Sales-to-price ratio, on the other hand, equals, as the name implies, net sales over market capitalization. Compared to earnings and cash flow, sales seems superior for research purposes in that it provides almost no opportunity for accounting manipulation, and that it never has negative values. On the downside, however, sales figures would say less about the ability of the firms to convert revenues into profits. Evidence on a *SPR* effect has been presented for both the U.S. (Senchack and Martin [1987], Jacobs and Levy [1988], Barbee, Mukherji, and Reines [1996]) and the Japanese Stock Markets (Aggarwal, Rao, and Hiraki [1990]).

2.6.4 Leverage Effect

Bhandari (1988) proposes that, regardless of possible variations in firm-level risk, an increase in debt-equity ratio of a firm increases the risk of its common equity. In his study, Bhandari documents, despite the presence of beta, there exists a significant positive relationship between leverage and average return, which, according to CAPM, should have been captured by beta.

Fama and French (1992) choose to use two different measures of financial leverage, namely, book leverage (the ratio of book assets to book value of equity [*A/BE*]) and market leverage (and the ratio of book assets to market value of equity [*A/ME*]). Their results indicate that both of these leverage measures are significantly related to average returns, yet, in opposite directions.[5] Barbee, Mukherji, and Reines (1996) also support Bhandari's proposition in a study of returns on the U.S. stock market during a period from 1979 to 1991.

2.6.5 Book-to-Market Effect

Another variable that investment analysts commonly employed in portfolio selection is the ratio of book value to current value of a company's shares, called book-to-market ratio (BMR). A significant negative relation between book-to-market ratio and subsequent stock returns is documented by several studies (Stattman [1980], Rosenberg, Reid and Lanstein [1985], DeBondt and Thaler [1987], Keim [1988])

Chan et al (1991) report after a study of the Japanese market that the book-to-market ratio consistently had the largest coefficient and the highest t-statistic in the tested models; and in the full model that include *EPR*, *MVE*, *BMR* and *CFPR*, it is among the two variables that bear coefficients statistically different from zero. The influential study conducted by Fama and French (1992) records *BMR* as the variable that bears the highest explanatory power on the cross-section of returns in the U.S. market. In their subsequent papers, Fama and French first generalized

[5] Stocks of the firms with higher market leverage earned higher returns, while stocks of the firms with higher book leverage earned lower returns. Both results are statistically significant with more than 4 standard errors from 0.

their model to a wider range of capital assets including bonds and stocks, and verified their prior conclusion that firm size and book-to-market ratio have significant explanatory powers on cross-section of returns (Fama and French [1993]). Then they changed the scale and studied the return behavior of industries and concluded that the three-factor model signals higher costs of equity for distressed industries than for strong industries, because of the higher HML (the return differential between high and low book-to-market portfolios) loadings of the distressed industries (Fama and French [1994]). In a later study, Fama and

French (1995) established the missing link between earnings and stock returns, showing that high earnings resulted in high stock returns and low earnings resulted in low stock returns.

Fama and French (1996) identify three schools on the economic interpretation of their results. The first school of researchers believes that asset pricing is rational and conforms to a three-factor inter-temporal CAPM or APT that does not reduce to the CAPM. The second school concedes that a three-factor model describes stock returns, but adds that this phenomenon is a natural result of irrationalities in investor behavior (Lakonishok, Shleifer, and Vishny [1994]). The third school defends that the CAPM holds, but is rejected because of testing methodology flaws such as survivorship bias (Kothari, Shanken, and Sloan [1995])[6], data snooping (Black [1993], MacKinlay [1995]), or the use of poor proxies for the market portfolio.

Fama and French (1996) counter the irrationality of investors story by arguing that the relative distress premium [the premium associated with *BMR*] is neither an arbitrage opportunity, nor a temporary result of investor overreaction, as the high distress premium in returns persists for at least five years after portfolio formation. In this study, Fama and French also remark that it would not necessarily be true to assume that the relative distress premium is irrational just because periods of poor returns on distressed stocks are not typically periods of low GNP growth or low market returns, as the expansions and contractions of the economy are minor compared to the fluctuations in industries. Fama and French respond to survivorship argument by citing the results of Chan et al (1991) as direct evidence to refute the claim. On the data snooping bias argument, conceding that data snooping can never be ruled out, they point at the supportive results that have been obtained in different time spans, and in different countries. Finally, Fama and French stress that if it is, at best, hard to obtain a good proxy for the market, multi-factor models are just a convenient way to improve on the CAPM.

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[6] Kothari et al. analyze the U.S. stock returns using data from the S&P Analyst's Handbook for the period from 1947 to 1987, and fail to find any significant relationship between BMR and stock returns. They contend that Fama and French might have been deceived by a survivorship bias that originates from the exclusion of high distress firms that go bankrupt from the Compustat data.

2.6.6 Dividend Yield

Dividend yield was first introduced to capital asset pricing models by Brennan (1970). Brennan's model was developed under the assumptions of unlimited borrowing and lending at the risk-free rate of interest, and unrestricted short sales. Also, dividends are assumed to be certain and known to investors. Then, the equilibrium relationship is given by:

$$E\,(R_i - r_f) = b_0\,\beta_i + c_0\,(d_i - r_f)$$

where R_i is the before tax total rate of return on asset i, β_i and d_i are the systematic risk and dividend yield on asset i respectively, and r_f is the risk-free rate. Brennan defines $b_0$and c_0 positive, with the implication that the stocks of high dividend yield firms should offer a return higher than that of low dividend yield firms.

Black and Scholes (1974) conduct the first empirical test of the effects of dividend yields on common stock returns and conclude that "it is not possible to demonstrate that the expected returns of high [dividend] yield stocks differ from the expected returns of low [dividend] yield stocks either before or *after taxes*".

To correct for problems (like error-in-variables) in Black and Scholes' study, Rosenberg and Marathé (1978) use a two stage generalized least-squares procedure. They, then, find a positive and significant relationship between dividends and stock returns.

Litzenberger and Ramaswamy (1982) show that there is a positive and non-linear relationship between stock returns and dividend yield. This study stresses that its conclusions cannot be attributed to a look-ahead bias about dividends as the prediction rule for expected dividends is based solely on information known to the investors at that time. Fama and French (1988) find that the power of dividend yields to forecast stock returns, measured by regression R^2, increases with the return horizon.

Goetzmann and Jorion (1993), on the other hand, use the bootstrap methodology and simulations to examine the ability of dividend yields to predict stock returns. The results of this study indicate that there is no strong statistical evidence indicating that dividend yields can be used to forecast stock returns.

2.6.7 Summary

In this section, we try to compare and interpret the findings on joint explanatory powers of the variables that have so far been discussed. Rest of the text follows a chronological perspective.

The first tests of joint explanatory powers of multiple company-specific variables concentrates on the relation between earnings yield and size, the earliest anomalies discovered. Basu (1983) tests earnings yield together with size and beta in a CAPM setting and shows that the common stocks of high *EPR* firms earn, on average, higher risk-adjusted returns than the common stocks of low *EPR* firms, and that this effect is clearly significant even when firm size is controlled for. Size effect virtually disappears when returns are controlled for differences in risk and EPR. Interestingly, results of Reinganum (1981) show just the opposite: "Although an earnings anomaly and a value [size] anomaly is detected when each variable is considered separately, the two anomalies seem to be related to the same set of factors. Furthermore, these factors appear to be more closely associated with firm size than with *EPR*". Further years of empirical research did not completely rule *EPR* or firm size out. Some later studies claim size subsumed the explanatory power of earnings yield (e.g. Peavy and Goodman [1983]); and some defend that neither effect dominates the other (e.g. Cook and Rozeff [1984], Jaffe, Keim, and Westerfeld [1989]). On a side note, the results of Jaffe et al (1989) add a seasonality notion to the size effect by pointing out that the size premium is negative and significant only in January.

Meanwhile, new variables that display significant explanatory power against beta were emerging and the models tested against CAPM started to include more and more of such variables. For instance, Chan et al (1991) tests the returns on Tokyo

Stock Exchange and finds that book-to-market ratio subsumes the explanatory powers of both earnings yield and firm size. One descendant of earnings yield, cash-flow yield, on the other hand, comes out to be significant even when used together with book-to-market ratio.

In their influential paper, Fama and French (1992) study the relation between market beta, earnings yield, firm size, book-to-market ratio and leverage. They find that firm size and book-to-market ratio combine to capture the cross-sectional variation in average stock returns. According to the results of this paper, market beta [estimated from the monthly stock returns] proves not to have any significant explanatory power, even when it is the sole measure of systematic risk; the positive premium associated with earnings yield loses its statistical significance when book-to-market ratio is added to the regression. The study also reaches to the conclusion that book to market ratio can mathematically be obtained from these two types of leverage measures [namely, book leverage and market leverage][7].

Davis (1994) also tests the relationship between returns and a variety of variables including market beta, stock price, firm size, earnings yield, cash flow yield,

[7] Fama and French have used two separate measures for leverage, namely, natural logarithms of assets/book value of equity (A/BVE) and assets/market value of equity (A/MVE). In the end, having found that the two factors were both significant with opposite signs, they reached to the conclusion that, as ln (A/BVE) – ln (A/MVE) = ln (BMR) would measure the total leverage related risk.

book-to-market ratio, and historical sales growth. He finds that, controlling for differences in book-to-market equity, cash flow yield has predictive ability with respect to subsequent stock returns.

Based on the prior research done by Bhandari (1988) and Fisher's exposition (1984) on the role of sales-to-price ratios in stock selection, Barbee, Mukherji and Reines (1996) study a period from 1979 to 1991 for the U.S. stocks. Results of this study indicate that sales-to-price ratio and debt-equity ratio subsumed the explanatory powers of book-to-market ratio and firm size when used together in regressions.

In Turkish market, Akdeniz et al (2000) test the a set of company specific factors including earnings yield, firm size, and book-to-market ratio against the CAPM. This study offers evidence on the significance of the three-factor model of Fama and French (1992) for the stock returns on the ISE for a period from 1992 to 1998. Furthermore, beta is shown to be insignificant for the cross-section of returns even when used as the only variable in the model.

Our study tests the explanatory powers of firm size, book-to-market ratio, sales-to-price ratio, gross profit-to-price ratio, debt-to-equity ratio, and dividend yield for the ISE stocks during a ten-year period from 1992 to 2001. Firm size and book-to-market ratio have already been shown to have significant explanatory powers over that of beta for the cross-section of returns on Turkish market for the period between 1992 and 1998 (Akdeniz et al [2000]). Sales-to-price ratio, gross profit-to-price ratio, and debt-to-equity ratio, to the best of our knowledge, have not been tested for the ISE. Our earnings proxy, sales-to-price ratio is preferred to earnings-to-price and cash flow-to-price ratios. As mentioned before, earnings-to-price ratio had certain drawbacks related to possible management manipulations and the difficulty of dealing with negative values in analysis. Cash flow-to-price ratio, on the other hand, requires the knowledge of depreciation figures of firms. In practice, depreciation account is decomposed into two parts, depreciation related to production, and depreciation not related to production. Of these parts, the former is reported in the cost of goods sold figure and is not known to the investors. Therefore, investors cannot do the computation of the actual cash flow-to-price ratio. As a result, sales-to-price ratio is preferred to cash flow-to-price ratio. Dividend yield is also found out to have a significant positive relation with stock returns (Fama and French [1988]) and, thus, is considered among our set of company-specific explanatory factors.

CHAPTER 3

DATA

The sample analyzed in this thesis includes all the firms that are listed on the ISE during the 1992 – 2001 period. Financial firms are excluded since characteristically high debt-to-equity ratios of such firms do not necessarily indicate financial distress, and hence, may distort our analysis. Holdings are excluded, as the stocks of such companies resemble more a mini-portfolio than a single security. Firms with more than one type of share quoted on the stock market are also taken out of the sample since a high correlation among returns to these securities is expected. Finally, firms that miss the required data for analysis are also excluded.

3.1 Data Sources

For each firm under study, three sets of data are needed. Data on monthly stock prices and number of shares outstanding on the initial public offering (IPO) date are obtained from databases maintained by the ISE. Data on required accounting figures, on the other hand, are compiled from the database of financial statements of the ISE firms published on the official web site of the ISE.[8]

3.1.1 Stock Price Data

Monthly stock price data includes the end-of-month stock prices of securities listed on the ISE during the period between June 1993 and December 2002. The unadjusted stock price data is used for the computation of the market values of equity for individual firms. This price data is adjusted for stock splits, capital increases, and dividends. These adjusted prices are used for the computation of monthly stock returns. Return on stock *i* for month *m*, $R_{i,m}$, is defined by:

$$R_{i,\,m,\,t} = (P_{i,\,m,,t} - P_{i,\,m\text{-}1,,\,t}) \,/\, P_{i,\,m\text{-}1,\,t}$$

where $P_{i,\ m,\ t}$ is the price of security *i* at the end of month *m* in year *t*. The corrections made for stock splits, capital increases, and stock dividends prevent possible distortions on monthly return data.

[8] This site can be accessed from the URL: www.imkb.gov.tr

3.1.2 Number of Shares Outstanding

Number of Shares Outstanding (NSO) data include, for each firm, the number of common stock outstanding at the IPO date during the period from December 1992 to December 2002. These NSO figures are adjusted for stock splits and capital increases over time to determine the exact number of shares outstanding for any firm at any point in time. The NSO data is used together with the unadjusted monthly stock price data to compute the market capitalization of firms.

3.1.3 Accounting Figures

Several company specific accounting figures are needed for the analysis carried out in this thesis. These figures consist of information from individual firms' balance sheets (total assets [*TA*], total equity [*TE*]) and income statements (sales [*S*], cost of goods sold [*COGS*], net earnings [*NE*]) as observed in the annual financial statements reported to the ISE. For the measurement period that starts at July 1^{st} of year $t+1$, data listed above are obtained from the annual financial statements of year t. Market value of equity is calculated as the number of shares outstanding times the stock price as of the beginning of the return measurement period, i.e. July 1^{st}. Required accounting data span a period from December 1992 to December 2001.

3.2 Company-Specific Factors

In the following subsections, the company specific factors that are derived from the three sets of data mentioned in the previous sections of this chapter is introduced. It is these factors whose explanatory powers on individual stock returns are tested in the later chapters of this thesis

3.2.1 Firm Size

Market capitalization (*MVE*) is used as a proxy for firm size, in consideration of the size effect. Market capitalization of firm *i* in year *t* is given by:

$$MVE_{i,t} = (P_{i,t+1})\,(NSO_{i,t+1})$$

where $P_{i,t+1}$ is the stock price for firm *i* at the July 1st of year $t+1$; and $NSO_{i,t+1}$ is the number of shares outstanding figure for firm *i*, at the July 1st of year $t+1$.

Based on earlier studies (Banz [1981], Reinganum [1981a], Fama and French [1992], Akdeniz et al. [2000]), we expect *MVE* to be in a negative relation with average stock returns.

3.2.2 Book-to-Market Ratio

Book-to-market ratio (*BMR*) is used in consideration of the book-to-market effect, or relative distress factor, as referred to by Fama and French (1996). *BMR* of firm *i* at the end of fiscal year *t* is given by:

$$BMR_{i,t} = TE_{i,t} / MVE_{i,t}$$

Research by Stattman (1980), Rosenberg, Reid, and Lanstein (1985), DeBondt and Thaler (1987), Keim (1988) and Fama and French (1992, 1993, 1996) indicate a positive relation between BMR and average stock returns. This relation is also confirmed for the ISE securities by Akdeniz et al. (2000).

3.2.3 Sales-to-Price Ratio

Sales-to-price ratio (*SPR*) is used as an alternative to earnings yield effect. SPR of firm *i* at the end of fiscal year *t* is given by:

$$SPR_{i,,t} = S_{i,,t} / MVE_{i,\ t}$$

As mentioned earlier despite its theoretical appeal, earnings yield is shown to have limited power in explaining the cross-sectional variation in stock returns. Yet, it is also argued that impediments like earnings manipulation by firms, or the fact that *EPR* is undefined for negative earnings[9] caused the downfall of an appealing predictor.

SPR is a variation of earnings yield that is freed of impediments mentioned above. Evidence of a positive relationship between average stock returns and *SPR* is documented for the U.S. and Japan. (Senchack and Martin [1987], Jacobs and Levy [1988], Aggarwal, Rao, and Hiraki [1990], Barbee, Mukherji, and Reines [1996]).

3.2.4 Gross Profit-to-Price Ratio

Gross profit-to-price ratio (*GPPR*) is used as another alternative to earnings yield effect. *GPPR* of firm *i* at the fiscal end of year *t* is given by:

$$GPPR_{i,t} = (S_{i,t} - CoGS_{i,t}) / MVE_{i,t}$$

GPPR is added to the analysis to see whether there could be an increase in the explanatory power of the earnings-proxy when the production efficiency is taken into consideration by using the revenue left after the costs of production, sales minus cost of goods sold, as the nominator.

[9] A firm reporting negative earnings is not a rarity in the relatively unstable Turkish economy.

3.2.5 Leverage

Debt-to-equity ratio (*DER*) is used in consideration of leverage effect. *DER* of firm *i* at the end of fiscal year *t* is given by:

$$DER_{i,\ t} = (TA_{i,\ t} - TE_{i,\ t}) \,/\, TE_{i,\ t}$$

The larger the DER of a firm is, the higher is its financial risk. And a higher risk should be compensated with a higher rate of return on its common stock according to the basic law of asset pricing. Therefore, a positive relation between DER and average stock returns is expected. Such a relation is documented for the U.S stock market by Bhandari (1988), Fama and French (1992) and Barbee et al. (1996).

3.2.5 Dividend Yield

The dividend yield that is used for firm *i* at a given year *t* is calculated as:

$$DY_{i,t} = \text{Dividend}_{i,t-1} \,/\, \text{Stock Price}_{i,\ t-1}$$

Evidence from the studies by Brennan (1970), Litzenberger and Ramaswamy (1982), Rozeff (1984), Fama and French (1988), and Kothari and Shanken (1996) point out a positive relation between returns and dividend yields.

CHAPTER 4

METHODOLOGY

In this chapter, the methodology employed in this thesis is discussed. Our methodology can be examined in four main stages: correlation analysis, univariate portfolio analysis, bivariate portfolio analysis, and cross-sectional regression analysis.

In the correlation analysis section, as the name implies, the correlations between the factors under study, and between these factors and returns are computed. Univariate portfolio analysis gives a preliminary idea about the sign and magnitude of the premium associated with each company-specific factor. Bivariate portfolio analysis helps us segregate the effects of two company specific factors at a time, shedding light on possible questions about joint and individual explanatory powers of some factors. Finally, in the cross-sectional regression analysis, Fama-MacBeth regression methodology is used. These cross-sectional regressions make the comparison of more than two factors at a time possible and thus enhance our interpretations about possible multi-factor return generating models.

In the following sections, details on the methodology used in correlation analysis, the univariate and bivariate analyses, and the cross-sectional regressions are presented.

4.1 Correlation Analysis

The analysis begins with the computation of the correlation coefficients between the company-specific factors, and between these factors and annual stock returns. It is especially crucial to know about the correlations between the factors that serve as independent variables in the regressions to take care of possible multicollinearity problems.

The correlation coefficients are calculated for the ten-year aggregate cross-sectional data on annual returns, dividend yields, and natural logarithms of firm size, book-to-market ratio, sales-to-price ratio, *GPPR*, and debt-to-equity ratio. The significances of these correlations are measured by t-values calculated according to the formula:

$$t = r\,(n-2)^{1/2} / (1-r^2)^{1/2}$$

where r is the correlation coefficient, and n is the number of observations.

4.2 Univariate Portfolio Analysis

The univariate portfolio analysis is a primal attempt to measure whether the hypothesized relationships between the company-specific factors and returns are valid for the ISE. For a given year *t,* stocks are ranked based on company-specific factor *F* at the beginning of July. Equally weighted portfolios of the top 30 percent, the middle 40 percent, and the bottom 30 percent of the ranked list form the high, moderate, and low factor *F* portfolios, respectively. Annual returns, and values of the measured variable are computed and recorded for each of these three portfolios. This procedure is carried out for each year in the study, resulting in 10 observations of portfolio characteristics for low *F (LF),* moderate *F,* (*MF*), and high *F* (*HF*) portfolios.

Returns differentials between high and low factor *F* portfolios ($R_{HF} - R_{LF}$) are calculated for each of these 10 observations, and a single-tailed one sample t-test is conducted to test whether the obtained sample of return differentials verify our prior expectations about a given factor. The mean return differential calculated for factor *F* is hereafter referred to as $HML_{\mathbf{F}}$. The calculation of returns on medium size portfolios allows us to see whether the returns are uniformly increasing or decreasing as factor *F* increases or decreases. In the following subsections, a more detailed discussion of our prior expectations about the factors under study, as well as the hypotheses tested for each factor can be found.

4.2.1 Portfolios Based on MVE

For a given year *t,* stocks are ranked based on their firm sizes at the beginning of July. Average characteristics of the constructed portfolios, and subsequent annual returns are recorded. The mean return differential between high and low capitalization firms is expected to be negative.

Hence, the hypothesis tested with the one-sample t-test on return differentials is:

Ho: $HML_{\mathbf{MVE}} \geq 0$

Ha: $HML_{\mathbf{MVE}} < 0$

4.2.2 Portfolios Based on BMR

For a given year *t,* stocks are ranked based on their book-to-market ratios computed dividing the book value reported at the end of fiscal year *t-1* by the market capitalization at the beginning of July of year *t*. We expect the mean return differential between high book-to-market and low book-to-market firms to be positive.

Then, the hypothesis tested with one-sample t-test on return differentials is:

Ho: $HML_{\mathbf{BMR}} \leq 0$

Ha: $HML_{\mathbf{BMR}} > 0$

4.2.3 Portfolios Based on SPR

For a given year *t,* stocks are ranked based on their *SPR* values computed dividing the sales revenue reported at the end of fiscal year *t-1* by the market capitalization at the beginning of July of year *t*. The return differential between high sales-to-price and low sales-to-price firms is expected to be positive.

So, the hypothesis tested with one-sample t-test on return differentials becomes:

Ho: $HML_{\mathbf{SPR}} \leq 0$

Ha: $HML_{\mathbf{SPR}} > 0$

4.2.3 Portfolios Based on GPPR

For a given year *t,* stocks are ranked based on their *GPPR* values computed dividing the gross profits reported at the end of fiscal year *t-1* by the market capitalization at the beginning of July of year *t*. Like *SPR,* a positive return differential between high and low *GPPR* portfolios is expected.

The hypothesis tested with one-sample t-test on return differentials is:

Ho: $HML_{\mathbf{GPPR}} \leq 0$

Ha: $HML_{\mathbf{GPPR}} > 0$

4.2.4 Portfolios Based on DER

For a given year *t,* stocks are ranked based on their *DER* values computed dividing the book value of debt reported at the end of fiscal year *t-1* by the book value of equity reported, again, at the end of fiscal year *t-1*. The denominator is taken as the book value of equity to avoid extremely high degree of correlation observed between *DER* and *SPR* when market value of equity is used instead. The return differential between high leverage and low leverage firms is expected to be positive. Given this expectation, the hypothesis tested with one-sample t-test is:

Ho: $HML_{\mathbf{DER}} \leq 0$

Ha: $HML_{\mathbf{DER}} > 0$

4.2.5 Portfolios Based on Dividend Yield

For a given year *t,* stocks are ranked based on their *DY* values computed dividing the dividends reported at the end of fiscal year *t-1* by the stock price at the end of fiscal year *t*. The hypothesized relationship between returns and dividend yields is positive (Brennan[1970], Litzenberger and Ramaswamy [1982], Rosenberg and Marathé [1978], Fama and French [1988], Kothari and Shanken [1996]); hence, the hypothesis tested is:

Ho: $HML_{\mathbf{DY}} \leq 0$

Ha: $HML_{\mathbf{DY}} > 0$

4.3 Bivariate Portfolio Analysis

To segregate the effects of the factors on stock returns, control portfolios are used. For example, to segregate the effect of factor i from that of factor j, for a given year t, cross-sectional data of year t is first ranked on factor i. Top and bottom 40 stocks in the ranked list are grouped into separate portfolios [a high factor i and a low factor i portfolio] and are marked for a second run. In the second run, each of the top and bottom portfolios is ranked again, separately, this time on factor j, and each one is subdivided into two portfolios, one with high factor j and the other with low factor j. For the four 20-stock portfolios generated, values for factor i, factor j, and annual returns are calculated and recorded. Portfolio formation, primary ranking, and secondary ranking operations are performed for all the years in the sample period, resulting in ten observations for each 20-stock portfolio. This effect-segregation procedure is carried out for all possible pairs of factors.

In the end, these operations yield 20 couples of portfolios for each factor i and factor j, given $i \neq j$. By construction, these couples display, among themselves, relatively equal values for the control factor, i, but significantly different values for their measurement factor, j. To test whether the premium for a given factor j is statistically significant when differences in a given factor i are controlled for, we calculate the return differential for each of the 20 couples of portfolios calculated for factor j controlled on i. Our question is whether the mean return differential

($HML_{j,i}$) for high minus low factor *j* portfolios holding factor *i* more or less constant is different from zero Hence, the hypothesis tested is:

Ho: $HML_{j,\,i} \leq 0$ (if positive coefficient is expected)

Ha: $HML_{j,\,i} > 0$

or Ho: $HML_{j,\,i} \geq 0$ (if a negative coefficient is expected)

Ha: $HML_{j,\,i} > 0$

$i, j = MVE, BMR, SPR, GPPR, DER, DY;$ and $i \neq j;$

$t = 1992, \ldots, 2001$

Using one-sample t-tests, the hypothesis given above is tested for each possible pair of *i* and *j*, and the respective t-values and p-values are reported. By this token, it is possible to see how changes in any factor *j* affect the return for two portfolios of similar factor *i* values. However, it should be noted that a high rate of correlation between the control factor and the measurement factor might not allow us to isolate the relationship between returns and the measurement variable.

4.4 Fama-MacBeth Regressions

In the cross-sectional regression stage, monthly company returns for the twelve-month period that starts from the July of year t+1 and ends at June of year t+2 are regressed on the natural logarithms of the company-specific variables that are calculated using the market capitalization values at the beginning of July of year t+1 and the accounting figures at the end of fiscal year t.

A six-month lag between the return measurements and financial-statement sourced variables is seen appropriate to eliminate a possible look-ahead bias that may arise due to including information that was actually not reachable at that particular moment in time.[10]

Then, for each month in the sample period, cross-sectional regressions of the tested statistical models is run, resulting in a total of 113[11] estimations of the coefficient for each company-specific variable (γ_i) for each model. The γ_i values are computed as the time-series averages of the monthly estimates; and their significance is evaluated using a simple t-test method. The overall explanatory power of each model is reported by its average adjusted R^2.

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[10] Companies listed on the ISE are obliged to report their financial statements to the Capital Market Board (CMB) and the ISE within 3 months after their fiscal year end. However, more than rarely, extensions, which may take as long as three more months, can be granted to this pre-set deadline. A 6-month lag between the computations of firm returns and company specific variables is, thus, seen appropriate in order to avoid a look-ahead bias. This 6-month lag is also consistent with earlier studies. (Fama and French [1992, 1993, 1995], Kothari et al. [1995], Akdeniz et al. [2000])

[11] The price data used starts from July 1993 and ends at December 2002, resulting in 113 return measurements.

4.2.1 Simple Regressions

We start by regressing returns on each company-specific factor one at a time. Coefficients of the variables are determined as the arithmetic averages of the monthly cross-sectional regressions. Null hypotheses tested by simple t-test method are:

$H_{0:}\ \gamma_{MVE} \geq 0$	$H_{0:}\ \gamma_{BMR} \leq 0$	$H_{0:}\ \gamma_{SPR} \leq 0$
$H_{a:}\ \gamma_{MVE} < 0$	$H_{a:}\ \gamma_{BMR} > 0$	$H_{a:}\ \gamma_{SPR} > 0$

$H_{a:}\ \gamma_{GPPR} \leq 0$	$H_{a:}\ \gamma_{DER} \leq 0$	$H_{a:}\ \gamma_{DY} \leq 0$
$H_{a:}\ \gamma_{GPPR} > 0$	$H_{a:}\ \gamma_{DER} > 0$	$H_{a:}\ \gamma_{DY} > 0$

Factors whose simple regression coefficients are not statistically different from zero are eliminated from further analyses.

4.2.2 Comparison between SPR and GPPR

The reason *GPPR* is added to our tests is to see whether accounting for production costs could result in a better earnings-proxy. However, due to high correlation between *SPR* and *GPPR*, there is a need to eliminate one of them before continuing with multiple regressions. We do this by jointly considering the premium calculated for each variable in univariate portfolio analysis, the bivariate portfolio analysis of these two variables, and the t-values and adjusted R-square values obtained from simple Fama-MacBeth regressions. In the end, one of these variables, hence, drops from further analysis.

4.2.3 Multiple Regressions

In the third and final phase of the cross-sectional regression analysis, we construct and test multi-parameter statistical models that encompass all possible combinations of the factors that survive the first and second phases. The cross-sectional regression methodology that is used in single-parameter models is applied, only difference being the number of independent variables.

Multiple regressions allow us to further the dual comparisons between our factors, and possibly enhance the analysis by rendering the comparison of three or more factors at a time possible. Again, interpretations on the factors' explanatory powers are based on t-values, and the choice between models is based on the average adjusted R^2s.

In the Results and Discussion Chapter, we document the results for the analysis that has so far been explained. The correlations between our factors, the univariate portfolio and bivariate portfolio characteristics, and the Fama-MacBeth regression results are all presented in tabular form and discussed in this chapter.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Correlation Analysis

Table I reports the correlations between the variables under study in the form they are used in the regression analysis. The reported values are calculated using Microsoft Excel Correlation function. The values in parentheses are the t-values for the correlation coefficients.

As MVE is used as denominator in the calculations of *BMR*, *SPR*, and *GPPR*, a certain amount of correlation is expected among these variables. *MVE* has a negative correlation with these variables with correlation coefficients varying between -0.257 and -0.309. *BMR*, *SPR*, and *GPPR* are positively correlated with each other. Hence, before coming up with economical interpretations for the correlations between these variables, one should keep in mind that the reason might simply be the common denominator effect.

On returns side, the highest positive correlation is observed for *SPR* (0.22) while the lowest negative correlation is observed for firm size (-0.27). All company specific factors but DY display statistically significant correlations with returns.

Table I

Correlation Coefficients

The correlation coefficients between subsequent returns, dividend yields, and natural logarithms of MVE, BMR, SPR, GPPR, and DER are reported for aggregate cross-sectional data. Return data covers a period from July 1993 to December 2002, while the accounting figures are derived from annual report data for a period from December 1992 to December 2001. The numbers in parentheses are t-values calculated for these coefficients.

	MVE	BMR	SPR	GPPR	DER	DY
BMR	**-0.278** (-11.15)					
SPR	**-0.257** (-10.26)	**0.286** (11.49)				
GPPR	**-0.309** (-12.51)	**0.246** (9.79)	**0.802** (51.81)			
DER	**-0.257** (-10.27)	**0.451** (19.45)	**0.616** (30.13)	**0.530** (24.07)		
DY	**-0.001** (-0.05)	**-0.048** (-1.87)	**-0.031** (-1.19)	**-0.014** (-0.53)	**-0.061** (-2.34)	
Return	**-0.268** (-10.72)	**0.157** (6.13)	**0.216** (8.53)	**0.197** (7.74)	**0.141** (5.49)	**0.006** (0.25)

Firm size displays negative and statistically significant correlations with returns, and with other company specific factors except dividend yield for which the correlation is insignificant. The negative relation between firm size and stock returns is in line with our expectation based on findings of Banz (1981), Reinganum (1981a), Fama and French (1992), Kothari et al. (1995). The negative correlations between firm size and other company specific factors are a natural result of the algebraic relationship between firm size and these factors.[12]

BMR has positive significant correlations with *SPR*, *GPPR*, *DER*, and returns. The positive correlation between *BMR* and expected returns is documented by several studies (Stattman [1980], Rosenberg et al. [1985], DeBondt and Thaler [1987], Keim [1988], Fama and French [1992]). Of these correlations, the correlation coefficient of 0.45 with *DER* is interesting. Fama and French (1993, 1995) find evidence that low book-to-market equity is typical of firms that have persistently strong earnings, while high book-to-market equity is associated with persistently low earnings. Considering the financial distress imposed upon firms with persistently low earnings, it might not be surprising to find the ratio of debt financing to equity financing being larger for high book-to-market equity firms.

SPR is positively correlated with expected returns (Stattman [1980], Barbee et al [1996]), *DER*, and naturally *GPPR*. Especially, the correlation coefficient of 0.61

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[12] MVE serves as a common denominator in the calculations of *BMR*, *SPR*, and *GPPR*.

observed between *SPR* and *DER* is interesting. Although the common denominator of these factors might explain a part of this, such a high value might also signal that there is more to this relationship. It is hard to pinpoint the exact source, but we believe that an increase in production, and in effect, sales, is made possible by a similar increase in company debt.

Finally, our correlation analysis indicates a low, but statistically significant negative relation between *DER* and *DY*. It so seems that high debt-to-equity ratio firms tend to have lower dividend yields. This might be a consequence of the higher debt financing costs these firms have to incur.

5.2 Univariate Portfolio Analysis

The aim of the univariate portfolio analysis is to know more about the relationships of the company-specific variables with future returns. Portfolios formed on the accounting figures of ISE firms at the fiscal end of a given year are matched with the annual returns for the one-year period that starts at July of the following year. The shortcoming is that, there are only 10 observations to test our alternative hypotheses that the premia for factors under study are different from zero, which would decrease the power of these tests.

5.2.1 Portfolios Formed on Firm Size

The ten-year averages of the annual returns and market capitalization values for the portfolios formed on firm size are reported in Table II. Size premium, $HML_{\mathbf{MVE}}$, is –47 percent, and significant at an α level of 10 percent. By examining the behavior of returns for high, medium, and low capitalization portfolios, we see that returns stagnate between large and medium size portfolios, and then increase for small size portfolios. The negative premium obtained for *MVE* is confirmatory of our prior expectations; yet, the fact that the average returns for high and medium size portfolios are about the same casts doubt on explanatory power of firm size.

Table II

Descriptive Statistics of Firm Size Ranked Portfolios

Average annual returns and market capitalization values (MVE) for portfolios sorted each June by firm size over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low capitalization portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	MVE ($*10^9$)	Returns
High MVE	*179,286*	*0.929*
Medium MVE	*13,472*	*0.921*
Low MVE	*3,295*	*1.400*
HML	*-0.470*	
t-value	*-1.520*	
p-value	*0.080*	

When the time series of size premia is examined, it is seen that the relation is not all that consistent.[13] Of a total of ten observations, seven give negative premium for size; and of these seven observations, in only four the returns do decrease uniformly from low to medium to high capitalization portfolios.

5.2.2 Portfolios Formed on Book-to-Market Ratio

Table III contains the ten-year averages of the annual returns and book-to-market values for the portfolios formed on *BMR*. Average annual returns decrease uniformly from high to medium to low book-to-market portfolios, and there is a book-to-market premium of 54 percent that is statistically significant at an α level of 5 percent. These findings support our belief that stocks of high book-to-market firms earn higher returns than the stocks of low book-to-market firms.

The time-series behavior of the portfolios formed on *BMR* depicts a relatively consistent positive relation with stock returns. Of a total of ten observations, seven give positive premium for *BMR*; and of these seven observations, six display a uniform decrease in returns as we move down the BMR ladder

[13] To save space, the time-series data on univariate portfolio results is given in Appendix.

5.2.3 Portfolios Formed on Sales-to-Price Ratio

The ten-year averages of the sales-to-price values and annual returns for the portfolios formed on sales-to-price ratio are reported in Table IV. Sales-to-price ratio commands the largest return premium, 83 percent, among the set of company-specific factors under study. Average annual returns decrease uniformly from high to medium to low sales-to-price portfolios. These findings confirm our expectations that stocks of high sales-to-price firms earn, on average, higher returns compared to stock of low sales-to-price firms.

Table III

Descriptive Statistics of Book-to-Market Ranked Portfolios

Average annual returns and book-to-market ratios (BMR) for portfolios sorted each June by book-to-market ratio over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low book-to-market portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	BMR	**Returns**
High BMR	*1.165*	*1.368*
Medium BMR	*0.505*	*1.018*
Low BMR	*0.220*	*0.827*
HML	*0.541*	
t-value	*1.920*	
p-value	*0.043*	

The time-series behavior of portfolios formed on sales-to-price ratio display a fairly consistent positive relation with stock returns. Of a total of ten observations, seven give positive premium for *SPR*; and for all of these seven observations, returns decrease uniformly from high to medium to low *SPR* portfolios.

Table IV

Descriptive Statistics of Sales-to-Price Ranked Portfolios

Average annual returns and sales-to-price ratios (SPR) for portfolios sorted each June by sales-to-price ratio over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low sales-to-price portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	SPR	**Returns**
High SPR	*3.316*	*1.540*
Medium SPR	*0.989*	*0.982*
Low SPR	*0.360*	*0.711*
HML	*0.829*	
t-value	*2.830*	
p-value	*0.010*	

5.2.4 Portfolios Formed on Gross Profit-to-Price Ratio

Table V reports the results of the univariate portfolio analysis performed on *GPPR*. The premium associated with this variable is 48 percent, and statistically significant at an α level of 5 percent; hence, our prior expectations are verified. Much like sales-to-price portfolios, returns decrease uniformly from high to medium to low *GPPR* portfolios. Yet, it seems that premium associated with *SPR* is economically more significant, and display higher t-values in tests.

Table V

Descriptive Statistics of GPPR Ranked Portfolios

Average annual returns and gross profit-to-price ratios (GPPR) for portfolios sorted each June by GPPR over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low GPPR portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	GPPR	**Returns**
High GPPR	*0.813*	*1.338*
Medium GPPR	*0.267*	*1.019*
Low GPPR	*0.148*	*0.857*
HML	*0.481*	
t-value	*2.170*	
P	*0.029*	

On year-by-year basis, portfolios formed on *GPPR* do not display a consistent relation with stock returns. Of a total of ten observations, six give positive premium for *GPPR*; and of these six observations, returns display a uniform decrease from high to medium to low *GPPR* portfolios in only three.

5.2.5 Portfolios Formed on Debt-to-Equity Ratio

Average annual returns and debt-to-equity ratio values for the portfolios formed on debt-to-equity ratio are presented in Table VI. Debt-to-equity ratio commands a 60 percent return premium, which is statistically significant at an α level of 5 percent. Returns decrease uniformly from high to medium to low leverage portfolios. Thus in line with our expectations, stocks of high leverage firms earn higher returns compared to stocks of low leverage firms.

The time-series behavior of debt-to-equity ratio portfolios is more or less consistent. Of a total of ten observations, seven give positive premium for *DER*; and of these seven observations, in only five do returns decrease uniformly from high to medium to low debt-to-equity portfolios.

5.2.6 Portfolios Formed on Dividend Yield

The ten-year averages of the annual returns and dividend yields are reported in Table VII. The premium associated with dividend yield is –52 percent and statistically significant at an α level of 10 percent. Returns decrease from high to medium dividend yield portfolios, and rise from medium to low dividend yield portfolios. Therefore, the relation between dividend yield and subsequent stock returns might not be linear as we foresaw. The time-series behavior of portfolios formed on dividend yield does not display a consistent picture either.

Table VI

Descriptive Statistics of Debt-to-Equity Ranked Portfolios

Average annual returns and debt-to-equity ratios (DER) for portfolios sorted each June debt-to-equity ratio over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low debt-to-equity portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	DER	**Returns**
High DER	*2.122*	*1.367*
Medium DER	*0.570*	*1.065*
Low DER	*0.184*	*0.765*
HML		*0.602*
t-value		*2.120*
p-value		*0.032*

Table VII

Descriptive Statistics of Dividend Yield Ranked Portfolios

Average annual returns and dividend yields (DY) for portfolios sorted each June by dividend yields over the period from 1992 to 2001 are reported. Also reported is the return differential between high and low dividend yield portfolios, t-value calculated for this return differential using a one-sample t test, and the p-value associated with this test.

	DY	Returns
High DY	*0.007*	*1.056*
Medium DY	*0.000*	*0.720*
Low DY	*0.000*	*1.576*
HML	*-0.520*	
t-value	*-2.000*	
p-value	*0.077*	

5.3 Bivariate Analysis

The bivariate analysis is an attempt to segregate the joint effects of the company-specific factors under study. We aim to measure the effect of a given factor by comparing the returns on two portfolios that are designed to bear nearly identical values for a second factor, the control variable, but differ significantly in the factor under measurement. The power of the one sample t-tests on the *HML* values for bivariate portfolios might be higher than that for univariate portfolios as the number of observations that aid us to test our alternative hypotheses are, this time, 20 instead of 10. The increase in the number of observations is a result of bivariate portfolio analysis methodology in which we double-rank the stocks on the control factor (*C*) and the measurement factor (*F*) respectively, obtaining four portfolios, high *C* – high *F* (HCHF), high *C* – low *F* (*HCLF*), low *C* – high *F* (*LCHF*), and low *C* – low *F* (*LCLF*). This procedure yields, for each year, two return differentials: $R_{HCHF} - R_{HCLF}$ and $R_{LCHF} - R_{LCLF}$. In the one-sample t-tests, we pool these two differentials in the same sack, as the level of control factor is irrelevant. In other words, what matters is having two portfolios of nearly identical values for the control factor, and significantly different values for the measurement factor. In the subsections that follow, the results obtained for each of these segregation attempts is going to be presented in tabular form and be discussed.

5.3.1 Firm Size

In Table VIII, we present ten-year averages for some characteristics of the portfolios that measure the size effect by controlling for the other factors one at a time. The t- and p-values are for the hypothesis that the return differential is less than zero.

The size premia, shown in the HML column, range between –0.23 and -0.11, and are consistently negative. Comparing the bivariate portfolio p-values of size premium obtained for portfolios controlled on *BMR* and *DY* with univariate portfolio p-value reveals that size premium retains its statistical significance despite the addition of these control factors. Controlling for *DER* reduces the significance to the level of 0.12. The size premia for portfolios controlled on *SPR* and *GPPR* are not at all significant at reasonable levels. These findings lead us to the conclusion that the size effect calculated in univariate portfolio analysis is primarily subsumed by *SPR*, *GPPR*, and *DER*. Among these factors, *SPR* and *GPPR* might have a stronger edge against firm size.

5.3.2 Book-to-Market Ratio

In Table IX, we present ten-year averages for some characteristics of the portfolios that measure the book-to-market effect by controlling for the other factors one at a time. The t- and p-values are again for the hypothesis that book-to-market premium, given in the column labeled with HML, is greater than zero.

The premium for *BMR* ranges between 0.04 and 0.26 for different control portfolios. Book-to-market ratio retains its statistical significance when controlled for differences in size. Although *SPR*, *GPPR*, and *DY* do cause notable decreases in the observed level of significance, the major threat to book-to-market effect comes from debt-to-equity ratio: when the portfolios are controlled for differences in the level of leverage, the book-to-market effect seems to completely disappear. If this is not a result specific to our sample, this finding is, indeed, interesting. DER and BMR might be proxies for the same underlying risk factor. Fama and

Table VIII

Controlled Portfolios of Firm Size

Average annual returns, market capitalizations (MVE), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then firm size over the time period from 1992 to 2001. First column shows the variable upon which the control is exerted. In the second, third and fourth columns, the MVE, control variable, and average annual return values for the high capitalization portfolios are reported respectively. Likewise, in the fifth, sixth, and seventh columns, the MVE, control variable, and average annual return values for the low capitalization portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High MVE			Low MVE			HML	t-value	p-value
		MVE ($*10^9$)	Control	Return	MVE	Control	Return			
BMR	High	17224	1.05	1.00	3593	1.12	1.28	-0.23	-1.41	0.09
	Low	159780	0.19	0.66	8403	0.19	0.84			
SPR	High	12881	2.56	1.21	2618	3.11	1.45	-0.18	-1.02	0.16
	Low	151078	0.27	0.59	10347	0.33	0.71			
GPPR	High	15361	0.64	1.14	2759	0.84	1.34	-0.11	-0.77	0.23
	Low	165965	0.08	0.71	9753	0.09	0.71			
DER	High	14104	6.27	1.05	2952	18.77	1.30	-0.20	-1.21	0.12
	Low	137753	2.25	0.65	9479	4.46	0.79			
DY	High	45966	0.01	0.74	5757	0.00	1.17	-0.29	-1.46	0.08
	Low	34396	0.00	0.47	3953	0.00	0.62			

French (1996) identify this factor as relative distress, and perhaps *DER* does a better job in explaining relative distress in the high inflation environment of Turkey than BMR does.

5.3.3 Sales-to-Price Ratio

In Table X, we present ten-year averages for some characteristics of the portfolios that measure the sales-to-price effect by controlling for the other factors one at a time. The t- and p-values are again for the hypothesis that sales-to-price premium, given in the column labeled with HML, is greater than zero.

The sales-to-price premium ranges between 0.38 and 0.51 for portfolios controlled for different factors. The consistent significance displayed by SPR is indeed impressive:

For *MVE*, *BMR*, *DER* and *DY*, this premium is positive and statistically significant at an α level of 1 percent. It is clear in our results that the statistical significance of sales-to-price effect is immune to whichever factor we choose to control the differences for. In other words, sales-to-price ratios might proxy some underlying risk factor that has not been captured by other company-specific factors under study.

Table IX

Controlled Portfolios of Book-to-Market Ratio

Average annual returns, book-to-market ratios (BMR), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then book-to-market ratio over the time period from 1992 to 2001. First column shows the variable upon which the control is exerted. In the second, third and fourth columns, the BMR, control variable, and average annual return values for the high book-to-market portfolios are reported respectively. Likewise, in the fifth, sixth, and seventh columns, the BMR, control variable, and average annual return values for the low book-to-market portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High BMR			Low BMR			HML	t-value	p-value
		BMR	Control	Return	BMR	Control	Return			
MVE	High	0.58	93424	0.95	0.19	173514	0.67	0.26	2.40	0.02
	Low	1.00	2712	1.30	0.33	2518	1.07			
SPR	High	1.04	2.69	1.51	0.37	2.95	1.17	0.26	1.60	0.07
	Low	0.63	0.32	0.74	0.20	0.27	0.56			
GPPR	High	0.96	0.74	1.36	0.34	0.74	1.12	0.22	1.67	0.06
	Low	0.70	0.09	0.81	0.20	0.09	0.61			
DER	High	1.19	2.03	1.17	0.41	1.73	1.17	0.04	0.38	0.36
	Low	0.54	0.18	0.76	0.20	0.15	0.68			
DY	High	0.64	0.00	1.07	0.25	0.00	0.84	0.13	1.36	0.09
	Low	0.92	0.00	0.56	0.27	0.00	0.53			

5.3.4 Gross Profit-to-Price Ratio

In Table XI, we present the ten-year averages for some characteristics of the portfolios that measure the premium associated with *GPPR* by controlling for the other factors one at a time. The t- and p-values are again for the hypothesis that *GPPR* premium, given in the column labeled with HML, is greater than zero.

The results obtained for *GPPR* are similar to those for *SPR*. The premia for the factor ranges between 0.23 and 0.41 and it is consistently positive and statistically significant at an α level of 5 percent. Furthermore, the significance of *GPPR* is not affected from the use of different control variables either.

5.3.5 Debt-to-Equity Ratio

In Table XIII, we present the ten-year averages for some characteristics of the portfolios that measure the leverage effect by controlling for the other factors one at a time. The t- and p-values are again for the hypothesis that the leverage premium, given in the column labeled with HML, is greater than zero.

Table X

Controlled Portfolios of Sales-to-Price Ratio

Average annual returns, sales-to-price ratios (SPR), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then sales-to-price ratio over the time period from 1992 to 2001. First column shows the variable upon which the control is exerted. In the second, third and fourth columns, the SPR, control variable, and average annual return values for the high sales-to-price portfolios are reported respectively. Likewise, in the fifth, sixth, and seventh columns, the SPR, control variable, and average annual return values for the low sales-to-price portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High SPR			Low SPR			HML	t-value	p-value
		SPR	Control	Return	SPR	Control	Return			
MVE	High	0.99	109549	1.06	0.26	147525	0.56	0.51	3.17	0.00
	Low	2.97	2486	1.44	0.83	2749	0.93			
BMR	High	2.25	1.11	1.37	0.67	1.06	0.91	0.47	4.44	0.00
	Low	1.53	0.20	0.99	0.32	0.18	0.51			
GPPR	High	3.73	0.92	1.48	1.27	0.57	0.99	0.41	2.17	0.02
	Low	0.72	0.11	0.87	0.20	0.07	0.55			
DER	High	3.09	2.17	1.48	0.92	1.62	0.87	0.45	3.95	0.00
	Low	0.93	0.20	0.87	0.23	0.13	0.58			
DY	High	1.68	0.00	1.18	0.45	0.00	0.73	0.38	4.01	0.00
	Low	1.84	0.00	0.70	0.45	0.00	0.39			

Table XI

Controlled Portfolios of GPPR

Average annual returns, gross profit-to-price ratios (GPPR), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then GPPR over the time period from 1992 to 2001. First column shows the variable upon which the control is exerted. In the second, third and fourth columns, the GPPR, control variable, and average annual return values for the high GPPR portfolios are reported respectively. Likewise, in the fifth, sixth, and seventh columns, the GPPR, control variable, and average annual return values for the low GPPR portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High GPPR			Low GPPR			HML	t-value	p-value
		GPPR	Control	Return	GPPR	Control	Return			
MVE	High	0.25	98954	0.95	0.08	165416	0.68	0.30	3.28	0.00
	Low	0.79	2546	1.35	0.21	2707	1.02			
BMR	High	0.58	4.50	1.28	0.15	2.53	1.00	0.29	2.76	0.01
	Low	0.39	22.83	0.89	0.10	7.98	0.61			
SPR	High	0.99	3.37	1.45	0.35	2.36	1.24	0.23	2.81	0.01
	Low	0.18	0.41	0.78	0.06	0.21	0.53			
DER	High	0.78	2.08	1.38	0.22	1.70	0.97	0.41	4.52	0.00
	Low	0.27	0.20	0.93	0.07	0.14	0.52			
DY	High	0.46	0.01	1.14	0.14	0.01	0.77	0.34	2.59	0.01
	Low	0.50	0.00	0.70	0.12	0.00	0.40			

The return premium on debt-to-equity ratio varies between 0.16 and 0.31, and is consistently positive. *DER* retains its statistical significance at an α level of 5 percent for all the factors under study except *BMR*. When controlled for differences in BMR, the debt-to-equity effect notably decreases. This evidence also verifies the finding in section 5.3.2 and leads us to the same idea that *BMR* and DER might be proxies for the same underlying risk factor.

Table XII

Comparison Between Book-to-Market and Debt-to-Equity Ratios

	BMR	**DER**
Univariate Analysis		
HML	0.541	0.602
t-value	(1.92)	(2.12)
Bivariate Analysis (BMR controlled on DER, and DER controlled on BMR)		
HML	0.04	0.16
t-value	(0.38)	(1.48)

It can clearly be seen above that debt-to-equity ratio is a stronger measure of that underlying risk factor. *DER* not only commands higher premia on both univariate, and bivariate portfolios, but also it retains much more of its significance when controlled for *BMR*, compared to the case in which *BMR* loses nearly all of its significance when controlled for *DER*.

Table XIII

Controlled Portfolios of Debt-to-Equity Ratio

Average annual returns, debt-to-equity ratios (DER), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then debt-to-equity ratio over the time period from 1992 to 2001. In the second, third and fourth columns, the DER, control variable, and average annual return values for the high leverage portfolios are reported respectively. Likewise, in the fifth, sixth, and seventh columns, the DER, control variable, and average annual return values for the low leverage portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High DER			Low DER			HML	t-value	p-value
		DER	Control	Return	DER	Control	Return			
MVE	High	0.64	107096	0.95	0.16	153846	0.67	0.31	3.06	0.00
	Low	1.95	2748	1.35	0.42	2489	1.02			
BMR	High	2.07	1.18	1.18	0.50	1.00	1.11	0.16	1.48	0.08
	Low	0.71	0.20	0.87	0.16	0.19	0.63			
SPR	High	2.30	3.12	1.51	0.62	2.55	1.18	0.20	2.24	0.03
	Low	0.49	0.36	0.68	0.12	0.25	0.63			
GPPR	High	2.17	0.80	1.39	0.61	0.68	1.09	0.29	3.13	0.00
	Low	0.59	0.10	0.85	0.13	0.08	0.57			
DY	High	0.85	0.00	1.17	0.20	0.01	0.75	0.27	2.73	0.01
	Low	1.57	0.00	0.60	0.31	0.00	0.49			

Table XIV

Controlled Portfolios of Dividend Yield

Average annual returns, dividend yields (DY), and value of the variable that the differences are controlled for, i.e. the control variable, are reported for portfolios sorted by control variable first and then dividend yield over the time period from 1992 to 2001. In the second, third and fourth columns the DY, control variable, and average annual return values for the high dividend yield portfolios are reported, respectively. Likewise, in the fifth, sixth, and seventh columns, the DY, control variable, and average annual return values for the low dividend yield portfolios are given. Eighth, ninth, and tenth columns depict the return differentials on these two portfolios, t-values calculated for these return differentials, and p-values associated with the tests conducted using these t-values based on our priory expectations.

Control Variable		High DY			Low DY			HML	t-value	p-value
		DY	Control	Return	DY	Control	Return			
MVE	High	0.03	114656	0.76	0.00	140874	0.86	-0.09	-1.09	0.15
	Low	0.02	3393	1.15	0.00	1787	1.22			
BMR	High	0.00	1.19	1.20	0.00	1.01	1.08	0.09	0.83	0.21
	Low	0.08	0.21	0.78	0.00	0.27	0.72			
SPR	High	0.02	3.31	1.27	0.00	2.48	1.42	-0.03	-0.16	0.44
	Low	0.03	0.34	0.70	0.00	0.34	0.61			
GPPR	High	0.02	0.88	1.30	0.00	0.66	1.18	0.09	0.72	0.24
	Low	0.03	0.10	0.74	0.00	0.17	0.68			
DER	High	0.01	2.16	1.22	0.00	1.68	1.13	0.05	0.55	0.30
	Low	0.07	0.17	0.72	0.00	0.25	0.72			

5.3.6 Portfolios Controlled on DY

In Table XIV, we present the ten-year averages for some characteristics of the portfolios that measure the dividend yield effect by controlling for the other factors one at a time. The t- and p-values are again for the alternative hypothesis that the leverage premium, given in the column labeled with HML, is greater than zero.

The return premium for dividend is not statistically significant. The results indicate that the dividend yield effect vanishes after controlling for other factors. The significance level that is reported for dividend yield in the Univariate Analysis section might be caused by random clustering of data; hence, might be sample specific.

5.2 Fama-MacBeth Regressions

The results of the Fama-MacBeth regressions are presented in Table XV. Panel A reports average monthly coefficients and respective t-values obtained from the single parameter Fama-MacBeth cross-sectional regressions. The coefficient for firm size comes out to be -0.006. The negative sign of the coefficient, yet another time, agree with our prior expectations. Akdeniz et al (2000) report, for the same coefficient, a value of –0.010, which is comparable to our results. Coefficients for *BMR*, *SPR*, *GPPR*, *DER* and *DY* are 0.010, 0.014, 0.012, 0.010, and 17.418

respectively. The t-values for these coefficients reveal that all variables except dividend yield are statistically significant at an α level of 5 percent. By glancing at the t-value of 1.031 computed for *DY*, it is seen that the null hypothesis of zero coefficient on dividend yield equals to zero cannot be rejected. Hence, dividend yield is eliminated from the rest of the analysis. The reason why dividend yield comes out to be insignificant might also be the linearity assumption we imposed on the relationship between returns and dividend yield. As our univariate portfolio results indicate, the relation may not be linear.

As reported in the Correlation Analysis Section, there is a high degree of correlation between *SPR* and *GPPR*. Therefore, using these two factors in the same model might lead to meaningless results. Thus, the analysis requires the elimination of one of these variables. Our conclusions from univariate and bivariate analysis favored sales-to-price ratio because of the higher economic and statistical significance it demonstrated. Here, we again find confirmatory evidence that sales-to-price ratio has a stronger explanatory power on the cross-sectional of returns. It has a higher coefficient, a higher t-value, and even a higher adjusted R-square value. Therefore, we conclude that *SPR* dominates *GPPR*, and so, GPPR is eliminated from further analysis.

Panel B depicts the two-parameter Fama-MacBeth cross-sectional regression results. In Model 7, we test the significances of *MVE* and *BMR* when used together and observe for this case a notable decrease in the explanatory powers of both factors. Results for model 9 and model 11 show that debt-to-equity ratio subsumes the explanatory powers of firm size and book-to-market ratio. Models 8, 10 and 12 portrait the power of SPR in cross-sectional regressions. In Panel C, the results of other multi-parameter Fama-MacBeth regressions are presented. These regressions mainly support our conclusions related to the explanatory powers of our variables, and the interrelationships between them.

MVE comes out to be significantly negatively related to cross-section of returns when used as the only parameter in the regression. Although a negative relation is observable in multi-parameter models that contain *MVE*, in none of these models the null hypothesis that the coefficient for *MVE* is greater than or equal to zero can be rejected at the 95 percent confidence level.

Simple cross-sectional regression gives out a significant positive coefficient for *BMR*. Like *MVE*, however, this significance vanishes in the multiple regressions. Book-to-market ratio displays a lower explanatory power for the returns on the ISE as compared to the NYSE (Fama and French [1996]). A reason for such an occurrence might be the distortion caused by high inflation rates on the book values, which may partly inhibit the ability of *BMR* figures to project future performance.

Table XV

Fama-MacBeth Cross-Sectional Regression Coefficients

Results are based on an Ordinary Least Squares model. The full model is:

$$R_i = \gamma_0 + \gamma_1 \ln MVE_i + \gamma_2 \ln BMR_i + \gamma_3 \ln SPR_i + \gamma_4 \ln GPPR_i + \gamma_5 \ln DER_i + \gamma_6 DY_i$$

R_i is the monthly return on security i; $\ln MVE_i$, $\ln BMR_i$ $\ln SPR_i$, $\ln GPPR_i$ and $\ln DER_i$, are the natural logarithms of firm size, book-to-market ratio, sales-to-price ratio, gross profit-to-price ratio, and debt-to-equity ratio, respectively; DY is the dividend yield. The average Fama-MacBeth Regression coefficients are reported. The numbers in parentheses are the t-values. The sample period is from July 1992 to December 2002. Average R-square values for different models are also reported. Panel A portraits the average single parameter regression coefficients, and respective t-values. In Panel B, average coefficients for two-parameter Fama-MacBeth regressions and t-values of these coefficients are presented. Panel C shows the multi-parameter regression results.

Panel A							
Model	**MVE**	**BMR**	**SPR**	**GPPR**	**DER**	**DY**	**R-sq**
1	**-0.006** -(2.297)						*0.032*
2		**0.010** (2.240)					*0.022*
3			**0.014** (4.093)				*0,022*
4				**0.012** *(3.638)*			*0.017*
5					**0.010** (3.329)		*0.023*
6						**1.742** (1.031)	*0.011*

Table XIV (Continued)							
Panel B							
Model	**MVE**	**BMR**	**SPR**	**GPPR**	**DER**	**DY**	**R-sq**
7	**-0.005**	**0.005**					*0.045*
	-(1.708)	(1.262)					
8	**-0.002**		**0.012**				*0.043*
	-(0.696)		(3.419)				
9	**-0.004**				**0.007**		*0.042*
	-(1.376)				(2.544)		
10		**0.005**	**0.013**				*0.032*
		(1.330)	(4.332)				
11		**0.005**			**0.008**		*0.032*
		(1.273)			(2.966)		
12			**0.012**		**0.002**		*0.029*
			(3.334)		(0.571)		

Panel C							
Model	**MVE**	**BMR**	**SPR**	**GPPR**	**DER**	**DY**	**R-sq**
13	**-0.002**	**0.004**	**0.012**				***0.051***
	-(0.704)	(1.126)	(3.597)				
14	**-0.003**		**0.011**		**0.002**		***0.046***
	-(1.015)		(2.788)		(0.578)		
15	**-0.004**	**0.004**			**0.006**		***0.049***
	-(1.509)	(0.932)			(2.347)		
16		**0.007**	**0.013**		**0.000**		***0.036***
		(1.659)	(3.438)		-(0.004)		
17	**-0.002**	**0.005**	**0.012**		**0.000**		***0.055***
	-(0.818)	(1.161)	(2.870)		-(0.057)		

Debt-to-equity ratio is positively related to the cross-section of returns, and the relation is quite strong. Except for the models that use *DER* together with *SPR*, the statistical significance of *DER* is verified. *DER* seems to subsume the explanatory powers of *MVE* and *BMR* when used together. The coefficient for *DER* varies between 0.006 and 0.010 for the models that do not contain SPR.

The coefficients for *SPR* are significantly greater than zero and remain relatively stable between 0.012 and 0.014 for different models. Explanatory powers of *MVE*, *BMR*, and *DER* are subsumed by *SPR*, the variable that demonstrates the strongest and the most consistent relationship with monthly stock returns. Yet, the interrelation between *SPR* and *DER* deserves special attention. The high correlation between *SPR* and *DER* signals an alarm for the problem of multicollinearity; yet, the fact that there are no great changes or sign reversals in the coefficients of *SPR* obtained from the twelve multi-parameter regressions that are run may relieve the reader of the possibility of an ill-structured model. The coefficients of *DER*, on the other hand, lose their significance once *SPR* is added to the model. Otherwise, the coefficient for *DER* varies between 0.006 and 0.010.

In sum, this study reveals that *SPR* and *DER* do a better job in explaining cross-section of returns in comparison to *BMR* and *MVE*, consistent with the findings of Barbee et al (1996) for the NYSE. Our results indicate that the explanatory powers of *BMR* and *MVE* are subsumed by *SPR* and *DER*. Moreover, *DER*, too, loses its statistical significance when used together with *SPR*. Hence, in the set of defined variables, *SPR* rises to be the single strong predictor of the cross-sectional variability in stock returns for the ISE securities.

CHAPTER 6

CONCLUSION

In this master thesis, the explanatory powers of firm size, book-to-market ratio, sales-to-price ratio, gross profit-to-price ratio, debt-to-equity ratio, and dividend yield for the cross-section of returns on the Istanbul Stock Exchange is examined. Our sample spans a 113 month time period from July 1992 to November 2002. In the end, we find that, by themselves, all of these company-specific variables except dividend yield command statistically significant premia on returns.

Using market capitalization as a proxy for the firm size, we show that a significant negative relationship exists between returns and firm size. The relationship between book-to-market ratio and returns, on the other hand, is positive and statistically significant. Coefficients found in Fama-MacBeth regressions for firm size and book to market ratio are -0.006 and 0.010 respectively, which are pretty close to the –0.010 and 0.013 stated by a similar study conducted on the ISE by Akdeniz et al (2000).

Sales-to-price ratio and debt-to-equity ratio were two company-specific variables that, to the best of our knowledge, had not been tested for the ISE. We test the explanatory powers of these variables and find statistically significant positive premia associated with both of these variables. Based on the results of our cross-sectional regressions, we also reach to the conclusion that sales-to-price and debt-to-equity ratios do a better job in capturing the cross-sectional variability of returns on the ISE compared to firm size or book-to-market ratio.

Gross profit-to-price ratio is also tested and its explanatory power is found inferior to that of sales-to-price ratio. Cost of goods sold figures include the depreciation related to manufacturing facilities. Inclusion of manipulation-prone depreciation account in calculation of cost of goods sold might cause such a decrease in the explanatory power.

Debt-to-equity ratio is shown to subsume the premia associated with firm size and book-to-market ratio. Especially, the bivariate analysis results for book-to-market portfolios controlled for differences in debt-to-equity ratio is interesting: in this case, the statistically significant premium associated with book-to-market ratio completely disappears. Seeing that our cross-sectional regression results also verify this statement, we reach to the conclusion that these two variables might jointly proxy for the same underlying risk factor, and this risk factor is probably financial distress.

Of all the variables tested, sales-to-price ratio is the most powerful. Univariate portfolio analysis results indicate the highest return premium is associated with

SPR. Bivariate portfolio results show that the statistical, and economical significances of this variable are immune to whatever control factor is used. Furthermore, Fama-MacBeth regression results agree on a relatively robust coefficient for *SPR*, which ranges between 0.011 and 0.014. Moreover, sales-to-price ratio subsumes the statistical significances of all other variables under study when used together in multiple Fama-MacBeth regressions. These results on the interrelationship between firm size, book-to-market ratio, sales-to-price ratio, and debt-to-equity ratio comply one to one with the results of a study by Barbee, Mukherji, and Reines (1996). This study is conducted for the U.S. market and served as a benchmark study for this master thesis.

Unfortunately, our study has some basic limitations. First and the most important of all, market betas are not included in the analysis. Although Akdeniz et al (2000) find insignificant explanatory power for market betas on the ISE during the period from 1992 to 1998, the inclusion of the market factor could have provided better insights to the analysis. Second, in the bivariate portfolio analyses conducted, we could not achieve a perfect control mechanism on variables with high correlations due to software and time limitations. Hence, our results would probably be distorted as the extent of correlation increases. Third, although we used the earliest data available for the ISE, we still had to work on a much smaller sample of returns compared to the tests conducted on extablished markets such as the New York Stock Exchange or the Tokyo Stock Exchange. The power of our tests, hence, is negatively effected.

There is still more to do to discover about the behavior of returns on the Istanbul Stock Exchange. Although our study adressed only some company-specific factors, models that contain a combination of external factors (like general economic activity as well as industry-specific factors), extracted factors (like market beta) and company-specific factors (like sales-to-price ratio) could do more to explain the cross-sectional variability in returns.

REFERENCES

Aggarwal, R., Rao, R. P., Hiraki, T. (1990), "Regularities in Tokyo Stock Exchange Security Returns: P/E, Size, and Seasonal Influences", *Journal of Financial Research,* 13/3, 249 - 263

Akdeniz, L., Altay-Salih, A., Aydoğan, K. (2000), "Cross-Section of Expected Stock Returns on the Istanbul Stock Exchange", *Russian and East European Finance and Trade,* Vol.36, 6 -26

Badrinath, S. G., Omesh, K. (2000), "The Robustness of Abnormal Returns from the Earnings Yield Contrarian Investment Strategy", *Journal of Financial Research,* 24/3, 385 - 401

Banz, R. W. (1981), "The Relationship between Return and Market Value of Common Stocks", *Journal of Financial Economics,* Vol. 9, 3 –18

Barbee, W. C. (1989), "Forecasting the Performance of a Company's Common Stock with a Model Based of Sales/Price Ratio", *Spectrum.* Fall, 45-49

Barbee, W. C., Mukherji, S. and Reines, G. A. (1996), "Do Sales-Price and Debt-Equity Explain Stock Returns Better than Book-Market and Firm Size?", *Financial Analysts Journal*, March/April, 56 -60

Basu, S. (1977), "Investment Performance of Common Stocks in Relation to their Price – Earnings Ratios: A Test of the Efficient Market Hypothesis ", *Journal of Finance*, Vol.32, 663-682

Bhandari, L. C. (1988), "Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence", *Journal of Finance,* Vol. 43, 507-528

Black, F. (1972), “Capital Market Equilibrium with Restricted Borrowing”, *Journal of Business,* Vol. 45, 444 – 454

Blume, M. E. and Stambaugh, R. F. (1983), “Biases in Computed Returns: An Application to the Size Effect”, *Journal of Financial Economics,* Vol. 12/3, 387 – 404

Brennan, M. J. (1970), “Investor Taxes, Market Equilibrium, and Corporation Finance”, Unpublished PhD Dissertation (Massachusetts Institute of Techonology, Cambridge, Massachusetts)

Chan, K.C., Chen, N., and Hsieh, D.A. (1985), “An Explanatory Investigation of the Firm Size Effect”, *Journal of Financial Economics,* Vol. 14/3, 451 - 471

Chan, K.C., Hamao, Y., Lakonishok, J. (1991), “Fundamentals and Stock Returns in Japan”, *Journal of Finance,* Vol. 46/5, 1739 - 1764

Chen, N. (1983), “Some Empirical Tests of the Theory of Arbitrage Pricing”, *Journal of Finance,* Vol. 38, 1393 - 1414

Chen, N., Pari, R.A. (1984), “An Empirical Test of the Arbitrage Pricing Theory”, *Journal of Financial Research,* 7/2, 121 – 130

Chen, N., Roll, R., Ross, S. A. (1986), “Economic Forces and the Stock Market”, *Journal of Business,* 59/1, 383 - 403

Cho, D.C., Elton, E.J., Gruber, M.J. (1984), “On the Robustness of Roll and Ross Arbitrage Pricing Theory”, *Journal of Financial and Quantitative Analysis,* 19/1, 1 – 10

Cook, T. J., Rozeff, M. S. (1984), “Size and Earnings-Price Ratio Anomalies: One Effect or Two?” *Journal of Financial and Quantitative Analysis,* 19/4, 449 - 466

Davis, J. L. (1994), “The Cross-Section of Realized Stock Returns: The Pre-COMPUSTAT Evidence”, *Journal of Finance,* 49/5, 1579 - 1593

DeBondt, W. F. M., Thaler, R. H. (1985), “Does the Stock Market Overreact”, *Journal of Finance,* 40, 557 - 581

Dhrymes, P.J., Friend, I., and Gültekin, N.B. (1984), “A Critical Reexamination of the Empirical Evidence on Arbitrage Pricing Theory”, *Journal of Finance,* 39/2, 323 - 346

Fama, E. F. (1981), “Stock Returns, Real Activity, Inflation, and Money”, *American Economic Review,* 71, 545 - 565

Fama, E. F. (1990), “Stock Returns, Expected Returns, and Real Activity”, *Journal of Finance,* 45, 1089 - 1109

Fama, E. F., French, K. R. (1988), “Dividend Yields and Expected Stock Returns”, *Journal of Financial Economics,* 22/1, 3 - 25

Fama, E. F., French, K. R. (1992), “The Cross-Section of Expected Stock Returns”, *Journal of Finance,* 47, 427- 465

Fama, E. F., French, K. R. (1993), “Common Risk Factors in the Returns on Stocks and Bonds”, *Journal of Financial Economics,* 33, 3 – 56

Fama, E. F., French, K. R. (1995), “Size and Book-to-Market Factors in Earnings and Returns”, *Journal of Finance,* 50, 131- 155

Fama, E. F., French, K. R. (1996), “Multifactor Explanations of Asset Pricing Anomalies”, *Journal of Finance,* 51/1, 55 – 84

Fama, E. F., Schwert, G. W. (1977), “Asset Returns and Inflation”, *Journal of Financial Economics,* 5, 115 - 146

Ferson, W. E., Harvey, C. R. (1997), "Fundamental Determinants of National Equity Market Returns: A Perspective on Conditional Asset Pricing", *Journal of Banking and Finance,* 21, 1625 - 1665

Geske, R., Roll, R. (1983), "The Monetary and Financial Links Between Stock Returns and Inflation", *Journal of Finance,* 38, 1 - 33

Graham, B., Dodd, D. (1940), *Security Analysis: Principles and Technique,* McGraw-Hill Book Company, Inc., New York

Hamao, Y. (1988), "An Empirical Investigation of the Arbitrage Pricing Theory", *Japan and the World Economy,* 1, 45 - 61

Handa, P., Kothari, S. P., Wasley, C., "The Relation between the Return Interval and Betas: Implications for the Size Effect", *Journal of Financial Economics,* 23/1, 79 – 100

Jacobs, B., Levy, K. (1988), "Disentangling Equity Return Regularities: New Insights and Investment Opportunities", *Financial Analysts Journal,* 44, 18 - 43

Jaffe, J., Keim, D. B., Westerfield, R., "Earnings Yields, Market Values, and Stock Returns", *Journal of Finance,* 44/1, 135 - 148

Jegadeesh, N. (1992), "Does Market Risk Really Explain Size Effect", *Journal of Financial and Quantitative Analysis,* 27/3, 337 - 351

He, J., Kan, R., Zhang, C. (1996), "Tests of the Relations Among Market-wide Factors, Firm-Specific Variables, and Stock Returns Using a Conditional Asset Pricing Model", *Journal of Finance,* 51, 1891 - 1908

Keim, D. B. (1988), "Stock Market Regularities: A Synthesis of Evidence and Explanations", *Stock Market Anomalies,* Cambridge University Press, Cambridge

Lakonishok, J., Shleifer, A., Vishny, R. W. (1994), "Contrarian Investment, Extrapolation, and Risk", *Journal of Finance,* 49/5, 1541 - 1578

Knez, P. J., Ready, M. J. (1997), "On the Robustness of Size and Book-to-Market in Cross-Sectional Regressions", *Journal of Finance,* 52/4, 1355 - 1382

Kothari, S. P., Shanken, J. and Sloan, R. G. (1995), "Another Look at the Cross-Section of Expected Stock Returns", *Journal of Finance,* 50, 185 - 224

Lehmann, B.N., David, M., "The Empirical Foundations of the Arbitrage Pricing Theory", *Journal of Financial Economics,* 21/2, 255 - 289

Litzenberger, R. H., Ramaswamy, K., (1982), "The Effects of Dividends on Common Stock Prices: Tax Effects or Information Effects?", *Journal of Finance,* 37, 429 – 443

Luenberger, D. G. (1998), "Investment Science", *Oxford University Press*, New York, 204 - 205

MacKinlay, A. C. (1995), "Multifactor Models Do Not Explain Deviations from CAPM", *Journal of Financial Economics,* 38/1, 3 - 28

Markowitz, H. (1991), "Foundations of Portfolio Theory", *Journal of Finance,* 46, 469-477

Muradoğlu, G., Taşkın, F., Bigan, I. (2000), "Causality of Stock Returns and Macroeconomic Variables in Emerging Markets", *Russian and East European Finance and Trade,* 36, 33 – 53

Nicholson, F. (1960), "Price-Earnings Ratios", *Financial Analysts Journal,* 39, 60 - 66

Peavy, J. W., Goodman, D. A. (1982), "The Significance of P/Es for Portfolio Returns", *Journal of Portfolio Management,* 9/2, 43 - 47

Reinganum, M. R. (1981), "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings Yields and Market Values", *Journal of Financial Economics,* 9, 19 – 46

Reinganum, M. R. (1981), "Empirical Tests of Multi-Factor Pricing Model", *Journal of Finance,* 36, 313 – 321

Reinganum, M.R. (1982), "A Direct Test of Roll's Conjecture on the Firm Size Effect", *Journal of Finance,* 27 - 35

Reisman, H. (1992), "Reference Variables, Factor Structure, and the Approximate Multi-Beta Representation", *Journal of Finance,* 47/4, 1303 - 1314

Roll, R., Ross, S. A. (1980), "An Empirical Investigation of the Arbitrage Pricing Theory", *Journal of Finance,* 35, 1073 – 1103

Roll, R., Ross, S. A. (1984), "The Arbitrage Pricing Theory Approach to Strategic Portfolio Planning", *Financial Analysts Journal,* May-June, 14 – 26

Roll, R., Ross, S. A. (1984), "A Critical Reexamination of the Empirical Evidence on Arbitrage Pricing Theory: A Reply", *Journal of Finance*, 39/2, 347 - 350

Ross, S. A. (1976), "The Arbitrage Theory of Capital Asset Pricing", *Journal of Economic Theory,* 13, 341 - 360

Rozeff, M. S. (1984), "Dividend Yields Are Equity Risk Premiums", *Journal of Portfolio Management,* 11/1, 68 – 75

Rozenberg, Reid, and Lanstein (1985), "Persuasive Evidence of Market Inefficiency", *Journal of Portfolio Management,* 11/3, 9 - 16

Senchack, A., Martin, J. (1987), "The Relative Performance of the PSR and PER Investment Strategies", *Financial Analysts Journal,* 43, 45 - 66

Shanken, J. (1985), "Multi-Beta CAPM or Equilibrium APT?: A Reply", *Journal of Finance,* Vol. 40, 1189 - 1196

Shanken, J. (1992), "The Current State of the Arbitrage Pricing Theory", *Journal of Finance,* 47/4, 1569 - 1574

Sharpe, W. F. (1991), "Capital Asset Pricing with and without Negative Holdings", *Journal of Finance,* 46, 489 – 509

Stattman, D. (1980), "Book Value and Stock Returns", *The Chicago MBA,* 4

Zivney, T. L., Thompson, D. J. (1987), "Relative Stock Prices and the Firm Size Effect", *Journal of Financial Research,* Vol. 10/2, 99 –110

APPENDIX A

ANNUAL UNIVARIATE PORTFOLIO ANALYSIS RESULTS

MVE	HMVE		MMVE		LMVE	
	*MVE (*10^9)*	*Return*	*MVE (*10^9)*	*Return*	*MVE (*10^9)*	*Return*
1992	4127	1.23	593	0.64	95	1.53
1993	7745	1.72	1006	2.40	152	4.59
1994	18265	0.74	2920	0.39	692	1.31
1995	30134	1.40	3763	1.24	1114	1.28
1996	67748	1.02	6388	1.54	1663	1.40
1997	146293	0.08	13399	-0.07	3484	-0.19
1998	160141	2.18	10829	2.30	2456	3.50
1999	443339	-0.21	35480	-0.19	9596	-0.18
2000	449374	0.09	27604	0.11	7573	0.19
2001	465697	1.04	32733	0.87	6123	0.58

BMR	HBMR		MBMR		LBMR	
	BMR	*Return*	*BMR*	*Return*	*BMR*	*Return*
1992	2.59	1.55	1.02	1.02	0.37	0.71
1993	0.48	3.89	0.26	2.92	0.14	1.74
1994	0.75	1.26	0.39	0.49	0.21	0.66
1995	1.04	1.13	0.50	1.26	0.28	1.53
1996	0.96	1.53	0.41	1.29	0.21	1.22
1997	0.87	-0.22	0.37	-0.07	0.16	0.11
1998	1.83	3.75	0.73	2.41	0.30	1.78
1999	0.64	-0.16	0.28	-0.19	0.12	-0.24
2000	1.36	0.33	0.56	0.08	0.22	-0.01
2001	1.13	0.63	0.53	0.97	0.19	0.77

SPR	HSPR		MSPR		LSPR	
	SPR	*Return*	*SPR*	*Return*	*SPR*	*Return*
1992	2.59	1.92	0.98	0.88	0.34	0.53
1993	2.80	4.37	0.94	2.55	0.35	1.74
1994	1.58	1.03	0.55	0.73	0.26	0.57
1995	2.08	1.61	0.81	1.27	0.35	1.04
1996	2.36	2.06	0.80	1.19	0.34	0.82
1997	2.04	-0.17	0.74	-0.02	0.30	0.00
1998	5.04	3.76	1.42	2.34	0.57	1.87
1999	2.11	-0.23	0.59	-0.16	0.26	-0.21
2000	3.43	0.26	1.21	0.17	0.40	-0.06
2001	9.13	0.80	1.85	0.87	0.42	0.81

GPPR	HGPPR		MGPPR		LGPPR	
	GPPR	*Return*	*GPPR*	*Return*	*GPPR*	*Return*
1992	0.72	1.55	0.25	1.16	0.12	0.53
1993	0.74	3.98	0.27	2.80	0.14	1.81
1994	0.43	0.99	0.18	0.48	0.18	0.93
1995	0.47	1.50	0.24	1.17	0.16	1.27
1996	0.63	1.78	0.22	1.35	0.11	0.90
1997	0.52	-0.05	0.22	-0.12	0.10	0.00
1998	1.10	2.91	0.37	2.43	0.17	2.60
1999	0.37	-0.16	0.15	-0.24	0.16	-0.17
2000	0.79	0.17	0.28	0.21	0.11	-0.02
2001	2.35	0.71	0.49	0.96	0.24	0.72

DER	HDER		MDER		LDER	
	DER	*Return*	*DER*	*Return*	*DER*	*Return*
1992	4.38	1.11	1.02	1.32	0.32	0.76
1993	0.70	4.06	0.27	2.76	0.11	1.79
1994	1.38	0.96	0.37	0.85	0.13	0.49
1995	1.59	1.57	0.47	1.33	0.20	1.00
1996	1.62	1.95	0.44	1.28	0.16	0.82
1997	1.48	-0.17	0.43	-0.09	0.14	0.08
1998	3.34	3.84	0.93	2.21	0.27	1.96
1999	1.50	-0.24	0.39	-0.23	0.13	-0.11
2000	2.66	0.15	0.66	0.21	0.20	0.00
2001	2.58	0.46	0.71	1.01	0.16	0.87

DY	HDY		MDY		LDY	
	DY	*Return*	*DY*	*Return*	*DY*	*Return*
1992	0.0008	1.13	0.0000	0.93	0.0000	1.24
1993	0.0008	2.37	0.0000	2.21	0.0000	4.20
1994	0.0012	0.90	0.0000	0.82	0.0000	0.57
1995	0.0006	1.06	0.0000	1.20	0.0000	1.67
1996	0.0003	1.70	0.0000	1.10	0.0000	1.30
1997	0.0005	-0.01	0.0000	-0.25	0.0000	0.14
1998	0.0005	2.37	0.0000	1.49	0.0000	4.40
1999	0.0005	-0.05	0.0000	-0.48	0.0000	0.03
2000	0.0013	0.14	0.0000	-0.25	0.0000	0.59
2001	0.0000	0.95	0.0000	0.41	0.0000	1.63