An Investigation into the Cross-Sectional Determinants of Expected Stock Returns in the London Stock Exchange

by

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Dedicated to my parents Nikolaos and Irene

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ABBREVIATIONS

β	Market Beta
A/BE	Book Leverage
A/ME	Market Leverage
AMEX	American Stock Exchange
APT	Arbitrage Pricing Theory
AS	Annual Sales
BE/ME	Book to Market Value of Equity
CAPM	Capital Asset Pricing Model
CCAPM	Consumption Capital Asset Pricing Model
CF/P	Cash Flow to Price
CRSP	Centre for Research in Security Prices
CSR	Cross-Sectional Regressions
D/E	Debt to Equity
DJIA	Dow Jones Industrial Average
DY	Dividend Yield
E/P	Earnings to Price
EIV	Errors in Variables
EMH	Efficient Market Hypothesis
FT-30	Financial Times Ordinary Share Index
FTSE	Financial Times Stock Exchange
GFA	Book Value of Gross Fixed Assets
GLS	Generalized Least Squares
GMM	Generalized Method of Moments
ICAPM	Intertemporal Capital Asset Pricing Model
LR	Lindenberg and Ross
LSE	London Stock Exchange
LSPD	London Share Price Database
NASDAQ	National Association of Securities Dealers Automated Quotation
NOE	Number of Employees
NPV	Net Present Value
NYSE	New York Stock Exchange
OLS	Ordinary Least Square

OTC	Over The Counter
q	Tobin's q
S&P	Standard & Poor
S/P	Sales to Price
SUR	Seemingly Unrelated Regressions
TA	Book Value of Total Assets

SUMMARY

This thesis entails the examination of the determinants of the cross-section of stock returns in the London Stock Exchange, over the period July 1975 to June 1996, and it brings us a step further in the integrated real and financial view of the firm's stock returns.

The recent empirical evidence on the behaviour of stock returns in the U.S. and other equity markets around the world is reviewed in chapter 2. We broadly classify the findings as being cross-sectional (e.g., asset pricing anomalies) or time series (e.g., calendar effects, return autocorrelations and other forecasting variables) in nature.

Chapter 3 describes our data set and presents the methods used to test the alternative hypothesis that the expected stock returns were not determined solely by their risk characteristics such as market beta, but other additional characteristics. In order that our results should have greater appeal, we use a broad data set on 1,420 stocks quoted on the London Stock Exchange. Thus, the use of such a broad data set provides a unique opportunity for the analysis of the behaviour of stock returns.

The Tobin's q ratio (the ratio of the market value of the firm to the replacement costs of its assets) in explaining the cross-section of average stock returns introduced in chapter 4. Our motivation for using the Tobin's q, for the first time in this literature, as an additional variable in explaining the cross-section of average stock returns is the lack of theoretical rationale of the predictive ability of the firm-specific variables. Tobin's q allows us to suggest that it may incorporate, to some degree, potential alternative sources of risk such as product price risk, poor investment opportunities risk and financial distress risk. Our results confirm the Tobin's q effect; stocks with a smaller Tobin's q ratio yield a higher average returns.

An investigation into the relationship between the average return and the most common used variables in the U.S. and Japanese markets (such as market value of equity, book to market equity, leverage, earnings to price, cash flow to price and dividend yield), as well as their relationship with each other is reported in chapter 5. Our results confirm that the empirical regularities observed in the U.S. market also exist in other countries (e.g., U.K. stock market). Thus we conclude that it is extremely unlikely for the book to market equity and the market value of equity effects, which are reported for the U.S. stock market, to be a consequence of data-snooping.

The first part of chapter 6 addresses Barbee, Mukherji, and Raines (1996) argument, that two alternative variables, the sales to price and the debt to equity ratio, have more explanatory power for stock returns than the book to market equity and the market value of equity. In addition, chapter 6 reveals that firm-specific variables such as Tobin's q, cash flow to price and sales to price have the most significant impact on average stock returns in the U.K. stock market. Thus, our findings suggest that these variables deserve greater attention, by academics and practitioners, in explaining the cross-section of average stock returns.

The results in chapter 7 empirically support Berk's (1995) argument that the negative relation between average return and market value of equity is not due to the existence of a relation between firm size and risk.

Chapter 1

Introduction...

1.1. Introduction

One of the important issues in finance is to determine the factors are that affect expected stock returns, the sensitivity of expected return to those factors, and the reward for bearing this sensitivity. There is a long history of testing in this area, and it is clearly one of the most investigated areas in finance. Despite substantial effort being made by academics and practitioners in trying to determine the factors that affect expected stock returns, this critical issue remains unresolved. The Capital Asset Pricing Model (CAPM; Sharpe (1964), Lintner (1965) and Black (1972)) has long served as the most important model to explain the required expected rate of return on the firm's assets.

However, studies have identified empirical deficiencies in the CAPM challenging its preeminence. One possible explanation of deviations from the CAPM is either missing risk factor or the misidentification of the market portfolio, which lead to the asset pricing anomalies[1], multifactor asset pricing models motivated by the Arbitrage Pricing Theory (APT) of Ross (1976), the Intertemporal Capital Asset Pricing model (ICAPM) of Merton (1973) and the Consumption Capital Asset Pricing Model (CCAPM) of Breeden (1979). However, empirical implementations of these models have failed to produce much confidence in their explanatory power (e.g., Hansen and Singleton (1982), Chan, Chen and Hsieh (1985), Chen, Roll, and Ross (1986), Connor and Korajczyk (1988), Lehmann and Modest (1988)). Other explanations

[1] Keim (1988b, p.35) traces the term anomaly to "Kuhn (1970) in his classic book, The Structure of Scientific Revolutions. Kuhn maintains that research activity in any normal science will revolve around a central paradigm and that experiments are conducted to test the predictions of the underlying paradigm and to extend the range of the phenomena it explains. Although research most often supports the underlying paradigm, eventually results are found that do not conform. Kuhn (1970, p.52-3) terms this stage 'discovery': Discovery commences with the awareness of anomaly, i.e., with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science" (Keim's emphasis).

include biases introduced in the empirical methodology, the existence of market frictions or explanations arising from the presence of irrational investors.

The lack of empirical support for the CAPM also has stimulated interest in the cross-sectional determinants of asset returns in the U.S. market. Over the past 25 years researchers have identified a number of related regularities in asset prices that have come to be regarded as anomalies. For example, Banz (1981) finds that the market value of equity (ME; size effect) adds to the explanation of the cross-section of average returns provided by market beta (β; the slope coefficient in the regression of a security's return on the market's return). Average returns on small (low ME) stocks are too high given their β estimates, and average returns on large stocks are too low. Basu (1977 and 1983), and Jaffe, Keim, and Westerfield (1989) show that earnings-price ratios (E/P) help explain the cross-section of average returns on U.S. stocks in tests that also include size and β. Bhandari (1988), finds a positive relationship between leverage and average return in tests that include size as well as β. Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) find that average returns on U.S. stocks are positively related to the ratio of a firm's book value of common equity to its market value (BE/ME). Chan, Hamao, and Lakonishok (1991) argue that book to market equity, also has a strong role in explaining the cross-section of average returns on Japanese stocks. DeBondt and Thaler (1985), find a reversal in long-term returns; stocks with low long-term past returns tend to have higher future returns. In contrast, Jegadeesh and Titman (1993), find that short-term returns tend to continue; stocks with higher returns in the previous twelve months tend to have higher future returns. Because these patterns in average stock returns are not explained by the CAPM, they are typically called anomalies.

The final blow, which opened the flood gates of academic criticism, came with the publication of the Fama and French (1992) critique of the CAPM. This article draws two main conclusions about the cross-section of average stock returns. Firstly, that the relation between market beta and average return is flat, even when beta is the only explanatory variable; there is only a weak positive relation over the period 1941 to 1990, and virtually no relation over the shorter period 1963 to 1990. Secondly, that firm size and book to market equity do a good job of capturing the cross-sectional variation in average returns over the 1963 to 1990 period. Since then, economists and financial practitioners have been scrambling to figure out just what's going on. What's wrong with the CAPM? Is beta dead? Is beta dead again? Reports of beta's death have they been greatly exaggerated? Are the Fama and French (1992) results being interpreted too broadly? Must the CAPM be abandoned and a new model developed? Or can the CAPM be modified in some way to make it still a useful tool?

The Fama and French (1992) paper splits academia into two groups: For one group, Fama's authority is sufficient proof that the model should be discarded. For the second group, the stalwart supporters of the model, the Fama and French's paper is a mundane empirical exercise that annuls a fable Fama was instrumental in creating.

Furthermore, Fama and French (1993, 1996a) show that a three-factor model including market value of equity and book to market equity, in combination with market beta, subsumes most of the other documented explanatory factors for average returns. Fama and French (1998) show that an international version of their multifactor model seems to describe average returns on portfolios formed on scaled price variables in 13 major markets.

There is controversy over why the firm-specific variables should predict stock returns. Some believe that these variables are proxies for unobservable common risk factors that are consistent with rational asset pricing (e.g., Fama and French (1992)). Others argue that such variables may be used to find securities that are systematically mispriced by the market (e.g., Lakonishok, Shleifer and Vishny (1994)). Yet others argue that the observed predictive relations are largely the result of data snooping and survivorship bias (e.g., Lo and MacKinlay (1990b) and Kothari, Shanken and Sloan (1995)). Explanations of the asset pricing anomalies described in more detail in subsection 2.2.4.

The cross-sectional relationship between firm-specific variables and stock returns have attracted a considerable amount of research attention in the U.S. and Japan. In contrast there is limited evidence[2] for the London Stock Exchange (LSE). The focus of this research is to fill this gap in the literature. London is the world's third largest equity market and is the second largest centre for fund management. However, in spite of the U.K. market's rapid growth and its increasing significance in the international financial arena only recently have a few researchers turned their attention[3] to the LSE.

1.2. The Objectives of this Dissertation

The first objective of this research is to provide a systematic examination of the cross-sectional behaviour of stock returns to market risk and firm-specific variables of firms on the LSE. Such an analysis is crucial not only because it will provide for the first time a comprehensive evaluation of all stock market anomalies using a

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[2] See, Levis (1985, 1989) and Strong and Xu (1997).

[3] See, for example, Poon and Taylor (1991), Clare and Thomas (1994), Dissanaike (1994), Mills and Coutts (1995), Draper and Paudyal (1995), Clare, Priestley and Thomas (1997) and Arsad and Coutts (1997).

unique set of data under a uniform methodology, but also because it offers the opportunity to draw parallels between our findings and those from similar studies using U.S. and Japanese data.

Our results, when placed alongside the evidence accumulated from studies of US and Japanese data may also be useful in evaluating empirical models of the determinants of stock returns. We have attempted to draw parallels between our findings and those from similar studies using US and Japanese data. On the one hand, finding that the same factors that are at work in the three countries would strengthen our confidence in the evidence accumulated for those countries. On the other hand finding that different factors that are at work in the three countries would suggest further research exploring institutional or behavioural differences between the three countries.

Given the controversies which continue about Fama and French's findings, the central motivation behind this first objective is to provide an analysis in the spirit of Fama and French (1992) and apply it to a completely independent data set. This will help to verify whether the U.S. findings are the results of "*data snooping*" or whether a process of triangulation using independent data sets leads to similar conclusions.

The second objective of this thesis is to introduce in the literature the Tobin's q ratio (the ratio of the market value of the firm to the replacement costs of its assets) in explaining the cross-section of average stock returns. Our motivation for using the Tobin's q, for the first time in this literature, as an additional variable in explaining the cross-section of average stock returns is the lack of consensus view on the reasons of the predictive ability of the firm-specific variables. Fama and French (1992) argue that the firm size and the book to market equity are proxies for unobservable common risk factors. Tobin's q allows us to suggests that it is a proxy for a number of risk factors (see, section 4.5). Thus Tobin's q could deepen our understanding of the economic reasons for the risk premia associated with the firm-specific variables.

The third objective of this study is to examine the Barbee, Mukherji, and Raines (1996) argument that two alternative variables, the debt to equity (D/E) and the sales to price (S/P) ratio have more explanatory power for stock returns than the book to market equity and the market value of equity. The fourth objective of this study is to investigate the interrelation between the variables involved in this research. Thus, evidence from the LSE helps to shed further light on whether one firm-specific variable (e.g., book to market equity) subsumes another (e.g., earnings to price). The final objective of this thesis is to empirically examine, using data from LSE Berk's argument that the negative relation between average return and market value of equity is not due to the existence of a relation between firm size and risk.

1.3. Structure of the Dissertation

This thesis generally consists of six major chapters. These chapters can be grouped in three major parts. The first part includes chapter 2 through 3 which referred in the literature review and research design respectively. The second part includes chapters 4 through 6 which covers two major issues in the context of empirical research into the U.K. stock market. The two major issues are the introduction in the literature the Tobin's q ratio in explaining the cross-section of average stock returns and the determinants of the cross-section of stock returns. The final part includes chapter 7 which the empirical reexamination of the firm size effect will be investigated.

More specifically, the remaining chapters of this thesis are organised as follows. Chapter 2 reviews the extant literature of the recent empirical evidence on the behaviour of stock returns in the U.S. and other equity markets around the world. We broadly classify the findings as being cross-sectional (e.g., asset pricing anomalies) or time series (e.g., calendar effects, return autocorrelations and other forecasting variables) in nature. As such, the discussion is divided along these lines.

Chapter 3 describes our data set and presents the methods used to estimate and test the asset pricing model (the alternative hypothesis that the expected stock returns were not determined solely by their risk characteristics such as market beta, but other additional characteristics). In order for our results to have greater appeal, we use a broad data set on 1,420 stocks quoted on the LSE over the period July 1975 to June 1996. Thus the use of such a broad data set provides a unique opportunity for the analysis of the behaviour of stock returns. Our empirical analysis based in cross-sectional regressions approach and portfolio grouping approach. In order to investigate that the inferences of the firm-specific variables in cross-section regressions are not affected by the use of the estimated market beta (imposes an errors in variables bias) an alternative method, the Seemingly Unrelated Regression is used. We found in chapter 4 (results are not reported) and chapter 7 (results are reported) that the use of the estimated market beta as an independent regressor did not affect the inferences of the other variables included in the cross-section regressions.

In chapter 4 we investigate the ability of the Tobin's q to predict stock returns and the interaction between the Tobin's q with the book to market equity, market value of equity and market beta. In addition, the possible sources of the Tobin's q predictive ability is reported. Chapter 5 provides an investigation into the relationship between the average return and the most common used variables in the U.S. and Japanese markets (such as market value of equity, book to market equity, leverage, earnings to price, cash flow to price and dividend yield) as well as their relationship with each other. While chapter 6 addresses Barbee, Mukherji, and Raines (1996) argument, that two alternative variables, the sales to price and the debt to equity ratio, have more explanatory power for stock returns than the book to market equity and the market value of equity. In addition, chapter 6 investigates which of the variables which was found to have greater power for explaining stock returns (as reported in the previous two chapters and in the first part of this chapter) has more explanatory power to explain cross-sectional variation of average stock returns in a multiple regression.

Chapter 7 empirically examine Berk's argument that the negative relation between average return and market value of equity is not due to the existence of a relation between firm size and risk. We will investigate this using four non-market measures of firm size (book value of total assets, book value of gross fixed assets, annual sales, and number of employees). More specifically if there is relationship between firm size and return then three other relationships should be observed in the market: i) other measures of firm size besides market value of equity should be inversely related to expected return; ii) when firm size is controlled for, the correlation between average returns and market value of equity should diminish; and iii) if the market value of equity absorbs the explanatory power of the market beta, then other measures of firm size, besides market value of equity, should absorb the explanatory power of the market beta.

Finally, Chapter 8 contains the conclusions drawn from this research. It summarises the research findings, discusses the research implications for theory and practice and proposes the directions for future research.

Chapter 2

A Critical Analysis of Influences on Security Returns...

2.1. Introduction

In this chapter we review the recent empirical evidence on the behaviour of stock returns in the U.S. and other equity markets around the world. Predictability in asset returns is a very broad and active research topic, and it is difficult to provide a complete survey of this vast literature in just a few pages. Therefore, in this chapter we focus on the recent empirical literature which has provided the most enduring results both over time and in respect of the number of stock markets in which they have been observed.

An extensive body of empirical research has documented the presence of persistent cross-sectional and time-series patterns in stock returns. As will be discussed, this research does not support the keystone theory of modern finance known as the Efficient Market Hypothesis[1] (EMH), and one of the fundamental tenets of modern finance known as the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966).

Whereas the CAPM attempts to describe the structural relationship between the expected return and the risk of securities, the EMH attempts to demonstrate the degree, speed and accuracy (i.e., the efficiency) with which the market responds to new information which could affect, and eventually become incorporated into, the security prices. Taken together, the EMH and CAPM appear to assert that the market price of a security should reflect the best possible estimate of its fundamental value. Ultimately, tests of the EMH are joint tests[2] of the validity of a specific pricing model

[1] See Fama (1970, 1991), Blume and Siegel (1992) and Dimson and Mussavian (1998) for a thorough review of this literature. For excellent, reviews of the CAPM, see Callahan (1989), McGoun (1992), Frankfurter (1995) and Jagannathan and MaGrattan (1995).

[2] Fama (1970) emphasises that market efficiency must be tested jointly with a model for expected returns (i.e., CAPM). The problem is that all models for expected returns are incomplete descriptions

and the correspondence of market prices to those implied by that pricing model. If the joint hypothesis is rejected, we cannot specifically attribute that rejection to one or the other branch of the hypothesis. In fact, a lively debate continues in the literature regarding the interpretation of these results. Fama (1991, p.1576) writes: "does the fact that market efficiency must be tested jointly with an equilibrium pricing model make empirical research on efficiency uninteresting? Does the joint-hypothesis problem make empirical work on asset-pricing models uninteresting? My answer is an unequivocal no".

Fama (1970) categorised market efficiency into three different levels: i) weak-form tests; ii) semi-strong-form tests and iii) strong-form tests. Weak-form tests claim that prices fully reflect the information implicit in the sequence of past prices. The semi-strong-form tests assert that prices reflect all relevant information that is publicly available while the strong-form tests asserts information that is known to any participant is reflected in market prices. Later, in his second review of efficient capital markets, Fama (1991) changed the name of each respective category to i) tests for return predictability ii) event studies[3] and iii) tests for private information. The first level not only changes the title, but also the coverage, which now includes the following areas: cross-sectional predictability (asset pricing models and the asset pricing anomalies); the calendar effects; the forecast power of past returns; the forecast power of other variables (i.e., dividend yields and term-structure variables);

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of the systematic patterns in average returns during any sample period. Thus, tests of efficiency are always adulterated by a model problem.

[3] Event studies introduced by Fama, Fisher, Jensen and Roll (1969). For excellent, recent reviews of this literature, see Strong (1992), Armitage (1995), MacKinlay (1997), Binder (1998), Fama (1998), Barberis, Shleifer and Vishny (1998) and Daniel, Hirshleifer, and Subrahmanyam (1998). For a rigorous justification of standard event study procedures, see Prabhala (1997). For problems in test on long-term returns, see Barber and Lyon (1997a), Kothary and Warner (1997) and Lyon, Barber and Tsai (1998).

and volatility tests. The second and third levels changes the title, but not the coverage.

The remainder of this chapter is organised into three sections. Section 2 describes the cross-sectional return predictability. The time-series return predictability is examined in Section 3. Section 4 concludes the chapter.

2.2. Cross-Sectional Return Predictability

In this section we briefly discuss the capital asset pricing model. Following this, we review in detail the asset pricing anomalies. The interrelation between the anomalies are discussed in section 2.2.3 and explanations of the asset pricing anomalies are offered in section 2.2.4.

2.2.1. The Capital Asset Pricing Model and Early Success

One important problem in modern financial economics is the quantification of the trade-off between risk and expected return. Common sense suggests that risky investments such as the stock market will generally yield higher returns than investments free of risk. Many theoretical models have been proposed to address this issue. The Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966), and its extension[4] by Black (1972) is probably viewed as the most important. According to the CAPM, given certain simplifying assumptions[5], in equilibrium, the expected returns on securities are a positive linear function of their market betas (βs) and also that the βs suffice to describe the cross-

[4] Black (1972) extended the CAPM to an economy that restricts short selling or does not possess a risk-free asset. The latter was important since uncertain inflation precludes the existence of an asset that is riskless in real terms.

[5] This equilibrium model is based on a number of assumptions: i) there exists a risk-free asset such that investors may borrow or lend without limit at the risk-free rate of interest; ii) investors are risk-averse individuals who have homogeneous beliefs about asset returns that have a joint normal distribution; iii)

section of expected returns. In the simple version of the CAPM, the expected return on stock i can be expressed as:

$$E(R_i) = R_f + \beta_i\,[E(R_m) - R_f] \qquad (2.1)$$

Where R_f is the risk-free interest rate, $E(R_m)$ is the expected return on the market portfolio of all assets in the economy, and β_i, the CAPM risk of stock i, is the slope in the regression of its excess return on the market's excess returns,

$$(R_i - R_f)_t = \alpha_i + \beta_i\,[R_m - R_f]_t + \varepsilon_{it} \qquad (2.2)$$

According to the CAPM, the cross-sectional relation between expected return and risk is (i.e., Black's (1972) version of the CAPM),

$$E(R_i) = \gamma_o + \gamma_1\beta_i \qquad (2.3)$$

Where β_i is defined as

$$\beta_i = Cov(R_i\,,R_m) / Var(R_m) \qquad (2.4)$$

If the model is correct and security markets are efficient, stock returns should on average conform to the above relation. Persistent departures from positive linearity would represent violations of the joint hypothesis that both the CAPM and the EMH are valid.

One of the earliest empirical studies of the CAPM is that of Black, Jensen and Scholes (1972). They find that the data are consistent with the predictions of the CAPM, given that the CAPM is an approximation to reality just like any other model. They use all of the stocks traded on the New York Stock Exchange (NYSE) from 1926 to 1965 to form 10 portfolios with different historical β estimates.

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there are no taxes or transactions costs; iv) there are no restrictions on short selling; and v) information is costless and simultaneously available to all investors.

Another classic empirical study of the CAPM is by Fama and MacBeth (1973). They examine whether there is a positive linear relation between average return and β and whether the squared value of β and the volatility of the return on an asset can explain the residual variation in average returns across assets that is not explained by β alone. Using monthly return data for the period from 1926 to 1968 for stocks traded on the NYSE, they find that the data generally support the CAPM.

The results of these studies are comforting. In fact, the CAPM gained much support among academics as well as professionals after their publication. However, the honeymoon was short-lived (see, Levy (1978) and Lakonishok and Shapiro (1986)). The strict set of assumptions underlying the CAPM has prompted numerous criticisms. The first attack is Roll's (1977) criticism that the early tests are not much evidence for the CAPM because the proxies used for the market portfolio do not come close to the portfolio of invested wealth called for by the model. In response to Roll's criticism of the earlier tests, Stambaugh (1982) conducted a sensitivity analysis to determine whether changing the nature of the market proxy has a significant impact on the results of tests of the CAPM. He expands the types of investments included in his proxy from stocks on the NYSE to corporate and government bonds to real estate to durable consumer goods such as house furnishings and automobiles. His results indicate that tests of the model with these broader indexes were not very sensitive to the composition of the proxy of the market portfolio.

The poor performance[6] of the single factor capital asset pricing model has motivated two approaches improve on the specification. The first is to revise the theoretical

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[6] The CAPM does have its erstwhile saviours. For example, studies find that dynamic versions of the CAPM with time-varying parameters and broader specifications for the market portfolio perform

basis of the models, giving rise to (*inter alia*) the Intertemporal Capital Asset Pricing Model of Merton (1973), the Arbitrage Pricing Theory of Ross (1976) and the Consumption Capital Asset Pricing Model of Breeden (1979). The empirical support for the consumption based models has been weak[7] whereas the support for the linear factor models and the Intertemporal Capital Asset Pricing Models has been more promising[8].

The second approach has been to generate empirically motivated models which propose some firm-specific variables as explanations of the cross-sectional differences of expected returns. Some remarkable examples in this category include size (Banz, 1981), earnings-to-price (Basu, 1983), leverage (Bhandari, 1988), book-to-market equity (Rosenberg, Reid and Lanstein, 1985; Fama and French, 1992), cash flow-to-price (Chan, Hamao and Lakonishok, 1991) and past sales growth (Lakonishok, Shleifer and Vishny, 1994). In the face of so many competing models, one of the important tasks for empirical researchers is to discover which best explains the cross-section of average stock returns. In practice, this question is often addressed using regression methodologies such as Cross-Sectional Regressions (CSR), Generalized Method of Moments (GMM) or Seemingly Unrelated Regressions (SUR). The most widely used methodology is the CSR developed by Fama and MacBeth (1973), in which the accepted practice is to test whether a variable (or variables) has explanatory power not captured by the CAPM beta. Thus

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better than traditional formulations of the model. See, for example, Gibbons and Ferson (1985), Harvey (1989), Ferson and Harvey (1991), Ferson and Korajczyk (1995), Ferson (1995) and Jagannathan and Wang (1996). See Glysels (1998) for a recent critique of conditional CAPMs.

[7] See Hansen and Singleton (1982), Epstein and Zin (1991), Cochrane and Hansen (1992) and Hansen and Jagannathan (1997).

[8] See Chen, Roll, and Ross (1986), Connor and Korajczyk (1988), Lehmann and Modest (1988), Cochrane (1991a, 1996), Ferson and Harvey (1992) and Jagannathan and Wang (1996). Prominent among the linear factor models is the specification proposed by Fama and French (1993). There has been substantial debate on the testability of the APT. Roll and Ross (1980), Shanken (1982), Dybvig

in the recent debate on the validity of the CAPM, the main point at issue is whether or not the market betas and firm-specific variables are significantly priced in statistical terms. However, little attention has been paid to whether or not these variables are economically significant in explaining the cross-section of average stock returns. The second approach will be discussed in detail in the following section. For an excellent review of the revised theoretical basis of the CAPM, see the sources listed in footnotes 6 and 7.

2.2.2. Asset Pricing Anomalies

The first empirical attack in the EMH and CAPM that appeared in the academic literature involved asset pricing anomalies. In the last 20 years, researchers have found numerous security characteristics that help explain expected stock returns. A list of such characteristics as those listed above will be discussed in detail in the following subsections.

2.2.2.1. The Size Effect (or Small Firm Effect)

The evidence that small firms, on average, earn higher returns than large firms has attracted much attention from both academics and practitioners. Banz (1981) was the first to document this phenomenon, referred to in the literature as the size effect. He estimated the following model:

$$E(R_i) = \gamma_o + \gamma_1\beta_i + \gamma_2 \ln MV_i + \varepsilon_i \qquad (2.5.)$$

Where $E(R_i)$ is a expected return of stock i; β_i is the beta of stock i; $\ln MV_i$ is the natural log of the market capitalisation of stock i; γ_o, γ_1, and γ_2 are regression parameters; and ε_i is the regression error. Testing the null hypothesis that size does

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and Ross (1985) and Connor and Korajczyk (1993, 1995) provide one interesting exchange.

not have any explanatory power beyond beta, that is, $\gamma_2 = 0$, with alternative hypothesis $\gamma_2 \neq 0$, (the asset pricing model does not capture all relevant risk factors). Banz finds that from 1931 to 1975, the average return to stocks of small firms (those with low values of market equity) was substantially higher than the average return to stocks of large firms after adjusting for risk using the CAPM. He reported that the t-statistic for γ_2 in (2.5.) is large in absolute value (-2.92), and concluded that the size effect is large and statistically significant. From these results, relative size seems to be able to explain a larger fraction of the cross-sectional variation in average return than beta can. Thus, the CAPM seems to be missing a significant factor firm size. After Banz (1981), a plethora of papers that examine the relation between firm size and return for the U.S. market[9] were published, with one remarkable example being Fama and French's (1992) paper. The researchers' interest not only concentrated on the relation between firm size and return, but also on the explanations of the size effect. Explanations for the size effect will be described in the next subsection.

The size effect is not confined to the U.S. market. Numerous studies, in most stock markets around the world, have examined the size effect. They include studies[10] in Australia, Belgium, Canada, Finland, France, Ireland, Japan, Mexico, New Zealand,

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Dhrymes, Friend and Gultekin (1984) also question the empirical relevance of the model.

[9] Other researchers who exam the relationship between firm size and return for the U.S. market include Reinganum (1981, 1982, 1983), Roll (1981, 1983a, 1983b), Keim (1983), Basu (1983), Blume and Stambaugh (1983), Brown, Kleidon and Marsh (1983), Banz and Breen (1986), Lakonishok and Shapiro (1986), Jaffe, Keim and Westerfield (1989), Lo and MacKinlay (1990b), Chan and Chen (1991), Fama and French (1992, 1993, 1995, 1996a, 1996b), He and Ng (1994), Davis (1994, 1996), Kothari, Shanken and Sloan (1995), Loughran (1997), Kim (1997) and Brennan, Chordia and Subrahmanyam (1998).

[10] See for Australia (Brown, Keim, Kleidon and Marsh (1983)), Belgium (Hawawini, Michel and Corhay (1989)), Canada (Berges, McConnell and Schlarbaum (1984) and Calvet and Lefoll (1989)), Finland (Wahlroos and Berglund (1986)), France (Hawawini and Viallet (1987)), Ireland (Coghlan (1988)), Japan (Kato and Schallheim (1985), Chan, Hamao, and Lakonishok (1991), Hawawini (1991) and Kubota and Takehara (1996)), Mexico (Herrera and Lockwood (1994)), New Zealand (Gillan (1990)), Singapore (Wong and Lye (1990)), Spain (Rubio (1988)), Switzerland (Corniolay and Pasquier (1991)), Taiwan (Ma and Shaw (1990)) and the United Kingdom (Levis (1985, 1989), Corhay, Hawawini and Michel (1988) and Strong and Xu (1997)).

Singapore, Spain, Switzerland, Taiwan, the United Kingdom and more recently, in 20 emerging markets (Rouwenhorst (1999)). Rouwenhorst (1999) reports that the size premium is only significant in a few countries. However, the strong performance of small stocks has not been uniform. Out of the five countries with the largest size returns four are from Latin America, and only in 12 of the 20 sample countries have size returns been positive. The portfolio evidence from international equity markets is summarised in Table 2.1 (including five countries from Rouwenhorst's (1999) study) for the stock markets of 20 countries. The monthly size premium (in percent) is defined as the difference between the average monthly return on the portfolio of smallest stocks and the average monthly return on the portfolio of largest stocks. In all countries, the size premium is positive during the reported sample periods. As expected, the size premium varies significantly across markets. It is most significant in Australia (5.73 percent), Argentina (3.84 percent), and Mexico (2.39 percent) and least significant in France (0.31 percent), Ireland (0.47 percent), and New Zealand (0.51 percent). There are, however, significant differences across the twenty markets in the size premium. However, because the size and number of portfolios as well as the sample periods differ across markets, it is difficult to measure whether the magnitude of the size premium is significantly different across countries. Differences in market structures and organisations may account for some of the reported variation in the size premium across markets.

Table 2.1. International Empirical Evidence of the Firm Size Effect

Country	Authors	Test Period	NF[a]	NP[b]	MSP[c]
Argentina	Rouwenhorst (1999)	1982-1997	49	3	3.84
Australia	Brown et al. (1983)	1958-1981	937	10	5.73
Belgium	Hawawini et al. (1989)	1969-1983	170	5	0.52
Brazil	Rouwenhorst (1999)	1982-1997	87	3	1.76
Canada	Berges et al. (1984)	1951-1980	391	5	0.78
Finland	Wahlroos et al. (1986)	1970-1981	50	10	0.76
France	Maroney et al. (1998)	1986-1994	88	7	0.31
Ireland	Coghlan (1988)	1977-1986	40	5	0.47
Japan	Kubota et al. (1996)	1981-1993	1100	10	1.68
Mexico	Rouwenhorst (1999)	1982-1997	98	3	2.39
New Zealand	Gillan (1990)	1977-1984	200	5	0.51
Singapore	Wong and Lye (1990)	1975-1985	63	3	0.41
Spain	Rubio (1988)	1963-1982	160	10	0.56
Switzerland	Cornioley et al. (1991)	1973-1988	153	6	0.52
Taiwan	Ma and Shaw (1990)	1979-1986	72	5	0.57
U.K.	Strong and Xu (1997)	1973-1992	1337	10	1.55
U.S.	Fama and French (1992)	1963-1990	2263	12	0.74
Venezuela	Rouwenhorst (1999)	1987-1997	20	3	1.37
Zimbabwe	Rouwenhorst (1999)	1982-1997	28	3	1.85

[a] NF = Number of firms.
[b] NP = Number of portfolios.
[c] MSP = Monthly Size Premium (%) which is the difference between the mean monthly returns of the lowest and highest market value portfolio.

2.2.2.1.1. Explanations of the Size Effect

A variety of explanations have been offered for Banz's (1981) finding that small firms, on average, earn higher returns than large firms. A list of explanations for the size effect include; i) misestimation of risks, ii) misestimation of return, iii) non-stationarity of beta, iv) inadequacy of the CAPM, v) the January effect, vi) transaction costs, vii) the information hypothesis viii) business cycles ix) Berk's argument, and x) outliers' effect. These will be discussed in the following subsections.

i) Misestimation of risks

Roll (1981) finds that the size effect may be a statistical artifact of improperly measured risk due to the infrequent or nonsynchronous trading of small firms. Reinganum (1982) estimates betas according to methods designed to account for these problems (see Dimson (1979), and Scholes and Williams (1977)). He finds that the magnitude of the size effect is not very sensitive to the use of these estimates. Chan and Chen (1988) re-examine this beta misestimation problem in a framework that allows both the market betas and the market premium to change over time. They find that when more accurate estimates of betas are employed, a firm size proxy does not have additional explanatory power for the cross-sectional differences in average returns. Handa, Kothari and Wasely (1989) argue that the size effect is sensitive to the return measurement intervals used for beta estimation and that it can be explained by betas estimated using annual rather than monthly returns. However, Jagadeesh (1992) shows that when the test portfolios are constructed so that correlations between firm size and beta are small, the size effect cannot be explained by betas and this result is not sensitive to the method used for estimating betas. So that the market risk explanation of the size effect is questioned.

ii) Misestimation of return

Roll (1983a) shows that the computed average returns of small firm portfolios decline as the length of the interval for rebalancing the portfolio increases, and stabilise when the interval length is a month or longer. Blume and Stambaugh (1983) demonstrate that the portfolio strategies which require daily rebalancing of the portfolio to equal weights yield upward-biased estimates of small firm portfolio returns due to a bid-ask bias. Since the magnitude of the size effect is apparently sensitive to the technique used to calculate average risk adjusted returns, both Roll (1983a) and Blume and Stambaugh (1983) question the empirical importance of this phenomenon.

iii) Non-stationarity of beta

Christie and Hertzel (1981) argue that the size effect could be due to non-stationarity of beta. The risk of the stock of a levered firm increases as the stock value decreases. Thus, historical estimates of beta that assume such risk is constant over time understate the risk of levered stocks whose value has decreased and overstate average risk adjusted returns. They adjust for this bias but the adjustment does not eliminate the size effect.

iv) Inadequacy of the CAPM

Chen (1983) shows that the size effect can be captured by the risk exposures in the framework of the arbitrage pricing theory of Ross (1976). This means that small firms are riskier in terms of certain common factors in the economy and consequently have higher average returns over time. Chan, Chen and Hsieh (1985) investigated the size effect in the framework of a multifactor pricing model for the period 1958 to 1977 using economically identifiable variables. They found a difference of one to two percent per year in the risk adjusted return of the top five percent and bottom five percent of NYSE firms.

v) January effect

The first study to combine the January and size effect was conducted by Keim (1983). He shows that the small firm premium is always positive in January from 1963 to 1979. Keim reports that nearly fifty percent of the average annual size effect can be attributed to the month of January, and more than half of the January effect occurs during the first week of trading. The most popular theoretical explanation of the January effect is the tax loss selling hypothesis. We shall discuss the January effect and the tax-loss-selling hypothesis in more detail below in subsection 2.3.1.1 and 2.3.1.1.1 respectively.

vi) Transaction costs

Trading in small firms involves substantially higher transaction costs. There is no doubt that buying and selling small firm stocks results in higher direct and indirect costs as a percentage of the price. Stoll and Whaley (1983) and Schultz (1983) present evidence indicating that the size effect may be substantially reduced when the higher transaction costs involved in trading with smaller firms are taken into account.

vii) The information hypothesis

Keim (1983) was the first to discuss the information hypothesis as a possible explanation for the size effect. The information hypothesis refers to the conjecture that small firms have less publicly available information than large firms. This lack of information leads to greater uncertainty and risk, resulting in higher returns. Barry and Brown (1984) attempted to test the information hypothesis as a possible explanation of the size effect. Using time of listing on the exchange as a proxy for the availability of information, they found that time of listing does explain some of the small firm effect. They concluded that information uncertainty plays at least a partial role in explaining the size effect.

viii) Business cycles

Chan, Chen and Hsieh (1985) find that small firms are more exposed to production risk and changes in the risk premium. Huberman, Kandel and Karolyi (1987) find that returns of firms within the same size range tend to respond to risk factors in similar ways, and their returns tend to move together. Chen (1988) argues that because "small firms tend to be marginal firms, they fluctuate more with business cycles and thus have higher risk exposure to the changing aggregate risk premium". Since small firms have greater exposure, on average, they are riskier and so there is a negative relation between firm size and average returns.

ix) Berk's argument

Berk (1995a, 1995b, 1997) argues that the reported negative relation between firm size and average returns is not a size effect at all. He makes this claim in light of his findings that there is no significant relationship between average returns and four non-market measures of firm size (the book value of assets, the book value of fixed assets, the total value of annual sales and the total number of employees). He concludes that his "results are evidence in favour of the hypothesis that the negative relation between firm size and average returns is due to the endogenous identity relating the market value of a firm to its discount rate". In addition, Berk argues that since "a firm's market value is endogenously determined in equilibrium as the discounted value of expected future cash flows, it depends on the discount rate. For example, if two firms have the same expected cash flow, the one with the larger discount rate will have the lower market value. Consequently, according to this view, expected returns will always be negatively correlated with firm market value, *ceteris paribus*". In chapter 7, we examine, using data from London Stock Exchange, Berk's argument.

x) Outliers' effect

More recently, Knez and Ready (1997) show that the negative relation between firm size and average returns is driven by a few extreme positive returns in each month. More specifically, the risk premium on size completely disappears when the one percent most extreme observations are trimmed each month, and a significant positive relation between firm size and average returns comes into view.

2.2.2.2. The Earnings-to-Price (E/P) Effect

The earnings-to-price (E/P) ratio has long been one of the most scrutinised measures by financial analysts in assessing equity value since they have found that returns on stocks with a high E/P ratio tend to be larger than stocks with a low E/P ratio. The earliest study is that of Graham and Dodd (1940) who said that "people who habitually purchase common stocks at more than about 20 times their average earnings are likely to lose considerable money in the long run". Nicholson (1960) published the first extensive study of the relationship between the P/E ratio (the reciprocal of the earnings-to-price ratio) and returns, showing that stocks with a low

P/E ratio earned returns greater than the average stock. Basu (1977) observes that, in a study of 1400 NYSE firms over the period 1956 to 1971, low P/E stocks were outperforming their high P/E counterparts by more than seven percent per year. He points out that the P/E ratio may explain violations of the CAPM. Basu regards his results as indicative of a market inefficiency. Some researchers argue that, because firms in the same industry tend to have similar P/E ratios, the P/E effect may in fact be an industry effect. However, Peavy and Goodman (1983) confirm the existence of the P/E effect even after controlling for the industrial effect. Ball (1978) argues that earnings-related variables like the E/P are proxies for expected returns. Thus, if the CAPM is an incomplete specification of priced risk, we would expect E/P to explain the portion of expected return that is in fact compensation for risk variables omitted from the tests. A valid question, then, is whether a documented relation between average returns and E/P is due to the influence of E/P, or whether E/P is merely a proxy for other explanators of expected returns. Analysing both NYSE and AMEX stocks, Reinganum (1981c) extended Basu's findings to 1979. Several studies have addressed the interrelation between E/P and size with inconclusive results. We will examine them in section 2.2.3.

There is less evidence of the earning-to-price effect in markets outside the U.S. market. This is possibly due to the lack of computerised accounting databases available for academic research. The evidence is also more varied than that for the size effect. Evidence of the E/P effect in markets outside the U.S. include Japan, the U.K., Singapore, Taiwan, New Zealand and Korea. Chan, Hamao and Lakonishok (1991) document a significant E/P effect for a sample of 1,570 firms listed on the first and second section of the Tokyo Stock Exchange during the period from 1971 to 1988. They find that high E/P stocks outperformed those with low E/P stocks with a difference of 0.40 percent average returns per month between the top and the bottom quartiles. These results are confirmed by Aggarwal, Hiraki and Rao (1988) and Kubota and Takehara (1996) for a sample of firms listed on the first section of the Tokyo Stock Exchange.

Strong and Xu (1997) report some evidence of the E/P effect for the period July 1973 to June 1992 for the U.K. stock market. They report an average monthly premium of 0.74 percent (8.90 percent annually) between the smallest and largest E/P deciles. However, there is no consistency within these groupings. For the Singapore stock market, Wong and Lye (1990) find that there is a significant E/P effect. They conclude that the E/P effect is stronger than the size effect though not independent of firm size.

In the case of Taiwan, Chou and Johnson (1990) document a significant E/P effect between 1979 and 1988. They report that the average monthly return of the highest quintile E/P portfolio exceeds that of the lowest quintile E/P portfolio by 2.27 percent (27.2 percent annually). They show that, after adjusting for differences in systematic risk, the E/P premium is still significant with an average monthly return of 1.88 percent (22.6 percent annually). Ma and Shaw (1990) find a weaker but still significant E/P effect for the Taiwanese market over the period 1979 to 1986. Dividing their sample into five portfolios, they reveal a significant average risk-adjusted monthly E/P premium of 0.85 percent (10.2 percent annually). However, the empirical evidence from studies of the stock markets in countries such as New Zealand and Korea did not support the E/P effect. More specifically, Gillan (1990) finds no evidence of a E/P effect during the period 1977 to 1984 for the New Zealand market. A similar conclusion is reached by Kim, Chung, and Pyun (1992) for Korea for the period 1980 to 1988.

In summary, the empirical evidence from four markets outside the United States (the U.K., Japan, Singapore and Taiwan) shows that there is a significant E/P effect, similar to that found in the U.S. market. However, there is no significant evidence of the E/P effect for New Zealand and Korea.

2.2.2.3. The Dividend-Yield (DY) Effect

The relation between dividend yields (DY) and stock returns has also received close scrutiny in the academic literature. For example, the studies of Black and Scholes (1974), Litzenberger and Ramaswamy (1979 and 1982), Blume (1980), Gordon and Bradford (1980), Miller and Scholes (1982), Morgan (1982), Elton, Gruber and Rentzler (1983), Christie (1990), Chen, Grundy and Stambaugh (1990), and more recently, Brennan, Chordia and Subrahmanyam (1998) and Naranjo, Nimalendran and Ryngaert (1998) point to a positive relation between DY and returns. Blume (1980) and Litzenberger and Ramaswamy (1980) find that the yield-return relation is not linear for some definitions of dividend yield. Keim (1985 and 1986) finds that this non-linear relation is primarily due to the exaggerated occurrence of the effect in January. He also documented a strong interaction between DY and firm size which suggests that the positive relation between yield and returns is a direct result of the concentration of smaller firms in certain high yield categories. Naranjo, Nimalendran and Ryngaert (1998) report that the dividend yield effect is not due to taxes and is not explained by other anomalies. Levis (1989) finds evidence of a relation between DY and average returns for U.K. firms. He documents that DY and E/P ratios subsume the firm size and share price effects.

2.2.2.4. The Book-to-Market (BE/ME) Effect

Fama and French (1992) note that the book-to-market ratio provides a simple and powerful characterisation of the cross-section of average returns for the period from 1963 to 1990. They report that stocks with high book-to-market ratios have reliably higher returns than low book-to-market stocks of the same size. However, there is less research, both in the United States and other countries, into the ability of the BE/ME to predict cross-sectional differences in average stock returns. Studies using U.S. data which have revealed a significant relationship between BE/ME and average stock returns include Stattman (1980), Rosenberg, Reid and Lanstein (1985) and Fama and French (1992). Fama and French show that the average monthly return of the highest BE/ME portfolio exceeds that of the lowest BE/ME portfolio by 1.53 percent (18.4 percent annually).

There is some evidence of a BE/ME effect outside the U.S. market. Empirical evidence on the Tokyo Stock Exchange documented by Aggarwal, Rao and Hiraki (1989), Chan, Hamao and Lakonishok (1991), Capaul, Rowley and Sharpe (1993) and Kubota and Takehara (1996). Chan, Hamao, and Lakonishok report the average monthly values for the difference in returns between highest and lowest BE/ME portfolios of 1.10 percent. Evidence from the London Stock Exchange reported by Capaul, Rowley, and Sharpe (1993) and Strong and Xu (1997). The BE/ME effect is examined in respect of other stock exchanges (France, Germany and Switzerland) by Capaul, Rowley and Sharpe (1993).

2.2.2.5. Cash Flow-to-Price (CF/P) Effect

One alternative to the earnings-to-price (E/P) ratio is the ratio of cash flow-to-price (CF/P) where cash flow is defined as reported accounting earnings plus depreciation.

Its appeal lies in the fact that accounting earnings may be a misleading and biased estimate of the economic earnings with which shareholders are concerned. Cash flow per share is less open to manipulation and, therefore, possibly a less biased estimate of economically important flows accruing to a firm's shareholders. The distinction between reported earnings and cash flow is important when examining these effects across countries with different accounting practices regarding the reporting of earnings. In some countries such as Japan, firms are required to use the same depreciation schedule to calculate earnings reported to shareholders and earnings subject to corporate taxes. In other countries, such as the U.S., firms can use accelerated depreciation for tax purposes (which reduces taxable profits) and straight-line depreciation for reporting purposes (which produces relatively higher reported earnings to shareholders).

The shortcomings of accounting earnings have motivated a number of researchers to explore the relationship between cash flow-to-price and stock returns, for example Wilson (1986), Bernard and Stober (1989), and Lakonishok, Shleifer and Vishny (1994) for the U.S. market and Chan, Hamao and Lakonishok (1991) for the Japanese market. Chan, Hamao and Lakonishok (1991) find evidence of a significant relationship between average returns and CF/P for the period 1971 to 1988. They document that the CF/P with the book to market ratio have the most significant impact on expected returns. Lakonishok, Shleifer, and Vishny (1994) report that on average, over the five postformation years, first decile CF/P stocks have a return of 9.1 percent per annum whereas the tenth decile CF/P stocks have an average return of 20.1 percent per annum, for a difference of 11 percent per annum.

2.2.2.6. Sales-to-Price (S/P) Effect

One option for the E/P, BE/ME and CF/P ratios is the sales-to-price (S/P) ratio. Compared to earnings, book value of equity and cash flow, total sales are probably least influenced by depreciation and inventory accounting methods, as well as by a firm's age. The S/P may have greater explanatory power than the E/P for average stock returns because a firm's total annual sales may be a more reliable and predictable indicator of its long-term profit potential than its reported earnings. Earnings are more unstable than sales and can be affected to a greater extent by temporary occurrences such as a high level of expenditures for product development, current cyclical conditions in the company's industry, and short-term pricing policies. Also, the S/P provides a meaningful relative valuation measure even when a firm is losing money, in which case its E/P will be meaningless. The S/P, unlike the E/P and BE/ME, can not have negative values for some firms which are difficult to interpret. In addition, the S/P may also be a more reliable indicator of a firm's relative market valuation than the BE/ME because sales figures are less affected by company specific factors. Finally, the S/P may be more a reflection of a company's relative popularity in the investment community rather than an indication of its long-term earnings prospects.

There is evidence of a S/P effect in both the U.S. (Senchack and Martin (1987), Jacobs and Levy (1988b) and more recently Barbee, Mukherji and Raines (1996)) and Japan (Aggarwal, Rao and Hiraki (1990)). Senchack and Martin (1987) observe a significant S/P effect for a sample of NYSE and AMEX firms over the period 1975 to 1984. Dividing their sample into five portfolios, they found a significant average annually S/P premium of 11.64 percent. Similar results were found by Aggarwal, Rao and Hiraki (1990) for the Japanese market.

2.2.2.7. Past Returns Effect (Contrarian and Momentum Strategies)

In recent years, a number of researchers have reported evidence that the cross-section of stock returns is predictable, based on past returns. For example, long-term return reversals (DeBondt and Thaler (1985)), short-term return reversals (Lehmann (1990)) and medium-term return continuation (Jegadeesh and Titman (1993)). DeBondt and Thaler (1985, 1987) report return reversals over longer horizons (i.e., contrarian strategies; buying past losers and selling past winners). They show that over three to five year holding periods, stocks that performed poorly over the previous three to five years obtained higher returns than stocks that performed well over the same period (i.e., long-term past losers outperform long-term past winners). Evidence of long-term return reversals has also been reported in a number of markets outside the U.S., including Belgium (Vermaelen and Versringe (1986)), Japan (Dark and Kato (1986)), Spain (Alonso and Rubio (1990)), Brazil (da Costa (1994)), and the U.K. (Clare and Thomas (1995) and Dissanaike (1996)). However, Kryzanowski and Zhang (1992) did not find supporting evidence using the Toronto Stock Exchange over the period 1950-1988.

DeBondt and Thaler (1985) explain these long-term return reversals as an overreaction in the market in which stock prices diverge from their fundamental value. However, Chan (1988) and Ball and Kothari (1989) argue that the abnormal risk-adjusted returns reported for contrarian investment strategies are due to failure to risk-adjust returns. They argue that the extreme winner and loser stocks should experience large risk changes between the portfolio formation period and the test period of DeBondt and Thaler's methodology. In addition, Zarowin (1989b) reports that the reversal effect is related to the size effect since loser firms tend to be small firms and winner firms tend to be large firms. In contrast to these studies, Chopra, Lakonishok and Ritter (1992) show that the reversal effect does not seem to disappear when returns are adjusted for size and risk. Providing other explanation, Ball, Kothari and Shanken (1995), and Conrad and Kaul (1993) point to market microstructure biases as the most likely causes.

More recent papers provide evidence of short-term return reversals. For example, Lehmann (1990) reports return reversal at weekly intervals while Jegadeesh (1990), and Lo and MacKinlay (1990c) report return reversal at monthly intervals. These papers show that contrarian strategies that select stocks based on their returns in the previous week or month produce significant abnormal returns. Chang, McLeavey and Rhee (1995) report short-term return reversals for the Japanese stock market, after adjusting returns for both size and risk. Kaul and Nimalendran (1990) and Jegadeesh and Titman (1995) explore whether bid-ask spreads can explain short-term return reversals. Furthermore, Lo and MacKinlay (1990c) document that a large part of the abnormal returns reported by the short-term return reversals studies is attributable to a delayed stock price reaction to common factors rather than to overreaction. In addition, Conrad, Hameed and Niden (1994) use weekly data to show that past trading volume is useful in explaining the short-term return reversals. More accurately, they report that short-term return reversal is driven by high volume stocks. High volume stocks experience short-term return reversals in the following week while low volume stocks experience return continuations. These results are consistent with the predictions of Campbell, Grossman and Wang (1993).

In contrast to the evidence of the long and short-term return reversals, Jegadeesh and Titman (1993) document that over a medium-term horizon of three to twelve months, past winners on average continue to outperform past losers so that there is momentum in stock prices. While many competing explanations have been suggested for the long and short-term return reversals, there is a shortage of potential explanations for the medium-term return continuation. Fama and French (1996a) show that long-term return reversals can be consistent with a multifactor model of returns but their model fails to explain medium-term return continuation. Chan, Jegadeesh and Lakonishok (1996) show that medium-term return continuation can be partially explained by an underreaction to earnings news but price momentum is not subsumed by earnings momentum. Rouwenhorst (1998) document medium-term return continuation in twelve other countries[11], suggesting that the effect is not likely to be due to a data snooping bias. Another possible explanation is that the profitability of momentum strategies stems from overreaction induced by positive feedback trading strategies. This explanation is consistent with the analysis of DeLong, Shleifer, Summers and Waldmann (1990).

2.2.3. Interrelation between the Effects

In the previous subsections, we discussed the ability of certain variables to explain average stock returns, also known in the literature as anomalies. In this section, we will discuss the interrelation between these anomalies.

Several studies have addressed the interrelation between size and E/P with inconclusive results. Reinganum (1981c), Banz and Breen (1986) and Rogers (1988) argue that the size effect absorbs the role of the E/P effect. The same result was reported in New Zealand by Gillan (1990). However, Basu (1983) and Peavy and

[11] Foerster, Prihar and Schmitz (1995) provide evidence on momentum strategies in the Canadian market.

Goodman (1983) argue otherwise. Similar results are shown by Wong and Lye (1990) in the case of Singapore and by Chou and Johnson (1990) in the case of Taiwan. Cook and Rozeff (1984) investigate January and non-January months separately from 1968 to 1981. Their findings suggest that both the firm size and E/P effects are significant, both in January and in the rest of the year. They conclude that stock returns are jointly related to both firm size and the E/P ratio. Jaffe, Keim and Westerfield (1989) re-examine the relation between the size and E/P effects for a much longer sample period from 1951 to 1986. They find significant size and E/P effects when estimated across all months over the entire period. This is consistent with the findings of Cook and Rozeff (1984) but inconsistent with those of Reinganum (1981c), Basu (1983), Peavy and Goodman (1983), Banz and Breen (1986) and Rogers (1988). This suggests that the conclusions drawn in the above studies may be attributable to the relatively short, and sometimes nonoverlapping, periods used, as well as the failure of the studies (with the exception of Cook and Rozeff (1984)) to account for potential differences between January and other months.

The possible interaction between size and BE/ME is examined by Stattman (1980), Rosenberg, Reid and Lanstein (1985) and Fama and French (1992) for U.S. firms. Stattman (1980) examines average risk-adjusted portfolio returns for the period from 1964 to 1979 and concludes that, even after taking account for the size effect, there remains a positive relationship between BE/ME and returns. Rosenberg, Reid and Lanstein (1985) examine market model residuals of BE/ME portfolios that are constructed to be orthogonal to size and other influences. They find a significant relationship between abnormal returns and the BE/ME for the period 1973 to 1984. Using data on NYSE, AMEX, and NASDAQ for the period 1963 to 1990, Fama and

French (1992) conclude that size and BE/ME are sufficient to characterise cross-sectional differences in expected returns.

Variables like the E/P and BE/ME seem to provide explanatory power for average returns beyond the influence of size. Fama and French (1992) investigate whether these two variables are proxies for the same additional influence. They find that E/P, leverage and BE/ME weaken, but do not fully absorb, the relationship between size and average returns. On the other hand, when size and BE/ME are used together, they leave no role for E/P or leverage in the cross-section of average returns. These results are confirmed by Chan, Hamao and Lakonishok (1991) and Strong and Xu (1997) for Japan and U.K. respectively. The strong evidence of Chan, Hamao, and Lakonishok (1991), Fama and French (1992) and Strong and Xu (1997) is that for Japanese, U.S. and U.K. stocks, BE/ME is the most powerful explanatory variable in the cross-section of average returns, with a weaker role for size.

2.2.4. Explanations of the Asset Pricing Anomalies

There is considerable disagreement about the explanations of the significant relation between firm-specific variables and average stock returns. Three common explanations for the observed predictive ability have been suggested. First, the observed explanatory power of these firm-specific variables is evidence of compensation for additional sources of risk that are not included in extant asset pricing models. Second, evidence that contradicts the Efficient Market Hypothesis. A third explanation is that the observed predictive ability is an artifact of the research design and database used to conduct these studies (i.e., data-snooping biases, and sample selection biases). We discuss these explanations in the following subsections.

2.2.4.1. The Higher Returns are Compensation for Additional Sources of Risk

One explanation for why firm-specific variables have produced superior returns, argued most forcefully by Fama and French (1992), is that they are fundamentally riskier. Therefore these variables measure the riskiness of stocks so that the correlation between the variables and subsequent returns reflects compensation for bearing risk (see, also Fama and French (1993, 1995, 1996a)). Fama and French (1993) suggest that book to market equity and market value of equity are proxies for distress and that distressed firms may be more sensitive to certain business cycle factors, like changes in credit conditions, than firms that are financially less vulnerable. In addition, the duration of high growth firms' earnings should be somewhat longer that the duration of the earnings of low growth firms. Therefore, term structure shifts should affect the two groups of firms differently.

Research attempting to discriminate between these competing explanations has tended to focus on examining the extent to which return behaviour is consistent with specific risk based explanations (Lakonishok, Shleifer and Vishny (1994), MacKinley (1995) and Daniel and Titman (1997). The results of this research have generally found that risk based explanations are unable to explain observed return behaviour, leading some to conclude that the evidence is therefore consistent with naive investor expectations (Lakonishok, Shleifer and Vishny (1994). However, Davis, Fama and French (1998) find that the risk based explanation provides a better story for the relation between firm-specific variables and average returns.

2.2.4.2 Evidence that Contradicts the Efficient Market Hypothesis

Several studies interpret the reported excess returns as evidence of market inefficiency. For example, some argued that the variables allow investors to identify stocks that are mispriced, thus creating opportunities for realised returns in excess of what is required to compensate investors for risk (Lakonishok, Shleifer and Vishny (1994), Haugen (1995), Haugen and Baker (1996) and Daniel and Titman (1997). More specifically, Lakonishok, Shleifer and Vishny (1994) suggest that the high returns associated with high book to market equity stocks (value stocks) are generated by investors who incorrectly extrapolate the past earnings growth rates of firms. They suggest that investors are overly optimistic about firms which have done well in the past and are overly pessimistic about those that have done poorly. They also suggest that low book to market equity stocks (growth stocks) are more glamorous than high book to market equity stocks and may thus attract naive investors who push up prices and lower the expected returns of these securities. Haugen (1995) refers that institutional investors avoid buying value stocks because these investors performance is measured against indexes of mostly large, glamour stocks.

2.2.4.3. The Results are due to the Research Design and Database Biases

A majority of the research attempting to explain the explanatory power of the firm-specific variables focuses on the possibility that data-snooping biases (see, for example Lo and MacKinlay (1990b), Black (1993a, 1993b) and MacKinlay (1995)) and sample selection biases (see, for example Kothari, Shanken and Sloan (1995) and Breen and Korajczyk (1995)) are important.

Data-snooping biases refer to the biases in statistical inference that result from using information from data to guide subsequent research with the same or related data. These biases are almost impossible to avoid due to the nonexperimental nature of economics. Lo and MacKinlay (1990b) illustrate the potential magnitude of data-snooping biases in the case where the firm-specific variables used to group stock returns into portfolios is selected not from theory but from previous observations of mean stock returns using related data. In addition, Black (1993a, 1993b) and MacKinlay (1995) argued that the relationship between firm-specific variables and average returns is a chance result unlikely to be observed out-of-sample. Specifically, Black (1993a, 1993b) suggests that the size effect noted by Banz (1981) could simply be a sample period effect: the size effect is observed in some periods and not in others.

Data-snooping bias can never be ruled out because we do not have the luxury of running another experiment to create a new dataset. However, the most obvious means of evaluating the data-snooping biases is to test using, for example, different countries[12], which can also be regarded as out-of-sample (Chan, Hamao and Lakonishok (1991)), different time periods (Davis (1994) and Davis, Fama and French (1998)), or a holdout sample (Barber and Lyon (1997)). Out-of-sample evidence is, however, provided by Chan, Hamao and Lakonishok (1991), Capaul, Rowley and Sharpe (1993) and Fama and French (1998). They document strong relations between average returns and firm-specific variables in markets outside the U.S. market. Davis (1994) forms book to market equity sorted portfolios free of selection bias in the 1940 to 1963 period (out-of-sample relative to the Fama and

French 1963 to 1992 sample period) and finds a book to market equity effect similar in magnitude to that found by Fama and French (1992). Davis, Fama and French (1998) extend the results in U.S. data back to 1929. Barber and Lyon (1997b) find the book to market equity and market value of equity effects in a sample of U.S. firms (a holdout sample of financial firms) that were not used by Fama and French in their original (1992) study.

Sample selection biases can arise when data availability leads to certain subsets of stocks being excluded from the analysis. Kothari, Shanken and Sloan (1995) claim that using betas estimated from annual rather than monthly returns produces a stronger positive relationship between average returns and beta. They also find that the relationship between average return and book to market equity observed by Fama and French (1992) and others is seriously exaggerated by survivorship bias in the COMPUSTAT sample.

Kothari, Shanken, and Sloan (1995) point out two potential sources of survivorship bias inherent in COMPUSTAT data that may lead to spurious relation between average stock returns and firm-specific variables (i.e., ME, BE/ME). Regarding the first source of bias, the "back-filling" bias arises because COMPUSTAT includes historical data when it adds firms to the database. The international COMPUSTAT dataset was first compiled in 1991; data were collected back to 1982. Thus, firms that did not survive into 1991 are rarely included in this dataset. The winners which lost market value in the past but subsequently performed well would be included in the dataset, while the high book to market equity losers that were subsequently liquidated would not be included. The second course of bias, the "distressed firm"

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[12] Data-snooping problems are countered by testing against a second sample (e.g. another country's stock market). Given that markets are often highly correlated, there is a question as to whether this

bias comes from the non-reporting of data by financially distressed firms already on COMPUSTAT. Missing accounting data of the firms that recover from financial distress are filled-in, while those that do not have higher subsequent returns because the sampling procedures tend to exclude firms that did not survive (i.e., that had very low returns). If the former are included in a database while many of the latter are excluded, firms with high book to market equity ratios will be found to have high subsequent returns, precisely because the nonsurviving firms are excluded from the study.

Kothari, Shanken, and Sloan (1995) mention that book to market equity can not be adequately studied due to the COMPUSTAT selection bias, but a similar claim can made about any variable which is calculated using accounting information. In addition, Breen and Korajczyk (1995) provide some direct evidence that supports the view that selection bias may be an important issue for tests that use standard sources of accounting data like COMPUSTAT. Banz and Breen (1986) and Jaffe, Keim and Westerfield (1989) discuss the role of survivorship bias in studies using earnings to price as an explanatory variable, and Lakonishok, Shleifer and Vishny (1994) and Davis (1994) address the issue of survivorship bias in studies that use cash flow to price to explain the cross-section of stock returns.

However, Chan, Jegadeesh and Lakonishok (1995) shows that the sample selection biases are not large. Further, Cohen and Polk (1996) construct portfolios in a way that completely eliminates the COMPUSTAT selection bias and find similar evidence. Fama and French (1996b) argue that survivorship biases do not explain the relation between book to market equity and average return. Finally, Davis (1996)

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entirely satisfies the need for independence of the second sample.

and Kim (1997) provide evidence that appears contrary to the survivorship bias hypothesis. Davis (1996) finds evidence of book to market equity, cash flow to price and earnings to price effects for a survivor bias free sample during the period from July 1963 to June 1978. Kim (1997) shows that survivorship biases do not significantly reduce the book to market equity and market value of equity.

In addition, Amihud, Christensen and Mendelson (1992) find that when a different statistical methods (joint pooled cross-section and time-series estimation, and generalised least squares estimation) are used, the estimated relation between average return and market beta is positive and significant. Mayers (1972), Jagannathan and Wang (1993) and Campbell (1996) hypothesise that labour-income risk is an important aggregate risk that may not be adequately captured by the stock index return factor. Jagannathan and Wang (1996) and Jagannathan, Kubota and Takehara (1998) empirically examine a multibeta asset pricing model in which one of the betas is the sensitivity of an asset's return to the growth rate of per capital labour income.

2.3. Time Series Return Predictability

There is considerable evidence that stock returns are predictable in time series. The academic literature on time series return predictability goes back at least to the late 1970s. In this section, we first discuss the calendar effects which seriously challenge the Efficient Market Hypothesis[13] (EMH). Next, we examine that returns are predictable from past returns. Finally, comes the evidence that other variables such as dividend yield, earnings yield and term-structure variables forecast stock returns.

2.3.1. Calendar Effects (Seasonal Effects)

In addition to the regularities discussed in Section 2.2.2., there is also a literature on stock market seasonalities[14], including the January effect, Monday effect, holiday effect, turn of the month effect and semi month effect, which will be discussed in the following subsections. However, there are some other calendar effects which have received much less attention recently, including the week of the month effect (Wang, Li and Erickson (1997)); time of the day effect (McInish and Wood (1990)); end of December effect (Lakonishok and Smidt (1988)) and Friday the thirteenth effect (Kolb and Rodriquez (1987)).

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[13] A further setback to the EMH consists of the growing body of research on the volatility of financial markets first proposed by Shiller (1981) and LeRoy and Porter (1981). These variance bound tests examine restrictions on the volatility of actual stock price implied by the EMH. Since stock price appears to be too volatile to be determined by the expected discounted value of cash dividends, the hypothesis is rejected. However, the overall evidence on the existence of excess stock price volatility and its implications for market efficiency is ambiguous. For excellent reviews of this literature, see West (1988), LeRoy (1989), Shiller (1989), Cochrane (1991b), Scott (1991), Gilles and LeRoy (1991) and Kupiec (1993).

[14] Thaler (1987a, 1987b), Haugen and Lakonishok (1988), Dimson (1988), Fama (1991), Ziemba (1994) and Brockman (1995) provide excellent reviews.

2.3.1.1. January (Turn of the Year) Effect

The January effect is the best known example of stock market seasonalities throughout the world[15]. It refers to the unusually large, positive average stock returns at the turn of the year. This anomaly was brought to the attention of modern finance by Rozeff and Kinney (1976) but it was first introduced to the academic literature more than 50 years ago by Wachtel (1942). A number of authors provide evidence supporting the view that the January effect is a firm size phenomenon (e.g., Keim (1983), Blume and Stambaugh (1983), Reinganum (1983) and Roll (1983b)). In fact, the pricing behaviour of stocks in January displays two separate anomalies (see Haugen and Lakonishok (1988)). First, the market returns for small firms are better than large firms in January. Second, all firms tend to do better in January than in any other month. Keim (1983) showed that approximately half of the annual size effect is attributable to abnormal returns in January.

Table 2.2. reports the January effect of twenty five countries. The January returns are larger than the mean returns for the full year, except in New Zealand. In all countries, the January returns are positive and in eighteen of the twenty five countries have a significant and a strong, positive January effect. From this table we can see that the January effect is a global phenomenon. In spite of the extensive research, there is no consensus in the literature as to why the January effect exists. In the next subsection, we will present potential explanations for the January effect.

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[15] For the U.S. market, see, for example, Keim (1983), Roll (1983b), Keim and Stambaugh (1984), Haugen and Lakonishok (1988) and Haugen and Jorion (1996); for the U.K., see Levis (1985), Reinganum and Shapiro (1987), Clare, Psaradakis and Thomas (1995), Mills and Coutts (1995), Arsad and Coutts (1997) and Draper and Paudyal (1997); for Japan, see Kato and Schallheim (1985), Jaffe and Westerfield (1985b), and Hawawini (1991); for Canada, see Berges, McConnell and Schlarbaum (1984), Tinic, Barone-Adesi and West (1987), Athanassakos (1992) and Griffiths and White (1993); for Australia, see Brown, Keim, Klidon and March (1983); for Netherlands, see van der Bergh and Wessels (1985); for Sweden, see Dahlquist and Sellin (1996); for international evidence, see Gultekin and Gultekin (1983), Corhay, Hawawini and Michel (1987), Lee (1992) and Agrawal and Tandon (1994).

Table 2.2. International Empirical Evidence of the January Effect

Country	Authors	Test Period	Index	Jan.	All mth
Australia	Agrawal et al. (1994)	1971-1987	All Ordinar.	3.40*	0.93
Austria	Gultekin et al. (1983)	1959-1979	EWI[a]	0.74	0.46
Belgium	Agrawal et al. (1994)	1971-1987	Belgium SE	3.36*	0.73
Brazil	Agrawal et al. (1994)	1972-1987	Rio d. J. SE	9.19*	7.11
Canada	Agrawal et al. (1994)	1976-1987	Toronto SE	1.86	1.13
Denmark	Agrawal et al. (1994)	1973-1987	Copenh. SE	2.36*	0.51
France	Agrawal et al. (1994)	1971-1987	CAC General	4.36*	1.02
Germany	Agrawal et al. (1994)	1971-1987	FAZ Atkien	2.20	0.77
Hong Kong	Lee (1992)	1970-1989	Hang Seng	7.98*	1.90
Italy	Agrawal et al. (1994)	1971-1987	Banca Com.	6.85*	1.11
Japan	Lee (1992)	1975-1989	Nikkei-Dow	3.86*	1.37
Korea	Lee (1992)	1975-1989	KCSI[b]	0.42	1.64
Luxembourg	Agrawal et al. (1994)	1977-1988	LSI[c]	2.73	1.19
Malaysia	Wong et al. (1990)	1970-1985	VWI[d]	1.70*	0.20
Mexico	Agrawal et al. (1994)	1977-1988	BMdV[e]	13.0*	5.54
Netherlands	van der Bergh et al. (1985)	1966-1982	EWI	3.74*	0.38
New Zealand	Agrawal et al. (1994)	1972-1987	Barclays Ind.	0.94	0.96
Norway	Gultekin et al. (1983)	1959-1979	EWI	4.34*	0.71
Singapore	Lee (1992)	1970-1989	Straits Times	7.81*	1.30
Spain	Rubio (1988)	1963-1982	VWI	3.04*	0.47
Sweden	Dahlquist et al. (1996)	1919-1994	VWI	3.17*	0.78
Switzerland	Agrawal et al. (1994)	1972-1987	SBCI[f]	2.52*	0.37
Taiwan	Lee (1992)	1970-1989	TSE[g]	6.26*	2.41
U.K.	Levis (1985)	1958-1982	FTSE-All	3.06*	1.08
U.K.	Agrawal et al. (1994)	1963-1987	FTO-30	4.62*	0.77
U.S.	Gultekin et al. (1983)	1949-1979	NYSE-EW	4.45*	1.24
U.S.	Lakonishok et al. (1988)	1952-1986	Dow-Jones	0.88	0.48

[a] EWI = Equal Weight Index; [b] KCSI = Korea Composite Stock Index;
[c] LSI = Luxembourg Shares Index; [d] VWI = Value Weight Index;
[e] BMdV = Bolsa Mexicana de Valores; [f] SBCI = Swiss Bkg. Corp. Index;
[g] TSE = Taiwan Stock Exchange.
* Significant at the five percent level.

2.3.1.1.1. Explanations of the January Effect

Several explanations are suggested to explain the January effect in stock returns. We will group these explanations into two categories in the subsequent discussion: a) explanations which suggests that the January effect indicates a failure of efficient market hypothesis and equilibrium asset pricing models; and b) explanations which suggests that the January effect is consistent with the joint framework of efficient market hypothesis and equilibrium asset pricing models.

A) The January effect is inconsistent with the joint hypothesis

This group of explanations includes i) the tax-loss selling hypothesis; and ii) the window-dressing hypothesis.

i) The tax-loss selling hypothesis

The tax-loss selling hypothesis has probably received the most attention among proposed explanations of the January effect[16]. It is not because the hypothesis is the most logical but because of the amount of data available across countries with different tax years. The tax-loss selling hypothesis is derived as a consequence of the U.S. tax system which motivates investors to sell shares that have declined in price during the year at the end of the year. Since returns from stocks of small firms are more volatile, they tend to have experienced large price declines and, therefore, are likely candidates for tax-loss selling. Investors do this to take advantage of the opportunity to write-off capital losses against ordinary income in computing their federal income taxes. As soon as the tax and calendar year ends, stocks are bought back and stock prices quickly rebound to their equilibrium levels. However, the tax trading is objectionable on theoretical grounds since it would require some degree of

[16] For U.S. evidence, see, for example, McEnally (1976), Branch (1977), Dyl (1977), Givoly and Ovadia (1983), Reinganum (1983), Roll (1983b), Constantinides (1984), Chan (1986), Badrinath and Lewellen (1991), Jones, Lee and Apenbrink (1991), Koogler and Maberly (1994), Jones and Lee (1995) and Sias and Starks (1997a).

irrationality on the part of investors (see Constantinides (1984)). There is no reason why arbitrage should not drive the effect away. The empirical evidence on the U.S. market on the tax-loss selling hypothesis is less than conclusive. Studies by Branch (1977), Dyl (1977), Givoly and Ovadia (1983) and Lakonishok and Smith (1984) provide support for the tax-loss selling hypothesis. Schultz (1984) tested the tax explanation by examining the returns prior to the War Revenue Act of 1917. During this period, the tax rates for U.S. investors were very low (or zero). He found no evidence of returns in January prior to 1917, but a January effect after this period. Schultz concludes that his findings are consistent with a tax explanation for the January effect. However, Jones, Pearce and Wilson (1987) found that the January effect in the U.S. market long before income taxes were introduced. Givoly and Ovadia (1983) and Lakonishok and Smith (1984) question whether this can be the only explanation of the January effect. Reinganum (1983) and Roll (1983b) both examine the hypothesis and their tests suggest that part, but not all, of the abnormal returns in January is due to tax related trading. More recently, Sias and Starks (1997a) report that their results are most consistent with the tax-loss selling hypothesis as an explanation for the January effect.

Some researchers have tested the tax-loss selling hypothesis by examining the monthly behaviour of returns in countries where tax codes and year-ends are different from those of the United States. Brown, Keim, Kleidon and Marsh (1983) find high stock returns not only in the July, but also in January in the Australian stock market where the tax-year ends in June. They interpret their results as providing evidence against the tax-loss selling hypothesis due to the unexplained presence of August and December peaks. Kato and Schallheim (1985) and Jaffe and Westerfield (1985b) document the seasonal effects in the Japanese stock market where there is no capital gains tax for individual investors (until 1989) and no tax benefit for losses. Berges, McConnell and Schlarbaum (1984) and Tinic, Barone-Adesi and West (1987) report that Canadian stocks showed a January effect even before capital gains were taxed, but they note that this could reflect the tax status of U.S. owners of Canadian stocks. Van den Bergh and Wessels (1985) conclude that their results reject the tax-loss selling hypothesis in the Amsterdam Stock Exchange. However, Reinganum and Shapiro (1987) detected no seasonality in the U.K. prior to the introduction of capital gains taxes (April 1965). After this period, seasonal variation in stock returns appeared both in January and April. Similarly, Corhay, Hawawini and Michel (1987) find a significantly positive January and April seasonal in the stock market returns. This variation could be explained with the tax-loss selling hypothesis as January is the beginning of the tax-year for most institutional investors and April is the same for individual investors. More recently, Clare, Psaradakis and Thomas (1995) and Draper and Paudyal (1997) find similar results. Dahlquist and Sellin (1996) find no support for the tax-loss selling hypothesis in the Swedish stock market.

Table 2.3. presents summary information on the tax on capital gains (column three) and the month of the beginning of tax year (column four) for twenty five countries. The evidence from this table supports the tax-loss selling hypothesis in most countries with a December tax year end and with capital gains taxes (except in Austria, Canada, Germany, Luxembourg and Sweden). However, the hypothesis is not supported in New Zealand where its tax years end in June or in Australia, Hong Kong, Japan, Korea, Malaysia, Netherlands, Singapore, Switzerland and Taiwan where there is no capital gains taxes. Thus from an empirical perspective, the issue of taxes and stock return seasonality still seems to be an open one. The inconsistent evidence regarding the tax-loss selling hypothesis has led to other potential explanations.

Table 2.3. International Empirical Evidence of the tax-loss selling Hypothesis

Country	Authors	TCG[a]	Beginning of tax year	Jan.	BTY[b]	All mths
Australia	Agrawal et al. (1994)	No	July	3.40*	-0.96	0.93
Austria	Gultekin et al. (1983)	Yes	January	0.74	-----	0.46
Belgium	Agrawal et al. (1994)	Yes	January	3.36*	-----	0.73
Brazil	Agrawal et al. (1994)	Yes	January	9.19*	-----	7.11
Canada	Agrawal et al. (1994)	Yes	January	1.86	-----	1.13
Denmark	Agrawal et al. (1994)	Yes	January	2.36*	-----	0.51
France	Agrawal et al. (1994)	Yes	January	4.36*	-----	1.02
Germany	Agrawal et al. (1994)	Yes	January	2.20	-----	0.77
Hong Kong	Lee (1992)	No	No fixed	7.98*	-----	1.90
Italy	Agrawal et al. (1994)	Yes	January	6.85*	-----	1.11
Japan	Lee (1992)	Yes[c]	January	3.86*	-----	1.37
Korea	Lee (1992)	No	January	0.42	-----	1.64
Luxembourg	Agrawal et al. (1994)	Yes	January	2.73	-----	1.19
Malaysia	Wong et al. (1990)	No	January	1.70*	-----	0.20
Mexico	Agrawal et al. (1994)	Yes	January	13.0*	-----	5.54
Netherlands	van der Bergh et al. (1985)	Yes[c]	January	3.74*	-----	0.38
New Zealand	Agrawal et al. (1994)	Yes	July	0.94	1.42	0.96
Norway	Gultekin et al. (1983)	Yes	January	4.34*	-----	0.71
Singapore	Lee (1992)	No	January	7.81*	-----	1.30
Spain	Rubio (1988)	Yes	January	3.04*	-----	0.47
Sweden	Dahlquist et al. (1996)	Yes	January	3.17	-----	0.78
Switzerland	Agrawal et al. (1994)	Yes[c]	January	2.52*	-----	0.37
Taiwan	Lee (1992)	No	January	6.26*	-----	2.41
U.K.	Levis (1985)	Yes	April	3.06*	3.57*	1.08
U.K.	Agrawal et al. (1994)	Yes	April	4.62*	3.69*	0.77
U.S.	Gultekin et al. (1983)	Yes	January	4.45*	-----	1.24
U.S.	Lakonishok et al. (1988)	Yes	January	0.88	-----	0.48

[a] TCG = Tax on capital gains
[b] BTY = the month of the beginning of tax year when it is not January.
[c] There is no capital gains tax for individual investors
* Significant at the five percent level.

ii) The window-dressing hypothesis

The window-dressing hypothesis suggests that the year-end portfolio rebalancing of institutional rather than individual investors is responsible for the January effect. According to this hypothesis, because institutional investors are evaluated in relation to their peers, just prior to the calendar year-end, they buy winners and sell losers in order to present respectable year-end portfolio holdings. Empirical evidence have resulted in mixed support for this hypothesis[17]. For example, Athanassakos (1992) concludes Canadian institutional investors exhibit seasonal rebalancing of their portfolios, and in case of the U.K. market, Clare, Psaradakis and Thomas (1995) find some evidence to support of the window-dressing hypothesis. However, Griffiths and White (1993) find little support for the hypothesis in their evaluation of Canadian block trades around the turn-of-the-year.

B) The January effect is consistent with the joint hypothesis

These explanations include i) omitted risk factors hypothesis; ii) seasonalities in the equity market risk; iii) information-release/insider-trading hypothesis; and iv) econometric and risk mismeasurement problems.

i) Omitted risk factors hypothesis

An explanation which is consistent with rational investors and efficient capital markets is the hypothesis of omitted risk factors (e.g., see Chan, Chen and Hsieh (1985)). If it is riskier to hold stocks in January than in other months of the year, because of some of the omitted risk factors in that month, then investors should get a higher return in January on average. Seyhun (1993) reports that the presence of stochastic dominance by January returns suggests that the omitted risk factors are not likely to explain the January effect. Dahlquist and Sellin (1996) find similar results in the Swedish stock market for the period from January 1919 to December 1994.

ii) Seasonalities in the equity market risk

Another plausible explanation for the January effect is that there is seasonal variation in the equity market risk, with some months being riskier for investors than others, which implies that investors require higher returns to take on risk at the turn of the year (e.g., see Tinic and West (1984) and Tinic and Rogalski (1986)). For example, if investors discover the month of January to be more risky, and August to be less risky, than other months, this may explain the high realised returns in January and negative realised returns across all portfolios in August. However, recently, Clare, Psaradakis and Thomas (1995) suggest that the seasonal effect in the U.K. equity market returns is not due to a rational seasonal variation in equity market risk.

iii) Information-release/insider-trading hypothesis

The logic behind this hypothesis is that, with most firms having a December fiscal year, management becomes aware of non-public information in early January. Some managers use this information to engage in trading in which the investors on the other side of the transaction lose, on average. To protect themselves, investors demand a higher required rate of return, thus creating the January effect (e.g., see Seyhun (1988)).

iv) Econometric and risk mismeasurement problems

This explanation states that either the January effect (or size effect) is spurious or that investors cannot trade at this price because of the high commission fees, bid-ask

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[17] See, for example, Lakonishok and Smidt (1984, 1988), Haugen and Lakonishok (1988), Ritter

spreads or market impact of the transactions. This explanation is already presented (in subsection 2.2.2.1.1) when we discussed explanations of the size effect.

2.3.1.2. Monday Effect (Day-of-the-Week Effect or Weekend Effect)

A large body of literature has shown that, on average, Monday's returns (from the previous Friday close to Monday close) are negative and lower than for other days of the week. An early discussion of the Monday effect is provided by Fields (1934). He examined the pattern of the Dow Jones Industrial Average (DJIA) for the period 1915 to 1930 and found that stock prices rose immediately before the weekend and fell on Mondays. Since Field's (1931) study, a number of other studies have documented the Monday effect in the U.S. market (e.g., see Fama (1965), Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982), Keim and Stambaugh (1984), Rogalski (1984), Smirlock and Starks (1986), Lakonishok and Smith (1988) and Connolly (1989)). Cross (1973) and French (1980) find negative Monday returns using the Standard and Poor's (S&P) Composite Index and Gibbons and Hess (1981) find negative Monday returns of the DJIA index. Keim and Stambaugh (1984) analysed a longer time period (from 1928 to 1982) with the S&P composite index and found consistently negative Monday returns, and size and Monday effect interactions. Rogalski (1984) and Smirlock and Starks (1986) examined intra-day patterns of securities returns, and found that the negative Monday returns accrue mostly over the non-trading weekend period from the close of the market on Friday until the open of the market on Monday rather than during the trading period on Monday. Lakonishok and Smidt (1988) extend the finding for the DJIA index to include the period 1897 to 1986.

(1988), Ritter and Chopra (1989) and Sias and Starks (1997).

This anomalous Monday return pattern exists not only in the U.S. stock market but also in foreign stock markets[18] and other markets apart from the stock market, such as the futures market, the treasury bill market and the bond market (e.g., see Cornell (1985), Flannery and Protopapadakis (1988) and Yadav and Pope (1992)).

The international empirical evidence of the Monday effect is reported in Table 2.4. It presents the mean return for each day of the week for each country. The research reported in the table covers periods of various lengths and returns are computed using the closing value of the index. In particular, Monday returns are computed from Friday close to Monday close and consequently include the nontrading weekend period (Friday close to Monday open) as well as Monday's trading hours (Monday open to Monday close). The six Pacific-Basin countries (Australia, Hong Kong, Japan, Korea, Malaysia and Singapore) show significantly negative Tuesday returns except in the case of Malaysia. Likewise, Monday returns were found to be significantly negative in two of these countries (Korea, Malaysia) and insignificantly negative in three others (Hong Kong, Japan and Singapore), instead, Australia has insignificantly positive returns. These countries have a time difference of twelve hours or more from the U.S. The time zone hypothesis predicts Tuesday returns to be negative in these countries. In most non Pacific-Basin countries, the Monday returns are significantly negative with the exception of France, Germany and Mexico.

Considerable empirical research has documented and tried to explain the Monday effect. Although none of the explanations have been found to be completely

[18] For the U.K., see Theobald and Price (1984), Board and Sutcliffe (1988), O'Hanlon (1988), Mills and Coutts (1995) and Arsad and Coutts (1997); for Japan, see Kato (1990), and Ziemba (1993); for Canada, see Athanassakos and Robinson (1994); for Australia, see Ball and Bowers (1988) and Easton and Faff (1994); for Spain, see Santesmases (1986); for Greece, see Alexakis and Xanthakis (1995); for Malaysia, see Clare, Ibrahim and Thomas (1998); and for international evidence, see Jaffe and

adequate and the search continues. Some of the explanations offered for the Monday effect include:

i) the settlement-delay hypothesis which states that the delay between trading and settlement (actual transfer of funds) is due to check clearing. For example, on the U.S. market there is a five business day settlement period to which an additional day is added for check clearing. This means that for stocks purchased on a business day other than Friday, the buyer will have eight calendar days before transferring funds. For stocks purchased on Friday, he or she will have ten calendar days and thus two more days of interest. In an efficient securities market, the buyer should be willing to pay more for stocks purchased on Friday by an amount not exceeding two days of interest. Consequently, observed returns on Friday should be higher than those on other days of the week and those of Monday should be lower (e.g., see Gibbons and Hess (1981), Lakonishok and Levi (1982) and Theobald and Price (1984)).

ii) the systematic patterns in investor buying and selling behaviour. Miller (1988) reports that the Monday effect can be explained by a tendency for self-initiated sell orders to exceed self-initiated buy orders over the weekend while broker-initiated buy trades cause a slight surplus of buying during the rest of the week. This causes security prices to fall over the weekend and during the day on Monday as market makers sell back stocks on the open. Prices then move higher during the week because of broker-induced buying. Lakonishok and Maberly (1990) document that individuals tend to increase trading activity (especially sell transactions) on Monday, which they believe may be explained partly of the Monday effect. They also find that Monday has the lowest trading volume. Institutional trading is the lowest on Monday

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Westerfield (1985a), Condoyanni, O'Hanlon and Ward (1987), Kim (1988), Aggarwal and Rivoli (1989), Jaffe, Westerfield and Ma (1989) and Agrawal and Tandon (1994).

of all trading days, but individual trading on Monday is the highest relative to other days of the week. Furthermore, Abraham and Ikenberry (1994) provide evidence to support the explanation that the trading behaviour of individual investors appears to be at least one factor contributing to the Monday effect.

iii) information flows (information timing hypothesis). Dyl and Maberly (1988) suggest that the distribution of good news and bad news is not even across the week and that the bad news is released after Friday's market closing. Similarly, Patell and Wolfson (1982) report that good news announcements are more likely to appear during trading hours than bad news announcements and that a higher proportion of announcement's appear after the close of trading on Friday than on any other day. Likewise, Penman (1987) documents that firms tend to delay making negative announcements until the markets are closed on Fridays (see also Damodaran (1989), Fishe, Gosnell and Lasser (1993) and Athanassakos and Robinson (1994)).

Other possible explanations of the Monday effect involve measurement errors in recorded prices (Gibbons and Hess (1981), Keim and Stambaugh (1984) and Smirlock and Starks (1986)); specialist trading activity (Keim and Stambaugh (1984) and Fortin (1990)); firm size effects (Rogalski (1984), Keim and Stambaugh (1984) and Harris (1986)); dividend effects (Lakonishok and Smidt (1988), Phillips-Patric and Schneweis (1988) and Athanassakos and Robinson (1994)); investor psychology hypothesis (Rystrom and Benson (1989)); and time zone differences between the U.S. and Pacific-Basin countries (Jaffe and Westerfield (1985a)). Despite the substantial effort academicians have exerted in trying to explain the phenomenon, the Monday effect remains puzzling.

Table 2.4. International Empirical Evidence of the Monday Effect
(Mean percentage rates of returns on common stock indices by day of the week)

Country	Authors	Test Period	Index	Mon	Tues	Wed	Thur	Fri
Australia	Ball and Bowers (1988)	1975-84	EWI[a]	0.044	-0.116*	0.045	0.198*	0.157*
Belgium	Agrawal et al. (1994)	1971-87	VWI[b]	0.052*	-0.072*	0.032	0.069*	0.090*
Brazil	Agrawal et al. (1994)	1972-87	RdJ[c]	-0.189*	0.083	0.625*	0.427*	0.615*
Canada	Athanassakos et al.(1994)	1977-89	VWI	-0.155*	0.017	0.110*	0.084*	0.137*
Denmark	Agrawal et al. (1994)	1973-87	CSE[d]	-0.062*	-0.023	0.081*	0.055	0.062*
France	Solnik et al. (1990)	1978-87	CAC	0.096	-0.089	0.089	0.087	0.132*
Germany	Agrawal et al. (1994)	1971-87	FAZ[e]	-0.078	-0.017	0.086*	0.091*	0.101*
Hong Kong	Agrawal et al. (1994)	1973-87	HSI[f]	-0.088	-0.157*	0.173*	0.092	0.176*
Japan	Kato (1990)	1982-87	VWI	-0.021	-0.133*	0.179*	0.120*	0.121*
Korea	Kim (1988)	1980-84	KCSI[g]	-0.072*	-0.087*	0.087	0.014	0.120
Malaysia	Clare et al. (1998)	1983-93	KLSE[h]	-0.109*	-0.063	0.114	0.231*	0.008
Mexico	Agrawal et al. (1994)	1977-88	BMV[i]	-0.028	0.008	0.319*	0.410*	0.578*
Singapore	Condoyanni et al. (1987)	1969-84	STI[j]	-0.036	-0.107*	0.079*	0.121*	0.100*
Spain	Santesmases (1986)	1979-83	VWI	--------	-0.072*	0.003	0.037	0.071*
Switzerland	Agrawal et al. (1994)	1972-87	SBCI[k]	-0.082*	-0.066*	0.061*	0.057*	0.107*
U.K.	Arsad and Coutts (1997)	1935-94	FT30	-0.129*	0.052*	0.066*	0.035*	0.074*
U.K.	Mills and Coutts (1995)	1986-92	FT350	-0.148*	0.052	0.103*	0.062	0.088*
U.S.	Keim et al. (1984)	1928-52	S&P[l]	-0.223*	0.076*	0.084*	0.066	0.029
U.S.	Keim et al. (1984)	1953-82	S&P	-0.154*	0.026	0.103*	0.036*	0.092*

[a] EWI = Equal Weight Index; [b] VWI = Value Weight Index;
[c] RdJ = Rio de Janeiro Stock Exchange [d] CSE = Copenhagen Stock Exchange
[e] FAZ = FAZ Atkien; [f] Hang Seng Index;
[g] KCSI = Korea Composite Stock Index; [h] KLSE = Kuala Lumpur Stock Exchange Composite Index
[i] BMdV = Bolsa Mexicana de Valores; [j] Straits Times Index;
[k] SBCI = Swiss Bkg. Corp. Index; [l] S&P = Standard and Poor's composite index;
* t-statistics for testing the hypothesis that the mean return is zero (significant at the five percent level).

2.3.1.3. The Holiday Effect

While the January and Monday effects are the best known, a wealth of different calendar effects have also been reported. Some of the first reports documenting anomalous stock return behaviour around public holidays[19] were provided by finance practitioners such as Merrill (1966) and Fosback (1976). These preliminary findings are later confirmed by numerous academic researchers (e.g., Lakonishok and Smidt (1988), Pettengill (1989) and Ariel (1990)). In his comprehensive analysis of the holiday effect, Ariel (1990) uses daily stock index returns from the CRSP equally and value-weighted portfolios over the 1963 to 1982 period to confirm that pre-holiday returns are significantly different from non-holiday returns. Lakonishok and Smidt (1988) also conducted a comprehensive analysis of the holiday effect. Using 90 years of DJIA daily returns from 1897 to 1986, they found that the average pre-holiday return was 0.220% compared to 0.0094% for the non-holiday return. The pre-holiday return, therefore, is more than 23 times larger than the average non-holiday return, and accounts for approximately 50% of the DJIA yearly return. Pettengill (1989) reported similar findings. Extending the analysis to over-the-counter (OTC) stocks, Liano, Marchand and Haung (1992) and Wilson and Jones (1993) conclude that the pre-holiday effect prevails in the OTC market.

Kim and Park (1994) provide additional insight into the holiday effect. They find that the holiday effect exists in all three of the major stock markets in the U.S. (NYSE, AMEX and NASDAQ) and on international stock markets (U.K. and Japan). They also report that the holiday effect in the U.K. and Japanese stock markets are

[19] While the precise holidays used by different researchers vary, most studies the pre-holiday trading days consist of trading days before New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Labour Day, Thanksgiving and Christmas. The remaining trading days are considered non-holiday trading days.

independent of the holiday effect in the U.S. stock market. In addition to Kim and Park (1994), numerous other researchers have shown evidence of international holiday effects. Kim (1988) reports that average pre-holiday returns are large and average post-holiday returns are small in Australia, Canada, Japan, Korea, U.K., and the U.S. Likewise, Cadsby and Ratner (1992) find that the pre-holiday effect are significant for Australia, Canada, Japan, Hong Kong and the U.S. but not for France, Germany, Italy, Switzerland and the U.K. However, the conclusion for the U.K. is challenged by the findings of Mills and Coutts (1995) and Arsad and Coutts (1997).

Researchers have examined the association between the holiday effect and the firm characteristics or market conditions. The high pre-holiday returns are not an indication of other calendar anomalies such as the January effect and the Monday effect (Ariel (1990)). There is less agreement on whether the holiday effect is independent of the size effect, with Pettengill (1989) claiming that the two effects are related and Ariel (1990) and Kim and Park (1994) providing evidence that the holiday effect is independent of the size. Liano and White (1994) report that the business cycle is related to the holiday effect. The literature offers five hypothesis as possible explanations of the holiday effect. So far, however, no single hypothesis has been able to provide a satisfactory explanation of this pattern. The explanations include i) the trading pattern hypothesis which attempts to explain this pattern by looking at the behaviour of bid and ask prices during the two days prior to holidays (Keim (1989)); ii) the inventory-holding hypothesis which states that investors are less likely to initiate short positions before a holiday than to initiate long positions (Fabozzi, Ma, and Briley (1994)); iii) the market-sentiment hypothesis which states that investor trading is subject to emotional swings associated with holidays (Fabozzi, Ma and Briley (1994); iv) the clientele hypothesis which states that this pattern is caused by certain clients preferring to buy, or avoid selling, on trading days immediately prior to holidays (Ariel (1990)); and v) the time-diffusion hypothesis which states that if prices follow a time-diffusion process, one would expect two day (three day or more) post-holiday returns to exceed one day pre-holiday and non-holiday returns (French (1980) and Oldfield and Rogalski (1980)).

2.3.1.4. The Turn of the Month Effect

Lakonishok and Smidt (1988) document that returns at the turn of the month (the last trading day of the previous month and the first three trading days of the new month) in the DJIA, are significantly higher than on other days of the month. Hensel and Ziemba (1996) examine the daily return in the S&P 500 from 1928 to 1993 to investigate the turn of the month effect[20]. They find that the mean returns were significantly positive at the turn of the month.

Cadsby and Ratner (1992) and Agrawal and Tandon (1994), using Lakonishok and Smidt's definition of the turn of the month, provide information on international stock markets. Cadsby and Ratner (1992) find that the difference between the turn of the month returns and the other days' returns is significantly greater than zero at the five percent level for Australia, Canada, Germany, Switzerland, the U.K. and the U.S. but not for Japan, Hong Kong, Italy and France. Similarly, Agrawal and Tandon (1994) find significantly positive returns around the turn of the month in ten of the eighteen countries.

Several theories have been advanced to explain this seasonal regularity. One explanation for the high returns at the turn of the month is that considerable cash flows come into the stock market at this time. Many salaries, dividends, principal payments and debt interest are payable on the last and the first days of the month. Thus investors who have substantial cash receipts at the turn of the month will at that time increase their demand for stocks (e.g., see Ogden (1990), Ziemba (1991) and Cadsby and Ratner (1992)). Other explanations for the turn of the month effect include seasonal tax induced trading (Lakonishok and Smidt (1986)); inventory adjustments of different traders (Ritter (1988)); the timing of trades by informed and uninformed traders (Admati and Pfleiderer (1988b)); window-dressing induced by periodic evaluation of portfolio managers (Haugen and Lakonishok (1988) and Ritter and Chopra (1989)); specialists strategies in response to informed traders (Admati and Pfleiderer (1989)); and behavioural (Penman (1987)).

2.3.1.5. The Semi Month Effect

Ariel (1987) finds that U.S. mean stock returns are positive only during the first half of the trading months[21] while during the second half, they are on average zero. Lakonishok and Smidt (1988) and Hensel and Ziemba (1996) confirm Ariel's finding for the DJIA and S&P 500 indices, respectively. Likewise, Linn and Lockwood (1988) document this pattern in all three of the primary markets for stocks in the U.S.: the NYSE, the AMEX and the OTC market. Jaffe and Westerfield (1989) report a similar semi-month effect for Australia, but not for Japan, Canada and the U.K. Mills and Coutts (1995) offer conflicting evidence, suggesting that the semi-month effect is significant in the UK. They find significant positive daily mean returns for the first half of trading months, but returns which are insignificantly

[20] The turn of the month is defined as the last trading day of the previous month and the first four trading days of the new month.

[21] The trading month is defined as the last trading day of the previous month (inclusive) to the last trading day of the current month (exclusive). The first half of the trading month is defined as the first nine trading days of the month. The last nine trading days are defined as the second half of the month. All remaining trading days are discarded.

different from zero for the second half of the month for the three FTSE indices (FTSE-100, 250 and 350). The cumulative returns over the sample period on the FTSE-350 during the first half of months has been 59.6% while that for the second half of months has been -0.6%, with similar results for the other two indices. Howe and Wood (1994) find significant returns in the first half of the trading months in the U.S., Hong Kong and Australian markets, but not in the Japanese, Taiwanese, and Singapore markets.

2.3.2. Return Autocorrelations

There is an ongoing debate in the literature questioning the empirical implications from tests of the weak form of market efficiency for stock returns. Contrary to what the random walk hypothesis suggests, several studies report positive autocorrelation for short-horizon returns and negative autocorrelation for long-horizon returns. The random walk hypothesis states that today's stock returns are independent of previous periods stock returns and that the deviations of returns from its long term level are strictly white noise. We examine the evidence on stock return autocorrelations first for short-horizon returns and then for long-horizon returns. Distinguishing between short and long returns horizons can be important because it is well known that weekly fluctuations in stock returns differ in many ways from movements in three to five year returns.

2.3.2.1. Short-Horizon Returns

Despite the fact that short-horizon individual stock returns are generally negatively autocorrelated (e.g., see Jegadeesh (1990) and Lehmann (1990)), short-horizon portfolio returns are strongly positively autocorrelated (e.g., see Lo and MacKinlay

(1988) and Conrad and Kaul (1989)). Because of variance reduction obtained from diversification, portfolio returns provide more powerful tests of the ability of past returns to predict future returns. However, this positive autocorrelation may be due to non-synchronous trading of stocks included in the portfolio. Lo and MacKinlay (1990a) develop a model of non-synchronous trading and conclude that the non-synchronous trading bias is not enough to explain this positive autocorrelation.

Lo and MacKinlay (1988) applied the variance-ratio method for portfolios and for individual stocks over the sample period 1962 to 1985. They find that for individual stocks, weekly returns are on average negatively correlated yet the correlation is not statistically significant. In contrast to results for individual stocks, for portfolio returns, weekly returns are strongly positively autocorrelated. In order to investigate that the significant positive autocorrelations are not attributable to non-synchronous trading, Conrad and Kaul (1988) examine portfolio autocorrelations using weekly returns, excluded stocks that did not trade. Their results are similar results to those of Lo and MacKinlay (1988).

Lo and MacKinlay (1990c) show that the positive autocorrelation in portfolio returns is due to positive cross-autocorrelations among individual stock returns. Although several studies have attempted to explain the positive cross-autocorrelations among individual stock returns. Three major explanations have been put forward to explain this phenomenon: i) non-synchronous trading (Boudoukh, Richardson and Whitelaw (1994)), ii) time-varying expected returns (Boudoukh, Richardson and Whitelaw (1994)), iii) differential speed of adjustment of security price to common private information (Lo and MacKinlay (1990c), Brennan, Jegadeesh and Swaminathan (1993), Chordia and Swaminathan (1994), Badrinath, Kale and Noe (1995) and

Connolly and Stivers (1997)). While the existence of these correlation patterns has been well documented, we are still far from having a complete understanding of their nature and sources.

2.3.2.2. Long-Horizon Returns

While weak evidence on short-horizon predictability has now been acknowledged by many researchers, there is great disagreement on long-horizon predictability, first reported by Fama and French (1988a) (e.g., see Richardson and Stock (1989), Kim, Nelson and Startz (1991) and McQueen (1992)). Fama and French (1988a) measured the correlation coefficients of ten, equally-weighted common stock portfolios over the period 1926 to 1985 for successive one and five year returns. They found strong negative correlation for the five year returns, particularly of small size companies, which could be explained as the initial overreaction of the market to new information and subsequent correction during this five year period.

Poterba and Summers (1988) employed three testing methods (Fama and French's (1988a) regression test, the variance-ratio test and the likelihood-ratio test) to test long-horizon mean reversion in stock returns for U.S. from 1871 to 1985 and for eighteen other countries including the U.K. stock market[22]. They find that stock prices exhibit statistically significant long-horizon mean reversion. However, Kim, Nelson and Startz (1991) question the true significance of the mean-reversion findings. They recalculate the mean-reversion test statistics on sub-samples of the data used by Fama and French (1988a) and Poterba and Summers (1988) and find that statistical evidence of mean reversion is generated by the data from the 1930s.

[22] Other published work on mean reversion in U.K. stock returns include McDonald and Power (1992, 1993) and Poon (1996).

These results call into question the statistical significance of the Fama and French, and Poterba and Summers mean-reversion findings.

2.3.3. Other Forecasting Variables

The lack of power of tests based on autocorrelations (because past realised returns are noisy measures of expected returns) has motivated researchers to identify forecasting variables that are less noisy proxies for expected returns than past returns. Several studies regress returns on predetermined variables to infer the existence of statistically significant time-variation in expected returns. In early works, researchers exposed a negative relation between short horizon stock returns and expected inflation (Bodie (1976), Nelson (1976), Jaffe and Mandelker (1976), Fama and Schwert (1977) and Fama (1981)). However, the implied variation in expected returns is a small part of the variance of returns (less than three percent). Recent research has used term-structure variables (such as the default spread and the term spread[23]) to predict returns (Keim and Stambaugh (1986) and Campbell (1987)). Harvey (1991) finds that the dividend yield and term-structure variables forecast the returns on portfolios of foreign common stocks. Campbell and Hamao (1992) find similar results for the U.K. and Japanese stocks.

Other researchers report that for long horizon returns, predictable variation is a larger part of return variances. For example, Rozeff (1984) and Shiller (1984) explore the explanatory power of dividend yields on annual stock returns. Similarly, Fama and French (1988b) found that between 25% and 40% of the returns on the value and equally-weighted portfolios of NYSE stocks over long periods could be attributable

[23] The default spread is defined as the difference between the yields on lower-grade and Aaa long-term corporate bonds while the term spread is defined as the difference between the long-term Aaa yield and the yield on one month Treasury bills.

to the dividend yield. Campbell and Shiller (1988) report that earnings to price ratios have reliable forecast power that also increases with the return horizon.

More recently, Kothari and Shanken (1997) use a Bayesian framework to document that the book to market ratio of the DJIA predicts market returns over the period 1926 to 1991. They also find that both the book to market ratio and the dividend yield track time series variation in expected real one year stock returns over the full period and the subperiod of 1941 to 1991. The book to market relation is stronger over the full period, while the dividend yield relation is stronger in the subperiod. Similarly, Pontiff and Schall (1998) document that during the period 1926 to 1994, the DJIA book to market ratio predicts market returns and the excess returns of small stocks over big stocks. In addition, the DJIA book to market ratio is a stronger predictor of market returns than previously examined variables such as interest rates and dividend yields.

The empirical evidence of the return autocorrelations and other forecasting variables focuses debate on whether return predictability represented movements of the market away from fundamental intrinsic values or whether it was related to long-term changes in expected returns, possibly related to business conditions as proposed by such efficient market supporters as Fama and French (1989). However, Fama (1991, p.1585) reports that "deciding whether return predictability is the result of rational variation in expected returns or irrational bubbles is never clear-cut. My view is that we should deepen the search for links between time-varying expected returns and business conditions, as well as for tests of whether the links conform to common sense and the predictions of asset-pricing models".

2.4. Conclusions

The purpose of this chapter was to review recent empirical evidence on the predictability of stock returns in the U.S. and other equity markets around the world. The predictability of stock returns has received an enormous amount of research attention in the last twenty years. An extensive body of empirical research has documented the presence of persistent cross-sectional and time-series patterns in stock returns which serious challenge the efficient market hypothesis and the capital asset pricing model.

The majority of the reported studies argue that the data-snooping biases and COMPUSTAT survivorship biases can not explain the relationship between firm-specific variables and average stock returns. However, international evidence (i.e., U.K. data) of the asset pricing anomalies will help to shed further light on these two potential biases. The critical issue, which remains unresolved, is whether firm-specific variables are proxies for unidentified risk factors (as suggested by Fama and French (1992)) or security mispricing (as suggested by Lakonishok, Shleifer and Vishny (1994)).

While the existence of these asset pricing anomalies and seasonal patterns have been well documented, we are far from having a complete understanding of their nature and sources. Considering all these that we have seen personally, we believe that more sophisticated models of asset pricing other than the CAPM are needed to identify the determinants of the expected returns on financial assets.

In the next chapter, we will record the data sources and the methodologies used to estimate and test the asset pricing model.

Chapter 3

Research Design...

3.1. Introduction

In the previous chapter we have reviewed recent empirical evidence on the predictability of stock returns in the U.S. and other equity markets around the world. The purpose of this chapter is to describe our data set and present the methods (such as portfolio grouping approach, cross-sectional regressions (CSR) and seemingly unrelated regressions (SUR)) used to test the alternative hypothesis that a variable (or variables) has explanatory power, not captured by the market beta, in explaining the average stock returns. The early empirical research on the determinants of expected stock returns was concerned with detecting an association between average returns on beta-sorted portfolios and their betas, as predicted by the capital asset pricing model (see, for example, Miller and Scholes (1972), Black, Jensen and Scholes (1972) and Fama and MacBeth (1973)). This work was refined by the introduction of statistical tests of whether the null hypothesis that expected stock returns are determined solely by betas could be rejected (see, Gibbons (1982) and Stambaugh (1982)). After the developments of the intertemporal capital asset pricing model of Merton (1973), the arbitrage pricing theory of Ross (1976) and the consumption capital asset pricing model of Breeden (1979), researchers then began to test the asset pricing models against specified alternatives (see, Banz (1981) and Basu (1983)). The alternative hypotheses suggested that the expected stock returns were not determined solely by their risk characteristics such as market beta , but other additional characteristics such as size, book to market equity, earnings to price and dividend yields. The most widely used methodology of testing the alternative hypotheses is the CSR developed by Fama and MacBeth (1973), in which the accepted practice is to test whether a variable (or variables) has explanatory power not captured by the market beta. Thus in the recent debate on the validity of the CAPM, the main point is whether or not the betas and firm-specific variables are statistically, significantly priced.

The remainder of this chapter is organised as follows. In Section 3.2 we describe our data set. Section 3.3 presents the methods used to evaluate the asset pricing model and finally Section 3.4 concludes the chapter.

3.2. Data Description

We rely on data from the London Share Price Database[1] (LSPD) and Datastream International to conduct our empirical analysis for the period July 1975 to June 1996. The sample consists of 1,420 UK non-financial companies. We excluded financial companies[2] because their leverage is strongly influenced by explicit (or implicit) investor insurance schemes such as deposit insurance. Furthermore, their debt-like liabilities are not strictly comparable to the debt issued by non-financial companies. In order to avoid survivorship bias in this study, we include all the companies with available data in Datastream that have been delisted over my sample period after becoming bankrupt or being taken over. In this way, we prevent the sample from suffering from survivorship bias which, as Banz and Breen (1986) find, might lead to distorted results.

We took monthly returns from the LSPD and all other variables from Datastream. In the sample there exist companies with different accounting year-ends. Since we match accounting data for all accounting year-ends in calendar year t-1 with returns for July of year t to June of year t+1, the gap between matching returns and the

[1] The LSPD contains several different samples. For example, a random sample of 33% of the companies quoted on the London Stock Exchange for the period January 1955 to December 1974 together with 33% of new issues in each year. Since January 1975, there is a complete history for all U.K. companies quoted in LSE. There is no survivorship bias in the LSPD after 1975.

[2] Barber and Lyon (1997b) find that the relation between market value of equity, book to market ratios, and security returns is similar for financial and non-financial firms.

accounting data varies across firms. We excluded companies with more than one class of ordinary share from our sample. We use a firm's accounting variables at the fiscal year-end that falls in year t-1 and form portfolios at the end of June year t (for each year), which implies that we do not use information that is not actually available to the investor at the time of portfolio formation, because firms report their balance sheet data after their fiscal year ends. The listed companies are required by the London Stock Exchange to publish their annual reports within six months of their fiscal year-end. Thus, by matching accounting data for firms with a fiscal year-end that falls in year t-1 with the return period starting in July t, it is likely that accounting data are publicly available prior to the return period for most firms in our sample. In this way a possible look-ahead bias is avoided (see Banz and Breen (1986)).

The returns (r_{it}) on the LSPD returns file are monthly and continuously compounded,

given by: $r_{it} = \ln\{(P_{it} + D_{it})/P_{it-1}\}$

where, P_{it} = the last traded price in month t;

D_{it} = dividends paid during month t; and

P_{it-1} = the last traded price in month t-1, adjusted for any capitalisation in order to make it comparable to P_{it}

In order to allow direct comparison with the U.S. studies, because the latter have used discretely compounded, monthly returns, we convert all LSPD returns back to discretely compounded returns (R_{it}).

where: $R_{it} = \exp[r_{it}] - 1 = \exp[\ln\{(P_{it} + D_{it})/P_{it-1}\}] - 1$

giving: $R_{it} = (P_{it} + D_{it} - P_{it-1})/P_{it-1}$

In deciding which firm-specific variables to include as possible determinants of expected returns, in order to test the alternative hypotheses that the expected stock returns were also affected by firm-specific variables, attention was given to those variables that had been found to be important in prior studies as well as those which have received a lot of attention recently[3]. The following variables are calculated for each firm in the sample:

- β = the individual company's market beta (the estimation of the betas is described in detail in subsection 3.3.2.1).
- Tobin's q = the ratio of the market value of a firm to the replacement cost of its assets (the estimation is described in detail in the next chapter in subsection 4.2.1).
- ME = the market value of the equity of the firm (common shares outstanding multiply by common stock price). We use a firm's market value at the end of December of year t-1 to compute Tobin's q, other accounting variables and market value at the end of June of year t to measure its size.
- BE/ME = the ratio between the book value of equity of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December in year t-1.
- A/ME = the ratio between the book value of total assets of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December in year t-1.
- A/BE = the ratio between the book value of total assets of a firm at the fiscal year-end that falls in year t-1 and the firm's book value of equity at the fiscal year-end that falls in year t-1. We interpret A/ME as a measure of market leverage, while A/BE is a measure of book leverage.
- E/P = the ratio between earnings of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December in year t-1.

[3] See, for example, Chan, Hamao, and Lakonishok (1991), Fama and French (1992), Lakonishok, Shleifer, and Vishny (1994), Davis (1996), Chan, Jegadeesh, and Lakonishok (1995), Kim (1997) and Brennan, Chordia, and Subrahmanyam (1998).

Earnings are defined as net income before extraordinary items, less taxes and preferred dividends. Consistent with Fama and French (1992), we use a dummy variable (E/P(D)) to allow for firms with negative earnings. Fama and French (1992, p.444) report that "when current earnings are negative, they are not a proxy for the earnings forecasts embedded in the stock price and E/P is not a proxy for expected returns. Thus, the slope for E/P in the Fama-MacBeth regressions is based on positive values; we use a dummy variable for E/P when earnings are negative". In the regressions, E(+)/P and E/P(D) are used, where:

$$\text{E(+)/P} = \begin{cases} E/P, & \text{if } E/P \geq 0 \\ 0, & \text{if } E/P < 0 \end{cases}$$

$$\text{E/P(D)} = \begin{cases} 1, & \text{if } E/P < 0 \\ 0, & \text{if } E/P \geq 0 \end{cases}$$

- CF/P = the ratio between cash flow of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December in year t-1. Cash flow is defined as earnings plus depreciation. Following Lakonishok, Shleifer and Vishny (1994) in order to see if there is a systematic return effect for firms with negative cash flow, we also included an dummy variable CF/P(D). In the regressions, CF(+)/P and CF/P(D) are used, where:

$$\text{CF(+)/P} = \begin{cases} CF/P, & \text{if } CF/P \geq 0 \\ 0, & \text{if } CF/P < 0 \end{cases}$$

$$\text{CF/P(D)} = \begin{cases} 1, & \text{if } CF/P < 0 \\ 0, & \text{if } CF/P \geq 0 \end{cases}$$

- DY = the ratio between the dividend of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December in year t-1.
- S/P = the ratio between the annual sales of a firm at the fiscal year-end that falls in year t-1 and the firm's market value at the end of December in year t-1.
- D/E = the ratio between the book value of the debt of a firm at the fiscal year-end that falls in year t-1 and the firm's market value of equity at the end of December

in year t-1. The book value of the debt is defined as the book value of total assets minus the book value of common equity.

In order to avoid giving extreme observations[4] heavy weight in the regressions, the smallest and largest 0.5 percent of the values for q, BE/ME, A/ME, A/BE, E(+)/P, CF(+)/P, DY, S/P, and D/E are set equal to (the next smallest or largest value of the ratios) the 0.005 and 0.995 fractiles. Table 3.1 reports the time-series averages of the cross-sectional means, medians, and standard deviations of the firm-specific variables. The variables display considerable skewness. Therefore, in our empirical analysis we follow Fama and French (1992) among others[5] in employing logarithmic transforms[6] of all these variables except earnings to price (E/P), cash flow to price (CF/P) and dividend yield (DY) (which may be zero). Where the prefix ln(.) denotes that the variable is used in natural logarithm form. Therefore, lnME is the natural logarithm of the market value of equity, lnq is the natural logarithm of the Tobin's q, lnBE/ME is the natural logarithm of the book to market equity, lnA/ME is the natural logarithm of the market leverage, lnA/BE is the natural logarithm of the book leverage, lnS/P is the natural logarithm of the ratio of sales to price and lnD/E is the natural logarithm of the ratio of book value of debt to market value of equity.

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[4] Possible some of the extreme values caused by meaningful changes which occur between the measurement dates. See, for example Fama and French (1992) and Brennan, Chordia and Subrahmanyam (1998).

[5] See, for example, Lakonishok, Shleifer, and Vishny (1994), Davis (1994, 1996), Kothari, Shanken, and Sloan (1995), Chan, Jegadeesh, and Lakonishok (1996), Loughram (1997) and Brennan, Chordia, and Subrahmanyam (1998).

[6] Log transformation very often reduces heteroscedasticity. This is because log transformation compresses the scales in which the variables are measured, thereby reducing a ten-fold difference between two values to a two-fold difference.

Table 3.1. Summary Statistics

The summary statistics represent the time-series averages of cross-sectional means for an average of 1,420 stocks over 16 years from 1980 to 1995. β is the full period post-ranking β, estimated using monthly returns. The estimation procedure of the post-ranking β is described in detail in the subsection 3.3.2.1. The row titled earnings to price only positive (E(+)/P) provides summary statistics for the earnings to price ratio after excluding all the firms with negative earnings. While the row titled cash flow to price only positive (CF(+)/P) provides summary statistics for the cash flow to price ratio after excluding all the firms with negative cash flows.

Variables	Mean	Median	Std. Dev.
Market beta (β)	0.945	0.931	0.280
Tobin's q (q)	0.934	0.732	0.743
Market value of equity (ME) (£ billion)	0.233	0.027	0.799
Book to market equity (BE/ME)	1.105	0.857	1.007
Market leverage (A/ME)	2.503	1.804	2.465
Book leverage (A/BE)	2.465	2.099	1.609
Earnings to price (E/P)	0.065	0.087	0.215
Earnings to price only positive (E(+)/P)	0.107	0.094	0.076
Cash flow to price (CF/P)	0.155	0.150	0.177
Cash flow to price only positive (CF(+)/P)	0.180	0.157	0.108
Dividend yield (DY) (%)	4.897	4.713	3.058
Sales to price (S/P)	3.775	2.408	4.268
Debt to equity (D/E) (a measure of leverage)	1.377	0.886	1.554

3.3. Methodologies

We primarily rely on three methodologies in our empirical analysis of the relationship between firm-specific variables and stock returns: i) the portfolio grouping approach, ii) cross-sectional regressions approach and iii) seemingly unrelated regressions (SUR) approach. Each approach will be discussed in detail in the following subsections.

3.3.1. The Portfolio Grouping Approach

It is standard practice in empirical finance to study return premiums by comparing the returns of portfolios, formed by sorting stocks on observable firm-specific variables. Similar to Fama and French (1992) and Lakonishok, Shleifer and Vishny (1994), we calculate the average values of returns, and other firm-specific variables for decile portfolios. At the end of June of year t, all stocks are sorted into 10 portfolios, based on their firm-specific variables, each portfolio has an average value for each variable. We assigned the bottom 10% into the first portfolio, the next 10% into the second portfolio and so on up to the tenth portfolio which consisted of the 10% of stocks with the largest values of the firm-specific variable. The return of each portfolio over the following year (i.e., July through June) is then recorded. This grouping procedure is repeated every year at the end of June in the sample period, thus the portfolios were re-balanced 16 times during the study. We then calculate and report the time-series average of each portfolio. Statistical tests are not reported for any of these results, but they provide a relatively simple and easily interpreted approach to demonstrating patterns in the data.

3.3.2. Fama-MacBeth Cross-Sectional Regressions Approach

We employ the Fama-MacBeth (1973) two-step methodology[7], to measure the return premiums associated with the firm-specific variables and market beta (β). In the first step, β estimates (post-ranking β) are obtained for each firm (this estimation procedure is described in detail in the next subsection). In the second step, in each month of the sample period we run a cross-sectional regression (CSR) of individual stock returns on β and other firm-specific variables, say Z. Each month from July 1980 to June 1996, the following CSRs are run:

$$R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln Z_{it} + \ldots + \varepsilon_{it} \qquad \text{for } i = 1,2,\ldots, N_t \qquad (3.1)$$

Where, R_{it} is the realised return on security i in time t, γ_{0t} is a constant, γ_{1t} and γ_{2t} are regression parameters, $\hat{\beta}_{it}$ are the estimated βs from the first step, $\ln Z_{it}$ is a measure of the log of other firm-specific variables of firm i, ε_{it} is an error term, and N_t is the number of firms in period t. Using the values of γ_{2t} from (3.1), we can test the hypothesis that the firm size does not have any explanatory power beyond β, so that the null hypothesis is that $\gamma_2 = 0$.

The error terms from each individual CSR are likely cross-sectionally correlated, and also heteroskedastic[8]. As a result, the t-test in this individual OLS CSR tends to overstate the precision of the actual significance of the estimated parameters. Recognising this problem, Fama and MacBeth run CSRs each month, generating time-series of each series of parameter estimates. The time-series averages from each

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[7] For some empirical application of this testing methodology see, Chan, Hamao, and Lakonishok (1991), Fama and French (1992, 1996), Jegadeesh (1992), Lakonishok, Shleifer, and Vishny (1994), Davis (1994, 1996), Kothari, Shanken, and Sloan (1995), Chan, Jegadeesh, and Lakonishok (1996), Loughram (1997) and Brennan, Chordia, and Subrahmanyam (1998), Opler, Pinkowitz, Stulz, and Williamson (1999). For a discussion of this testing methodology see, Fama (1976) and Shanken (1992, 1996).

series of parameter estimates are used to represent the coefficient of the variables and the t-test technique is used to assess the statistical significance of the independent variables, assuming that the time-series monthly coefficients are independently and identically distributed. The value of the t-statistic is calculated as follows:

Defining $\hat{t}(\bar{\hat{\gamma}}_j)$ as the t-statistic[9], we have

$$\hat{t}(\bar{\hat{\gamma}}_j) = \frac{\bar{\hat{\gamma}}_j}{\hat{\sigma}(\hat{\gamma}_j)/\sqrt{T}} \tag{3.2}$$

where,

$$\bar{\hat{\gamma}}_j = \frac{1}{T}\sum_{t=1}^{T}\hat{\gamma}_{jt} \tag{3.3}$$

and,

$\hat{\gamma}_{jt}$ = the cross-sectional estimates for each t; $t = 1,\ldots,T$

$\bar{\hat{\gamma}}_j$ = the average of the cross-sectional estimates of $\hat{\gamma}_{jt}$;

$\hat{\sigma}(\hat{\gamma}_j)$ = the standard deviation of the $\hat{\gamma}_{jt}$; and

T = the number of cross-sectional estimates (i.e. 192);

This procedure ignores the information from each individual CSR that could be used to estimate the standard errors of the coefficients, and uses only its time series standard error to calculate the t-test. One advantage of the standard error of this procedure is that it there is no requirement to estimate the covariance matrix of asset returns, which makes it suitable for studying a large cross section of individual stocks. When the assumption of normality of the time-series monthly coefficients is violated, the t-tests obtained from the Fama-MacBeth procedure are misspecified, and if the distribution of the time-series monthly coefficients has excess kurtosis this

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[8] See Black, Jensen, and Scholes (1972) and Miller and Scholes (1972). Jagannathan and Wang (1998) show that Fama and MacBeth's estimator may not be biased under these conditions.

[9] Many researchers use the distribution of the t-ratio as student t with (T-1) degrees of freedom which is not the appropriate measure, as shown by Kan and Zhang (1999).

leads to an inflated significance level. In our case with a sample of 192 time-series monthly coefficients it is unlikely that deviations from normality will have an important effect on the calculated significance levels. However, we bootstrap[10] the distribution of the monthly coefficients in order to investigate whether deviations from normality have any significant effect on the t-test of the coefficients. Another concern over the use of the t-tests obtained from the Fama-MacBeth procedure is that they potentially are sensitive to serial dependence of the time series of monthly coefficients. Shanken (1996, p.702) states that "since the true variance of each monthly estimator depends on the covariance matrix of returns, cross-sectional correlation and heteroskedasticity are reflected in the time series of monthly estimates. The monthly gamma estimates are not serially independent". In order to examine whether the t-statistics are potentially sensitive to serial dependence of the monthly coefficients we use the procedure[11] of Newey and West (1987) to calculate adjusted t-statistics and compare them to the standard t-statistics.

As Lo and MacKinlay (1990b) point out, the portfolio approach may bias test statistics and parameter estimates. Consequently, we use data on individual stock levels. The resulting problem of inference is illustrated in Fama and French (1996a) and Brennan, Chordia and Subrahmanyam (1997), who present results for six and seven sets of portfolios, respectively, and obtain quite different results depending on the criteria used in portfolio formation.

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[10] The bootstrap method, introduced by Efron (1979). See Jeong and Maddala (1993), Vinod (1993), and Horowitz (1997) who provide excellent surveys for bootstrap in econometrics, with mention to some applications of bootstrap methods in finance.
[11] See Greene (1997, p.506) for a complete discussion.

3.3.2.1. Estimation of the Betas

We estimate βs using a similar methodology to Fama and French (1992) in our data set of non-financial firms. In the present research, 25 portfolios are formed. For every calendar year, firms are classified into five size portfolios, based on their market value of equity at the end of June of year t. For each size group, the β of each firm (pre-ranking β) is estimated using 24 to 60 months of past return data ending in June of year t and using the equally-weighted index of all quoted companies on the LSPD database[12]. Firms that have less than 24 continuous monthly return observations are omitted. To avoid problems[13] of "*thin-trading*" we employ a generalized Scholes and Williams (1977) estimator. Assuming that all stocks are traded at least once within a fixed interval of time, Scholes and Williams demonstrate that average traded stocks β are overstated whereas very frequently or infrequently

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[12] Roll (1977) argues that inferences about the CAPM's validity are sensitive to incorrect specification of the market index portfolio (see, also Roll and Ross (1994)). On the other hand, Fama and French (1992) and Jegadeesh (1992), among others confirm Stambaugh's (1982) empirical evidence that the model are not sensitive to the choice of a market proxy. Kandel and Stambaugh (1995) show that this extreme sensitivity can potentially be mitigated by using a generalized least squares (GLS) estimation approach in place of ordinary least squares. However their result depends on knowing the true covariance matrix of returns. The gains from using GLS with an estimated covariance matrix are as yet uncertain.

[13] The thin-trading or nontrading effect arises when asset prices are taken to be recorded at time intervals of one length when in fact they are recorded at time intervals of other lengths. The thin-trading effect induces a positive autocorrelation in market index and potentially serious biases in the moments and co-moments of stock returns such as their means, variances, covariances, market betas, and autocorrelation and cross-autocorrelation coefficients. Several methods and alternatives have been proposed to correct for the bias in beta estimates produced by thin-trading. There are three notable approaches: i) the trade to trade method (see, Franks, Broyles and Hecht (1977), Schwert (1977) and March (1979)), ii) the method originally developed by Scholes and Williams (1977) which has been generalized by Cohen, Hawawini, Maier, Schwartz and Withcomb (1983a), and iii) the aggregated coefficients method by Dimson (1979). There also exists some ad hoc procedure for avoiding thin-trading bias such as Pogue and Solnik (1974), Ibbotson (1975), Theobald (1980, 1983) and Cohen, Hawawini, Mayer, Schwartz and Withcomb (1983b). Whereas earlier studies considered the effects of nontrading on empirical applications of the CAPM, the APT and the event studies (see, for example, Schwartz and Whitcomb (1977a, 1977b), Cohen, Maier, Schwartz and Whitcomb (1978), Fowler, Rorke and Jog (1979, 1989), Hawawini and Michel (1979), Dimson and Marsh (1983), Fung, Schwartz and Whitcomb (1985), Berry, Gallinger and Henderson (1987), Shanken (1987), Berglund, Liljeblom and Loflund (1989), Maynes and Rumsey (1993)), more recent attention has been focused on spurious autocorrelations induced by nonsynchronous trading (see, for example, Cohen, Maier, Schwartz and Whitcomb (1979), Atchison, Butler, and Simonds (1987), Lo and MacKinlay (1988, 1990a, 1990c), Mech (1993), Boudoukh, Richardson and Whitelaw (1994), Sias and Starks (1997b).

common stocks are understated. Therefore, a one lead and one lag regressions is needed in order to reduce the bias. Cohen, Hawawini, Maier, Schwartz and Whitcomb (1983a) propose an extension of this model when more leads and lags are necessary. However, Fowler and Rorke (1983) find that sum βs are biased when the market return is autocorrelated. Since our market index proxy is autocorrelated, to ensure a consistent estimate of βs, we divide the sum of βs (using five leading, one matching and five lagged market returns) by the τth-order autocorrelation coefficient of the monthly market returns. Thus,

$$\hat{\beta}_{it} = \frac{\sum_{\tau=-5}^{5} \hat{\beta}_{i\tau}}{1 + 2\sum_{\tau=1}^{5} \hat{\rho}_{m}^{\tau}} \tag{3.4}$$

where,

$\hat{\beta}_{i\tau}$ is the slope in the regression of R_{it} on $R_{m,\tau\text{-}t}$; and

$\hat{\rho}_{m}^{\tau}$ is an estimate of the τth-order autocorrelation coefficient of the monthly market returns.

To make the variation of β unrelated to size, each size portfolio is sub-divided into five portfolios on the basis of pre-ranking βs for individual stocks. In this way, we construct 25 portfolios that provide wide variations in these two variables. These grouping procedures produce portfolios with smaller estimated errors in β than those originally estimated at the individual firm level. Thus, the portfolio grouping method is applied to estimate the post-ranking βs in order to minimise the errors-in-variables (EIV) problem. The true βs are unobservable and, thus, estimated βs are used as a proxy for the unobservable βs. Since the independent variable in the Cross-Sectional Regressions (CSR) is measured with error, the second-pass estimator is subject to an

EIV problem. Handa, Kothari, and Wasley (1989) and Kim (1995) show that the EIV problem induces an under-estimation of the price of beta risk and an over-estimation of the other CSR coefficients associated with fundamental variables that are observed without error such as firm size, book to market equity and earnings to price. A greater correlation between the estimated βs and the fundamental variables causes more downward bias in the price of the beta risk estimate and more exaggeration of the explanatory power of the fundamental variables. Several methods have been proposed to address the EIV problem. Aware of this problem Black, Jensen and Scholes (1972), Blume and Friend (1973) and Fama and MacBeth (1973) employ elaborate portfolio grouping procedures designed to minimise measurement error. A second method, developed by Litzenberger and Ramaswamy (1979) and refined by Shanken (1992), provides an adjustment for the standard errors to correct for the biases introduced by the EIV. Another method developed by Kim (1995) provides direct correction factors for the least squares CSR coefficients. However, whilst the above mentioned methods go some way towards eliminating the EIV problem, the question of which one does the best job is still a subject for research.

Next the monthly returns on each of these portfolios for the next 12 calendar months (July t to June t+1) are computed. Portfolio monthly returns are calculated by equally weighting the returns on stocks in the portfolio. Firms with less than six observations during this 12 months period are excluded. This procedure is repeated for each calendar year from 1980 to 1995. This gives a time-series of equally weighted post-ranking monthly returns (192 observations) from July 1980 to June 1996 for each size-β portfolio. We used these post-ranking monthly returns to estimate the full-period, post-ranking βs for each size-β portfolio. In order to account for the fact that βs may vary over time we allocate the full-period post-ranking β of a size-β portfolio to each stock in the portfolio. Notice that this procedure does not mean that an individual company's β is constant through time; rather its β can change from one 12 month period to the next if it switches among the 25 size-β portfolios. So we create time-series for individual firms' βs.

3.3.3. Seemingly Unrelated Regressions (SUR) Approach

The Fama-MacBeth approach is particularly useful because it can easily be modified to accommodate additional risk measures beyond the β, and allows a stock's β not to be constant over time, it also allows the coefficients of the explanatory variables to vary across months. In spite of the usefulness of this approach, the use of error estimated βs (in the second-pass) as an independent regressor, invokes an errors-in-variables problem which possibly affects the inferences of the firm-specific variables in cross-section regressions. We will therefore compare our results using the Fama-MacBeth methodology to an alternative, the Seemingly Unrelated Regression (SUR) technique[14] advanced by Zellner (1962), where the cross-sectional relation between portfolio average return and portfolio average firm-specific variables are tested while the portfolio βs are simultaneously estimated. However, in our empirical analysis (chapter 4 and chapter 7) we found that the use of the estimated βs as an independent regressor does not affect the inferences of the other variables included in the cross-section regressions. Which means that the portfolio grouping method used to minimise the errors-in-variable problem has done a good job. Such results are reported in chapter 7, when we use both the Fama-MacBeth regression and SUR

[14] See Brown, Kleidon, and Marsh (1983), Jaffe, Keim, and Westerfield (1989), Chan, Hamao, and Lakonishok (1991), Eleswarapu (1997) and Lewellen (1999) for a discussion of the SUR method.

methodology to estimate the relationship between average returns and β and firm size. We find that the size premium is not sensitive to the choice of the methodology is used.

The SUR methodology, unlike the Fama-MacBeth method, takes account of the fact that the errors for cross-portfolios may be contemporaneously correlated and thus the off-diagonal blocs in the error covariance matrix may not be equal to zero ($\sigma_{ij} \neq 0$). The disadvantages of this approach are that the βs for the portfolios and the coefficient estimates are constant over time.

All the stocks are classified into ten portfolios on the basis of firm market value of equity at the end of June of year t. This portfolio formation procedure is updated in June of each subsequent year, from 1980 through 1995 in chapter 4 and from 1984 through 1995 in chapter 7. The average monthly returns and the average of the firm size and other firm-specific variables of these portfolios are used as dependent and independent variables respectively in the SUR model. Each stock receives the same weight within its portfolio.

Our model is a system of ten equations with T time-series observations, where the β for each portfolio is estimated and simultaneously the cross-sectional relation between portfolio average return and average firm size is estimated.

We use the following SUR model:

$$R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln Z_{pt} + \ldots + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt} \qquad (3.5)$$

$$t = 1,\ldots,T, \text{ (i.e. 192 or 144)} \qquad \text{and} \quad P = 1,\ldots,10,$$

Where R_{pt} is the average return on portfolio P in month t, R_{ft} is the risk-free rate, in month t, proxied by the monthly rate on UK three-month Treasury bills and taken from Datastream, $\ln Z_{pt}$ is the natural logarithm of the average firm size for each portfolio in month t, R_{mt} is the monthly return on the equally-weighted index of all quoted companies on the LSPD database, in month t and ε_{pt} is the residual term on portfolio P in month t.

Given an error covariance matrix structure that recognises that contemporaneous correlation between cross-portfolio errors may exist ($\sigma_{ij} \neq 0$) and with a common coefficient for the constant and firm size, so that the restrictions are:

$$\alpha_{01} = \alpha_{02} = \ldots = \alpha_{010} \qquad \text{and} \quad \alpha_{11} = \alpha_{12} = \ldots = \alpha_{110}$$

The statistical model could be written in the following restricted form:

$$y = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ \vdots \\ R_{10} \end{bmatrix} = \begin{bmatrix} i_T & R_m & 0_T & \cdots & 0_T & Z_1 \\ i_T & 0_T & R_m & \cdots & 0_T & Z_2 \\ \vdots & \vdots & \vdots & & \vdots & \vdots \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ i_T & 0_T & 0_T & \cdots & R_m & Z_{10} \end{bmatrix} \begin{bmatrix} \alpha_0 \\ \beta_1 \\ \vdots \\ \beta_{10} \\ \alpha_1 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \vdots \\ \varepsilon_{10} \end{bmatrix} = X\beta + \varepsilon \tag{3.6}$$

Where R_i , R_m , Z_i and ε_i are (T x 1) vectors of $(R_{pt}-R_{ft})$, $(R_{mt}-R_{ft})$, $\ln Z_{pt}$ and ε_{pt} respectively, and i_T and 0_T are (T x 1) vectors of ones and zeros. The stacked 10 equation system, will consist of, y a (PT x 1) vector, X a (PT x 12) matrix, β a (12 x 1) vector of unknown coefficients, and ε a (PT x 1) random error vector with the characteristics

$$\varepsilon \sim N(0, \Sigma)$$

Where the estimated covariance matrix $\hat{\Sigma}$ is given by

$$\hat{\Sigma} = \begin{bmatrix} \hat{\sigma}_{11}I_T & \hat{\sigma}_{12}I_T & \cdots & \hat{\sigma}_{110}I_T \\ \hat{\sigma}_{21}I_T & \hat{\sigma}_{22}I_T & \cdots & \hat{\sigma}_{210}I_T \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \hat{\sigma}_{101}I_T & \hat{\sigma}_{102}I_T & \cdots & \hat{\sigma}_{1010}I_T \end{bmatrix} = \frac{1}{T} \begin{bmatrix} \hat{\varepsilon}_1'\hat{\varepsilon}_1 I_T & \hat{\varepsilon}_1'\hat{\varepsilon}_2 I_T & \cdots & \hat{\varepsilon}_1'\hat{\varepsilon}_{10} I_T \\ \hat{\varepsilon}_2'\hat{\varepsilon}_1 I_T & \hat{\varepsilon}_2'\hat{\varepsilon}_2 I_T & \cdots & \hat{\varepsilon}_2'\hat{\varepsilon}_{10} I_T \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \hat{\varepsilon}_{10}'\hat{\varepsilon}_1 I_T & \hat{\varepsilon}_{10}'\hat{\varepsilon}_2 I_T & \cdots & \hat{\varepsilon}_{10}'\hat{\varepsilon}_{10} I_T \end{bmatrix} \tag{3.7}$$

Where use is made of the least squares residuals $\hat{\varepsilon}_1$, $\hat{\varepsilon}_2,\ldots,\hat{\varepsilon}_{10}$ for the individual portfolio equations. The estimated generalized least squares estimator is,

$$\hat{\hat{\beta}} = (X'\Sigma^{-1}X)^{-1}X'\Sigma^{-1}y$$

with covariance matrix,

$$\mathrm{cov}(\hat{\hat{\beta}}) = (X'\Sigma^{-1}X)^{-1}$$

Notice that contemporary correlation across portfolio errors is assumed although there is no time serial correlation.

3.4. Conclusions

In empirical finance the quality of data set (in terms of sample period and number of companies) is very important in the analysis of the behaviour of stock returns. Focusing on the period July 1975 to June 1996, this thesis studies the behaviour of stock returns for the U.K. stock market using a large and updated data set (1,420 firms) that has not been previously used for such a purpose. The use of such a broad data set provides a unique opportunity for this analysis.

We employ three methodologies in our empirical analysis of the relationship between average stock returns and firm-specific variables; the portfolio grouping approach, the cross-sectional regressions approach and the seemingly unrelated regressions approach. The most widely used methodology is the cross-sectional regressions as it can easily be modified to accommodate additional risk measures beyond the market beta. In order to investigate that the results are not sensitive to the choice of the methodology is used; we apply the seemingly unrelated regressions approach as an alternative to the cross-sectional regressions approach. Such a comparison is discussed in chapter 7. In the next four chapters, we will report the results of this empirical work.

Chapter 4

Tobin's q: Its Relation to Cross-Sectional Returns...

4.1. Introduction

As was mentioned in chapter 2, since the Fama and French (1992) study, considerable empirical evidence has been generated suggesting that a number of firm-specific variables have more explanatory power for the cross-section of average stock returns than do traditional measures of risk, such as market beta. However, there is no consensus view on the reasons for the predictive ability of these variables (see subsection 2.2.4). This issue motivates what we do in this chapter. Thus, our motivation for using the Tobin's q, for the first time in this literature, as an additional variable in explaining the cross-section of average stock returns is the lack of theoretical rationale of the predictive ability of the firm-specific variables. We chose the Tobin's q as an explanatory variable because it is underpinned by a theory which allows us to suggest that it is a proxy for more fundamental sources of risk (see section 4.5). A low Tobin's q suggests riskier firms require higher expected returns[1] as is explained in section 4.5, so that stocks with a smaller Tobin's q ratio yield a higher average return.

The purpose of this chapter is three fold. First, it is to investigate the ability of Tobin's q to predict stock returns. The empirical results of this study suggest that Tobin's q does indeed have explanatory power. Second, it is to exam the interaction between Tobin's q with the book to market equity, the market value of equity (since, these two variables have emerged as the two prominent variables that are significantly related to stock returns) and the market beta. The final contribution of the chapter is to explore possible explanations of the Tobin's q predictive ability. We believe that identifying and investigating the explanations for the Tobin's q

[1] Of course, there are some risky firms with high Tobin's q values (e.g. Amazon.com). Current thing is that high market valuation give to Hi-Tech companies is because of embedded real options (clearly it is not due to low risk).

ability to predict returns could deepen our understanding of the economic reasons for the risk premia associated with the firm-specific variables. Thus, the Tobin's q will provide an additional perspective on the predictive ability of the firm-specific variables.

The remainder of this chapter is organised as follows. In Section 4.2, we discuss the theory of Tobin's q. The estimation of Tobin's q is provided in Section 4.3. Section 4.4 contains our results from both one-way and two-way classification by financial attributes of each firm and the results from regression models. Section 4.5 provides economic interpretation of the Tobin's q predictive ability. Section 4.6 offers conclusions.

4.2. The Theory of Tobin's q

Tobin (1969) originally introduced the Tobin's q ratio (the ratio of the market value of the firm to the replacement costs of its assets) in an attempt to explain aggregate investment[2] behaviour in the economy. He argued that if Tobin's q exceeded unity, firms would have an incentive to invest, since the value of their new capital investment would exceed its cost. They would stop investing only when q is less than unity since the value of their new capital investment is worth less than its replacement cost. Indeed, when Tobin's q is less than 1, it may be cheaper to acquire assets through mergers rather than through buying new assets. In theory, investment should react to marginal q (the ratio of the market value of an additional unit of capital to its replacement cost). Unfortunately, as noted by several researchers (see, for example, Hayashi (1982) and Galeotti (1988)) the observability of marginal q is not feasible because there is no way to distinguish between changes in a firm's

[2] Empirical tests of the Tobin's q model of investment using aggregate time-series data include, for example, von Furstenberg (1977), Summers (1981), Hayashi (1982), Poterba and Summers (1983) and Poret and Torres (1989). While, empirical tests using panel data on companies include, for example,

market value due to incremental assets and market value changes due to existing assets. Thus, the empirical work with Tobin's q has relied on average q (the ratio of the market value of existing capital to its replacement cost), which is observable. Hayashi (1982) has shown that if the firm is a price-taker with constant returns to scale in both production and installation, then marginal q is equal to average q. Tobin and Brainard (1977, p.243) have argued that "we can expect that the same factors which raise or lower q on the margin likewise raise or lower q on average".

Furthermore, Tobin's q has important applications outside of the investment literature. For example, it has gained broad acceptance as a measure of firm performance because it provides an insight into the relative value of a firm's intangible assets, such as market power in the product market, high quality managers, goodwill and growth opportunities, where the value is assumed to reflect the results of performance.

There are some interesting empirical studies which use Tobin's q. These include Lindenberg and Ross (1981), who examine the industry structure-performance relationship; Chen, Cheng and Hite (1986), who investigate the relationship between market power and systematic risk; Morck, Shleifer and Vishny (1988), who examine the relation between management's ownership in a firm and Tobin's q (which is the proxy for the market valuation of the firm's assets); Lang and Litzenberger (1989), who attempt to distinguish empirically between the cash flow signalling and overinvestment hypothesis by using Tobin's q, and Lang, Stulz and Walkling (1989), who use Tobin's q to investigate the cross-sectional variation of bidder and target abnormal returns from successful tender offers. They find that the best take-overs, in terms of value creation, are those where a high q firm takes over a low q firm. In

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Chappell and Cheng (1982), Salinger and Summers (1983), Fazzari, Hubbard and Petersen (1988), Schaller (1990), Hayashi and Inoue (1991) and Blundell, Bond, Devereux and Schiantarelli (1992).

addition, McConnell and Servaes (1990) also use Tobin's q to further investigate the relation between equity ownership and firm value. Other empirical studies which use the Tobin's q are listed in Table 4.1.

4.3. The Estimation of Tobin's q

We follow the method used in Chung and Pruitt (1994), who build on Lindenberg and Ross (1981) (hereafter LR) Model (see Appendix A for the estimation of this model), to compute Tobin's q for the firms in our sample. The Tobin's q is defined[3] as follows:

$$\text{Tobin's q} = \frac{\text{Comval} + \text{Prefval} + \text{Debt}}{\text{TA}}$$

where,

Comval = the year-end market value of the firm's common stock;
Prefval = the year-end book value of the firm's preferred stock;
Debt = the year-end book value of the firm's debt; and
TA = the firm's year-end book value of total assets.

The formula implicitly assumes that the book and market values of debt are identical, and that the accounting values of the firm's total assets correspond to their replacement values. However, Chung and Pruitt (1994) find that 96.6% of the total variability in the LR values of q is explained by their estimation. Similarly, Perfect and Wiles (1994) find that the correlation coefficients between the LR method and the above estimation of Tobin's q is 0.931. Amit, Livnat, and Zarowin (1989) report that the above estimation and Tobin's q are highly correlated and that in their empirical tests the above estimation of Tobin's q is a good proxy for q. We adopt the Chung and Pruitt measure of Tobin's q because of these high correlations, and to maximise the availability of data.

[3] We define Tobin's q as in Billett, Flannery and Garfinkel (1995), Agrawal and Knoeber (1996) and Nohel and Tarhan (1998) among others.

Table 4.1. Empirical Studies which have Employed the Tobin's q

Industry Structure-Performance Relationship:
- Lindenberg and Ross (1981)
- Smirlock, Gilligan and Marshall (1984)
- Hirschey (1985)

The Impact of Taxes on Investment Decisions:
- Salinger and Summers (1983)

The Relationship between Managerial Performance and Tender Offer Gains:
- Chappell and Cheng (1984)
- Hasbrouck (1985)
- Lang, Stulz and Walkling (1989); (1991)
- Servaes (1991)

Market Power-Systematic Risk Relationship:
- Chen, Cheng and Hite (1986)
- Lee, Liaw and Rahman(1990)
- Sun (1993)
- Peyser (1994)
- Lee, Chen and Liaw (1995)
- Wong (1995)

The Relation between Management Ownership Structure and Corporate Value:
- Morck, Shleifer and Vishny (1988)
- McConnell and Servaes (1990)
- Chen, Hexter and Hu (1993)

The Impact of the Announcement of Dividend Changes on Market Value:
- Lang and Litzenberger (1989)
- Howe, He and Kao (1992)
- Denis, Denis and Sarin (1994)
- Perfect, Petersen and Petersen (1995)
- Yoon and Starks (1995)

The Role of Boards of Directors in Disciplining Senior Management:
- Morck, Shleifer and Vishny (1989)

The Agency-Cost Motivations for Recapitalizations and Leveraged Buyouts:
- Lehn, Netter and Poulsen (1990)

The Payoff from Sophisticated Capital Budgeting Techniques:
- Myers, Gordon and Hamer (1991)

Management's Financial Reporting Decisions:
- Skinner (1993)

Board Size and Firm Value:
- Yermack (1996)

The Benefits-or Lack Thereof-of Corporate Diversification:
- Lang and Stulz (1994)

4.4. Empirical Results

In the previous two sections we have discussed the theory and the estimation of Tobins's q. In this section we will investigate the ability of the Tobin's q to predict stock returns and the interaction between the Tobin's q with the book to market equity, market value of equity and market beta. The empirical analysis presents both descriptive statistics and formal test results. The first subsection presents summary statistics for the stocks in the sample, sorted into deciles by each of the variables. The second subsection presents the portfolio statistics, when 25 portfolios are formed by the two-way classification scheme by market value and pre-ranking β. In the third subsection a Fama-MacBeth cross-sectional regression results is presented and the last subsection shows the seasonal behaviour of the premiums of the variables.

4.4.1. Return Behaviour of One-Dimensional Classified Portfolios

Table 4.2 shows properties when 10 portfolios are formed every year based on pre-ranking β (Panel A), Tobin's q (Panel B), market value of equity (Panel C) and book to market equity (Panel D). The returns shown in Table 4.2 are the time-series average of 192 monthly, equal-weighted portfolio returns from July 1980 to June 1996, in percent terms. β is the full-period, post-ranking equally-weighted portfolio β, estimated using monthly data from July 1980 to June 1996.

In Panel A of Table 4.2, we can see that there is no obvious relationship between average returns and pre-ranking βs. Similarly, there is no clear relation between pre-ranking β and both market value and book to market value. However, the highest β decile gives the highest average return and smallest market value. The second column shows that the post-ranking βs reproduce the ordering of the pre-ranking βs.

Column one shows the negative relationship between Tobin's q and pre-ranking βs (see also Figure 4.1A).

From the second panel formed on Tobin's q in Table 4.2 we can see the negative relationship between Tobin's q and average returns. The smallest Tobin's q ratio portfolio earns 2.77% per month while the largest Tobin's q ratio portfolio earns 1.24% per month. The Tobin's q variable generates a return differential of 1.53% each month (18.36% on an annualised basis) between these extreme portfolios. We will refer to this as a Tobin's q effect. We also find that the market value increases with the Tobin's q and both β and book to market value decrease with Tobin's q, leading us to believe that Tobin's q is related to β, market value and book to market value (see also Figure 4.1B).

In Panel C of Table 4.2, when portfolios are formed on market value alone we can see a strong negative relationship between market value and average returns, commonly referred to as the size effect. Average returns fall from 3.32% for small-ME portfolio to 1.56% for large-ME portfolio, a difference of 1.76% per month (21.12% on an annualised basis). There is a strong positive relationship between post-ranking β, book to market value and average returns. Note that the portfolio βs decline with increasing market value (almost perfectly correlated), from 1.28 for small-ME portfolio to 0.60 for large-ME portfolio. The relationship between Tobin's q and average returns is consistent with the results in Panel B (see also Figure 4.1C).

Panel D of Table 4.2 reports the positive relationship between book to market value and average returns. The smallest BE/ME portfolio earns 1.09% per month while the largest BE/ME portfolio earns 2.66% per month. The BE/ME variable generates a return differential of 1.57% each month (18.84% on an annualised basis) between these extreme portfolios. The results in this Panel also reveal the negative relationship between BE/ME and q and ME (see also Figure 4.1D).

In addition to documenting a relationship between firm specific variables and stock returns, careful inspection of Table 4.2 also indicates that there are correlations among the variables. The correlations between these variables indicate that β, BE/ME, A/ME, E/P, CF/P, DY, S/P and D/E have positive relationships with each other and negative relationships[4] with q and ME. It is not surprising to find high correlation among these variables, since each is a scaled version of price. These relationships are confirmed by examining the average cross-sectional correlations between the variables. Table 4.3 reports these correlations between the variables that we use in our analysis in this chapter and in the next two chapters. The largest correlations are between q and A/ME, D/E, S/P and BE/ME, BE/ME and A/ME, D/E and S/P, A/ME and D/E and S/P, and S/P and D/E. The other correlations are smaller than 0.50 in absolute value. Therefore, a multivariate analysis is required to disentangle the impact of the various firm specific variables on stock returns (see subsection 4.3.3).

The negative correlations between q and D/E and A/ME (see Table 4.2 Panel B and Table 4.3), which clearly has a direct impact on the riskiness of a company's stock, suggests that Tobin's q may be affected by risk effects. Similarly, the negative correlation between ME and D/E and A/ME (see Table 4.2 Panel C and Table 4.3) and the positive correlation between BE/ME and D/E and A/ME (see Table 4.2 Panel D and Table 4.3) support the supposition of Fama and French (1992) that those two variables are proxies of a company's risk.

[4] Tobin's q is a function of book to market equity and leverage, and there is a high correlation among all three of these.

In summary, with this one-dimensional classification scheme, we find that the post-ranking βs reproduce the ordering of the pre-ranking βs, i.e. a negative relationship between average returns and market value, a strong negative relationship between average returns and Tobin's q and a strong positive relationship between average returns and book to market value. Since βs of market value portfolios are perfectly correlated with market value, we can further rank portfolios by a two-dimensional classification scheme and analyse this sample further.

4.4.2. Return Behaviour of Two-Dimensional Classified Portfolios

In order to allow for variation in post-ranking βs that is unrelated to size, since βs of market value portfolios are perfectly correlated with market value, 25 portfolios are formed by the two-way classification scheme by market value and pre-ranking β. Average monthly returns are shown in Panel A of Table 4.4, average market value in Panel B of Table 4.4 and post-ranking βs in Panel C of Table 4.4 (see Figure 4.2).

Panel A of Table 4.4 shows that smaller market value portfolios generally produce higher average monthly returns. The pre-ranking β sort produces no obvious relation between β and average returns. In Panel B of Table 4.4, it is clear that the pre-ranking β sort is not a refined market value sort. So that, in any market value quintile, the average market values are similar across the pre-ranking β sorted portfolios.

Panel C of Table 4.4 shows that forming portfolios on market value and pre-ranking βs rather than on market value alone produces wide variation in post-ranking βs. It was our original intention to produce 25 two-way classification portfolios. Let us investigate whether we have succeeded in producing them. From Panel C in Table

Table 4.2. Properties of Portfolios Formed on Pre-Ranking β or Tobin's q or Market Value of Equity or Book to Market Equity: July 1980 to June 1996

In each panel the stocks are grouped in to 10 portfolios by a different variable, and the grouping procedure is repeated every year at the end of June. The Tobin's q (q), the book to market equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY), the sales to price (S/P) and the book value of debt to market value of equity (D/E) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P is the earnings to price ratio including only firms with positive earnings. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P is the cash flow to price ratio including only firms with positive cash flow. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. Pre-ranking β is estimated using 24-60 monthly observations over the five year period ending June of year t. The estimation of the post-ranking beta (β) is described in detail in the text. Returns is the time-series average of 192 monthly, equal-weighted portfolio returns, in percent terms. β is the time-series average of the full-period, post-ranking equally-weighted portfolio beta, estimated using monthly returns. q, lnME, BE/ME, lnA/ME, lnA/BE, E(+)/P, CF(+)/P, DY, lnS/P, and lnD/E are the time-series average of the annual values of these variables in each portfolio. E/P(D) and CF/P(D) gives the average proportion of stocks with negative earnings and negative cash flow in each portfolio respectively. The prefix ln(.) denotes that the variable is used in natural logarithm form. N denotes the average number of securities in each portfolio.

Panel A: Portfolios Formed on Pre-Ranking β

	Ret %	β	q	lnME	BE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-β	1.82	0.96	1.05	2.98	1.00	0.43	0.82	0.09	0.12	0.16	0.08	4.49	0.68	-0.27	81
β-2	1.84	0.86	0.99	3.70	1.00	0.40	0.74	0.10	0.07	0.16	0.04	4.89	0.64	-0.37	81
β-3	1.70	0.78	0.96	3.77	1.04	0.45	0.75	0.10	0.06	0.17	0.04	5.05	0.70	-0.31	81
β-4	1.81	0.78	0.97	3.77	1.04	0.44	0.76	0.10	0.07	0.17	0.05	5.15	0.71	-0.30	81
β-5	1.76	0.80	0.92	3.69	1.09	0.49	0.76	0.10	0.07	0.17	0.04	5.29	0.77	-0.25	81
β-6	1.93	0.86	0.94	3.49	1.04	0.48	0.77	0.10	0.08	0.17	0.05	5.35	0.76	-0.24	81
β-7	1.94	0.93	0.88	3.33	1.12	0.56	0.79	0.10	0.10	0.18	0.06	5.09	0.84	-0.16	81
β-8	1.79	1.02	0.86	3.13	1.23	0.64	0.81	0.10	0.11	0.18	0.07	5.05	0.92	-0.05	81
β-9	1.92	1.14	0.87	2.77	1.24	0.67	0.84	0.10	0.16	0.18	0.10	4.76	0.93	-0.01	81
Large-β	2.10	1.32	0.91	2.35	1.27	0.69	0.95	0.08	0.24	0.17	0.14	3.84	0.95	0.06	80

Table 4.2. Continued

Panel B: Portfolios Formed on Tobin's q

	Ret %	β	q	lnME	BE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-q	2.77	1.15	0.25	1.69	2.91	1.78	0.97	0.15	0.33	0.23	0.20	5.09	2.17	1.20	81
q-2	2.35	1.07	0.40	2.33	1.74	1.26	0.88	0.11	0.20	0.22	0.11	6.09	1.59	0.62	81
q-3	2.15	1.01	0.50	2.76	1.40	1.02	0.84	0.10	0.14	0.20	0.08	5.99	1.30	0.35	81
q-4	2.04	0.97	0.59	3.07	1.21	0.84	0.82	0.10	0.10	0.20	0.06	5.79	1.06	0.15	81
q-5	1.83	0.92	0.68	3.43	1.00	0.64	0.78	0.10	0.08	0.18	0.05	5.60	0.85	-0.09	81
q-6	1.73	0.90	0.79	3.60	0.84	0.46	0.78	0.10	0.06	0.17	0.03	5.27	0.70	-0.28	81
q-7	1.76	0.88	0.92	3.76	0.71	0.27	0.76	0.09	0.04	0.16	0.03	4.83	0.53	-0.47	81
q-8	1.41	0.85	1.12	3.97	0.57	0.05	0.74	0.08	0.03	0.14	0.02	4.27	0.29	-0.72	81
q-9	1.31	0.85	1.45	4.08	0.43	-0.25	0.72	0.07	0.03	0.12	0.02	3.56	-0.01	-1.04	81
Large-q	1.24	0.83	2.67	4.21	0.25	-0.85	0.70	0.05	0.06	0.09	0.04	2.44	-0.63	-1.66	80

Panel C: Portfolios Formed on Market Value of Equity

	Ret %	β	q	lnME	BE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-ME	3.32	1.28	0.58	0.46	1.87	1.06	0.83	0.09	0.33	0.16	0.23	3.90	1.40	0.32	81
ME-2	2.21	1.26	0.65	1.32	1.54	0.88	0.82	0.10	0.22	0.18	0.14	5.12	1.20	0.16	81
ME-3	2.02	1.14	0.73	1.87	1.35	0.76	0.81	0.11	0.17	0.19	0.09	5.17	1.06	0.05	81
ME-4	1.54	1.10	0.82	2.36	1.15	0.62	0.80	0.10	0.12	0.18	0.07	5.33	0.95	-0.09	81
ME-5	1.77	0.96	0.93	2.84	1.09	0.52	0.80	0.10	0.09	0.18	0.05	5.38	0.82	-0.19	81
ME-6	1.60	0.94	1.02	3.32	0.94	0.39	0.77	0.09	0.07	0.17	0.04	5.04	0.64	-0.33	81
ME-7	1.51	0.78	1.11	3.86	0.82	0.28	0.79	0.09	0.04	0.17	0.02	4.85	0.54	-0.42	81
ME-8	1.47	0.77	1.17	4.51	0.85	0.25	0.78	0.09	0.03	0.15	0.02	4.62	0.42	-0.47	81
ME-9	1.60	0.62	1.19	5.43	0.74	0.21	0.78	0.09	0.02	0.16	0.01	4.75	0.42	-0.50	81
Large-ME	1.56	0.60	1.14	7.02	0.72	0.25	0.81	0.09	0.01	0.16	0.00	4.81	0.42	-0.43	80

Table 4.2. Continued

Panel D: Portfolios Formed on Book to Market Value of Equity

	Ret %	β	q	lnME	BE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
S-BE/ME	1.09	0.87	2.38	4.07	0.21	-0.64	1.05	0.05	0.09	0.10	0.05	2.57	-0.27	-1.20	81
BE/ME-2	1.43	0.86	1.46	3.96	0.38	-0.18	0.87	0.07	0.05	0.13	0.03	3.48	0.14	-0.83	81
BE/ME-3	1.53	0.89	1.11	3.71	0.52	0.09	0.84	0.08	0.04	0.14	0.03	4.23	0.42	-0.57	81
BE/ME-4	1.70	0.89	0.96	3.69	0.65	0.26	0.78	0.09	0.05	0.16	0.03	4.82	0.56	-0.46	81
BE/ME-5	1.77	0.89	0.82	3.70	0.79	0.43	0.76	0.10	0.05	0.17	0.03	5.23	0.70	-0.28	81
BE/ME-6	1.75	0.92	0.71	3.47	0.93	0.59	0.75	0.10	0.07	0.18	0.05	5.58	0.86	-0.14	81
BE/ME-7	1.82	0.96	0.61	3.16	1.12	0.78	0.75	0.11	0.09	0.19	0.06	5.90	1.02	0.03	81
BE/ME-8	2.32	1.01	0.53	2.76	1.37	0.96	0.73	0.11	0.13	0.20	0.07	5.84	1.17	0.17	81
BE/ME-9	2.44	1.05	0.44	2.46	1.76	1.21	0.74	0.10	0.21	0.21	0.12	6.03	1.42	0.43	81
L-BE/ME	2.66	1.12	0.32	1.88	3.39	1.75	0.72	0.15	0.30	0.21	0.18	5.26	1.88	0.96	80

Table 4.3. Average Cross-Sectional Correlation Coefficients of the Explanatory Variables: 1980 to 1995

The Tobin's q (q), the book to market equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY), the sales to price (S/P) and the book value of debt to market value of equity (D/E) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P is the earnings to price ratio including only firms with positive earnings. CF(+)/P is the cash flow to price ratio including only firms with positive cash flows. The estimation of the post-ranking beta (β) is described in detail in the text. Each average correlation coefficient is the time-series average of the yearly cross-sectional correlation coefficients between the explanatory variables. The prefix ln(.) denotes that the variable is used in natural logarithm form.

	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E/P	E(+)/P	CF/P	CF(+)/P	DY	lnS/P
q	-0.239											
ME	-0.321	0.388										
BE/ME	0.253	-0.803	-0.323									
A/ME	0.263	-0.954	-0.331	0.860								
A/BE	0.099	-0.193	-0.023	-0.222	0.288							
E/P	-0.138	0.018	0.130	0.024	-0.063	-0.182						
E(+)/P	0.146	-0.494	-0.176	0.489	0.504	0.005	------					
CF/P	-0.051	-0.147	0.052	0.125	0.141	0.050	0.324	0.359				
CF(+)/P	0.159	-0.456	-0.162	0.381	0.479	0.199	0.359	0.359	------			
DY	-0.078	-0.287	0.025	0.292	0.262	-0.052	0.239	0.250	0.168	0.224		
S/P	0.241	-0.814	-0.330	0.632	0.821	0.384	-0.023	0.463	0.175	0.456	0.281	
D/E	0.244	-0.858	-0.264	0.642	0.926	0.567	-0.084	0.431	0.147	0.475	0.227	0.839

Table 4.4. Portfolios Formed on Market Value of Equity and then on Pre-Ranking β: July 1980 to June 1996

In each panel the stocks are first sorted into five size portfolios based on market value of equity (lnME). Within each size portfolio, firms are sorted into five portfolios based on pre-ranking β to form 25 size-pre-ranking β portfolios. The monthly equal-weighted returns on each of these portfolios for the next 12 calendar months (July t to June t+1) are then computed. This grouping procedure is repeated every year at the end of June from 1980 to 1995. Pre-ranking β is estimated using 24-60 monthly observations over the five year period ending June of year t. Market value of equity is measured by the natural log (lnME) at the end of June of year t which is denominated in millions of pounds. Returns is the time-series average of 192 monthly, equal-weighted portfolio returns, in percent terms. lnME is the time-series average of the annual values of the market value in each portfolio. Post-ranking β is the time-series average of the full-period, post-ranking equally-weighted portfolio β, estimated using monthly returns.

Panel A: Average Monthly Returns (in Percent)

	Low-β	β-2	β-3	β-4	High-β
Small-ME	1.48	1.26	1.55	1.20	1.40
ME-2	1.01	1.04	1.26	0.83	1.15
ME-3	0.46	1.24	1.06	1.15	0.62
ME-4	0.73	1.12	1.05	0.97	0.63
Large-ME	1.02	1.14	1.17	1.04	0.60

Panel B: Average Market Value (lnME)

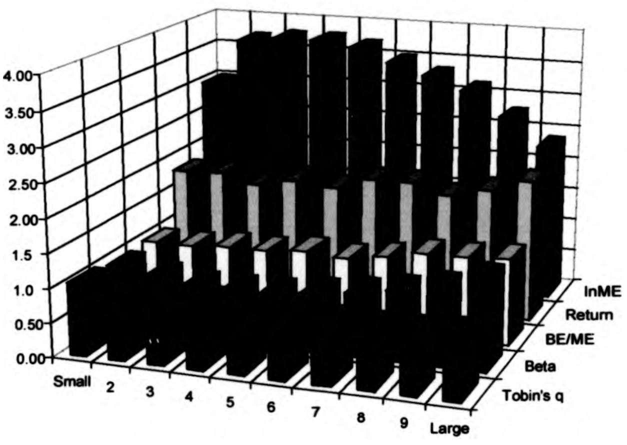
	Low-β	β-2	β-3	β-4	High-β
Small-ME	1.21	1.18	1.23	1.22	1.12
ME-2	2.34	2.35	2.35	2.32	2.31
ME-3	3.28	3.31	3.28	3.28	3.25
ME-4	4.38	4.42	4.41	4.40	4.44
Large-ME	7.10	7.15	6.95	7.12	6.88

Panel C: Full-Period Post-Ranking βs

	Low-β	β-2	β-3	β-4	High-β
Small-ME	1.23	1.02	1.31	1.23	1.58
ME-2	1.01	0.98	0.93	1.17	1.54
ME-3	1.00	0.81	0.83	1.08	1.11
ME-4	0.80	0.69	0.66	0.80	0.92
Large-ME	0.58	0.55	0.59	0.56	0.78

Figure 4.1. Properties of Portfolios Formed on Pre-Ranking Beta, Tobin's q, Market Value of Equity and Book to Market Equity

A: Portfolios Formed on Pre-Ranking Beta



B: Portfolios Formed on Tobin's q

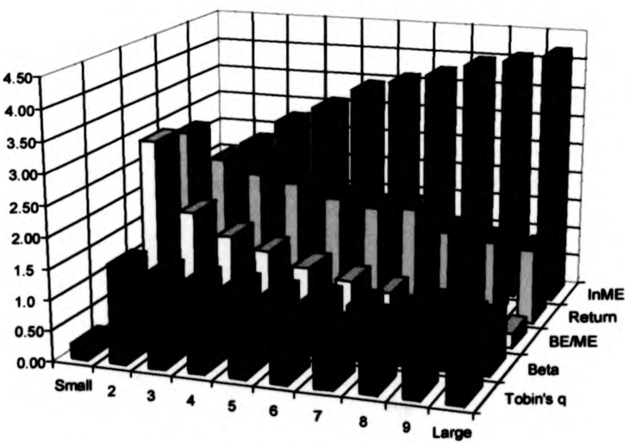
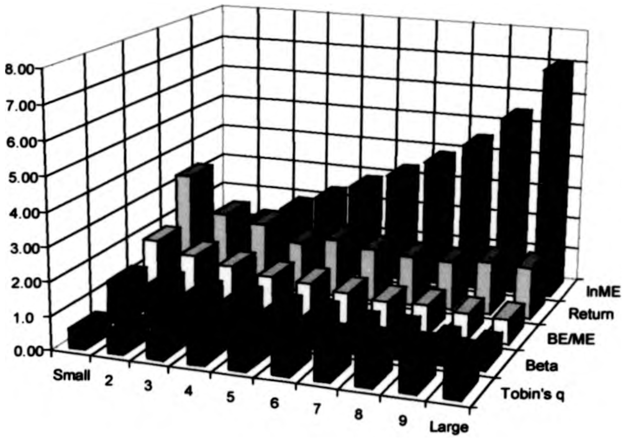


Figure 4.1. Continued



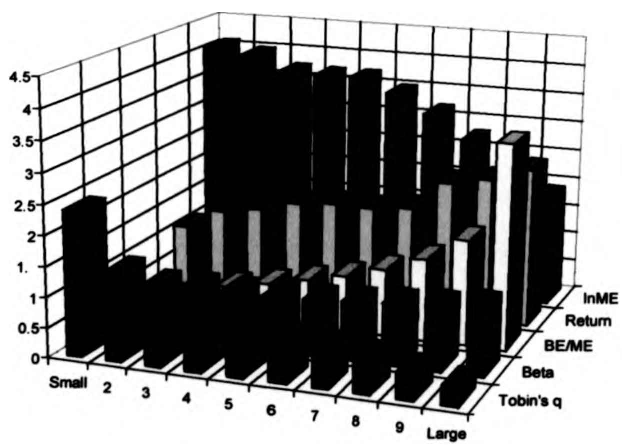
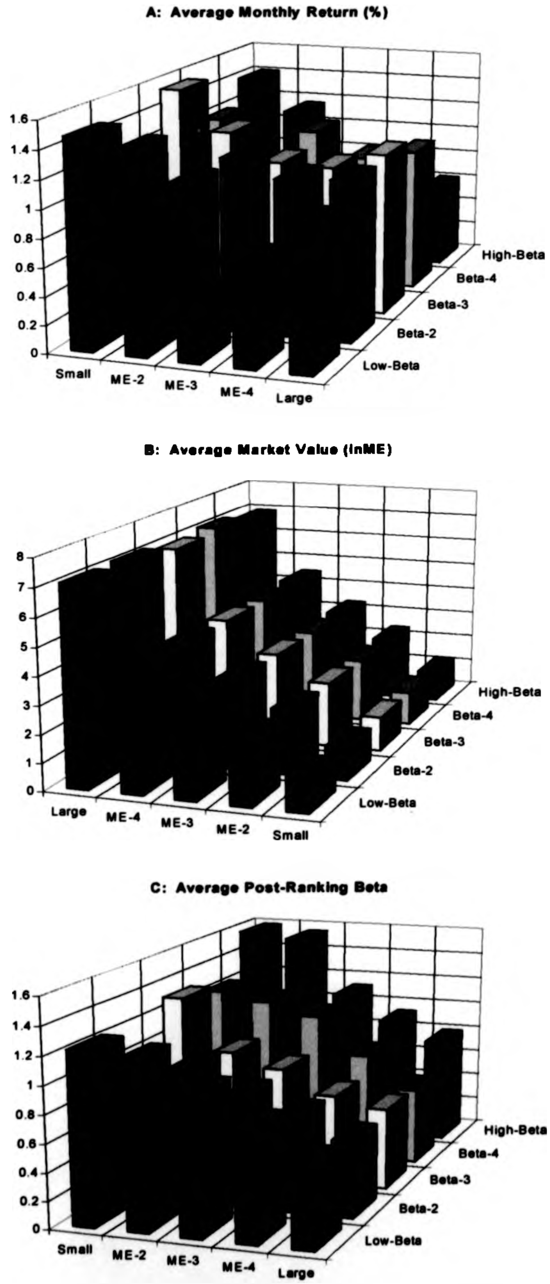


Figure 4.2. Portfolios Formed on Market Value of Equity and then on Pre-Ranking Beta



4.2, sorted on market value alone, the variation in post-ranking βs is from 0.60 to 1.28 (spread 0.68). Across all 25 two-way classification portfolios, the variation in post-ranking βs ranges from 0.55 to 1.58 (spread 1.03), a spread of 1.5 times that produced with market value portfolios alone.

In summary, with this two-dimensional classification scheme, we find that the pre-ranking β sort produces strong variation in post-ranking βs that is unrelated to market value and that market value was strongly related to average returns while this was not obvious for β.

4.4.3. Fama-MacBeth Cross-Sectional Regressions

From the informal analysis of the data in the previous subsections, we find that Tobin's q, market value of equity and book to market equity are strongly related to average returns, while the relationship between β and average returns is not obvious. To confirm this, we run the month-by-month Fama-MacBeth regressions of the cross-section of stock returns on β, Tobin's q, market value of equity and book to market equity. Table 4.5 presents the results for these regressions at the individual security level. The Table shows the average coefficients from 192 monthly (July 1980 to June 1996) cross-sectional regressions of stock returns on various combination of those variables. The figure in parenthesis is the t-statistic which is the average slope divided by its time-series standard error.

The first four models are the univariate regressions on β, Tobin's q, market value of equity and book to market equity. When β is the only explanatory variable, the relationship between average returns and β is significant, with a t-statistic of 2.75, indicating that β has the power to explain average returns. This result contrasts with the insignificant positive coefficient found by Fama and French (1992) for the period 1963 to 1990 in the US, and is similar to the results of a study by Strong and Xu (1997) for the period 1973 to 1992 in the UK. However, when Tobin's q, market value of equity and book to market equity are included in the regressions as the control variables (model E, F and G), the coefficient of β has no explanatory power and eventually changes its sign, except in model E and G where its sign remains positive.

Model B of Table 4.5 confirms the importance of Tobin's q in describing the cross-sectional differences in average returns. The average slope from the monthly regressions of returns on Tobin's q alone is -0.65%, with a t-statistic of -6.25. The Tobin's q does not replace market value of equity in describing average returns (Model H). However, when both Tobin's q and book to market equity are included in the regressions (Model I and K), Tobin's q absorbs the role of the book to market equity in explaining stock returns. The Tobin's q effect (stocks with a smaller Tobin's q yield a higher average return) is thus robust in the July 1980 to June 1996 returns on U.K. stocks.

Model C of Table 4.5 shows that the market value of equity has a significant negative coefficient of -0.20%, with a t-statistic -3.46. This significant negative correlation remains when other explanatory variables are incorporated into the regression (Model F, H, J and K). This result is consistent with the size effect. The fourth model in the table is a regression of returns on a book to market equity. We find a significant positive relation between returns and book to market equity. This positive relation continues to be significant after adding market value to the regression (Model J). However, the statistical significance of the book to market equity disappears when

Tobin's q is included in the regressions (Model I and K). Our results confirm that tests on non-US data produce relations between average returns and variables like market value of equity and book to market equity much like those observed in U.S. data (e.g., Fama and French (1992)). This allows us to reject the hypothesis that this relation is a result of collective data-snooping.

As discussed in section 3.3.2 the t-tests obtained from the Fama-MacBeth procedure implicitly assume that the time series of estimated monthly coefficients are normal and independently distributed. We bootstrap the distribution of the time series monthly coefficients in order to investigate that deviations from normality will have an important effect on the calculated significance levels. However, bootstrap simulations indicate that any possible deviations from normality do not have an important effect on the calculated significance levels. Another concern over the use of the t-tests, as was mentioned in section 3.3.2, is that they are potentially sensitive to serial dependence of the time series of monthly coefficients, so we recompute the t-tests using the Newey-West correction. However, the above results is unaffected by the Newey-West adjustments for serial correlation in the time series of estimated coefficients, as in Kothari, Shanken and Sloan (1995). In addition, we reach similar results (not shown) when we use the above alternative testing procedures in the other chapters.

In order to investigate that the inferences of the firm-specific variables in cross-section regressions (Table 4.5) are not a product of the use of the estimated market beta (in the second-pass) as an independent regressor, an alternative methodology, a seemingly unrelated regression (SUR), is used. Since, true β is unobservable an estimated value must be used, which imposes an errors in variables bias on the other variables included in the cross-section regressions. However, this problem has been alleviated by employing portfolios of returns as we have did (see, subsection 3.3.2.1). The results using the SUR methodology are qualitatively similar to results reported in Table 4.5. Thus, we can conclude that the use of the estimated β as an independent regressor does not affect the inferences of the other variables included in the cross-section regressions.

Table 4.6 reports the results of the empirical analysis for two equal subperiods: subperiod one from July 1980 to June 1988 (Panel A) and subperiod two from July 1988 to June 1996 (Panel B). The sign of the coefficients in subperiod one remain the same as those in the Table 4.5 which presents the results for the full sample period, except in two cases (Model I and K) where the coefficients of book to market equity became negative. However, in subperiod two, the results yield different conclusions to those for the full sample period. The sign of the coefficients remain the same as those in the Table 4.5 except in two cases (Model I and K) where the coefficients of Tobin's q become positive, but not significant. In subperiod two all the coefficients for both β and market value of equity are insignificant, in contrast to the coefficients for both Tobin's q and book to market equity which are significant except in two cases (Model I and K) where the coefficients of Tobin's q become insignificant.

Table 4.7 shows results from the yearly cross-sectional OLS regressions at the individual stock level. We follow the same procedure that we used to construct Table 4.5. The only difference is that here we use yearly stock returns instead of monthly stock returns. A serious problem can be created by the fact that the coefficients and the t-statistics are based on 16 observations. This bases the interpretation of the coefficients on the small sample properties of the time-series t-statistics. Moving to annual regressions does not affect the signs of the coefficients only the t-statistics, which in two cases become insignificant (Model A and K).

4.4.4. Seasonal variation

A growing number of empirical studies have documented unusual price behaviour in the month of January. In studying the impact of firm-specific variables on stock returns, it is therefore of interest to examine January separately from other months. Keim (1983), who first documented the January effect, shows that the size effect is stronger in January. Tinic and West (1984) report that the return premium of β is also higher in January and not statistically significant in non-January months. Keim (1988b) reports a strong January seasonal book to market equity effect for NYSE firms over the 1964 to 1982 period.

Table 4.8 presents average regression coefficients separately for January and non-January months. Focusing on the univariate regressions, we can see that the coefficient for β and market value are significant only in non-January while that for both Tobin's q and book to market equity are significant in both January and non-January months. The average January slopes for both Tobin's q and book to market equity are essentially larger than during the rest of the year. However, the strong relationship between average stock returns and Tobin's q and book to market equity are not a phenomenon specific to the month of January, with higher t-values in non-January months.

Table 4.5. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β, Tobin's q, Market Value of Equity and Book to Market Equity: July 1980 to June 1996

The Tobin's q (lnq) and book to market equity (lnBE/ME) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (lnME) is measured in June of Year t. The estimation of the post-ranking beta (β) is described in detail in the text. The average slope (in percent) is the time-series average of the monthly regression slopes for July 1980 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln q_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{i}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln BE/ME_{it} + \varepsilon_{it}$

	γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
(A)	0.93	0.98				0.011
	(2.05)	(2.75)				
(B)	1.60		-0.65			0.006
	(4.57)		(-6.25)			
(C)	2.48			-0.20		0.015
	(5.93)			(-3.46)		
(D)	2.02				0.55	0.006
	(5.66)				(6.79)	
(E)	1.16	0.51	-0.55			0.016
	(2.53)	(1.47)	(-6.03)			
(F)	3.08	-0.46		-0.26		0.019
	(6.60)	(-1.40)		(-3.95)		
(G)	1.40	0.63			0.46	0.016
	(3.06)	(1.78)			(6.11)	
(H)	2.11		-0.46	-0.14		0.019
	(5.34)		(-5.00)	(-2.33)		
(I)	1.70		-0.54		0.11	0.010
	(5.10)		(-3.02)		(0.83)	
(J)	2.45			-0.15	0.40	0.019
	(6.04)			(-2.53)	(5.14)	
(K)	2.21		-0.34	-0.14	0.13	0.022
	(6.03)		(-2.19)	(-2.31)	(0.95)	

Table 4.6. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β, Tobin's q, Market Value of Equity and Book to Market Equity: July 1980 to June 1996

The Tobin's q (lnq) and book to market equity (lnBE/ME) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (lnME) is measured in June of Year t. The estimation of the post-ranking beta (β) is described in detail in the text. The average slope (in percent) is the time-series average of the monthly regression slopes for each subperiod, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln q_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{i}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln BE/ME_{it} + \varepsilon_{it}$

	γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
Panel A: Subperiod 1: July 1980 to June 1988						
(A)	1.21	1.54				0.011
	(1.82)	(3.01)				
(B)	2.24		-0.87			0.007
	(4.28)		(-5.88)			
(C)	3.64			-0.33		0.015
	(6.14)			(-3.94)		
(D)	2.75				0.63	0.007
	(5.31)				(4.83)	
(E)	1.45	0.88	-0.74			0.017
	(2.21)	(1.74)	(-5.57)			
(F)	4.59	-0.75		-0.42		0.020
	(7.21)	(-1.48)		(-4.27)		
(G)	1.69	1.09			0.52	0.017
	(2.57)	(2.11)			(4.09)	
(H)	3.11		-0.59	-0.24		0.019
	(5.42)		(-4.47)	(-2.85)		
(I)	2.10		-1.12		-0.25	0.011
	(4.09)		(-4.57)		(-1.16)	
(J)	3.54			-0.27	0.39	0.020
	(6.13)			(-3.17)	(3.11)	
(K)	2.98		-0.80	-0.24	-0.22	0.023
	(5.47)		(-3.93)	(-2.80)	(-1.01)	

Table 4.6. Continued

	γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
Panel B: Subperiod 2: July 1988 to June 1996						
(A)	0.65	0.42				0.011
	(1.05)	(0.85)				
(B)	0.96		-0.43			0.005
	(2.10)		(-2.99)			
(C)	1.32			-0.07		0.015
	(2.32)			(-0.93)		
(D)	1.28				0.47	0.004
	(2.67)				(4.90)	
(E)	0.86	0.14	-0.37			0.015
	(1.35)	(0.29)	(-2.96)			
(F)	1.57	-0.17		-0.10		0.018
	(2.42)	(-0.40)		(-1.17)		
(G)	1.11	0.17			0.42	0.015
	(1.73)	(0.35)			(4.84)	
(H)	1.11		-0.34	-0.03		0.019
	(2.11)		(-2.61)	(-0.39)		
(I)	1.30		0.05		0.48	0.008
	(3.06)		(0.20)		(3.08)	
(J)	1.37			-0.03	0.40	0.018
	(2.47)			(-0.36)	(4.48)	
(K)	1.45		0.12	-0.03	0.47	0.022
	(3.00)		(0.55)	(-0.42)	(3.02)	

Table 4.7. Average Slopes % (t-Statistics) for Fama-MacBeth Regressions of Stock Returns on β, Tobin's q, Market Value of Equity and Book to Market Equity: July 1980 to June 1996 (using yearly returns)

The Tobin's q (lnq) and book to market equity (lnBE/ME) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (lnME) is measured in June of Year t. The estimation of the post-ranking beta (β) is described in detail in the text. The average slope (in percent) is the time-series average of the yearly regression slopes for July 1980 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln q_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{i}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln BE/ME_{it} + \varepsilon_{it}$

	γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
(A)	0.94	0.97				0.033
	(3.14)	(1.77)				
(B)	1.61		-0.65			0.026
	(4.35)		(-5.02)			
(C)	2.48			-0.20		0.036
	(3.94)			(-2.67)		
(D)	2.03				0.56	0.023
	(5.17)				(5.81)	
(E)	1.17	0.50	-0.55			0.051
	(4.27)	(0.95)	(-4.84)			
(F)	3.09	-0.46		-0.26		0.053
	(4.42)	(-0.73)		(-3.13)		
(G)	1.42	0.62			0.47	0.050
	(4.78)	(1.13)			(5.08)	
(H)	2.11		-0.46	-0.14		0.048
	(3.54)		(-4.58)	(-1.95)		
(I)	1.73		-0.50		0.14	0.033
	(5.69)		(-1.99)		(0.76)	
(J)	2.46			-0.15	0.40	0.049
	(4.11)			(-2.03)	(4.56)	
(K)	2.24		-0.31	-0.14	0.16	0.054
	(4.26)		(-1.48)	(-1.95)	(0.87)	

Table 4.8. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β, Tobin's q, Market Value of Equity and Book to Market Equity for January and non-January Months: July 1980 to June 1996

The Tobin's q (lnq) and book to market equity (lnBE/ME) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (lnME) is measured in June of Year t. The estimation of the post-ranking beta (β) is described in detail in the text. The first two rows in each model shows average slopes and t-statistics for January only (16 observations) and the last two rows in each model shows average slopes and t-statistics for February to December (176 observations). The average slope (in percent) is the time-series average of the monthly regression slopes for July 1980 to June 1996 and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln q_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{i}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln BE/ME_{it} + \varepsilon_{it}$

		γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
(A)	Jan	3.33	1.66				0.013
		(2.19)	(1.17)				
	Feb-Dec	0.71	0.92				0.011
		(1.50)	(2.50)				
(B)	Jan	4.22		-1.28			0.010
		(3.86)		(-3.15)			
	Feb-Dec	1.36		-0.59			0.006
		(3.74)		(-5.56)			
(C)	Jan	5.60			-0.23		0.014
		(3.74)			(-1.06)		
	Feb-Dec	2.20			-0.20		0.015
		(5.10)			(-3.28)		
(D)	Jan	4.97				1.21	0.009
		(4.32)				(3.98)	
	Feb-Dec	1.75				0.49	0.005
		(4.74)				(5.92)	
(E)	Jan	3.74	0.54	-1.14			0.019
		(2.46)	(0.42)	(-3.70)			
	Feb-Dec	0.92	0.51	-0.50			0.016
		(1.93)	(1.41)	(-5.24)			

Table 4.8. Continued

		γ_0	β	lnq	lnME	lnBE/ME	Avg.R^2
(F)	Jan	4.42	0.93		-0.12		0.018
		(2.59)	(0.83)		(-0.61)		
	Feb-Dec	2.96	-0.58		-0.27		0.019
		(6.10)	(-1.71)		(-3.92)		
(G)	Jan	4.32	0.65			1.11	0.020
		(2.85)	(0.48)			(4.38)	
	Feb-Dec	1.14	0.63			0.41	0.016
		(2.38)	(1.71)			(5.18)	
(H)	Jan	4.43		-1.17	-0.05		0.020
		(3.24)		(-4.29)	(-0.23)		
	Feb-Dec	1.90		-0.40	-0.15		0.019
		(4.63)		(-4.12)	(-2.36)		
(I)	Jan	4.76		-0.39		0.88	0.012
		(4.50)		(-0.73)		(2.39)	
	Feb-Dec	1.42		-0.55		0.04	0.009
		(4.13)		(-2.92)		(0.30)	
(J)	Jan	5.18			-0.06	1.11	0.021
		(3.58)			(-0.31)	(4.82)	
	Feb-Dec	2.21			-0.16	0.33	0.019
		(5.26)			(-2.55)	(4.15)	
(K)	Jan	4.98		-0.29	-0.05	0.86	0.022
		(3.80)		(-0.71)	(-0.26)	(2.29)	
	Feb-Dec	1.96		-0.35	-0.14	0.06	0.022
		(5.19)		(-2.08)	(-2.33)	(0.42)	

4.5. Economic Interpretation of the Tobin's q Predictive Ability

In this section, we investigate the interpretation of Tobin's q as a proxy for alternative sources of risk, capturing some elements of product price risk, poor investment opportunities risk and financial distress risk, maintaining that it is these factors which are being priced in the cross-sectional return relationship.

4.5.1. Tobin's q as a proxy for Product price risk

In the literature, as was mentioned in previous chapters, a rich body of papers has investigated the relationship between firm-specific variables and average stock returns. However, specific links from the microeconomic variables of the firm (such as market power, labour-capital ratio and change in a firm's wage rate[5]) to its average stock returns has not been examined. In this section we examine whether the Tobin's q is indeed a proxy for product price risk. Previous empirical studies have used size, market share, concentration ratios, and Lerner's index as proxies for market power. Recently, financial economists have used Tobin's q to measure[6] the firm's market power in the product market. Lindenberg and Ross (1981) have shown that Tobin's q is theoretically and empirically superior to the traditional measures previously employed.

Chen, Cheng and Hite (1986) following the seminal work of Subrahmanyam and Thomadakis (1980), develop a theoretical model (see Appendix B) of firm decisions that links systematic risk to market power in the product market as measured by

[5] Recently, Jagannathan and Wang (1996) and Jagannathan, Kubota and Takehara (1998) empirically examine, using U.S. and Japanese data respectively, a multibeta asset pricing model in which one of the betas is the sensitivity of an asset's return to the growth rate of per capital labour income. More particular, stocks that are more sensitive to changes in the monthly growth rate of labour income earn a higher return on average (labour-income risk).

[6] Lindenberg and Ross (1981), Salinger (1984), Smirlock, Gilligan, and Marshall (1984),Chen, Cheng, and Hite (1986), Bernier (1987), Peyser (1994), and Wong (1995).

Tobin's q. Their results, based on a sample of 94 US companies, indicate that systematic risk and market power are inversely[7] related. Hence, they conclude that firms with high q values (low q values) are low-risk (high-risk) firms and consequently have lower cost of equity capital (via a lower required rate of return). The rationale, put forward by Chen, Cheng and Hite, for the negative relationship between those two variables is that market power or monopoly power in the product market (as this is reflected by high q values) creates lower product price risk and hence lower systematic risk.

4.5.2. Tobin's q as a proxy for Poor investment opportunities risk

The free cash flow hypothesis advanced by Jensen (1986) states that managers endowed with free cash flow will invest it in negative net present value (NPV) projects rather than pay it out to shareholders. Jensen defines free cash flow as cash flow left after the firm has invested in all available positive NPV projects. The free cash flow hypothesis argues that firms with excess cash and poor portfolio of investment opportunities will face sizeable agency costs if the excess cash is not distributed to shareholders. Managers who act in the interest of shareholders distribute the free cash flow to the shareholders. Any failure to do so is not in the best interest of shareholders since the rate of return earned on additional investment projects is below the opportunity cost of capital. On the other hand, managers who prefer to maximise their own utility may refuse to distribute the excess cash to the shareholders and invested in unprofitable projects because paying out cash reduces the size of the firm and the utility of the managers (see, Stulz (1991)). Some of these projects may include the acquisition of another company, often in an unrelated

[7] Lee, Liaw and Rahman (1990), Sun (1993) and Lee, Chen and Liaw (1995) had reached a similar

industry, and stock repurchases. While such projects reduce shareholder wealth, they increase the private benefits of the managers (see, for example, Morck, Shleifer and Vishny (1990), Lang, Stulz and Walkling (1991) and Nohel and Tarhan (1998)).

Lang and Litzenberger (1989) and Lang, Stulz and Walkling (1991) use Tobin's q as a measure of a firm's investment opportunities[8], to distinguish between firms that have good investment opportunities and those that do not. High q firms are likely to have positive NPV projects. Therefore, these firms are expected to use their internally generated funds productively. Low q firms are not likely to have positive NPV projects. Therefore, they should pay out cash flow to shareholders or invest in unprofitable projects. Thus, firms with low q are likely to be more risky than firms with high q due to poor investment opportunities (or few growth opportunities).

If firms with valuable growth opportunities conserve cash by paying lower dividends, there should be an inverse relation between dividend yield and investment opportunities. Smith and Watts (1992) and Gaver and Gaver (1993) provide evidence consistent with the hypothesis that the amount of dividends paid is inversely related to the firm's investment opportunities. Our results are consistent with this hypothesis. Specifically, when the stocks are grouped in to 10 portfolios based on Tobin's q (Table 4.2 Panel B), we can see that the portfolio with the largest q contains the stocks of the companies with the lowest dividend yield (DY). Overall, this evidence provides some support for the hypothesis that investment opportunities

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conclusion.

[8] Other empirical studies which use the Tobin's q as an empirical proxy for the firm's investment opportunities include Pilotte (1992), Denis (1994), Jung, Kim and Stulz (1996), Lang, Ofek and Stulz (1996) and Chung, Wright and Charoenwong (1998). Recently, Tobin's q has been frequently employed as a proxy for firm performance. See, for example, Lang, Stulz and Walkling (1989), McConnell and Servaes (1990), Lang and Stulz (1994) and Agrawal and Knoeber (1996).

play a role in explaining the negative relationship between Tobin's q and average stock returns.

4.5.3. Tobin's q as a proxy for Financial distress risk

The costs of financial distress[9] include bankruptcy costs and agency problems associated with risky debt. If the prospect of bankruptcy distorts real investment decisions, one may refer to these as agency costs of debt. If debt increases, then the degree of financial risk goes up, and consequently equity risk increases. Bhandari (1988) observed that the debt to equity ratio (D/E) is a natural proxy for the risk of its stock. He showed that higher leverage is associated with higher average returns, even after controlling for market beta and firm size. From Table 4.2 Panel B, when the stocks are grouped in to 10 portfolios based on Tobin's q, we can see that the portfolio with small q containing the stocks of the companies with the highest leverage (debt to equity ratio) and the portfolio with large q containing the stocks of the companies with the lowest leverage (last column of Table 4.2 Panel B). These results are the same, even after using the leverage measures examined by Fama and French (i.e., the ratio of book assets to market value of equity and the ratio of book assets to book equity), reported in columns six and seven of Table 4.2 Panel B. Thus, there is a clear negative relationship between Tobin's q and leverage (see also the average cross-sectional correlation coefficients between these two variables, Table 4.3). These results are consistent with the Myers' (1977) and Jensen's (1986) arguments, that firms with high growth opportunities (firms with high q) should have lower debt. Thus, firms with a smaller Tobin's q ratio yield a higher average return due to leverage. Since, there is a positive relationship between Tobin's q and market play a role in explaining the negative relationship between Tobin's q and average stock returns.

4.5.3. Tobin's q as a proxy for Financial distress risk

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4.6. Conclusions

Although the Capital Asset Pricing Model (CAPM) is a theoretically attractive model, the literature points to a number of empirical difficulties, with the result that a variety of empirical models have been put forward. Prominent among these are those that use variables that relate to firm market value of equity and book to market equity. This chapter examines the relationship between average returns and β, Tobin's q, market value of equity and book to market equity. We find that in the univariate regression, β is able to explain cross-sectional differences of expected returns on the London Stock Exchange for the period July 1980 to June 1996. However, β becomes insignificant when Tobin's q, market value of equity and book to market equity are included in a multivariate regression.

We then find that Tobin's q, market value of equity, and book to market equity are strongly significant. However, when both Tobin's q and book to market equity are included in the regressions Tobin's q absorbs the role of the book to market equity in explaining stock returns but it does not absorb the role of the market value of equity. Our findings confirm the existence of a Tobin's q effect (stocks with a smaller Tobin's q yield a higher average return) and also an additional size effect.

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[9] See, for example, Jensen and Meckling (1976), Altman (1984 and 1993), Myers and Majluf (1984), Titman and Wessels (1988), Harris and Raviv (1991), Asquith, Gertner and Sharfstein (1994), and Dichev (1998).

The sign of the coefficients general is consistent across 2 subperiods, although the significance level in each subperiod is lower than in full period. The conclusions in subperiod one remain the same as those for the full sample period. However, in subperiod two, the results yield different conclusions to those for the full sample period. In addition, the predictive role of those variables is not a phenomenon specific to the month of January.

We suggest that the Tobin's q effect is useful, not only as a new return predictor, but because it may also incorporate, to some degree, potential alternative sources of risk such as product price risk, poor investment opportunities risk and financial distress risk. The negative relationship between Tobin's q and book to market value of equity and the positive relationship between Tobin's q and market value of equity allow us to suggest that market value of equity and book to market equity serve as proxies for growth opportunities. Our evidence, in combination with that of Davis (1994) for the pre-1962 COMPUSTAT period, Daniel, Titman and Wei (1997) for Japanese markets and Barber and Lyon (1997) for a holdout sample of financial firms, confirms the relation between average return and book to market value of equity and allows us to reject the hypothesis that this relation is a result of collective data-snooping.

In the next two chapters we will investigate the prominent role of other variables to predict stock returns, which appeared in the literature, and the interaction between each of those variables and the variables which have been used in this chapter.

Chapter 5

A Re-examination of Some Popular Stock Returns Anomalies...

5.1. Introduction

The relationship between average stock returns and market beta, Tobin's q, market value of equity (firm size) and book to market equity were investigated in the previous chapter. To continue exploring the cross-sectional determinants of expected returns of stocks in the London Stock Exchange, both this chapter and chapter 6 are devoted to the empirical analysis of the relationship between average stock returns and firm-specific variables using data on individual firms. Specifically, this chapter provides an investigation into the relationship between the average return and the most common used variables in the U.S. and Japanese markets (such as market value of equity, book to market equity, leverage, earnings to price, cash flow to price and dividend yield), as well as their relationship with each other. On the other hand, chapter 6 addresses Barbee, Mukherji, and Raines (1996) argument, that two alternative variables, the sales to price and the debt to equity ratio, have more explanatory power for stock returns than the book to market equity and the market value of equity. In addition, chapter 6 investigates which of the variables which was found to have greater power for explaining stock returns has more explanatory power to explain cross-sectional variation of average stock returns in a multiple regression.

The ratio of book to market equity and the market value of equity have emerged as the most prominent of these variables largely due to the work of Fama and French (1992, 1993, 1995, 1996a). In particular, Fama and French (1992) examine the first four of the above referred variables simultaneously and conclude that the cross-sectional variation of expected returns on U.S. stocks can be captured by only two of these variables, namely market value of equity and book to market equity. Chan, Hamao and Lakonishok (1991) and Daniel, Titman and Wei (1997) also find that book to market equity plays a significant role in explaining the cross-sectional variation of stock returns in the Japanese market. Chan, Hamao and Lakonishok (1991) and Lakonishok, Shleifer and Vishny (1994) find evidence of a significant relationship between average returns and the ratio of cash flow per share to price per share (CF/P) for both Japanese and U.S. stocks. More recently, Brennan, Chordia and Subrahmanyam (1998) use dividend yield to predict stock returns. However, some researchers still remain unconvinced about the robustness of the Fama and French (1992) results and argue that documented predictive ability of these variables are simply a result of extensive data-snooping by academics (Lo and MacKinlay (1990b), Black (1993a) and MacKinlay (1995)). A number of studies have investigated the data-snooping hypothesis by testing the robustness of the results using, for example, different time periods (Davis (1994)), a holdout sample of financial firms (Barber and Lyon (1997b)), or tests on international data (Daniel, Titman and Wei (1997)). In this chapter we will have the opportunity to address the data-snooping bias in U.S. data by using '*out-of-sample*' data for a different country.

In contrast to the voluminous research in the U.S. and Japan relating to the cross-sectional behaviour of stock returns to market beta and firm-specific variables, there has been very limited research relating to the U.K. stock market. This gap motivated us to focus of our attention, in this chapter, to the examine the relationship between average stock returns and the firm-specific variables referred to above in the U.K. stock market. We also examine simultaneously the effects of those variables on the stock returns.

The remainder of this chapter is organised as follows. Section 5.2 contains our results from one-way classification by financial attributes of each firm. In Section 5.3 we present the results from regression models. Section 5.4 offers conclusions.

5.2. Portfolio Results

We present both descriptive statistics and formal test results. This section presents important summary statistics for the stocks in the sample, sorted into deciles by each of the variables. In the next section a Fama-MacBeth cross-sectional regression analysis is presented in order to determine which factors have explanatory power with respect to the cross-section of stock returns. In chapter 4 from Panels C and D of Table 4.2 we have seen that the average returns are negatively related with the market value of equity and positively related with the book to market equity. Table 5.1 presents the properties of the portfolios formed on one-dimensional sorts by market leverage (Panel A), book leverage (Panel B), earnings to price (Panel C), cash flow to price (Panel D) and dividend yield (Panel E) (see also Panel A and Panel B of Figure 5.1). The returns shown in Table 5.1 are the time-series averages of 192 monthly, equal-weighted portfolio returns from July 1980 to June 1996, in percentage terms. The values of the firm-specific variables are the time-series averages of the annual values of these variables in each portfolio (see the table for more details).

The ranking, based on market leverage (A/ME), is the first to be considered here (Panel A of Table 5.1). Portfolio S-A/ME includes firms with the lowest A/ME ratios, while portfolio L-A/ME includes those with the largest A/ME ratios. Panel A shows that average returns are generally increasing with market leverage, ranging from 1.26% for the smallest A/ME portfolio to 2.73% per month for the largest A/ME portfolio, a difference of 1.47% per month (17.64% on an annualised basis). The results for the portfolios sorted by book leverage (A/ME) are quite different (Panel B of Table 5.1). A clear pattern is not evident in the returns of these portfolios. Fama and French (1992) show that higher (lower) book leverage is associated with (higher) lower average returns. In our case this does not happen. The smallest portfolio does not have the highest return. In contrast, the largest portfolio has a higher return than the smallest portfolio (and any other portfolio).

The relation between average returns and E/P is a U-shape (Panel C of Table 5.1). Average returns fall from 2.63% per month for the negative E/P portfolio to 1.52% for the firms in portfolio E/P-4. Average return then increase monotonically from E/P-5 portfolio to largest E/P portfolio. The E/P variable generates a return differential of 0.74% each month (8.88% on an annualised basis) between the smallest and largest E/P deciles.

The cash flow to price (CF/P) effect presented in Panel D of Table 5.1. The highest CF/P portfolio earns an average stock return of 3.38% per month while the lowest CF/P portfolio earns 1.01% per month. The difference in average stock returns between these two extreme portfolios is 2.37% per month (28.44% on an annualised basis). This spread is 1.6 and 3.2 times larger than the difference between the average monthly returns on smallest and largest A/ME and E/P portfolios respectively. However, the firms with negative cash flow have not higher average returns (1.51% per month). Similarly, as was reported for the E/P, the relation between average returns and dividend yield has a U-shape (Panel E of Table 5.1).

The results in Table 5.1 also reveal that the various firm-specific variables are correlated. For example, market leverage is correlated positively with book to market equity, earnings to price, cash flow to price and dividend yield and negatively with market value of equity. These relationships can be confirmed by examining the average cross-sectional correlation coefficients between those variables, which are presented in Table 4.3 in Chapter 4.

In summary, with this one-dimensional classification scheme, we find a strong positive relationship between average returns and market leverage and cash flow to price. However, this is not obvious between average returns and book leverage, whereas the U-shaped relation between average return and earnings to price and between average returns and dividend yield is observed.

The descriptive statistics discussed above broadly confirm that the empirical regularities observed in the U.S. also exist in the other countries. In the next section the results of the Fama-MacBeth cross-sectional regression tests, that explore the statistical significance of the relations discussed above, are presented.

Table 5.1. Properties of Portfolios Formed on Market Leverage or Book Leverage or Earnings to Price or Cash Flow to Price or Dividend Yield: July 1980 to June 1996

In each panel the stocks are grouped in to 10 portfolios by a different variable, and the grouping procedure is repeated every year at the end of June. For E/P and CF/P there are 11 portfolios; portfolio Neg. E/P and Neg.CF/P is stocks with negative E/P and CF/P respectively. The Tobin's q (q), the book to market value of equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY), the sales to price (S/P) and the book value of debt to market value of equity (D/E) are measured using accounting variables and market value (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P is the earnings to price ratio including only firms with positive earnings. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P is the cash flow to price ratio including only firms with positive cash flow. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. Pre-ranking β is estimated using 24-60 monthly observations over the five year period ending June of year t. The estimation of the post-ranking beta (β) is described in detail in the text. Returns is the time-series average of 192 monthly, equal-weighted portfolio returns, in percent terms. β is the time-series average of the full-period, post-ranking equally-weighted portfolio beta, estimated using monthly returns. lnq, lnME, lnBE/ME, lnA/ME, lnA/BE, E(+)/P, CF(+)/P, DY, lnS/P, and lnD/E are the time-series average of the annual values of these variables in each portfolio. E/P(D) and CF/P(D) gives the average proportion of stocks with negative earnings and negative cash flow in each portfolio respectively. The prefix ln(.) denotes that the variable is used in natural logarithm form. N denotes the average number of securities in each portfolio.

Panel A: Portfolios Formed on Market Leverage

	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
S-A/ME	1.26	0.84	0.87	4.15	-1.52	-0.85	0.67	0.05	0.06	0.09	0.04	2.46	-0.62	-1.68	81
A/ME-2	1.29	0.86	0.31	3.93	-0.96	-0.26	0.70	0.07	0.02	0.12	0.02	3.67	0.01	-1.07	81
A/ME-3	1.41	0.87	0.04	3.80	-0.68	0.03	0.71	0.08	0.04	0.14	0.03	4.28	0.29	-0.77	81
A/ME-4	1.78	0.89	-0.15	3.64	-0.48	0.25	0.72	0.09	0.03	0.16	0.02	4.88	0.53	-0.53	81
A/ME-5	1.82	0.91	-0.32	3.51	-0.32	0.43	0.75	0.10	0.06	0.17	0.03	5.29	0.69	-0.33	81
A/ME-6	1.76	0.93	-0.46	3.34	-0.16	0.61	0.76	0.10	0.06	0.18	0.04	5.60	0.85	-0.14	81
A/ME-7	2.01	0.95	-0.61	3.19	-0.03	0.80	0.82	0.11	0.09	0.20	0.05	5.91	1.05	0.11	81
A/ME-8	2.22	1.00	-0.78	2.86	0.15	1.01	0.85	0.10	0.14	0.21	0.08	5.91	1.28	0.36	81
A/ME-9	2.22	1.05	-0.99	2.50	0.37	1.30	0.93	0.10	0.23	0.22	0.13	5.94	1.60	0.72	81
L-A/ME	2.73	1.13	-1.37	1.94	0.84	1.94	1.08	0.14	0.36	0.23	0.21	5.00	2.23	1.43	80

Table 5.1. Continued

Panel B: Portfolios Formed on Book Leverage

	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
S-A/BE	1.80	0.97	-0.16	2.94	-0.08	0.20	0.27	0.09	0.09	0.13	0.06	4.47	0.04	-1.28	81
A/BE-2	1.87	0.94	-0.19	3.19	-0.17	0.27	0.43	0.10	0.06	0.15	0.04	4.71	0.38	-0.78	81
A/BE-3	1.80	0.91	-0.21	3.39	-0.22	0.32	0.53	0.11	0.04	0.16	0.04	5.01	0.51	-0.57	81
A/BE-4	1.82	0.93	-0.27	3.39	-0.21	0.41	0.62	0.10	0.07	0.17	0.04	5.07	0.65	-0.36	81
A/BE-5	1.88	0.93	-0.34	3.37	-0.21	0.49	0.70	0.11	0.07	0.17	0.05	5.25	0.79	-0.20	81
A/BE-6	1.87	0.93	-0.35	3.46	-0.27	0.52	0.79	0.09	0.09	0.18	0.06	5.07	0.86	-0.09	81
A/BE-7	1.95	0.92	-0.39	3.51	-0.28	0.60	0.88	0.09	0.10	0.18	0.07	5.17	0.97	0.06	81
A/BE-8	1.69	0.93	-0.44	3.44	-0.31	0.68	0.99	0.10	0.11	0.18	0.07	5.20	1.07	0.21	81
A/BE-9	1.76	0.96	-0.48	3.32	-0.41	0.74	1.15	0.09	0.17	0.18	0.10	4.85	1.18	0.36	81
L-A/BE	2.06	1.03	-0.60	2.88	-0.65	1.00	1.63	0.08	0.28	0.20	0.14	4.14	1.44	0.75	80

Panel C: Portfolios Formed on Earnings to Price

	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Neg E/P	2.63	1.20	-0.74	1.69	0.04	1.08	1.03	0.00	1.00	0.14	0.35	2.81	1.24	0.45	88
Small-E/P	1.58	1.00	-0.04	3.02	-0.61	0.19	0.79	0.03	0.00	0.12	0.09	3.40	0.29	-0.55	72
E/P-2	1.57	0.89	0.09	3.80	-0.72	0.04	0.76	0.05	0.00	0.12	0.03	3.74	0.25	-0.71	72
E/P-3	1.54	0.86	0.01	3.93	-0.63	0.11	0.74	0.07	0.00	0.13	0.02	4.39	0.33	-0.65	72
E/P-4	1.52	0.84	-0.07	4.01	-0.57	0.21	0.78	0.08	0.00	0.15	0.02	4.55	0.47	-0.51	72
E/P-5	1.58	0.85	-0.19	3.91	-0.44	0.32	0.77	0.09	0.00	0.16	0.02	5.17	0.58	-0.41	72
E/P-6	1.64	0.88	-0.26	3.71	-0.35	0.39	0.74	0.10	0.00	0.17	0.01	5.41	0.72	-0.34	72
E/P-7	1.78	0.88	-0.36	3.65	-0.24	0.51	0.75	0.11	0.00	0.18	0.03	5.77	0.81	-0.21	72
E/P-8	1.81	0.91	-0.46	3.37	-0.16	0.62	0.78	0.13	0.00	0.21	0.02	6.11	0.97	-0.08	72
E/P-9	2.10	0.98	-0.59	2.99	-0.04	0.76	0.80	0.15	0.00	0.23	0.03	6.41	1.14	0.06	72
Large-E/P	2.32	1.06	-0.99	2.46	0.48	1.29	0.80	0.27	0.00	0.27	0.04	6.48	1.61	0.58	71

Table 5.1. Continued

Panel D: Portfolios Formed on Cash flow to Price

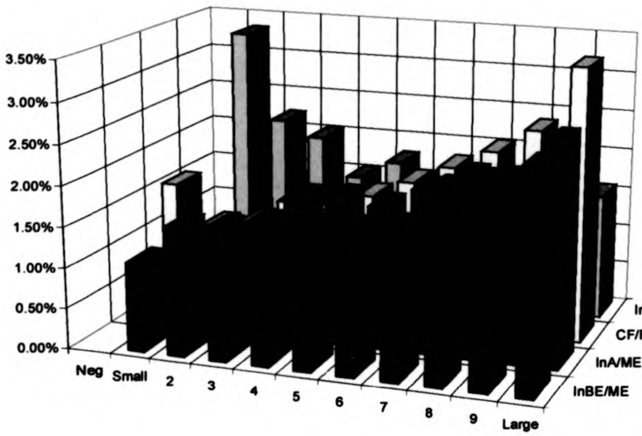
	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Neg CF/P	1.51	1.20	-0.75	1.56	0.09	1.06	0.96	0.04	0.57	0.00	1.00	3.74	1.18	0.40	53
S-CF/P	1.01	1.01	0.01	2.92	-0.60	0.13	0.73	0.06	0.16	0.05	0.00	3.53	0.22	-0.68	76
CF/P-2	1.11	0.89	0.10	3.71	-0.71	0.02	0.70	0.07	0.06	0.09	0.00	3.80	0.18	-0.81	76
CF/P-3	1.42	0.87	0.00	3.84	-0.61	0.11	0.71	0.08	0.04	0.11	0.00	4.13	0.33	-0.69	76
CF/P-4	1.44	0.86	-0.09	3.88	-0.54	0.22	0.75	0.09	0.04	0.13	0.00	4.77	0.48	-0.53	76
CF/P-5	1.59	0.87	-0.23	3.79	-0.40	0.36	0.76	0.10	0.04	0.15	0.00	5.06	0.66	-0.37	76
CF/P-6	1.81	0.88	-0.33	3.68	-0.30	0.50	0.79	0.10	0.06	0.17	0.00	5.34	0.81	-0.21	76
CF/P-7	2.04	0.90	-0.43	3.56	-0.19	0.62	0.80	0.11	0.05	0.19	0.00	5.66	0.94	-0.07	76
CF/P-8	2.28	0.94	-0.54	3.26	-0.09	0.73	0.82	0.12	0.06	0.22	0.00	5.92	1.07	0.06	76
CF/P-9	2.58	0.98	-0.67	3.04	0.05	0.91	0.85	0.12	0.08	0.27	0.00	5.89	1.26	0.26	76
L CF/P	3.38	1.07	-0.93	2.40	0.30	1.26	0.95	0.14	0.15	0.44	0.00	5.61	1.62	0.67	75

Panel E: Portfolios Formed on Dividend Yield

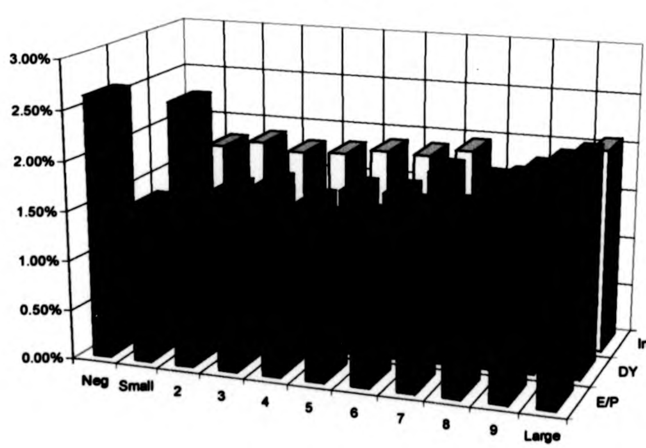
	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-DY	2.43	1.16	-0.44	1.97	-0.29	0.73	1.00	0.04	0.47	0.15	0.24	0.23	0.87	0.09	81
DY-2	1.56	0.96	0.05	3.24	-0.70	0.11	0.81	0.06	0.18	0.14	0.08	1.56	0.26	-0.62	81
DY-3	1.65	0.90	-0.02	3.68	-0.62	0.14	0.75	0.08	0.07	0.14	0.04	2.74	0.37	-0.62	81
DY-4	1.51	0.88	-0.14	3.84	-0.48	0.27	0.75	0.09	0.05	0.15	0.03	3.58	0.51	-0.49	81
DY-5	1.67	0.89	-0.26	3.76	-0.35	0.41	0.76	0.10	0.05	0.17	0.03	4.34	0.69	-0.33	81
DY-6	1.68	0.90	-0.36	3.58	-0.26	0.50	0.77	0.11	0.04	0.18	0.03	5.11	0.79	-0.22	81
DY-7	1.93	0.90	-0.40	3.59	-0.21	0.57	0.78	0.11	0.03	0.19	0.03	5.91	0.88	-0.15	81
DY-8	1.87	0.90	-0.49	3.48	-0.11	0.66	0.77	0.12	0.04	0.19	0.03	6.83	0.96	-0.05	81
DY-9	2.01	0.94	-0.62	3.11	0.03	0.82	0.79	0.12	0.05	0.21	0.05	8.01	1.17	0.13	81
Large-DY	2.19	1.01	-0.78	2.65	0.20	1.03	0.83	0.12	0.10	0.20	0.09	10.72	1.39	0.37	80

Figure 5.1. Average Monthly Returns for Portfolios Sorted by each Variable

Panel A:



Panel B:



5.3 Regression Results

5.3.1. Fama-MacBeth Regressions

In the previous chapter we have seen that market value (ME) and book to market equity (BE/ME) in the univariate regressions or bivariate regression both have explanatory power to predict stock returns. In this section we will investigate the explanatory power of leverage, earnings to price, cash flow to price and dividend yield for expected returns and the interaction between each of those variables with ME and BE/ME.

Table 5.2 reports the average coefficients (in percent) from 192 monthly Fama-MacBeth cross-sectional regressions of stock returns for various combination of the above variables. The figure in parenthesis is the t-statistic which is the average coefficient divided by its time-series standard error. The first three models presented are the bivariate regressions of leverage, E/P and CF/P. The E/P and CF/P are presented in this form in order to reflect the firms with negative earnings and cash flow.

Fama and French (1992) note that the book to market equity is equivalent to the ratio of market leverage to book leverage. These authors measure market leverage and book leverage as the ratios of book value of total assets to market equity and book equity respectively. Thus, the difference between market and book leverage is book to market equity, ln(BE/ME) = ln(A/ME) - ln(A/BE). In contrast to Fama and French (1992), when the book to market equity variable is broken down into market leverage and book leverage, the market leverage has a significant positive coefficient of 0.59%, with a t-statistic 6.78 and captures the whole effect of the book to market equity (Model A of Table 5.2). The average coefficient of the market leverage is indeed very close to the average coefficient of the book to market equity (0.63%). One possible explanation of why market leverage absorbs the role of the book leverage is that market leverage may have properties similar to book leverage in the U.K. market. If this were true then the time series averages of cross-sectional means of book to market equity should be closer to one that is the case (see Table 3.1). Adding the lnME as another explanatory variable to the leverage regressions (Model E), both market value and market leverage have significant coefficients. The coefficient of the book leverage remains insignificant.

Consistent with Fama and French (1992), we transform the E/P variable into a variable, E(+)/P, that equals E/P if earnings are positive, and zero if earnings are negative. To see if there is a systematic return effect for firms with negative earnings, we also included an E/P dummy variable (E/P(D)) which takes the value zero if earnings are positive and one if earnings are negative. Model B of Table 5.2 reports that both E(+)/P and E/P(D) variables have a significant positive relationship with returns, with an average coefficient on E(+)/P of 3.79% (t-statistic of 4.49) and 1.19% (t-statistic of 4.45) for E/P(D). This is consistent with the Fama and French (1992) and Strong and Xu (1997) results.

One alternative to the earnings to price ratio is the ratio of cash flow to price[1] (CF/P), where cash flow is defined as reported accounting earnings plus depreciation. Its appeal lies in the fact that accounting earnings are more easily manipulable and form biased estimates of the economic earnings with which shareholders are concerned (see, Bernard and Stober (1989)). Cash flow per share is less manipulable and, therefore, possibly a less biased estimate of economically important flows accruing to the firm's shareholders. However, there has been no published study used the CF/P variable for the U.K. market and this chapter is an attempt to fill that gap in the literature.

Similarly, as we have done for the E/P, the CF/P variable will be transformed into a variable, CF(+)/P, that equals CF/P if cash flow is positive, and zero if cash flow is negative (see, for example, Lakonishok, Shleifer and Vishny (1994) and Davis (1994, 1996)). To see if there is a systematic return effect for firms with negative cash flow, we also included an CF/P dummy variable (CF/P(D)) which takes a value of zero if cash flow is positive and one if cash flow is negative. Model C of Table 5.2 reports the significant coefficient for both cash flow variables, with an average coefficient on CF(+)/P of 6.98% (t = 14.7) and 0.71% (t = 2.05) for CF/P(D).

The fourth Model of Table 5.2 shows that the dividend yield appears to have a strongly significant and positive effect on stock returns, with an average coefficient of 0.05% (t-statistic 2.63). However, running dividend yield and book to market equity together (Model H), or with other variables, dividend yield become insignificant (t-statistic 0.09). Multivariate regressions that include dividend yield as an independent variable are not shown, since dividend yield adds no explanatory power to such regressions.

Model F of Table 5.2 attempts to clarify the separate influences of market value and earnings to price. The empirical evidence of the existing literature is controversial. For example, Reinganum (1981), Banz and Breen (1986) and Strong and Xu (1997) argue that firm size effect subsumes the E/P effect, whereas Basu (1983) and Levis (1989) assert quite the opposite when both variables are jointly considered. We find

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[1] Empirical studies which have used cash flow to price to predict stock returns include, for example, Chan, Hamao and Lakonishok (1991) and Lakonishok, Shleifer and Vishny (1994) for Japanese and

a significant E(+)/P (t = 3.28), E/P(D) (t = 3.46) and lnME (t = -2.80). This is consistent with the Cook and Rozeff (1984), Jaffe, Keim and Westerfield (1989) and Fama and French (1992) results.

Adding the lnBE/ME as another independent variable to the E/P regressions (Model I of Table 5.2) subsumes the E(+)/P variable (t = 0.37) and lowers the average coefficient on E/P(D) variable form 1.19 to 0.43. While both lnME and lnBE/ME variables remain significant. Model K of Table 5.2, when the lnBE/ME is replaced by the leverage, shows that both E(+)/P (t = 0.16) and E/P(D) (t = 1.52) are subsumed by the influence of the market leverage.

In Model G, earnings yield variables are replaced by the cash flow to price variables. In this model the CF(+)/P is significantly positive with a t-statistic of 13.6, while the CF/P(D) has a positive coefficient, but became insignificant (t = 0.91). Thus the high average returns of negative cash flow stocks are better captured by market value. Adding both lnME and lnBE/ME to the CF/P regressions (Model J), the CF(+)/P has a positive coefficient and t-statistic of 11.7, while the CF/P(D) remains insignificant (t = 0.51). These results suggest that the CF(+)/P may be a more reliable variable in predicting stock returns than E(+)/P.

In summary, the market value of equity and the ratio of book to market equity capture the cross-sectional relation between average returns and market value of equity, book to market equity, earnings to price, leverage, and dividend yield. The cash flow to price variable CF(+)/P brings additional power to predict stock returns[2] together with the other two variables, namely market value of equity and book to market equity.

U.S. stock market respectively.

[2] Lakonishok, Shleifer and Vishny (1994) find that cash flow to price and sales growth absorb the role of the book to market equity and market value of equity to explain the cross-section of average stock returns.

5.3.2. Subperiods Results

The message from the full sample period (Table 5.2) is that the variables that stand out in the multiple regressions are market value of equity, book to market equity and cash flow to price. Table 5.3 shows the Fama-MacBeth cross-sectional regression results for two equal subperiods; subperiod one from July 1980 to June 1988 (Panel A) and subperiod two from July 1988 to June 1996 (Panel B). Similarly in the results for the full sample period, in subperiod one, the market value of equity has significant coefficients in all the models, while in subperiod two its coefficients drop significantly. Unlike the market value of equity coefficients, the book to market equity coefficients are significant in all models in both subperiods (except Model J, subperiod two). The market leverage coefficients are significant in both subperiods as for the full sample period. However, the book leverage coefficients in subperiod one remain insignificant (positive sign), while in subperiod two its coefficients became significant with the same sign as for the full sample period (negative sign).

The subperiods results for the earnings to price variables yield similar conclusions to those for the overall period. In both subperiods, in Model B and F, its coefficients remain significant, but remain insignificant in Model I and K (except in Model I the earnings to price dummy variable became insignificant in both subperiods). Like the overall period, the subperiods coefficients for the cash flow to price are significant, while the significant level in subperiods are lower than in the overall period. The cash flow to price dummy coefficients remain insignificant, with a negative sign in some models. The dividend yield coefficients appear insignificant in both subperiods.

The subperiod results thus support the conclusion that, among the variables considered here, book to market equity and cash flow to price are consistently the most powerful variables in explaining cross-sectional variation of average stock returns.

5.3.3. Seasonal Patterns

There is mounting evidence documenting unusual market activity in the month of January. For example, Jaffe, Keim and Westerfield (1989) report that the coefficient for the market value of equity is significant only in January, while that for earnings to price is significant in both January and non-January months (for more information about January effects see, subsection 2.3.1.1).

Table 5.4 presents the cross-sectional regression results separately for January and non-January months. The market value of equity, earnings to price and dividend yield coefficients are insignificant in January but significant during the remainder of the year. In contrast, the book to market equity, market leverage and cash flow to price coefficients are significant in both January and non-January months, but their coefficients are larger in January than during the rest of the year, with higher t-values in non-January months (except in two cases for the market leverage, Model E and K). The book leverage coefficients remain insignificant in both January and non-January months. However, the January effect is obvious for the cash flow to price dummy variable, where its coefficients are significant in January and insignificant in the non-January months.

In summary, the strong relationship between average stock returns and market value of equity, book to market equity and cash flow to price are not a phenomenon specific to the month of January.

Table 5.2. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value, Leverage, Earnings to Price, Cash Flow to Price, and Dividend Yield: July 1980 to June 1996

The book to market equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P, the earnings to price ratio if earnings are positive, and zero if earnings are negative. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average slope (in percent) is the time-series average of the monthly regression slopes for July 1980 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln A/ME_{it} + \gamma_{2t}\ln A/BE_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}DY_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}E(+)/P_{it} + \gamma_{3t}E/P(D)_{it} + \varepsilon_{it}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}CF(+)/P_{it} + \gamma_{3t}CF/P(D)_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}DY_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \gamma_{4t}E(+)/P_{it} + \gamma_{5t}E/P(D)_{it} + \varepsilon_{it}$

	γ_0	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	Avg.R^2
(A)	1.702			0.591	-0.173						0.010
	(5.68)			(6.78)	(-1.25)						
(B)	1.386					3.789	1.189				0.008
	(4.00)					(4.49)	(4.45)				
(C)	0.673							6.983	0.717		0.013
	(1.96)							(14.8)	(2.05)		
(D)	1.635									0.052	0.004
	(4.56)									(2.63)	
(E)	2.155	-0.137		0.451	-0.107						0.023
	(6.33)	(-2.28)		(5.45)	(-0.76)						
(F)	2.035	-0.164				2.730	0.783				0.021
	(5.14)	(-2.80)				(3.28)	(3.46)				
(G)	1.338	-0.176						6.447	0.291		0.027
	(3.41)	(-3.02)						(13.6)	(0.91)		
(H)	2.036		0.583							0.002	0.009
	(5.63)		(7.33)							(0.09)	
(I)	2.316	-0.125	0.428			0.346	0.473				0.025
	(5.95)	(-2.12)	(4.97)			(0.37)	(2.10)				
(J)	1.470	-0.155	0.203					5.859	0.160		0.030
	(3.82)	(-2.61)	(2.59)					(11.7)	(0.51)		
(K)	2.131	-0.125		0.444	-0.165	0.142	0.328				0.029
	(6.06)	(-2.12)		(4.70)	(-1.20)	(0.16)	(1.52)				

Table 5.3. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value, Leverage, Earnings to Price, Cash Flow to Price, and Dividend Yield

The book to market equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P, the earnings to price ratio if earnings are positive, and zero if earnings are negative. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average slope (in percent) is the time-series average of the monthly regression slopes for each subperiod, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln A/ME_{it} + \gamma_{2t}\ln A/BE_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}DY_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}E(+)/P_{it} + \gamma_{3t}E/P(D)_{it} + \varepsilon_{it}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}CF(+)/P_{it} + \gamma_{3t}CF/P(D)_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}DY_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \gamma_{4t}E(+)/P_{it} + \gamma_{5t}E/P(D)_{it} + \varepsilon_{it}$

	γ_0	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	Avg.R^2
Panel A: Subperiod one: July 1980 to June 1988											
(A)	2.046			0.729	0.182						0.011
	(4.46)			(5.53)	(0.84)						
(B)	2.153					3.12	1.643				0.009
	(4.11)					(4.51)	(3.87)				
(C)	1.389							5.97	1.292		0.013
	(2.70)							(11.3)	(2.35)		
(D)	2.452									0.048	0.004
	(4.33)									(1.83)	
(E)	2.823	-0.247		0.521	0.30						0.023
	(5.61)	(-2.86)		(4.17)	(1.36)						
(F)	3.20	-0.283				1.665	0.988				0.022
	(5.68)	(-3.39)				(2.51)	(2.74)				
(G)	2.406	-0.286						5.24	0.615		0.027
	(4.27)	(-3.43)						(9.77)	(1.25)		
(H)	2.867		0.706							-0.018	0.011
	(5.00)		(5.40)							(-0.69)	
(I)	3.449	-0.237	0.467			-0.749	0.613				0.027
	(6.20)	(-2.82)	(3.29)			(-0.93)	(1.74)				
(J)	2.54	-0.264	0.186					4.577	0.468		0.031
	(4.59)	(-3.12)	(1.44)					(7.99)	(0.97)		
(K)	2.966	-0.236		0.557	0.203	-1.405	0.295				0.030
	(5.78)	(-2.80)		(3.80)	(0.962)	(-1.63)	(0.88)				

Table 5.3. Continued

	γ_0	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	Avg.R^2
Panel B: Subperiod two: July 1988 to June 1996											
(A)	1.359			0.452	-0.528						0.009
	(3.53)			(4.00)	(-3.17)						
(B)	0.620					4.454	0.735				0.007
	(1.40)					(2.89)	(2.30)				
(C)	-0.043							7.993	0.140		0.014
	(-0.10)							(10.3)	(0.33)		
(D)	0.820									0.055	0.004
	(1.92)									(1.88)	
(E)	1.487	-0.027		0.382	-0.510						0.023
	(3.29)	(-0.33)		(3.50)	(-3.02)						
(F)	0.866	-0.044				3.795	0.578				0.020
	(1.62)	(-0.55)				(2.49)	(2.11)				
(G)	0.269	-0.066						7.659	-0.032		0.027
	(0.51)	(-0.82)						(10.0)	(-0.08)		
(H)	1.205		0.460							0.002	0.007
	(2.82)		(5.12)							(0.74)	
(I)	1.183	-0.013	0.388			1.441	0.334				0.023
	(2.26)	(-0.16)	(3.97)			(0.87)	(1.19)				
(J)	0.401	-0.046	0.220					7.141	-0.149		0.029
	(0.78)	(-0.56)	(2.46)					(8.92)	(-0.36)		
(K)	1.296	-0.014		0.330	-0.533	1.688	0.361				0.028
	(2.77)	(-0.18)		(2.78)	(-3.13)	(1.05)	(1.32)				

Table 5.4. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value, Leverage, Earnings to Price, Cash Flow to Price, and Dividend Yield for January and non-January Months: July 1980 to June 1996

The book to market equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P, the earnings to price ratio if earnings are positive, and zero if earnings are negative. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The first two rows in each model shows average slopes and t-statistics for January (J) only (16 observations) and the last two rows in each model shows average slopes and t-statistics for (F-D) February to December (176 observations). The average slope (in percent) is the time-series average of the monthly regression slopes for July 1980 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln A/ME_{it} + \gamma_{2t}\ln A/BE_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}DY_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}E(+)/P_{it} + \gamma_{3t}E/P(D)_{it} + \varepsilon_{it}$

(G): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}CF(+)/P_{it} + \gamma_{3t}CF/P(D)_{it} + \varepsilon_{it}$

(H): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}DY_{it} + \varepsilon_{it}$

(I): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}E(+)/P_{it} + \gamma_{2t}E/P(D)_{it} + \varepsilon_{it}$

(J): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln BE/ME_{it} + \gamma_{1t}CF(+)/P_{it} + \gamma_{2t}CF/P(D)_{it} + \varepsilon_{it}$

(K): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln A/ME_{it} + \gamma_{3t}\ln A/BE_{it} + \gamma_{4t}E(+)/P_{it} + \gamma_{5t}E/P(D)_{it} + \varepsilon_{it}$

	γ_0	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	Avg.R^2
(A)	3.997			1.271	0.099						0.014
J	(3.86)			(3.76)	(0.19)						
	1.494			0.529	-0.198						0.010
F-D	(4.83)			(5.95)	(-1.38)						
(B)	4.351					4.090	1.84				0.009
J	(4.37)					(1.27)	(1.80)				
	1.117					3.761	1.130				0.008
F-D	(3.09)					(4.29)	(4.08)				
(C)	3.035							9.468	3.636		0.016
J	(3.05)							(6.47)	(2.86)		
	0.458							6.757	0.451		0.013
F-D	(1.27)							(13.6)	(1.26)		
(D)	4.510									0.077	0.003
J	(3.99)									(1.43)	
	1.375									0.049	0.004
F-D	(3.69)									(2.36)	
(E)	4.247	-0.061		1.168	0.141						0.025
J	(3.40)	(-0.29)		(4.76)	(0.24)						
	1.965	-0.144		0.386	-0.129						0.023
F-D	(5.59)	(-2.29)		(4.49)	(-0.89)						

Table 5.4. Continued

	γ_0	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	Avg.R^2
(F)	5.090	-0.167				2.784	1.388				0.021
J	(3.67)	(-0.77)				(0.94)	(1.54)				
	1.757	-0.163				2.725	0.728				0.021
F-D	(4.30)	(-2.69)				(3.13)	(3.12)				
(G)	3.507	-0.109						9.041	3.358		0.028
J	(2.48)	(-0.52)						(6.26)	(2.91)		
	1.141	-0.182						6.211	0.012		0.027
F-D	(2.80)	(-2.97)						(12.5)	(0.04)		
(H)	5.061		1.194							-0.006	0.012
J	(4.33)		(3.77)							(-0.11)	
	1.761		0.528							0.003	0.009
F-D	(4.71)		(6.52)							(0.12)	
(I)	5.487	-0.056	1.167			-2.428	0.456				0.026
J	(3.91)	(-0.26)	(4.73)			(-0.79)	(0.54)				
	2.027	-0.132	0.361			0.598	0.475				0.025
F-D	(5.08)	(-2.13)	(4.02)			(0.62)	(2.03)				
(J)	3.584	-0.027	0.685					7.697	2.840		0.031
J	(2.55)	(-0.13)	(2.92)					(4.73)	(2.43)		
	1.278	-0.167	0.159					5.69	-0.084		0.030
F-D	(3.21)	(-2.68)	(1.94)					(10.9)	(-0.26)		
(K)	4.649	-0.054		1.288	-0.020	-3.215	-0.069				0.029
J	(3.65)	(-0.25)		(4.76)	(-0.04)	(-1.07)	(-0.09)				
	1.902	-0.132		0.367	-0.178	0.448	0.364				0.029
F-D	(5.25)	(-2.14)		(3.74)	(-1.25)	(0.47)	(1.62)				

5.4. Conclusions

In this chapter we have continued exploring the cross-sectional determinants of expected stock returns using data on individual firms. This is important since, as Lo and MacKinlay (1990b) have shown, the use of portfolios is very likely to give rise to a data-snooping bias. Specifically, we have investigated the relationship between average stock returns and firm-specific variables such as market value of equity, book to market equity, leverage, earnings to price, cash flow to price and dividend yield.

The market value of equity, the ratio of book to market equity and cash flow to price have emerged as the most prominent of the above variables to explain the cross-sectional variation of average stock returns. The strong relationship between average stock returns and these three variables is not a phenomenon specific to the month of January. The subperiods results strongly suggest that the significance of the book to market equity and cash flow to price effect are not sensitive to the period in which it is measured. Thus, these results are not period-specific. However, the market value of equity coefficients are significant in the early subperiod, but insignificant in the last subperiod.

Our results in this chapter confirm that the empirical regularities observed in the U.S. market also exist in other countries (e.g., U.K. market). Thus we conclude that it is extremely unlikely for the book to market equity and the market value of equity effects, which are reported for the U.S. stock market, to be a consequence of data-snooping.

In the next chapter we will examine, using data from London Stock Exchange, the Barbee, Mukherji, and Raines (1996) argument, that two alternative variables, the sales to price and the debt to equity ratio, have more explanatory power for stock returns than the book to market equity and the market value of equity. In addition, in the next chapter we will investigate which of the variables which was fund to have greater power for explaining stock returns have more explanatory power to explain cross-sectional variation of average stock returns in a multiple regression.

Chapter 6

A Further Investigation of Stock Returns Anomalies…

6.1. Introduction

In the previous two chapters we have extensively examined the determinants of the cross-section of stock returns in the London Stock Exchange. This chapter consists of two parts. We first examine the Barbee, Mukherji, and Raines (1996) argument that two alternative variables, the debt to equity (D/E) and the sales to price (S/P) ratio have more explanatory power for stock returns than the book to market equity and the market value of equity. In our second part, we investigate which of the variables found to have greater power for explaining stock returns (as reported in the previous two chapters and in the first part of this chapter) have more explanatory power to explain cross-sectional variation of average stock returns in a multiple regression.

In contrast to the evidence found in the U.S. market by Barbee, Mukherji, and Raines (1996), we find that the S/P and D/E ratios do not absorb the roles of the BE/ME and ME in explaining the cross-section of average stock returns, but S/P has significant explanatory power, beyond the contribution of BE/ME and ME. However, the explanatory power of D/E is captured by S/P, as found in the study by Barbee, Mukherji, and Raines (1996). In the second part of this chapter we find that the Tobin's q, cash flow to price and sales to price, when simultaneously considered, have explanatory power for explaining average stock returns.

The remainder of this chapter is organised as follows. Section 6.2 examines the Barbee, Mukherji, and Raines argument and is organised in two parts. First, we analyse descriptive evidence on the relation between the stock returns and book to market of equity, market value of equity, debt to equity and sales to price. Second, we provide formal tests of the relation between the stock returns and these variables considered here. Section 6.3 examines the roles of Tobin's q, cash flow to price and sales to price in explaining average returns, and finally Section 6.4 concludes the chapter.

6.2. Do S/P and D/E Explain Stock Returns Better than BE/ME and ME?

As was mentioned earlier, Fama and French (1992) document that book to market equity and the market value of equity, as a proxy of the firm size, suffice to explain cross-sectional variation of stock returns in the U.S. market during the 1963 to 1990 period. However, Barbee, Mukherji, and Raines (1996) document that two alternative variables, the sales to price[1] and the debt to equity ratio, have more explanatory power for stock returns than the book to market equity and the market value of equity. The purpose of this section is to examine their arguments using data from the London Stock Exchange.

The empirical analysis in this part takes two forms. First, the stocks in the sample are ranked by the variables, and deciles are formed based on these rankings. The second form of the empirical analysis involves a Fama-MacBeth (1973) cross-sectional regression analysis to determine which of these variables are significant in a multiple regression.

6.2.1 Portfolio Results

Before proceeding further in the cross-sectional regressions it will be useful to examine the returns on portfolios formed from sales to price and debt to equity. We have already seen, for portfolios formed on market value of equity and book to market equity (Panel C and D of Table 4.2 in Chapter 4), that the average returns are

[1] See subsection 2.2.2.6 in chapter 2 the discussion that the S/P variable may be is a more reliable indicator of a firm's relative market valuation than other variables (e.g., BE/ME).

negatively related with the market value of equity and positively with the book to market equity. Specifically, the smallest book to market equity portfolio earns 1.09% per month while the largest book to market equity portfolio earns 2.66% per month. It generates a return differential of 1.57% each month (18.84% on an annualised basis) between these extreme portfolios (see also Figure 6.1). While returns fall from 3.32% for small market value of equity portfolio to 1.56% for large market value of equity portfolio (see also Figure 6.1), a difference of 1.76% per month (21.12% on an annualised basis).

Table 6.1 gives properties of portfolios formed on one-dimensional sorts by sales to price (Panel A) and debt to equity[2] (Panel B). The returns shown in Table 6.1 is the time-series average of 192 monthly, equal-weighted portfolio returns from July 1980 to June 1996, in percent terms. The values of the firm-specific variables are the time-series averages of the annual values of these variables in each portfolio. Panel A of Table 6.1 reveals the positive relationship between average stock returns and sales to prices (S/P). The smallest S/P portfolio earns 1.20% per month while the largest S/P portfolio earns 2.75% per month. The sales to price variable generates a return differential of 1.55% each month (18.60% on an annualised basis) between these extreme portfolios (see also Figure 6.1). Panel B of Table 6.1 shows that average returns are generally increasing with the ratio of debt to equity (D/E), increasing from 1.29% for the smallest D/E portfolio to 2.73% per month for the largest D/E portfolio, a difference of 1.27% per month (15.24% on an annualised basis).

In summary, with this one-dimensional classification scheme, we find a strong relation between average returns and BE/ME, ME, S/P, and D/E.

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[2] The definition of the leverage measure (the debt to equity) is the same as in Bhandari (1988).

6.2.2. The Fama-MacBeth Regressions

The informal analysis of the data in the previous subsection reveal that book to market equity, market value of equity, sales to price and debt to equity are strongly related to average stock returns. In this subsection, we ask which of these variables are significant in a multiple regression[3]. Table 6.2 presents the results for these regressions at the individual security level. This table shows the average coefficients from the Fama-MacBeth cross-sectional regressions from the full sample period (July 1980 to June 1996). The figure in parenthesis is the t-statistic which is the average coefficient divided by its time-series standard error.

Model A of Table 6.2 shows that the debt to equity ratio appears to have a significant and positive effect on stock returns, with an average coefficient of 0.16% (t-statistic 2.09), when simultaneously regressed as independent variable with the BE/ME and ME variables. This result also support Bhandari's conclusion that the debt to equity has a significant positive relationship with average stock returns. However, the results in this Model reveal that both the BE/ME and ME variables have a significant relationship with average stock returns, with an average coefficient on BE/ME of 0.29% (t-statistic 3.65), and -0.14% (t-statistic -2.30) for ME. This is inconsistent with the Barbee, Mukherji, and Raines (1996) result that D/E absorbs the roles of the BE/ME and ME in explaining stock returns during the 1979 to 1991 for the U.S. market.

The explanatory power of the debt to equity ratio is captured by the sales to price ratio, as in Barbee, Mukherji, and Raines (1996), when the S/P and D/E are used in

[3] Some argue that more than three variables are required to characterise the multidimensional nature of risk. A number of earlier papers estimate cross-sectional regression models similar to Fama and French (1992) but using a larger and richer set of independent variables (e.g., Rosenberg and Marathe (1979), Sharpe (1982) and Jacobs and Levy (1988b)).

combination with any one of the other two explanatory variables. For example, when ME, S/P and D/E are included in the same regression, the first two are significant but D/E is not (Model B). Similarly, when BE/ME, S/P and D/E are included in the same regression, BE/ME and S/P are significant, but D/E is not (Model C).

In Model D, the S/P has a significant coefficient, with an average coefficient of 0.30% (t-statistic 5.16), when it is used in combination with the BE/ME and ME, both of which have a significant coefficient, with an average coefficient on BE/ME of 0.18% (t-statistic 2.30), and -0.13% (t-statistic -2.16) for ME. These results are inconsistent with the Barbee, Mukherji, and Raines (1996) results that S/P absorbs the roles of the BE/ME and ME in explaining stock returns. Model E confirms the above results when the S/P is used in combination with all of the other three explanatory variables.

In summary, our results reveal that among the four variables considered here the S/P variable is significant in explaining the cross-sectional average stock returns, beyond the contribution of BE/ME and ME.

6.2.2.1. Subperiod Results

The results from the full sample period reveal that, among the variables considered here, the book to market equity, market value of equity and sales to price have explanatory power for explaining average stock returns. Table 6.3 presents the average coefficients from the Fama-MacBeth cross-sectional regressions for two equal subperiods; subperiod one from July 1980 to June 1988 (Panel A) and subperiod two from July 1988 to June 1996 (Panel B).

The book to market equity coefficients become insignificant in subperiod one (in Model D and E with negative sign) but remain significant in subperiod two. The significance level of the coefficients in subperiod two are higher than in the full sample period. Similarly as was reported in two previous chapters, the market value of equity coefficients are significant in the early subperiod (Panel A) but insignificant in the latter subperiod (Panel B). The subperiods results for the debt to equity variable yield similar conclusions to those for the overall period. However, its sign in Model B, C and E become positive in subperiod one. Unlike the market value of equity and book to market equity, the sale to price coefficients are significant in both subperiods (except in Model D in subperiod two).

In summary, the subperiods results show that, among the variables considered here, the sales to price is consistently the most powerful variable in explaining cross-sectional variation of average stock returns.

6.2.2.2. Are the Premia Concentrated in January?

Table 6.4 reports the seasonal behaviour of premiums on the four firm characteristics. The BE/ME coefficient is larger in January than during the rest of the year, but average returns are positively related to BE/ME in both January and non-January months, with higher t-values in non-January months (except Model D). The size premium in January months is negative and insignificant in all models. However, the size premium in non-January months is negative and significant in all models. Similarly the size effect, the S/P effect is insignificant in January months and significant in the other months of the year. The results for these three variables for non-January months are similar to the results across all the months presented in Table 6.1. Unlike the other three variables, the D/E effect has a strong seasonal pattern. It is significantly positive in January months and becomes insignificantly negative in non-January months (except in Model A where it remains positive).

Table 6.1. Properties of Portfolios Formed on Sales to Price or Debt to Equity: July 1980 to June 1996

In each panel the stocks are grouped in to 10 portfolios by a different variable, and the grouping procedure is repeated every year at the end of June. The Tobin's q (q), the book to market value of equity (BE/ME), the market leverage (A/ME), the book leverage (A/BE), the earnings to price (E/P), the cash flow to price (CF/P), the dividend yield (DY), the sales to price (S/P) and the book value of debt to market value of equity (D/E) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. E(+)/P is the earnings to price ratio including only firms with positive earnings. E/P(D) is a dummy variable, equal to zero if earnings are positive, and one if earnings are negative. CF(+)/P is the cash flow to price ratio including only firms with positive cash flow. CF/P(D) is a dummy variable, equal to zero if cash flow is positive, and one if cash flow is negative. Pre-ranking β is estimated using 24-60 monthly observations over the five year period ending June of year t. The estimation of the post-ranking beta (β) is described in detail in the text. Returns is the time-series average of 192 monthly, equal-weighted portfolio returns, in percent terms. β is the time-series average of the full-period, post-ranking equally-weighted portfolio beta, estimated using monthly returns. lnq, lnME, lnBE/ME, lnA/ME, lnA/BE, E(+)/P, CF(+)/P, DY, lnS/P, and lnD/E are the time-series average of the annual values of these variables in each portfolio. E/P(D) and CF/P(D) gives the average proportion of stocks with negative earnings and negative cash flow in each portfolio respectively. The prefix ln(.) denotes that the variable is used in natural logarithm form. N denotes the average number of securities in each portfolio.

Panel A: Portfolios Formed on Sales to Price

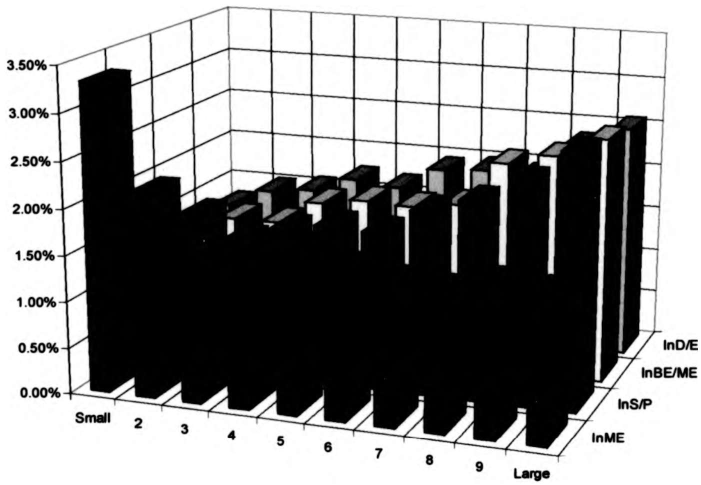
	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-S/P	1.20	0.86	0.62	4.09	-1.14	-0.55	0.59	0.05	0.09	0.09	0.06	2.54	-0.95	-1.54	81
S/P-2	1.43	0.86	0.20	3.93	-0.74	-0.11	0.64	0.08	0.04	0.12	0.03	3.81	-0.18	-0.99	81
S/P-3	1.48	0.86	0.02	3.92	-0.61	0.08	0.69	0.08	0.04	0.14	0.03	4.35	0.18	-0.73	81
S/P-4	1.65	0.89	-0.13	3.73	-0.47	0.25	0.72	0.09	0.04	0.16	0.02	4.88	0.45	-0.51	81
S/P-5	1.74	0.91	-0.28	3.51	-0.34	0.41	0.75	0.10	0.06	0.17	0.03	5.02	0.69	-0.32	81
S/P-6	1.72	0.92	-0.40	3.41	-0.24	0.55	0.79	0.10	0.07	0.18	0.04	5.54	0.92	-0.13	81
S/P-7	2.00	0.98	-0.56	3.07	-0.11	0.74	0.85	0.10	0.11	0.18	0.07	5.75	1.15	0.10	81
S/P-8	2.15	1.00	-0.70	2.87	0.03	0.93	0.90	0.11	0.11	0.21	0.08	6.07	1.41	0.33	81
S/P-9	2.40	1.06	-0.91	2.39	0.22	1.19	0.97	0.11	0.20	0.23	0.11	5.80	1.76	0.65	81
Large-S/P	2.75	1.12	-1.31	1.95	0.62	1.75	1.11	0.15	0.32	0.23	0.18	5.20	2.48	1.26	80

Table 6.1. Continued

Panel B: Portfolios Formed on Debt to Equity

	Ret %	β	lnq	lnME	lnBE/ME	lnA/ME	lnA/BE	E(+)/P	E/P(D)	CF(+)/P	CF/P(D)	DY	lnS/P	lnD/E	N
Small-D/E	1.29	0.86	0.71	3.97	-1.16	-0.69	0.46	0.06	0.07	0.09	0.04	2.74	-0.66	-1.85	81
D/E-2	1.50	0.87	0.24	3.67	-0.76	-0.20	0.56	0.08	0.03	0.12	0.02	3.92	-0.02	-1.16	81
D/E-3	1.56	0.90	0.02	3.63	-0.58	0.04	0.62	0.09	0.03	0.14	0.03	4.40	0.27	-0.81	81
D/E-4	1.73	0.90	-0.16	3.55	-0.45	0.24	0.68	0.09	0.04	0.16	0.03	4.88	0.53	-0.54	81
D/E-5	1.68	0.90	-0.27	3.62	-0.37	0.39	0.76	0.10	0.04	0.17	0.04	5.24	0.68	-0.30	81
D/E-6	1.93	0.94	-0.43	3.37	-0.25	0.57	0.82	0.10	0.07	0.18	0.04	5.46	0.88	-0.07	81
D/E-7	1.97	0.95	-0.57	3.25	-0.12	0.76	0.88	0.10	0.10	0.19	0.07	5.71	1.07	0.17	81
D/E-8	1.94	0.97	-0.73	3.12	0.01	0.97	0.96	0.11	0.11	0.21	0.07	5.84	1.30	0.43	81
D/E-9	2.34	1.04	-0.94	2.62	0.23	1.27	1.03	0.10	0.22	0.21	0.13	5.81	1.63	0.78	81
Large-D/E	2.56	1.12	-1.31	2.08	0.65	1.90	1.22	0.14	0.37	0.23	0.21	4.95	2.22	1.47	80

Figure 6.1 **Average Monthly Returns for Portfolios Sorted by Market Value of Equity, Sales to Price, Book to Market Equity and Debt to Equity**



In summary, the explanatory power of the book to market, firm size, and sales to price ratio is not a phenomenon specific to the month of January. In contrast, the D/E premium is concentrated on January months.

Table 6.2. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value of Equity, Debt to Equity and Sales to Price: July 1980 to June 1996

The book to market equity (BE/ME), the book value of debt to market value of equity (D/E) and the sales per share to price (S/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average coefficient (in percent) is the time-series average of the monthly regression coefficients for July 1980 to June 1996, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \gamma_{4t}\ln S/P_{it} + \varepsilon_{it}$

	γ_0	lnBE/ME	lnME	lnD/E	lnS/P	Avg.R^2
(A)	2.403	0.292	-0.136	0.159		0.0225
	(6.02)	(3.65)	(-2.30)	(2.09)		
(B)	1.919		-0.135	-0.044	0.395	0.0222
	(4.47)		(-2.30)	(-0.44)	(5.08)	
(C)	1.605	0.283		-0.106	0.410	0.0124
	(4.30)	(3.52)		(-1.02)	(5.10)	
(D)	2.076	0.183	-0.128		0.303	0.0217
	(5.46)	(2.30)	(-2.16)		(5.16)	
(E)	2.004	0.200	-0.125	-0108	0.372	0.0253
	(4.79)	(2.45)	(-2.11)	(-1.05)	(4.77)	

Table 6.3. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value of Equity, Debt to Equity and Sales to Price: July 1980 to June 1996

The book to market equity (BE/ME), the book value of debt to market value of equity (D/E) and the sales per share to price (S/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average coefficient (in percent) is the time-series average of the monthly regression coefficients for each subperiod, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \gamma_{4t}\ln S/P_{it} + \varepsilon_{it}$

	γ_0	lnBE/ME	lnME	lnD/E	lnS/P	Avg.R^2
Panel A: Subperiod one: July 1980 to June 1988						
(A)	3.416	0.140	-0.245	0.380		0.0228
	(5.98)	(1.08)	(-2.88)	(4.18)		
(B)	2.826		-0.235	0.010	0.516	0.0224
	(4.60)		(-2.76)	(0.08)	(4.94)	
(C)	2.129	0.122		0.017	0.567	0.0132
	(3.90)	(0.91)		(0.13)	(5.46)	
(D)	2.839	-0.006	-0.234		0.531	0.0227
	(5.05)	(-0.05)	(-2.73)		(7.39)	
(E)	2.848	-0.010	-0.234	0.017	0.521	0.0256
	(4.72)	(-0.08)	(-2.73)	(0.13)	(5.01)	
Panel B: Subperiod two: July 1988 to June 1996						
(A)	1.391	0.444	-0.028	-0.061		0.0222
	(2.56)	(4.78)	(-0.34)	(-0.52)		
(B)	1.013		-0.035	-0.098	0.274	0.0221
	(1.72)		(-0.44)	(-0.64)	(2.39)	
(C)	1.080	0.444		-0.229	0.252	0.0117
	(2.14)	(5.07)		(-1.43)	(2.09)	
(D)	1.314	0.371	-0.023		0.075	0.0207
	(2.61)	(4.23)	(-0.28)		(0.86)	
(E)	1.160	0.411	-0.017	-0.233	0.223	0.0250
	(2.03)	(4.41)	(-0.21)	(-1.44)	(1.94)	

Table 6.4. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Book to Market Equity, Market Value of Equity, Debt to Equity and Sales to Price for January and non-January Months: July 1980 to June 1996

The book to market equity (BE/ME), the book value of debt to market value of equity (D/E) and the sales per share to price (S/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. Firm market value of equity (ME) is measured in June of year t which is denominated in millions of pounds. The prefix ln(.) denotes that the variable is used in natural logarithm form. The first two rows in each model shows average coefficients and t-statistics for January only (16 observation) and the last two rows in each model shows average coefficients and t-statistics for February to December (176 observations). The average coefficient (in percent) is the time-series average of the monthly regression coefficients for July 1980 to June 1996, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln D/E_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln S/P_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln BE/ME_{it} + \gamma_{2t}\ln ME_{it} + \gamma_{3t}\ln D/E_{it} + \gamma_{4t}\ln S/P_{it} + \varepsilon_{it}$

		γ_0	lnBE/ME	lnME	lnD/E	lnS/P	Avg.R^2
(A)	Jan.	5.270	0.436	-0.078	0.694		0.0246
		(3.68)	(2.13)	(-0.37)	(2.50)		
	Feb-Dec	2.143	0.279	-0.142	0.111		0.0223
		(5.21)	(3.27)	(-2.29)	(1.41)		
(B)	Jan.	5.242		-0.099	0.894	0.012	0.0248
		(3.30)		(-0.47)	(2.58)	(0.05)	
	Feb-Dec	1.617		-0.138	-0.129	0.430	0.0222
		(3.68)		(-2.25)	(-1.28)	(5.24)	
(C)	Jan.	5.030	0.502		0.740	-0.007	0.0155
		(4.06)	(2.06)		(2.15)	(-0.03)	
	Feb-Dec	1.293	0.263		-0.183	0.447	0.0122
		(3.37)	(3.10)		(-1.71)	(5.30)	
(D)	Jan.	4.926	0.708	-0.084		0.360	0.0228
		(3.54)	(2.83)	(-0.40)		(1.73)	
	Feb-Dec	1.817	0.135	-0.132		0.298	0.0216
		(4.66)	(1.63)	(-2.13)		(4.86)	
(E)	Jan.	5.345	0.456	-0.078	0.736	-0.070	0.0266
		(3.41)	(1.97)	(-0.37)	(2.08)	(-0.29)	
	Feb-Dec	1.700	0.177	-0.130	-0185	0.412	0.0252
		(3.97)	(2.04)	(-2.09)	(-1.74)	(5.04)	

6.3. One Effect or Many?

We have already seen in previous chapters that a variety of variables have explanatory power to predict stock returns. Specifically, in chapter 4 the Tobin's q is the only variable that consistently has a significant role in explaining stock returns when simultaneously considered with market beta, market value of equity and book to market equity. The cash flow to price and sales to price are the most significant in explaining the cross-sectional behaviour of stock returns in chapter 5 and the first part of this chapter. In this section we ask which of these variables have more explanatory power to explain cross-sectional variation of average stock returns.

Table 6.5 reports the regression results for these variables. The table shows the average coefficients and the t-statistics. The average coefficient (in percent) is the time-series average of the monthly regression coefficients for July 1980 to June 1996, and the t-statistic is the average coefficient divided by its time-series standard error. In the first two models the Tobin's q has a significant coefficient with the expected negative value (as in Chapter 4) when it is used in combination with any one of the S/P and CF(+)/P, both of which has a significant coefficient. Model C of Table 6.5 shows that when the S/P and the CF(+)/P are simultaneously included in the regression, both variables have a significant coefficient, with an average coefficient on S/P of 0.27% (t-statistic 3.58), and 5.84% (t-statistic 9.65) for CF(+)/P.

In Model D, the CF(+)/P coefficient remain high significant when it is used in combination with the Tobin's q and S/P, whereas the coefficient on the Tobin's q and S/P variables become marginally significant. The CF(+)/P ratio consistently has the largest coefficient and the highest t-statistic in every model in Table 6.5.

Table 6.6 presents the results for two equal subperiods; subperiod one from July 1980 to June 1988 (Panel A) and subperiod two from July 1988 to June 1996 (Panel B). It can be seen from this table that the subperiods results yield similar conclusions to those for the full sample period (Table 6.5). The Tobin's q and S/P have greater coefficients in subperiod one than in subperiod two. In contrast, the CF(+)/P has greater coefficients in subperiod two than in subperiod one.

Table 6.7 presents the cross-sectional regression results separately for January and non-January months. The Tobin's q and sales to price coefficients are significant in both January (except in Model D) and non-January months, but their coefficients are larger in January than during the rest of the year, with higher t-values in non-January months. The cash flow to price coefficients remain almost the same, in both January and non-January months, as in the full sample period. However, its t-statistics are higher in non-January months.

In summary, the results in this part indicate that Tobin's q, cash flow to price and sales to price have explanatory power in explaining the cross-section of average stock returns.

Table 6.5. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Tobin's q, Sales to Price and Cash Flow to Price: July 1980 to June 1996

The Tobin's q (q), sales to price (S/P) and cash flow to price (CF/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average coefficient (in percent) is the time-series average of the monthly regression coefficients for July 1980 to June 1996, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln S/P_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \gamma_{3t}CF(+)/P_{it} + \varepsilon_{it}$

	γ_0	lnq	lnS/P	CF(+)/P	Avg.R^2
(A)	1.480	-0.330	0.296		0.0087
	(4.31)	(-2.65)	(3.97)		
(B)	0.788	-0.395		5.741	0.0128
	(2.15)	(-3.39)		(9.53)	
(C)	0.672		0.271	5.838	0.0123
	(1.86)		(3.58)	(9.65)	
(D)	0.740	-0.220	0.148	5.693	0.0151
	(2.04)	(-1.72)	(1.96)	(9.29)	

Table 6.6. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Tobin's q, Sales to Price and Cash Flow to Price: July 1980 to June 1996

The Tobin's q (q), sales to price (S/P) and cash flow to price (CF/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The average coefficient (in percent) is the time-series average of the monthly regression coefficients for each subperiod, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln S/P_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \gamma_{3t}CF(+)/P_{it} + \varepsilon_{it}$

	γ_0	lnq	lnS/P	CF(+)/P	Avg.R^2
Panel A: Subperiod one: July 1980 to June 1988					
(A)	2.018	-0.381	0.452		0.0101
	(3.91)	(-1.98)	(4.42)		
(B)	1.630	-0.654		3.561	0.0133
	(2.99)	(-3.74)		(5.15)	
(C)	1.447		0.385	3.534	0.0120
	(2.71)		(4.51)	(5.35)	
(D)	1.521	-0.255	0.141	3.412	0.0155
	(2.83)	(-2.25)	(2.28)	(4.90)	
Panel B: Subperiod two: July 1988 to June 1996					
(A)	0.943	-0.278	0.140		0.0073
	(2.10)	(-2.25)	(2.31)		
(B)	-0.054	-0.136		7.921	0.0124
	(-0.11)	(-2.10)		(8.44)	
(C)	-0.103		0.157	8.142	0.0127
	(-0.22)		(2.55)	(8.48)	
(D)	-0.041	-0.184	0.155	7.974	0.0148
	(-0.09)	(-1.88)	(2.12)	(8.33)	

Table 6.7. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on Tobin's q, Sales to Price and Cash Flow to Price for January and non-January Months: July 1980 to June 1996

The Tobin's q (q), sales to price (S/P) and cash flow to price (CF/P) are measured using accounting variables and market value of equity (ME) in December of year t-1. CF(+)/P, the cash flow to price ratio if cash flow are positive, and zero if cash flow are negative. The prefix ln(.) denotes that the variable is used in natural logarithm form. The first two rows in each model shows average coefficients and t-statistics for January only (16 observation) and the last two rows in each model shows average coefficients and t-statistics for February to December (176 observations). The average coefficient (in percent) is the time-series average of the monthly regression coefficients for July 1980 to June 1996, and the t-statistic is the average coefficient divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln S/P_{it} + \gamma_{2t}CF(+)/P_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln q_{it} + \gamma_{2t}\ln S/P_{it} + \gamma_{3t}CF(+)/P_{it} + \varepsilon_{it}$

		γ_0	lnq	lnS/P	CF(+)/P	Avg.R^2
(A)	Jan.	4.066	-0.731	0.507		0.0119
		(3.70)	(-1.71)	(2.04)		
	Feb-Dec	1.245	-0.293	0.277		0.0084
		(3.49)	(-2.25)	(3.54)		
(B)	Jan.	3.417	-1.020		5.759	0.0140
		(3.40)	(-2.31)		(3.88)	
	Feb-Dec	0.549	-0.338		5.740	0.0127
		(1.42)	(-2.82)		(8.91)	
(C)	Jan.	3.200		0.687	6.004	0.0133
		(3.25)		(2.31)	(3.61)	
	Feb-Dec	0.442		0.233	5.823	0.0123
		(1.17)		(3.00)	(9.05)	
(D)	Jan.	3.315	-0.593	0.349	5.687	0.0159
		(3.29)	(-1.40)	(1.33)	(3.46)	
	Feb-Dec	0.506	-0.186	0.130	5.693	0.0151
		(1.33)	(-1.88)	(1.94)	(8.72)	

6.4. Conclusions

In the first part of this chapter we have examined, using data from London Stock Exchange, the Barbee, Mukherji, and Raines (1996) argument that two alternative variables, the debt to equity ratio and the sales to price ratio have more explanatory power for stock returns than the book to market equity and the market value of equity in the U.S. market during the 1979 to 1991 period. In contrast with the evidence found by Barbee, Mukherji, and Raines (1996), we find that the debt to equity ratio and the sales to price ratio do not absorb the roles of the book to market equity and market value of equity in explaining the cross-section of average stock returns, but the sales to price ratio has significant explanatory power, beyond the contribution of the book to market equity and market value of equity. However, the explanatory power of the debt to equity ratio is captured by the sales to price ratio, as found in the study by Barbee, Mukherji, and Raines (1996).

Our findings, from the second part of this chapter, reveal that firm-specific variables such as Tobin's q, cash flow to price and sales to price have the most significant impact on average stock returns in the U.K. stock market. Thus, these results suggest that these variables deserve greater attention, by academics and practitioners, in explaining the cross-section of average stock returns.

In the next chapter we use data from London Stock Exchange to investigate empirically Berk's argument that the negative relation between average stock return and market value of equity is not due to the existence of a relation between firm size and risk.

Chapter 7

Does Firm Size Predict Stock Returns?...

7.1. Introduction

One of the most enigmatic empirical findings reported in finance is the size effect (firms with small market value of equity, on average, earn higher returns than firms with large market value of equity), which was discovered by Banz (1981), and is referred in the literature as an anomaly. However, Berk (1995a, 1995b, 1997) argues that the size effect should not be regarded as an anomaly, and that the negative relation between average return and market value of equity is not due to the existence of a relation between expected return and firm size. He makes the claim in light of his findings that there is no significant cross-sectional relation between average returns and four non-market measures of firm size. Berk concludes that "his results are evidence in favour of the hypothesis that the size effect is due to the endogenous identity relating the market value of a firm to its discount rate". More specifically, Berk argues that "since a firm's market value is endogenously determined in equilibrium as the discounted value of expected future cash flows, it depends on the discount rate. For example, if two firms have the same expected cash flow, the one with the larger discount rate will have the lower market value. Consequently, according to this view expected returns will always be negatively correlated with firm market value, ceteris paribus".

In the previous three chapters we have examined the determinants of the cross-section of stock returns in the London Stock Exchange. The purpose of this chapter is to empirically examine, using data from London Stock Exchange over the period from July 1984 to June 1996, Berk's argument, that the negative relation between average return and market value of equity is not due to the existence of a relation between firm size and risk. We will investigate this, using four non-market measures of firm size (book value of total assets, book value of gross fixed assets, annual sales, and number of employees). More specifically, if the size of the firm is related to its return, three other relationships should be observed in the market: i) other measures of firm size besides market value of equity should be inversely related to expected return; ii) when firm size is controlled for, the correlation between average returns and market value of equity should diminish; and iii) if the market value of equity absorbs the explanatory power of the market beta, then other measures of firm size, besides market value of equity, should absorb the explanatory power of the market beta. This chapter evaluates Berk's conclusion using data from the UK equity market. Therefore, we intend to formulate parallels between our results and those from the Berk study.

Our findings, using data from London Stock Exchange over the period from July 1984 to June 1996, confirm Berk's conclusion that the negative relation between average return and market value of equity (the size effect) is not due to the existence of a relation between expected return and firm size.

The remainder of this chapter is organised as follows. In section 7.2, the data are described. Section 7.3 contains our results when the relation between firm size, and stock returns is examined. Results from the relation between stock returns, firm size and market beta are in section 7.4. Conclusions are presented in section 7.5.

7.2. Data Description

The sample period for this chapter is shorter (1984 to 1996) than for the other chapters due to data unavailability for the measures of firm size. We took monthly returns from the London Share Price Database (LSPD) and the five measures of firm size variables from Datastream. A firm's market value of equity (ME) at the end of June of year t is used to measure firm size. The other four non-market measures of the firm size, besides market value of equity, are the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). Unlike market value of equity, the other firm size variables are measured at the end of December of year t-1, for the reason that we have already discussed in section 3.2. We employ logarithmic transformation of all these variables. The five measures of firm size, except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. Our proxy for the market portfolio is the equally-weighted index of all quoted companies on the LSPD database.

7.3. Results of the Relation between Average Returns and Size

The purpose of this section is to investigate the first two relationships that should be observed in the market, if the size of the firm is related to its return. We construct both informal tests based on the average returns of portfolios sorted by the different size measures and formal test based on the cross-sectional regression analysis.

7.3.1. Portfolio Results of One-Dimensional Classified Portfolios

Before analysing the results of the cross-sectional regressions it is helpful to look at returns on portfolios formed from size variables. At the end of June of each year t (1984 to 1995) stocks are ranked and divided into ten equal groups by each of the five measures of firm size. The equally-weighted monthly return and the average of each of the five measures of the firm size of each portfolio over the following 12 months (July t to June t+1) are then calculated. This portfolio formation procedure is repeated during the sample period and gives a time-series of equally-weighted monthly returns (144 observations) from July 1984 to June 1996 for each portfolio. In the first column of each Panel in Table 7.1, we present the average (in percent) of the time-series of equally-weighted monthly returns of each portfolio (see also Figure 7.1). From the first column of Panel A we see that the average returns are generally decreasing with firm market value of equity. Instead, the average returns of the portfolios formed on the other four size variables do not monotonically decrease as the values of the other four size variables increase (see column one of Panel B through Panel E). In Panel B, C, D and E the highest decile does not have the lowest return. Also, when firms are formed using number of employees the lowest decile does not have the highest return (Panel E). The difference in returns between the two extreme portfolios sorted by market value is 1.87 percent per month, which is much larger than the spread in returns of the portfolios formed on the other four size variables. For example, the return dispersion of the portfolios formed on the number of employees is 0.40 percent per month.

In column two through six of each Panel, we can see that there is a clear positive relation between the five measures of firm size at the portfolio level. These relationships are confirmed by examining the average correlation coefficients (at the individual level) between the variables, which is the average of the yearly cross-sectional correlation coefficients of the five size measures for the 12 years in the sample period (see Table 7.2). The correlations of each of the four non-market measures of firm size and market value of equity are lower than their correlations with each other, with the exception of the correlation between market value of equity and number of employees. In Table 7.2 we also present the correlation between each of the five measures of firm size and post-ranking β, where all correlations are quite small. The high correlation between market value of equity and β that is found in the other studies of Chan and Chen (1988) and Jegadeesh (1992), does not exist here.

In summary, with this one-dimensional classification scheme, we find a strong negative relationship between average returns and market value of equity. On the other hand, the four non-market measures of firm size show no obvious strong relation between average returns and themselves.

7.3.2. Return Behaviour of Two-Dimensional Classified Portfolios

In order to investigate the second relationship that should be observed in the market, if the size of the firm is related to its return, we first rank all available stocks on total assets and form them into quintiles. Within each quintile, stocks are sorted into quintiles based on market value of equity to form 25 portfolios. Panel A of Table 7.3 presents the average returns of the stocks in these portfolios. The first row of panel A shows the average return of each market value of equity quintile where the average returns are generally decreasing with market value of equity, ranging from 2.51 percent for the smallest market value of equity stocks to 1.30 percent per month for the largest market value stocks. The return spread of the market value of equity sorted portfolios is 1.21 percent per month, which does not appear to be much different than when stocks are sorted on market value of equity alone (first column, Panel A1). This spread is much larger than the return differential of portfolios formed on the basis of total assets 0.69 (first column Panel A). We can thus conclude that when firm size is controlled for, the relation between market value of equity and return remains the same as when firm size is not controlled for.

Table 7.1. Properties of Portfolios Formed on the Five Measures of Firm Size: July 1984 to June 1996

At the end of June of each year t (1984 to 1995) stocks are ranked and divided into ten equal groups for each of the five measures of firm size. The equally-weighted monthly return of each portfolio over the following 12 months (July t to June t+1) and other characteristics are then calculated. This portfolio formation procedure is repeated 12 times during the sample period. This gives a time-series of equally-weighted monthly returns (144 observations) from July 1984 to June 1996 for each portfolio. In each panel the stocks are grouped into 10 portfolios by each of the five measures of firm size. The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average return is the time-series average of 144 monthly, equally-weighted portfolio returns, in percent terms. lnME, lnTA, lnGFA, lnAS, lnNOE are the time-series averages of the monthly averaged values of these variables in each portfolio. N denotes the average number of securities in each portfolio.

Panel A: Portfolios Formed on Market Value of Equity

	Return %	lnME	lnTA	lnGFA	lnAS	lnNOE	N
Small-ME	3.26	0.77	1.61	0.89	1.93	5.15	87.6
ME-2	2.16	1.65	2.24	1.42	2.56	5.55	87.6
ME-3	1.82	2.20	2.58	1.78	2.86	5.83	87.6
ME-4	1.20	2.67	2.89	2.05	3.21	6.10	87.6
ME-5	1.57	3.13	3.24	2.41	3.54	6.43	87.6
ME-6	1.54	3.60	3.59	2.78	3.83	6.73	87.6
ME-7	1.44	4.14	4.01	3.20	4.26	7.14	87.6
ME-8	1.43	4.78	4.65	3.83	4.83	7.68	87.6
ME-9	1.41	5.69	5.58	4.82	5.74	8.51	87.6
Large-ME	1.39	7.34	7.34	6.83	7.46	10.14	87.0

Panel B: Portfolios Formed on Book Value of Total Assets

	Return %	lnME	lnTA	lnGFA	lnAS	lnNOE	N
Small-TA	2.26	1.33	1.11	0.26	1.37	4.54	87.6
TA-2	1.98	1.90	2.00	1.20	2.31	5.35	87.6
TA-3	1.74	2.38	2.47	1.66	2.78	5.79	87.6
TA-4	1.79	2.67	2.88	2.10	3.18	6.09	87.6
TA-5	1.65	2.98	3.29	2.48	3.68	6.51	87.6
TA-6	1.65	3.50	3.70	2.92	3.95	6.84	87.6
TA-7	1.63	3.95	4.21	3.45	4.44	7.35	87.6
TA-8	1.51	4.54	4.82	3.98	4.98	7.78	87.6
TA-9	1.38	5.54	5.79	5.00	5.99	8.78	87.6
Large-TA	1.49	7.18	7.45	6.95	7.53	10.22	87.0

Table 7.1. Continued

Panel C: Portfolios Formed on Book Value of Gross Fixed Assets

	Return %	lnME	lnTA	lnGFA	lnAS	lnNOE	N
Small-GFA	1.99	1.65	1.40	-0.07	1.62	4.44	87.6
GFA-2	1.74	2.10	2.15	1.09	2.50	5.38	87.6
GFA-3	1.97	2.33	2.47	1.63	2.84	5.79	87.6
GFA-4	1.87	2.70	2.93	2.09	3.29	6.20	87.6
GFA-5	1.62	2.97	3.24	2.51	3.53	6.49	87.6
GFA-6	1.69	3.35	3.61	2.93	3.88	6.84	87.6
GFA-7	1.66	3.87	4.14	3.49	4.40	7.35	87.6
GFA-8	1.56	4.36	4.67	4.15	4.84	7.83	87.6
GFA-9	1.47	5.48	5.71	5.17	5.87	8.73	87.6
Large-GFA	1.51	7.16	7.40	7.01	7.47	10.21	87.0

Panel D: Portfolios Formed on Annual Sales

	Return %	lnME	lnTA	lnGFA	lnAS	lnEMP	N
Small-AS	2.17	1.52	1.31	0.49	1.13	4.38	87.6
AS-2	1.89	2.03	2.08	1.25	2.22	5.31	87.6
AS-3	1.72	2.36	2.51	1.76	2.74	5.78	87.6
AS-4	1.61	2.67	2.90	2.16	3.20	6.17	87.6
AS-5	1.78	3.03	3.30	2.47	3.63	6.52	87.6
AS-6	1.53	3.40	3.65	2.84	4.04	6.94	87.6
AS-7	1.85	3.97	4.18	3.35	4.51	7.33	87.6
AS-8	1.63	4.47	4.73	3.90	5.08	7.81	87.6
AS-9	1.42	5.44	5.72	4.96	6.02	8.70	87.6
Large-AS	1.48	7.09	7.35	6.80	7.65	10.33	87.0

Panel E: Portfolios Formed on Number of Employees

	Return %	lnME	lnTA	lnGFA	lnAS	lnNOE	N
Small-NOE	1.89	1.89	1.60	0.47	1.53	4.02	87.6
NOE-2	2.05	2.13	2.13	1.24	2.37	5.18	87.6
NOE-3	1.76	2.37	2.52	1.65	2.80	5.70	87.6
NOE-4	1.77	2.59	2.90	2.04	3.19	6.12	87.6
NOE-5	1.84	3.00	3.26	2.52	3.59	6.52	87.6
NOE-6	1.47	3.38	3.65	2.92	3.98	6.95	87.6
NOE-7	1.69	3.81	4.11	3.38	4.44	7.40	87.6
NOE-8	1.66	4.43	4.69	4.02	4.95	8.01	87.6
NOE-9	1.46	5.38	5.62	5.03	5.90	8.91	87.6
Large-NOE	1.49	6.98	7.25	6.73	7.47	10.44	87.0

Figure 7.1. Average Monthly Returns for Portfolios Sorted by each of the Five Measures of Firm Size. The five measures of Firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. This figure shows the average monthly return (in percent) from July 1984 to June 1996 for each portfolio.

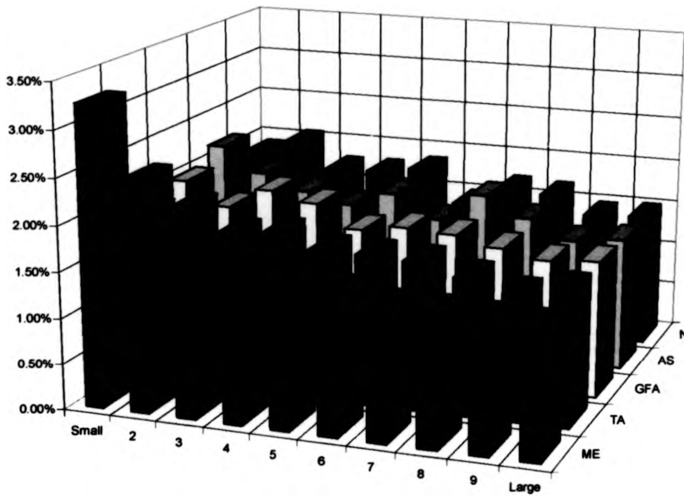


Table 7.2. Average Cross-Sectional Correlation Coefficients of the Five Measures of Firm Size and Post-Ranking β: 1984 to 1995

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The estimation of the post-ranking β is described in detail in the text. Each average correlation coefficient is the average of the yearly cross-sectional correlation coefficients of the five measures of firm size and the post-ranking β.

	ME	TA	GFA	AS	NOE
TA	0.851				
GFA	0.806	0.910			
AS	0.789	0.930	0.908		
NOE	0.746	0.729	0.645	0.742	
β	-0.292	-0.233	-0.190	-0.236	-0.330

Table 7.3. Average Monthly Returns (%) for Portfolios Formed on Non-Market Measures of Firm Size and then by Market Value of Equity and Reverse: July 1984 to June 1996

We rank firms according to their non-market measures of firm size (market value) at the end of June in each year t and divide them into quintiles. Within each quintile, stocks are sorted into quintiles based on market value (non-market measures of firm size) to form 25 portfolios. The equally-weighted monthly return of each portfolio over the following 12 months (July t to June t+1) are then calculated. This portfolio formation procedure is repeated 12 times during the sample period. This gives a time-series of equally-weighted monthly returns (144 observations) from July 1984 to June 1996 for each portfolio. The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average return is the time-series average of 144 monthly, equally-weighted portfolio returns, in percent terms. lnME, lnTA, lnGFA, lnAS, lnNOE are the time-series averages of the monthly averaged values of these variables in each portfolio.

Panel A: Stocks Sorted by Total Assets and then by Market Value of Equity

	All	S-ME	ME-2	ME-3	ME-4	L-ME
All		2.51	1.79	1.59	1.38	1.30
Small-TA	2.14	3.91	2.47	1.88	1.43	1.02
TA-2	1.76	2.87	2.22	1.20	1.23	1.28
TA-3	1.66	2.29	1.34	1.64	1.58	1.47
TA-4	1.55	1.98	1.50	1.56	1.37	1.34
Large-TA	1.45	1.48	1.40	1.68	1.31	1.37

Panel A1: Stocks Sorted by Market Value of Equity and then by Total Assets

	All	S-TA	TA-2	TA-3	TA-4	L-TA
All		1.52	1.57	1.82	1.72	1.91
Small-ME	2.72	2.97	2.48	2.78	2.33	3.04
ME-2	1.51	1.15	1.26	1.58	1.71	1.83
ME-3	1.54	1.11	1.35	1.71	1.70	1.82
ME-4	1.39	1.31	1.39	1.46	1.38	1.39
Large-ME	1.39	1.08	1.35	1.58	1.49	1.45

Panel B: Stocks Sorted by Gross Fixed Assets and then by Market Value of Equity

	All	S-ME	ME-2	ME-3	ME-4	L-ME
All		2.70	1.71	1.65	1.28	1.23
Small-GFA	1.87	3.84	2.01	1.42	1.10	0.99
GFA-2	1.91	3.06	2.14	1.76	1.29	1.30
GFA-3	1.67	2.75	1.26	1.76	1.31	1.29
GFA-4	1.62	2.20	1.76	1.60	1.35	1.20
Large-GFA	1.49	1.66	1.39	1.70	1.33	1.37

Table 7.3. Continued

Panel B1: Stocks Sorted by Market Value of Equity and then by Gross Fixed Assets						
	All	S-GFA	GFA-2	GFA-3	GFA-4	L-GFA
All		1.43	1.56	1.73	1.80	2.01
Small-ME	2.72	2.78	2.29	2.49	2.98	3.06
ME-2	1.50	0.93	1.44	1.65	1.29	2.21
ME-3	1.54	1.04	1.41	1.70	1.65	1.89
ME-4	1.39	1.32	1.34	1.28	1.63	1.38
Large-ME	1.39	1.09	1.32	1.55	1.45	1.53

Panel C: Stocks Sorted by Annual Sales and then by Market Value of Equity						
	All	S-ME	ME-2	ME-3	ME-4	L-ME
All		2.65	1.79	1.56	1.34	1.24
Small-AS	2.04	3.71	2.37	1.75	1.27	1.12
AS-2	1.66	2.74	2.11	1.29	1.15	1.01
AS-3	1.68	2.71	1.33	1.61	1.40	1.36
AS-4	1.73	2.56	1.71	1.49	1.53	1.34
Large-AS	1.46	1.53	1.41	1.67	1.33	1.36

Panel C1: Stocks Sorted by Market Value of Equity and then by Annual Sales						
	All	S-AS	AS-2	AS-3	AS-4	L-AS
All		1.46	1.63	1.70	1.78	1.96
Small-ME	2.72	2.78	2.84	2.52	2.39	3.08
ME-2	1.51	0.89	1.50	1.43	1.81	1.90
ME-3	1.53	1.26	1.08	1.53	1.78	2.02
ME-4	1.39	1.21	1.38	1.53	1.43	1.38
Large-ME	1.39	1.18	1.33	1.51	1.51	1.43

Panel D: Stocks Sorted by Number of Employees and then by Market Value of Equity						
	All	S-ME	ME-2	ME-3	ME-4	L-ME
All		2.65	1.77	1.54	1.34	1.27
Small-NOE	1.97	3.59	2.43	1.60	1.08	1.17
NOE-2	1.77	2.79	1.98	1.54	1.34	1.21
NOE-3	1.67	2.78	1.47	1.31	1.44	1.36
NOE-4	1.67	2.37	1.68	1.55	1.46	1.27
Large-NOE	1.49	1.70	1.30	1.69	1.40	1.35

Panel D1: Stocks Sorted by Market Value of Equity and then by Number of Employees						
	All	S-NOE	NOE-2	NOE-3	NOE-4	L-NOE
All		1.58	1.60	1.61	1.82	1.93
Small-ME	2.72	2.77	2.69	2.61	2.54	2.98
ME-2	1.51	1.18	1.40	1.30	1.75	1.91
ME-3	1.54	1.33	1.43	1.22	1.75	1.96
ME-4	1.38	1.48	1.14	1.39	1.52	1.39
Large-ME	1.39	1.13	1.34	1.53	1.56	1.39

When the order of the ranking is reversed, that is when stocks are aggregated into portfolios, first on the basis of the market value, then by total assets the results differ dramatically. Panel A1 of Table 7.3 shows the average returns of the stocks in these portfolios where the firm size is positively related to average return. The above grouping procedure is repeated when we use firm size variables (such as GFA, AS, and NOE) other than total assets, (Panel B through Panel D1) the results remain the same as reported in Panel A and Panel A1.

In summary, with this two-dimensional classification scheme, we find that market value of equity is strongly related to average returns, when firm size is controlled for, implying that this relation is not due to a relation between firm size and returns.

7.3.3. Cross-Sectional Regressions

From the informal analysis of the data in the previous subsections, we find a strong negative relationship between average returns and market value of equity, whereas this is not obvious between average returns and the four non-market measures of firm size. Also, when firm size is controlled for, the relation between market value of equity and average returns does not diminish, implying that this relation is not due to a relation between firm size and returns. To confirm the first intuition, we run the month-by-month Fama-MacBeth regressions of the cross-section of stock returns on market value of equity, and each of the other four non-market measures of firm size. Table 7.4 presents the results for these regressions at the individual security level. This Table shows the average coefficients from 144 monthly (July 1984 to June 1996) univariate cross-sectional regressions of stock returns on each of the five measures of firm size variables. The figure in parenthesis is the t-statistic which is the average slope divided by its time-series standard error. These results indicate that there is a strong cross-sectional relation between average returns and market value (model A). In contrast to the consistent explanatory power of the market value of equity, the other four non-market measures of firm size show no power in explaining average returns (model B through model E). Moreover, the results are consistent with the portfolio results of one-dimensional classified portfolios presented in Table 7.1. To address whether our results are not based on period-specific findings, we run regressions for two subperiods: July 1984 to June 1990 and July 1990 to June 1996. The results are reported in Table 7.5. When the subperiods' results are compared to the overall period reported in Table 7.4, it appears that the overall results are not based on period-specific findings. Table 7.6 presents average regressions coefficients separately for January and non-January months. The market value of equity coefficient is insignificant in January and significant in the non-January months. The four non-market measures of firm size coefficients are insignificant both in January and non-January months. The results of this table suggest that the negative relationship between returns and market value of equity is concentrated on non-January months.

We now turn to an investigation of the second intuition that when firm size is controlled for, the relation between market value of equity and average returns should be reduced. To control for firm size, the natural logarithm of market value of equity is annually cross-sectionally regressed, first onto the natural logarithm of each of the four non-market measures of firm size individually, and second onto the natural logarithm of all of the four non-market measures of firm size. The residuals of each of these regressions (controlled for firm size) are used as independent variables in the univariate cross-sectional regressions with the stock returns. The average cross-sectional correlation coefficients of those residuals are presented in Table 7.7, which shows that these residuals are highly correlated. Table 7.8 reports the results of these regressions. These residuals are negatively related to average returns and statistically significant, which is consistent with our earlier finding presented in Table 7.3. The positive relation between the four non-market measures of firm size and average return controlled for the market value of equity, found in Table 7.3, will be examined. In order, to query this proposition we use the residuals of the univariate cross-sectional regression of each of the four non-market measures of firm size on market value of equity as explanatory variables in the regression with the stock returns. The results presented in Table 7.9 show that these residuals are positively related to average returns with a significant t-statistic, and are similar with the results presented in Table 7.3. To this point our results are compatible with Berk's (1995b, 1997) finding using data from the U.S.

7.4. Results of the Relation between Average Returns, Size and Beta

Fama and French (1992) find no relation between average return and β over the period 1963 to 1990, even when β is the only explanatory variable. In contrast, they find that market value of equity has explanatory power for the cross-section of average stock returns, but when both are included as independent variables in the cross-sectional regressions market value of equity absorbs the explanatory power of β and eventually changes its sign to be negative. If there is relation between firm size and average return, then the other four non-market measures of firm size, beside market value of equity, should have additional explanatory power in a joint test of it and the CAPM. We investigate this in the next two subsections using both Fama-MacBeth cross-sectional regression and the seemingly unrelated regression methodology.

Table 7.4. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on the Five Measures of Firm Size: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average slope is the time-series average of the monthly regression coefficients from July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$ (B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln TA_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln GFA_{it} + \varepsilon_{it}$ (D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln AS_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln NOE_{it} + \varepsilon_{it}$

Variables	γ_0	lnME	lnTA	lnGFA	lnAS	lnNOE	Av. R^2
(A)	2.421	-0.210					0.0148
	(4.61)	(-2.96)					
(B)	2.100		-0.103				0.0118
	(4.24)		(-1.58)				
(C)	1.934			-0.072			0.0104
	(4.03)			(-1.31)			
(D)	2.010				-0.072		0.0108
	(4.10)				(-1.19)		
(E)	2.241					-0.077	0.0101
	(3.68)					(-1.29)	

Table 7.5. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on the Five Measures of Firm Size: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average slope is the time-series average of the monthly regression coefficients from July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$ (B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln TA_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln GFA_{it} + \varepsilon_{it}$ (D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln AS_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln NOE_{it} + \varepsilon_{it}$

Variables	γ_0	lnME	lnTA	lnGFA	lnAS	lnNOE	Av. R^2
Panel A: Subperiod 1: July 1984 to June 1990							
(A)	2.771	-0.225					0.0178
	(3.47)	(-2.06)					
(B)	2.234		-0.068				0.0136
	(2.92)		(-0.70)				
(C)	2.074			-0.025			0.0123
	(2.87)			(-0.31)			
(D)	2.125				-0.029		0.0123
	(2.78)				(-0.33)		
(E)	2.154					-0.019	0.0117
	(2.30)					(-0.22)	
Panel B: Subperiod 2: July 1990 to June 1996							
(A)	2.157	-0.204					0.0121
	(3.11)	(-2.25)					
(B)	1.967		-0.138				0.0099
	(3.11)		(-1.57)				
(C)	1.785			-0.117			0.0086
	(2.81)			(-1.57)			
(D)	1.895				-0.115		0.0092
	(3.06)				(-1.39)		
(E)	2.309					-0.132	0.0086
	(2.92)					(-1.62)	

Table 7.6. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on the Five Measures of Firm Size for January and non-January Months: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The first two rows in each model shows average slopes and t-statistics for January only and the last two rows in each model shows average slopes and t-statistics for February to December. The average slope is the time-series average of the monthly regression coefficients from July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln ME_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln TA_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln GFA_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln AS_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\ln NOE_{it} + \varepsilon_{it}$

Variables		γ_0	lnME	lnTA	lnGFA	lnAS	lnNOE	Av. R^2
(A)	Jan	5.405	-0.213					0.0148
		(2.71)	(-0.75)					
	Feb-Dec	2.15	-0.209					0.0148
		(3.98)	(-2.85)					
(B)	Jan	4.795		-0.023				0.0118
		(2.65)		(-0.11)				
	Feb-Dec	1.855		-0.110				0.0118
		(3.63)		(-1.61)				
(C)	Jan	4.858			-0.046			0.0104
		(2.73)			(-0.22)			
	Feb-Dec	1.668			-0.074			0.0104
		(3.38)			(-1.30)			
(D)	Jan	4.824				-0.031		0.0108
		(2.70)				(-0.15)		
	Feb-Dec	1.754				-0.076		0.0108
		(3.47)				(-1.19)		
(E)	Jan	5.086					-0.065	0.0101
		(2.15)					(-0.31)	
	Feb-Dec	1.983					-0.078	0.0101
		(3.16)					(-1.25)	

Table 7.7. Average Cross-Sectional Correlation Coefficients of the Residuals of the Logarithm of Market Value of Equity Regressed onto the Logarithm of the Four Non-Market Measures of Firm Size: 1984 to 1995

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. Each average correlation coefficient is the average of the yearly cross-sectional correlation coefficients of the residuals of the logarithm of market value regressed on the logarithm of each of the four non-market measures of firm size separately and onto the logarithm of the four non-market measures of firm size together (indicated in row ALL).

	TA	GFA	AS	NOE
GFA	0.832			
AS	0.839	0.728		
EMP	0.758	0.795	0.832	
ALL	0.993	0.817	0.823	0.723

Table 7.8. Average Slopes (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns onto Orthogonalized Market Value of Equity Measures: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average slope is the time-series average of the monthly regression coefficients for July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\,\hat{\varepsilon}\,(ME\sim TA)_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\,\hat{\varepsilon}\,(ME\sim GFA)_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\,\hat{\varepsilon}\,(ME\sim AS)_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\,\hat{\varepsilon}\,(ME\sim NOE)_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\,\hat{\varepsilon}\,(ME\sim ALL)_{it} + \varepsilon_{it}$

Variables	γ_0	TA	GFA	AS	NOE	ALL	Avg.R^2
(A)	1.720	-0.566					0.0075
	(3.95)	(-5.02)					
(B)	1.718		-0.498				0.0081
	(3.95)		(-5.37)				
(C)	1.721			-0.494			0.0085
	(3.96)			(-5.05)			
(D)	1.714				-0.418		0.0083
	(3.94)				(-4.95)		
(E)	1.715					-0.554	0.0070
	(3.94)					(-5.07)	

Table 7.9. Average Slopes (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns onto Size Measures Orthogonal to Market Value of Equity: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The average slope is the time-series average of the monthly regression slopes for July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\varepsilon}(TA{\sim}ME)_{it} + \varepsilon_{it}$ (B): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\varepsilon}(GFA{\sim}ME)_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\varepsilon}(AS{\sim}ME)_{it} + \varepsilon_{it}$ (D): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\varepsilon}(NOE{\sim}ME)_{it} + \varepsilon_{it}$

Variables	γ_0	TA	GFA	AS	NOE	Avg.R^2
(A)	1.715	0.424				0.0048
	(3.95)	(4.59)				
(B)	1.714		0.325			0.0038
	(3.94)		(6.08)			
(C)	1.717			0.354		0.0047
	(3.95)			(5.01)		
(D)	1.709				0.273	0.0036
	(3.93)				(5.24)	

7.4.1. Cross-Sectional Regressions

The results of our cross-sectional regression tests are presented in Table 7.10. Model A is the univariate regressions on β. When β is the only explanatory variable, the relationship between average returns and β is significant, with a t-statistic of 2.61. This indicates that β helps explain the cross-section of average stock returns. This result contrasts with the insignificant positive coefficient found by Fama and French (1992) for the period from 1963 to 1990 in the U.S., and is similar to the results of study by Strong and Xu (1997) for the period 1973 to 1992 in the U.K. However, when market value of equity is included in the regressions as the control variable (model B), the coefficient of β has no explanatory power and its sign turns negative, with a t-statistic of -1.12, but the estimated coefficient of market value of equity is significant with a t-statistic of -3.50. In contrast, when we consider each of the other four non-market measures of firm size in place of market value of equity in the bivariate regressions (model C through model F), the coefficient of β has explanatory power in each model but the other four non-market measures of firm size have no explanatory power. The average coefficients of β in the bivariate regressions are nearly the same (range between 1.044 to 1.199, model C, D, E and F), as those in the univariate β regression (of 1.100, model A), even though its t-statistics are higher. The sign of the coefficients in subperiods (see Table 7.11) remain the same to those for the full sample period reported in Table 7.10, except in subperiod two where the coefficients of GFA, AS and NOE become negative. The coefficients in both subperiods remain insignificant (or significant) as those in the full sample period, except in subperiod one where the coefficient of β become insignificant (Model A). However, the significance level in both subperiods is different to those in full period.

The results are not a phenomenon specific to the month of January (see, Table 7.12). In summary, the evidence in Table 7.10 is consistent with the above task that firm size has no additional explanatory power in a joint test of it and the CAPM.

7.4.2. Seemingly Unrelated Regressions (SUR)

The use of a potential error estimated βs (in the second-pass) as an independent regressor, invokes an errors-in-variables problem which possibly affect the inferences of the firm size in cross-section regressions. On that account, we compare our results using the Fama-MacBeth methodology to an alternative using the Seemingly Unrelated Regression (SUR) methodology where the cross-sectional relation between portfolio average return and portfolio average firm size is tested while the portfolio βs are simultaneously estimated. We present the results of this method in Table 7.13. Panel A shows the results when the error covariance matrix is estimated from unrestricted least square (LS) residuals (residuals estimated without restricting the coefficients in the system 3.5, see also page 84). The results when the error covariance matrix is estimated from restricted least square (LS) residuals (residuals estimated with restricting the coefficients in the system 3.5, see also page 84) are reported in Panel B. Qualitatively the results between these two panels are almost the same. Thus, the results here are not sensitive to the choice of the method for estimating the residuals. The odd columns in each panel contain the results when the residuals covariance matrix is non-diagonal ($\sigma_{ij} \neq 0$) and the even columns contain results when the residuals covariance matrix is diagonal ($\sigma_{ij} = 0$). The significance level of the coefficients between odd and even columns are very different. When the residuals covariance matrix is non-diagonal the main conclusion remain the same to those in cross-sectional regressions (see Table 7.10). However, the significance level of the coefficients are different.

Table 7.10. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β and Five Measures of Firm Size: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The estimation of the post-ranking β is described in detail in the text. The average slope is the time-series average of the monthly regression slopes for July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln TA_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln GFA_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln AS_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln NOE_{it} + \varepsilon_{it}$

	γ_0	β	lnME	lnTA	lnGFA	lnAS	lnNOE	Avg.R^2
(A)	0.686	1.100						0.0115
	(1.31)	(2.61)						
(B)	2.994	-0.377	-0.260					0.0177
	(5.59)	(-1.12)	(-3.50)					
(C)	0.790	1.044		-0.012				0.0169
	(1.75)	(2.67)		(-0.20)				
(D)	0.546	1.199			0.017			0.0156
	(1.17)	(3.32)			(0.39)			
(E)	0.537	1.179				0.022		0.0160
	(1.23)	(3.02)				(0.41)		
(F)	0.679	1.097					0.001	0.0155
	(1.37)	(2.96)					(0.02)	

Table 7.11. Subperiods Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β and Five Measures of Firm Size:

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The estimation of the post-ranking β is described in detail in the text. The average slope is the time-series average of the monthly regression coefficients for July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$ (B): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln TA_{it} + \varepsilon_{it}$ (D): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln GFA_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln AS_{it} + \varepsilon_{it}$ (F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln NOE_{it} + \varepsilon_{it}$

	γ_0	β	lnME	lnTA	lnGFA	lnAS	lnNOE	Avg.R^2
Panel A: Subperiod 1: July 1984 to June 1990								
(A)	1.124	1.006						0.0135
	(1.41)	(1.61)						
(B)	3.782	-0.706	-0.311					0.0221
	(5.25)	(-1.55)	(-2.77)					
(C)	1.006	1.060		-0.013				0.0188
	(1.60)	(2.23)		(0.17)				
(D)	0.719	1.257			0.053			0.0186
	(1.04)	(2.50)			(0.87)			
(E)	0.711	1.228				0.052		0.0179
	(1.13)	(2.52)				(0.77)		
(F)	0.748	1.121					0.035	0.0182
	(0.99)	(2.17)					(0.54)	
Panel B: Subperiod 2: July 1990 to June 1996								
(A)	0.245	1.211						0.0090
	(0.36)	(2.14)						
(B)	2.160	-0.028	-0.201					0.0142
	(2.72)	(-0.05)	(-2.04)					
(C)	0.575	1.027		-0.038				0.0149
	(0.89)	(1.65)		(-0.40)				
(D)	0.373	1.140			-0.019			0.0126
	(0.59)	(2.18)			(-0.30)			
(E)	0.427	1.117				-0.021		0.0144
	(0.72)	(1.88)				(-0.25)		
(F)	0.611	1.074					-0.034	0.0127
	(0.93)	(2.00)					(-0.50)	

Table 7.12. Average Slopes % (t-Statistics) for Fama-MacBeth Type Regressions of Stock Returns on β and Five Measures of Firm Size for January and non-January Months: July 1984 to June 1996

The five measures of firm size are the market value of equity (ME), the book value of total assets (TA), the book value of gross fixed assets (GFA), the annual sales (AS), and the number of employees (NOE). The market value of equity is measured at the end of June of year t, while the other four variables are measured at the end of December of year t-1. The five measures of firm size except for the number of employees are denominated in millions of pounds. The number of employees is denominated in units. The estimation of the post-ranking β is described in detail in the text. The first two rows in each model shows average slopes and t-statistics for January only and the last two rows in each model shows average slopes and t-statistics for February to December. The average slope is the time-series average of the monthly regression slopes for July 1984 to June 1996, and the t-statistic is the average slope divided by its time-series standard error. The numbers in parentheses are t-values.

(A): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \varepsilon_{it}$

(B): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln ME_{it} + \varepsilon_{it}$

(C): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln TA_{it} + \varepsilon_{it}$

(D): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln GFA_{it} + \varepsilon_{it}$

(E): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln AS_{it} + \varepsilon_{it}$

(F): $R_{it} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{it} + \gamma_{2t}\ln NOE_{it} + \varepsilon_{it}$

	γ_0	β	lnME	lnTA	lnGFA	lnAS	lnNOE	Avg.R^2
(A)	3.272	1.432						0.0115
Jan	(1.96)	(0.90)						
F-D	0.451	1.069						0.0115
	(0.82)	(2.44)						
(B)	4.115	0.953	-0.101					0.0177
Jan	(2.09)	(1.37)	(-0.35)					
F-D	2.892	-0.497	-0.274					0.0177
	(5.18)	(-1.38)	(-3.57)					
(C)	1.023	2.786		0.272				0.0169
Jan	(0.80)	(1.75)		(1.76)				
F-D	0.769	0.885		-0.038				0.0169
	(1.61)	(2.21)		(-0.59)				
(D)	2.237	2.148			0.014			0.0156
Jan	(1.71)	(1.72)			(1.03)			
F-D	0.392	1.112			0.006			0.0156
	(0.79)	(2.94)			(0.13)			
(E)	1.208	2.624				0.242		0.0160
Jan	(0.72)	(1.51)				(1.60)		
F-D	0.476	1.048				0.002		0.0160
	(1.05)	(2.64)				(0.03)		
(F)	2.197	1.78					0.104	0.0155
Jan	(1.54)	(1.37)					(0.93)	
F-D	0.541	1.035					-0.009	0.0155
	(1.03)	(2.67)					(-0.17)	

Table 7.13. Estimates of Coefficients % (t-Statistics) of the Seemingly Unrelated Regressions (SUR): July 1984 to June 1996

Firm market value lnME is measured in June of Year t. Panel A shows the results for Seemingly Unrelated Regressions (SUR) when the least squares (LS) residuals are estimated without restricting the coefficients in the system. Panel B shows the results when the least squares residuals are estimated with restricting the coefficients in the system. The odd columns in each panel contain the results when the residuals covariance matrix is non-diagonal ($\sigma_{ij}\neq 0$) and the even columns contain results when the residuals covariance matrix is diagonal ($\sigma_{ij}=0$). The numbers in parentheses are t-values.

(A): $R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln ME_{pt} + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt}$ (B): $R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln TA_{pt} + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt}$

(C): $R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln GFA_{pt} + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt}$ (D): $R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln AS_{pt} + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt}$

(E): $R_{pt}-R_{ft} = \alpha_0 + \alpha_1 \ln NOE_{pt} + \beta_p(R_{mt}-R_{ft}) + \varepsilon_{pt}$

	α_0		lnME		lnTA		lnGFA		lnAS		lnNOE	
Panel A: Restricted SUR with unrestricted LS residuals												
	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$
(A):	1.533	1.527	-0.144	-0.174								
	(7.20)	(11.25)	(-2.70)	(-4.88)								
(B):	1.178	1.406			-0.050	-0.137						
	(4.78)	(8.73)			(-0.85)	(-3.25)						
(C):	1.087	1.267					-0.033	-0.126				
	(5.79)	(10.08)					(-0.61)	(-3.12)				
(D):	1.199	1.477							-0.052	-0.146		
	(4.41)	(8.22)							(-0.83)	(-3.30)		
(E):	1.341	2.033									-0.050	-0.166
	(2.72)	(6.11)									(-0.73)	(-3.42)
Panel B: Restricted SUR with restricted LS residuals												
	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$	$\sigma_{ij}\neq0$	$\sigma_{ij}=0$
(A):	1.595	1.524	-0.158	-0.172								
	(7.40)	(10.94)	(-2.91)	(-4.73)								
(B):	1.332	1.410			-0.085	-0136						
	(5.35)	(8.56)			(-1.42)	(-3.19)						
(C):	1.216	1.270					-0.069	-0.126				
	(6.39)	(9.88)					(-1.26)	(-3.06)				
(D):	1.367	1.483							-0.089	-0.146		
	(4.98)	(8.08)							(-1.41)	(-3.25)		
(E):	1.716	2.039									-0.102	-0.166
	(3.48)	(6.01)									(-1.49)	(-3.36)

7.5. Conclusions

Following the Fama and French (1992) estimation procedure of market beta, we find that in the univariate regression, market beta is able to explain cross-sectional differences in average returns of stocks listed on the London Stock Exchange over the period from July 1984 to June 1996. However, when market value of equity is included in the regressions as an explanatory variable, the coefficient of β has no explanatory power and its sign turns negative, but the coefficient of the market value of equity is significant. In contrast, when we consider each of the other four non-market measures of firm size in place of market value of equity in the bivariate regressions, the coefficient of β has explanatory power in each model but the other four non-market measures of firm size have no explanatory power. In the univariate regressions there is a strong cross-sectional relation between average returns and market value of equity. In contrast to the consistent explanatory power of the market value of equity, the other four non-market measures of firm size show no power to explain average returns. We also found that the relation between market value of equity and average stock returns is unaffected when each of the other four non-market measures of firm size are used to control of the size of the firm. These results support the Berk's argument that the negative relation between market value of equity and average stock return is not due to the existence of a relation between expected return and firm size. The above results are not sensitive to the choice of the methodology is used. The subperiods results support the full period results, which are not a phenomenon specific to the month of January

Chapter 8

Conclusions...

There is now considerable evidence that the cross-section of average stock returns can be explained by firm-specific variables such as market value of equity, book to market equity, leverage, earnings to price and dividend yield. This evidence contradicting the prediction of the Sharpe (1964), Lintner (1965) and Black (1972) capital asset pricing model (CAPM) that the cross-section of expected returns is linear in market beta and that the market beta are the only risk factor to explain the cross-sectional variation of expected returns. Fama and French (1992) found that market value of equity, book to market equity, but not the market beta capture much of the cross-section of average stock returns. In the same spirit of Fama and French (1992) we investigate the determinants of the cross-section of stock returns on 1,420 stocks quoted on the London Stock Exchange, over the period July 1975 to June 1996, and it brings us a step further in the integrated real and financial view of the firm's stock returns.

The main body of the thesis is in three parts. The first part includes chapter 2 through 3. Chapter 2 is a critical analysis of influences on security returns and chapter 3 is the research design. The second part includes chapter 4 through 6 which covers the main issue in this thesis which is a systematic examination of the cross-sectional behaviour of stock returns to market beta and firm-specific variables (such as Tobin's q, market value of equity, book to market equity, leverage, earnings to price, dividend yield, cash flow to price and sales to price) using data on individual firms. The final part includes chapter 7 which is an empirical re-examination of the firm size effect.

Chapter 2 was classified into two parts according to the major research directions of the financial literature relevant to my empirical work. The academic literature on return predictability emphasises two views of the predictive power of financial ratios that are relevant in both cross-section and time series. Thus our discussion in this chapter is divided along these lines (cross-sectional return predictability and time series return predictability). The first part of chapter 2 starts with a brief discussion on the capital asset pricing model, followed by review in detail the asset pricing anomalies (i.e., the size effect, the earnings to price effect, the dividend yield effect, the book to market effect, cash flow to price effect, sales to price effect and past return effect). The first part also includes the interrelation between the anomalies referred above and the explanations of the asset pricing anomalies. The second part of chapter 2 reports the calendar effects (i.e., the January effect, the Monday effect, the holiday effect, the turn of the month effect and the semi month effect), followed by mention on return autocorrelations and other forecasting variables.

Chapter 3 describes our data set and presents the methods (such as portfolio grouping approach, cross-sectional regressions (CSR) and seemingly unrelated regressions (SUR)) used to test the alternative hypothesis that the expected stock returns were not determined solely by their risk characteristics such as market beta, but other additional characteristics. In this thesis the main methodology of testing the alternative hypotheses is the CSR developed by Fama and MacBeth (1973), on individual stock level. Using individual stocks, this approach has one further advantage; according to the findings of Lo and MacKinlay (1990b), grouping stocks into portfolios on the basis of observed characteristics can bias test results, a bias that is absent when individual stocks are being used. Using an alternative methodology (SUR) we found in chapter 4 and chapter 7 that the use of the estimated market beta (imposes an errors in variables bias) as an independent regressor did not affect the inferences of the other variables included in the cross-section regressions. This SUR methodology avoids the errors-in-variables bias associated with the Fama and MacBeth (1973) methodology, but does not permit direct tests of the importance of market beta cross-sectionally, nor does it permit the cross-sectional parameters to vary over time.

Chapter 4 reveals the ability of Tobin's q in explaining the cross-section of average stock returns. More specifically, stocks with a smaller Tobin's q ratio yield a higher average return. In this chapter also investigated the interaction between the Tobin's q with the book to market equity, market value of equity (since, these two variables play a dominant role in explaining cross-sectional differences in expected returns, see Fama and French (1992)) and market beta. We find that in the univariate regression, market beta is able to explain cross-sectional differences of expected returns on the LSE for the period July 1980 to June 1996. This result contrasts with the insignificant positive coefficient found by Fama and French (1992) for the period 1963 to 1990 in the U.S. stock market, and is similar to the results of a study by Strong and Xu (1997) for the period 1973 to 1992 in the U.K. stock market. However, market beta becomes insignificant when Tobin's q, market value of equity and book to market equity are included in a bivariate or multivariate regression, as in the above two referred studies.

We then find that Tobin's q, market value of equity, and book to market equity are strongly significant in the univariate regression. However, when both Tobin's q and book to market equity are included in the regressions Tobin's q absorbs the role of the book to market equity in explaining stock returns but it does not absorb the role of the market value of equity. The subperiod results support the conclusion that Tobin's q is consistently the most powerful variable for explaining the cross-section of average stock returns. In addition, the predictive role of those variables is not a phenomenon specific to the month of January.

Although the results in the anomalies literature may signal economically important deviations from the CAPM, there is little theoretical motivation for the firm-specific characteristics studied in this literature. Thus, our motivation for using the Tobin's q for the first time in this literature, as an additional variable in explaining the cross-section of average stock returns is the lack of theoretical rationale of the predictive ability of the firm-specific variables. Tobin's q allows us to suggest that it may incorporate, to some degree, potential alternative sources of risk such as product price risk, poor investment opportunities risk and financial distress risk. Our hope, using Tobin's q, is to provide a new ground and a promising direction for future research in this area.

The exploration of the cross-sectional determinants of expected stock returns, using data on individual firms continued in chapter 5. Specifically, we have investigated the relationship between average stock returns and firm-specific variables such as market value of equity, book to market equity, leverage, earnings to price, cash flow to price and dividend yield. The market value of equity, the ratio of book to market equity and cash flow to price have emerged as the most prominent of the above variables to explain the cross-sectional variation of average stock returns. The strong relationship between average stock returns and these three variables is not a phenomenon specific to the month of January. The subperiods results strongly suggest that the significance of the book to market equity and cash flow to price effect are not sensitive to the period in which it is measured. Thus, these results are not period-specific. However, the market value of equity coefficients are significant in the early subperiod, but insignificant in the last subperiod.

Our findings from chapter 4 and 5, in combination with that of Davis (1994) for the pre-1962 COMPUSTAT period, Chan, Hamao and Lakonishok (1991) and Daniel, Titman and Wei (1997) for Japanese markets and Barber and Lyon (1997b) for a holdout sample of financial firms confirm that the empirical regularities observed in the U.S. market also exist in other countries (e.g., U.K. stock market). Thus we conclude that it is extremely unlikely for the book to market equity and the market value of equity effects which are reported for the U.S. stock market, to be a consequence of data-snooping.

The results in the first part of the chapter 6 are in contrast to the evidence found by Barbee, Mukherji, and Raines (1996), in the U.S. stock market over the period 1979 to 1991. We find that the debt to equity ratio and the sales to price ratio do not absorb the roles of the book to market equity and market value of equity in explaining the cross-section of average stock returns, but the sales to price ratio has significant explanatory power, beyond the contribution of the book to market equity and market value of equity. However, the explanatory power of the debt to equity ratio have been captured by the sales to price ratio as found in the study by Barbee, Mukherji, and Raines (1996).

The second part of the chapter 6 reveals that firm-specific variables such as Tobin's q, cash flow to price and sales to price have the most significant impact on average stock returns in the U.K. stock market. Thus our findings suggest that these variables deserve greater attention by academics and practitioners in explaining the cross-section of average stock returns. We do hope that these variables in near future will play significant role on the predictability (cross-sectional and time series) of stock returns.

The results of chapter 7 support the Berk's argument that the negative relation between average stock return and market value of equity is not due to the existence of a relation between firm size and risk. We make this claim investigated three other relationships that should be observed in the market if the size of the firm is related to its return; i) other measures of firm size besides market value of equity should be inversely related to expected return; ii) when firm size is controlled for, the correlation between average returns and market value of equity should diminish; and iii) if the market value of equity absorbs the explanatory power of the market beta, then other measures of firm size, besides market value of equity, should absorb the explanatory power of the market beta.

On the basis of this exploratory research several research directions can be identified that may be worth pursuing. First, it would be useful to investigate the ability of an aggregate Tobin's q ratio (i.e., of the DJIA or FT-30) to forecast market returns, using the randomisation method of Nelson and Kim (1993) or a Bayesian-bootstrap simulation (Kothari and Shanken (1997)). In addition we can use other aggregate variables (such as book to market equity, dividend yields, default spreads, interest rates, and term structure slopes) to predict market returns for the U.K. stock market as in Kothari and Shanken (1997) and Pontiff and Schall (1998) for the U.S. stock market.

As we have seen in this thesis a plethora of empirical studies have investigated either the explanatory power of firm-specific variables or the interrelations between aggregate market returns and macroeconomic variables. Not much attention had been devoted to models that incorporate both types of variables. As a result another direction for future research is to examine the joint forecasting power of firm-specific variables and macroeconomic variables using a random effects panel data model (error-components model) or bilinear panel data model (see, Hsiao (1986)).

The research may be extended to multifactor asset pricing models based on the three factors proposed by Fama and French (1996a). Alternative, the research may be extended to Fama and French's three-factor model plus other variables (e.g., Tobin's q or dividend yield or term structure variable). This suggests that the Fama and French's three-factor model may leave out important variables in expected stock returns that are related to cross-sectional differences in average stock returns. These Fama and French's factors are the excess return on a broad market portfolio (MKT), the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB), and the difference between the return on a portfolio of high book to market equity stocks and the return on a portfolio of low book to market equity stocks (HML). In addition, the research may be extended to Fama and French's three-factor model on conditional expected returns (see, Ferson and Harvey (1999)).

Future research may try to cross-validate the models (i.e., Tobin's q effect, size effect etc.) of this research by using international dataset of individual stock returns. The lack of international evidence is in part due to the difficulties in assembling a comprehensive international dataset of individual stock returns. As a consequence, most of the previous literature focuses on either explaining differences in average country index returns or reports results for a single individual market. However, recently there are available international databases such as MSCI (Morgan Stanley's

Capital International Perspectives), EMDB (Emerging Markets Database published by the International Finance Corporation (IFC)), COMPUSTAT Global Vantage and IIA (Independence International Associates). As a result some studies have appeared in the literature which have used international dataset of individual stock returns. Arshanapalli, Coggin and Doukas (1998), Fama and French (1998), Rouwenhorst (1998), Heston, Rouwenhorst and Wessels (1999) and Rouwenhorst (1999)) are recently examples of work with this perspective.

Another area that deserves attention is the determination of how much of the return variation is explained by each firm-specific variable (asset pricing anomalies). From a theoretical viewpoint, some alternative sources of risk have been examined as potential explanations for the asset pricing anomalies. Although it is unlikely that I have the final answers here, nevertheless it is hoped that this dissertation has convinced the reader that it is a worthwhile study and points to promising directions for future research in this area.

Appendices...

Appendix A:

Lindenberg and Ross (1981) Methodology

Lindenberg and Ross (1981) (LR) have used Tobin's q ratios to measure economic rents and market power. They have described their computational procedures in detail. As we have seen, the Tobin's q is the ratio of the firm's market value to the replacement cost of its assets. LR have calculated values for each of these components of the Tobin's q ratio separately.

Market Value

LR determine the market value of the firm by taking the sum of the market value of (1) common stock, (2) preferred stock, (3) short-term debt and (4) long-term debt.

$$MV = Comval + Prefval + STDebt + LTDebt$$

1. The market value of common stock is estimated by multiplying the price per share by the number of shares outstanding.

2. The market value of preferred stock is estimated by dividing the amount of preferred dividends by Standard & Poor's preferred stock yield index.

3. The market value of the firm's short-term debt with maturity less than one year is assumed to be equal to its book value.

4. The market value of long-term debt depends on the coupon rate, the current market yield and the number of years to maturity. Thus, to estimate its value, first, the fractions of the book values of the current long-term debt issued in prior years are estimated. The fractions, $f_{t,t-i}$, represent the proportion of the book value of the time t when long-term debt newly issued at time t-i. Second, bond yields are used with this debt maturity distribution to estimate the market value of the firm's long-term debt. The following formula is used by LR to estimate the LTDebt variable:

$$LTDebt = SBond_t \sum_{j=0}^{n-2} f_{t,t-j}\{(\rho^z_{t-j} / \rho^z_t)[I - (1+\rho^z_t)^{-(n-j)}] + (1+\rho^z_t)^{-(n-j)}\}$$

where,

$SBond_t$ = the year-end book value of the firm's long-term debt in year t,

j = t - n + 2, t-n + 1,..., t-1, t,

$f_{t,t-i} = N_{t-i} / \sum_{k=0}^{n-2} N_{t-k}$; $i = 0,\ldots,n-2$,

N_t = the sum of all new debt issued in year t,

ρ_t^z = the yield to maturity of a firm's debt at time t, when the firm's bond rating is z.

n = 20,

Replacement Costs

The approach developed by LR, both for net plant and equipment and inventories, involves the selection of an initiation date on which the replacement cost of the assets is assumed to be equal to their book values.

The replacement cost of the firm's assets, RC, is defined as:

$$RC_t = TA_t + (RNP_t - HNP_t) + (RINV_t - HINV_t)$$

where,

TA_t = the book value of total assets in year-end t,

RNP_t = the estimated replacement cost of net plant and equipment in year-end t,

HNP_t = the historical book value of net plant and equipment in year-end t,

$RINV_t$ = the firm-reported replacement value of inventories in year-end t,

$HINV_t$ = the historical book value of inventories in year-end t,

The replacement cost of plant and equipment RNP_t is computed as:

$$RNP_t = RNP_{t-1}\left[\frac{(1+\phi_t)}{(1+\delta_t)(1+\theta_t)}\right] + (GNP_t - GNP_{t-1}), \text{ for } t > 0,$$

where,

$RNP_{t=0} = HNP_{t=0}$,

GNP_t = the book value of gross plant and equipment as of year-end t,

ϕ_t = the rate of growth of capital goods prices in year-end t,

δ_t = the real depreciation rate in year-end t,

θ_t = the rate of cost-reducing technical progress,

The growth of capital goods prices in year-end t, ϕ_t, is estimated by the Gross National Product (GNP) deflator for nonresidential fixed investment. The real depreciation rate in year-end t is estimated by:

$$\delta_t = \frac{DEP_t}{HNP_{t-1}}$$

where DEP_t is the book depreciation in year-end t.

The replacement cost of inventories, $RINV_t$, is computed as:

The replacement value of inventory is dependent upon the firm's selection of its inventory accounting method. If the firm uses more than one method, the LR rule is to assume that the dominant method reported applies to all inventories.

Last In, First Out (LIFO). This method underestimates the replacement cost of inventory in inflationary periods. Thus, the beginning inventory is adjusted for a full year's inflation and any change in reported inventory is adjusted for one-half year's inflation. The adjustment for this method is given by:

$$RINV_t = RINV_{t-1}\left(\frac{P_t}{P_{t-1}}\right) + (HINV_t - HINV_{t-1})\left(\frac{0.5(P_t + P_{t-1})}{P_{t-1}}\right)$$

where P_t is the wholesale price index appropriate to inventories. If year $t = 0$ is the initialisation date for the calculations, $RINV_o$ is set equal to $HINV_o$ to begin the inventory series.

First In, First Out (FIFO). If the firm in question accounts on this inventory accounting method basis, replacement cost is taken to be equal to book inventory:

$$RINV_t = HINV_t$$

Average Cost Method. In this method, inventory is reported at time t is approximately equal to the average of the prices at t-1 and t. Then the approximation to replacement cost of inventories in this case is:

$$RINV_t = HINV_t\left(\frac{2P_t}{P_t + P_{t-1}}\right)$$

Retail Cost Method. Under this method, inventory quantities are priced at the expected retail prices. The adjustment for this method is given by:

$$RINV_t = HINV_t\left(\frac{P_t}{R_t}\right)$$

where R_t is the retail price index.

Appendix B:

Chen, Cheng and Hite (1986) Model

Chen, Cheng and Hite (1986) want to test whether market power as measured by Tobin's q is correlated with market beta. Assuming a constant-proportions production function and, going through the value-maximization procedure, they derive the following relationship between a firm's systematic risk (β_E) and Tobin's q.

$$\beta_E = 1/var(R_m) \,.\, cov(S/K, R_m) \,.\, 1/q \,.\, (1 + D/E)$$

Where the first firm-specific term, $cov(S/K, R_m)$, represents the systematic business risk of the firm as measured by the covariance between the ratio of sales to the capital stock and the rate of return on the market portfolio. The second term, 1/q, is the inverse of the firm's market power as measured by Tobin's q. The final term, D/E, is the debt to equity ratio. In order to take care of the differential business risk across industries, they use industries dummy variables. Thus, the model at this point can be stated functionally as:

$$\beta_E = f\{cov(S/K, R_m), q, D/E, Dummies\}$$

Their model predict and their empirical results (based on a sample of 94 US companies) confirm that systematic risk is positively related to business risk as measured by the sensitivity of firm sales to aggregate economy sales, positively related to financial leverage as measured by debt to equity ratios, and negatively related to market power (or monopoly power) in the product market as measured by Tobin's q.

Bibliography...

Abraham, A. and D.L. Ikenberry, 1994, The individual investor and the weekend effect?, Journal of Financial and Quantitative Analysis, 29, 263-277.

Admati, A. R., and P. Pfleiderer, 1989, Divide and conquer: A theory of intra-day and day of the week mean effects, Review of Financial Studies, 2, 189-223.

Admati, A.R., and P. Pfleiderer, 1988a, Selling and trading on information in financial markets, American Economic Review, 78, 96-103.

Admati, A.R., and P. Pfleiderer, 1988b, A theory of intra-day patterns: Volume and price variability, Review of Financial Studies, 1, 3-40.

Aggarwal, R. and J.D. Schatzberg, 1997, Day of the week effects, information seasonality, and higher moments of security returns, Journal of Economics and Business, 49, 1-20.

Aggarwal, R. and P. Rivoli, 1989, Seasonal and day-of-the-week effects in four emerging stock markets, Financial Review, 24, 541-550.

Aggarwal, R., R. Rao and T. Hiraki, 1989, Price/Book value ratios and equity returns on the Tokyo Stock Exchange: An empirical study, working paper, John Carroll University.

Aggarwal, R., R. Rao and T. Hiraki, 1990, Equity return regularities based on the price/sales ratio: An empirical study of the Tokyo stock exchange, in S. G. Rhee and R. P. Chang (eds.), Pacific-Basin Capital Markets Research, North Holland.

Aggarwal, R., T. Hiraki and R. Rao, 1988, Earning/Price ratios, size and seasonal anomalies in the Japanese securities market, working paper, John Carroll University.

Agrawal, A. and C.R. Knoeber, 1996, Firm performance and mechanisms to control agency problems between managers and shareholders, Journal of Financial and Quantitative Analysis, 31, 377-397.

Agrawal, A. and K. Tandon, 1994, Anomalies or illusions? Evidence from stock markets in eighteen countries, Journal of International Money and Finance, 13, 83-106.

Alexakis, P. and M. Xanthakis, 1995, Day of the week effect on the Greek stock market, Applied Financial Economics, 5, 43-50.

Alonso, A. and G. Rubio, 1990, Overreaction in the Spanish equity market, Journal of Banking and Finance, 14, 469-481.

Altman, E., 1984, A further empirical investigation of the bankruptcy cost question, Journal of Finance, 39, 1067-1090.

Altman, E., 1993, Corporate Financial Distress and Bankruptcy, Wiley, New York.

Amihud, Y. and H. Mendelson, 1986, Asset pricing and the bid-ask spread, Journal of Financial Economics, 17, 223-249.

Amihud, Y., and H. Mendelson, 1989, The effects of beta, bid-ask spread, residual risk, and size on stock returns, Journal of Finance, 44, 479-487.

Amihud, Y., B.J. Christensen and H. Mendelson, 1992, Further evidence on the risk-return relationship, Working paper no. S-93-11, New York University.

Amit, R., J. Livnat and P. Zarowin, 1989, A classification of mergers and acquisitions by motives: Analysis of market responses, Contemporary Accounting Research, 6, 143-158.

Ariel, R.A., 1987, A Monthly effect in stock returns, Journal of Financial Economics, 18, 161-174.

Ariel, R.A., 1990, High stock returns before holidays: Existence and evidence on possible causes, Journal of Finance, 45, 1611-1626.

Armitage, S., 1995, Event study methods and evidence on their performance, Journal of Economic Surveys, 8, 25-52.

Arsad, Z. and J.A. Coutts, 1997, Security price anomalies in the London International Stock Exchange, Applied Financial Economics, 7, 455-464.

Arshanapalli, B., T.D. Coggin and J. Doukas, 1998, Multifactor asset pricing analysis of international value investment strategies, Journal of Portfolio Management, 24, 10-23.

Asness, C., 1995, The power of past stock returns to explain future stock returns, unpublished manuscript, Goldman Sachs Asset Management.

Asness, C.S., J.M. Liew and R.L. Stevens, 1996, Parallels between the cross-sectional predictability of stock returns and country returns, Working paper, Goldman Sachs Asset Management.

Asquith, P., R. Gertner and D. Sharfstein, 1994, Anatomy of financial distress: An examination of junk-bond issuers, Quarterly Journal of Economics, 109, 625-658.

Atchison, M.D., K.C. Butler and R.R. Simonds, 1987, Nonsynchronous security trading and market index autocorrelation, Journal of Finance, 42, 111-118.

Athanassakos, G. and M.J. Robinson, 1994, The day-of-the week anomaly: The Toronto stock exchange experience, Journal of Business Finance and Accounting, 21, 833-856.

Athanassakos, G., 1992, Portfolio rebalancing and the January effect in Canada, Financial Analysts Journal, 48, 67-78.

Badrinath, S.G. and W. Lewellen, 1991, Evidence on tax-motivated securities trading behaviour, Journal of Finance, 46, 369-382.

Badrinath, S.G., J.R. Kale and T.H. Noe, 1995, Of shepherds, sheep and the Cross-autocorrelations in equity returns, Review of Financial Studies, 8, 401-430.

Ball, R. and J. Bowers (1988), Daily seasonal in equity and fixed-interest returns: Australian evidence and tests of plausible hypothesis, in Dimson, E. ed., Stock Market Anomalies, Cambridge University Press, Cambridge.

Ball, R. and S.P. Kothari, 1989, Nonstationary expected returns: Implications for tests of market efficiency and serial correlation in returns, Journal of Financial Economics, 25, 51-74.

Ball, R., 1977, A note on errors in variables and estimates of systematic risk, Australian Journal of Management, 2, 79-84.

Ball, R., 1978, Anomalies in relationships between securities' yields and yield-surrogates, Journal of Financial Economics, 6, 103-126.

Ball, R., S.P. Kothari and J. Shanken, 1995, Problems in measuring portfolio performance: An application to contrarian investment strategies, Journal of Financial Economics, 39, 79-107.

Banz, R.W. and W. Breen, 1986, Sample dependent results using accounting and market data: Some evidence, Journal of Finance 41, 779-793.

Banz, R.W., 1981, The relationship between return and market value of common stocks, Journal of Financial Economics 9, 3-18.

Barbee, W.C., Jr., S. Mukherji and G.A. Raines, 1996, Do sales-price and debt-equity explain stock returns better than book-market and firm size? Financial Analysts Journal, 52, 56-40.

Barber, B.M. and J.D. Lyon, 1997a, Detecting long-run abnormal stock returns: The empirical power and specification of test statistics, Journal of Financial Economics, 43, 341-372.

Barber, B.M. and J.D. Lyon, 1997b, Firm size, book-to-market ratio, and security returns: A holdout sample of financial firms, Journal of Finance, 52, 875-884.

Barberis, N., A. Shleifer and R. Vishny, 1998, A model of investor sentiment, Journal of Financial Economics, 49, 307-343.

Barry, C.B. and S.J. Brown, 1984, Differential information and the small firm effect, Journal of Financial Economics, 13, 283-294.

Basu, S., 1977, Investment performance of common stocks in relation to their price earnings ratio: A test of the efficient market hypothesis, Journal of Finance, 32, 663-682.

Basu, S., 1983, The relationship between earnings' yield, market value, and return for NYSE common stocks: Further evidence, Journal of Financial Economics 12, 129-156.

Berges, A., J. McConnell and G. Schlarbaum, 1984, The turn-of-the-year in Canada, Journal of Finance, 39, 185-192.

Berglund, T., E. Liljeblom and A. Loflund, 1989, Estimating betas on daily data for a small stock market, Journal of Banking and Finance, 13, 41-64.

Berk, J.B., 1995a, A critique of size related anomalies, Review of Financial Studies, 8, 275-286.

Berk, J.B., 1995b, An empirical re-examination of the relation between firm size and return, Working paper, University of Washington.

Berk, J.B., 1997, Does size really matter?, Financial Analysts Journal, 53, 12-18.

Bernard, V. and T. Stober, 1989, The nature and amount of information in cash flows and accruals, Accounting Review, 64, 624-652.

Bernier, G., 1987, Market power and systematic risk: An empirical analysis using Tobin's q ratio, Journal of Economics and Business, 39, 91-99.

Berry, M.A., G.W. Gallinger and G.V. Henderson, Jr, 1987, Adjusting for nonsynchronous data: How important is it? Akron Business and Economic Review, 18, 52-56.

Bhandari, L.C., 1988, Dept/equity ratio and expected common stock returns: Empirical evidence, Journal of Finance 43, 507-528.

Bhardwaj, R.K. and L.D. Brooks, 1992, The January anomaly: Effects of low share price, transaction costs, and bid-ask bias, Journal of Finance, 47, 553-575.

Billett, M.T., M.J. Flannery and J.A. Garfinkel, 1995, The effect of lender identity on a borrowing firm's equity return, Journal of Finance, 50, 699-718.

Binder, J., 1998, The event study methodology since 1969, Review of Quantitative Finance and Accounting, 11, 111-137.

Black, F. and M. Scholes, 1974, The effects of dividend yield and dividend policy as common stock prices and returns, Journal of Financial Economics, 2, 1-22.

Black, F., 1972, Capital market equilibrium with restricted borrowing, Journal of Business 45, 444-455.

Black, F., 1974, International capital market equilibrium with investment barriers, Journal of Financial Economics, 1, 337-352.

Black, F., 1993a, Beta and return, Journal of Portfolio Management 20, 8-18.

Black, F., 1993b, Estimating expected return, Financial Analysts Journal , September-October, 36-38.

Black, F., M.C. Jensen and M. Scholes, 1972, The capital asset pricing model: Some empirical tests, in M.C. Jensen, ed., Studies in the theory of capital markets (Praeger, New York, NY), 79-121.

Blume, M. and F. Husic, 1973, Price, beta and exchange listing, Journal of Finance, 28, 283-299.

Blume, M. and I. Friend, 1973, A new look at the capital asset pricing model, Journal of Finance 28, 19-33.

Blume, M. and J. Siegel, 1992, The theory of security pricing and market structure, Financial Markets, Institutions and Instruments, 1, 1-57.

Blume, M. and R. Stambaugh, 1983, Biases in computed returns: An application to the size effect, Journal of Financial Economics, 12, 387-404.

Blume, M., 1980, Stock returns and dividend yields: Some more evidence, Review of Economics and Statistics, 62, 567-577.

Blundell, R., S. Bond, M. Devereux and F. Schiantarelli, 1992, Investment and Tobin's q: Evidence from company panel data, Journal of Econometrics, 51, 233-257.

Board, J.L.G. and C.M.S. Sutcliffe, 1988, The weekend effect in the UK stock market returns, Journal of Business Finance and Accounting, 15, 199-213.

Bodie, Z., 1976, Common stocks as a hedge against inflation, Journal of Finance, 31, 459-470.

Boudoukh, J., M.P. Richardson, and R.F. Whitelaw, 1994, A tale of three schools: Insights on autocorrelations of short-horizon stock returns, Review of Financial Studies, 7, 539-573.

Branch, B., 1977, A tax loss selling rule, Journal of Business, 50, 198-207.

Breeden, D., 1979, An intertemporal asset pricing model with stochastic consumption and investment opportunities, Journal of Financial Economics, 7, 265-296.

Breeden, D., M. Gibbons and Litzenberger, 1989, Empirical tests of the consumption-oriented CAPM, Journal of Finance, 44, 231-262.

Breen, W.J. and R.A. Korajczyk, 1995, On selection biases in book-to-market based test of asset pricing models, Working paper, Northwestern University.

Brennan, M.J. and A. Subrahmanyam, 1995, Investment analysis and price formation in securities markets, Journal of Financial Economics, 38, 361-381.

Brennan, M.J., 1970, Taxes, market valuation and corporate financial policy, National Tax Journal, 417-427.

Brennan, M.J., 1971, Capital market equilibrium with divergent borrowing and lending rates, Journal of Financial and Quantitative Analysis, 6, 1197-1205.

Brennan, M.J., N. Jegadeesh and B. Swaminathan, 1993, Investment analysis and the adjustment of stock prices to common information Review of Financial Studies, 6, 799-824.

Brennan, M.J., T. Chordia and A. Subrahmanyam 1997, Cross-Sectional determinants of expected returns, in Modest, D. eds., On Finance: In Honour of Fisher Black, Oxford University Press.

Brennan, M.J., T. Chordia and A. Subrahmanyam 1998, Alternative factor specifications, security characteristics,and the cross-section of expected stock returns, Journal of Financial Economics, 49, 345-373.

Brenner, M. and S. Smidt, 1977, A simple model of non-stationarity of systematic risk, Journal of Finance, 32, 1081-1092.

Brockman, P. 1995, A review and analysis of the holiday effect, Financial Markets, Institutions and Instruments, 37-58.

Brown, P., A.W. Kleidon and T.A. Marsh, 1983, New evidence on the nature of size-related anomalies in stock prices, 12, 33-56.

Brown, P., D.B. Keim, A.W. Kleidon and T.A. Marsh, 1983, Stock return seasonalities and the tax-loss selling hypothesis: Analysis of the arguments and Australian evidence, Journal of Financial Economics, 12, 105-127.

Burmeister, E. and M.B. McElroy, 1988, Joint estimation of factor sensitivities and risk premia for the arbitrage pricing theory, Journal of Finance, 43, 721-735.

Cadsby, C.B. and M. Ratner, 1992, Tum-of-month and pre-holiday effects on stock returns: Some international evidence, Journal of Banking and Finance, 16, 497-509.

Callahan, C.M. and R.M. Mohr, 1989, The determinants of systematic risk: A synthesis, Financial Review, 24, 157-181.

Calvet, A. and J. Lefoll, 1989, Risk and return on Canadian capital markets: Seasonality and size effect, Journal of the French Finance Association, 10, 21-39.

Campbell, J.Y. and R.J. Shiller, 1988, Stock prices, earnings, and expected dividends, Journal of Finance, 43, 661-676.

Campbell, J.Y. and Y. Hamao, 1992, Predictable stock returns in the U.S., and Japan: A study of long-term capital market integration, Journal of Finance, 47, 43-72.

Campbell, J.Y., 1987, Stock returns and the term structure, Journal of Financial Economics, 18, 373-400.

Campbell, J.Y., 1996, Understanding risk and return, Journal of Political Economy, 104, 298-345.

Campbell, J.Y., S.J. Grossman and J. Wang, 1993, Trading volume and serial correlation in stock returns, Quarterly Journal of Economics, 107, 905-939.

Capaul, C., I. Rowley and W. Sharpe, 1993, International value and growth stock returns, Financial Analysts Journal, 49, 27-36.

Chan, K.C. and N. Chen, 1988, An unconditional asset-pricing test and the role of firm size as an instrumental variable for risk, Journal of Finance, 43, 309-325.

Chan, K.C. and N. Chen, 1991, Structural and return characteristics of small and large firms, Journal of Finance, 46, 1467-1484.

Chan, K.C., 1986, Can tax-loss selling explain the January seasonal in stock return?, Journal of Finance, 41, 1115-1128.

Chan, K.C., 1988, On the contrarian investment strategy, Journal of Business, 61, 147-163.

Chan, K.C., N. Chen and D. Hsieh, 1985, An exploratory investigation of the firm size effect, Journal of Financial Economics, 14, 451-471.

Chan, L.K.C. and J. Lakonishok, 1993, Are the reports of beta's death premature? Journal of portfolio management, 51-62.

Chan, L.K.C., J. Karceski and J. Lakonishok, 1998, The risk and return from factors, Journal of Financial and Quantitative Analysis, 33, 159-188.

Chan, L.K.C., N. Jegadeesh and J. Lakonishok, 1995, Evaluating the performance of value versus glamour stocks: The impact of selection bias, Journal of Financial Economics, 38, 269-296.

Chan, L.K.C., N. Jegadeesh, and J. Lakonishok, 1996, Momentum strategies, Journal of Finance, 51, 1681-1713.

Chan, L.K.C., Y. Hamao and J. Lakonishok, 1991, Fundamentals and stock returns in Japan, Journal of Finance 46, 1739-1764.

Chang, R., D. McLeavey and G. Rhee, 1995, Short-term abnormal returns of the contrarian strategy in the Japanese stock market, Journal of Business Finance and Accounting, 22, 1035-1048.

Chappell, H.W. and D.C. Cheng, 1982, Expectations, Tobin's q, and Investment: A Note, Journal of Finance, 37, pp. 231-236.

Chappell, H.W. and D.C. Cheng, 1984, Firms' acquisition decision and Tobin's q ratio, Journal of Economics and Business 36, 29-42.

Chen, H.J., L. Hexter and M.Y. Hu, 1993, Management ownership and corporate value, Managerial and Decision Economics 14, 335-346.

Chen, K.C., D.C. Cheng and G.L. Hite, 1986, Systematic risk and market power: An application of Tobin's q, Quarterly Review of Economics and Business 26, 59-72.

Chen, N., 1983, Some empirical tests of the theory of arbitrage pricing, Journal of Finance, 38, 1393-1414.

Chen, N., 1988, Equilibrium asset pricing models and the firm size effect, in Elroy Dimson ed., Stock Market Anomalies, Cambridge University Press, Cambridge, U.K.

Chen, N., Grundy B. and R.F. Stambaugh, 1990, Changing risk, changing risk premiums, and dividend yield effects, Journal of Business, 63, S51-S70.

Chen, N., R. Roll. and S.A. Ross. 1986, Economic forces and the stock market, Journal of Business, 59, 383-403.

Chen, S.N., 1986, An intertemporal capital asset pricing model under heterogeneous beliefs, Journal of Economics and Business, 38, pp.317-330.

Cheung, Y.W. and L.K. Ng, 1992, Stock price dynamics and firm size: An empirical investigation, Journal of Finance, 47, 1985-1997.

Cho, D.C., E.J. Elton and M.J. Gruber, 1984, On the robustness of the Roll and Ross arbitrage pricing theory, Journal of Financial and Quantitative Analysis, 19, 1-10.

Chopra, N., J. Lakonishok and J. Ritter, 1992, Measuring abnormal returns: Do stocks overreact?, Journal of Financial Economics, 31, 235-268.

Chopra, N., J. Lakonishok and J. Ritter, 1992, Measuring abnormal returns: Do stocks overreact?, Journal of Financial Economics, 31, 235-268.

Chordia, T. and B. Swaminathan, 1994, Differential speeds of adjustment and cross-autocorrelations in stock returns, Working paper, Cornell University.

Chou, S. R. and K. Johnson, 1990, An empirical analysis of stock market anomalies: Evidence from the Republic of China in Taiwan, in S.G. Rhee and R.P. Chang (eds.), Pacific-Basin Capital Markets Research, North Holland.

Christie, A. and M. Hertzel, 1981, Capital asset pricing anomalies, working paper, University of Rochester.

Christie, W., 1990, Dividend yield and expected returns: The zero-dividend puzzle, Journal of Financial Economics, 28, 95-125.

Chung, K.H. and S.W. Pruitt, 1994, A simple approximation of Tobin's q, Financial Management 23, 70-74.

Chung, K.H., P. Wright and C. Charoenwong, 1998, Investment opportunities and market reaction to capital expenditure decisions, Journal of Banking and Finance, 22, 41-60.

Clare, A.D. and S H. Thomas, 1994, Macroeconomic factors, the APT and the UK stock market, Journal of Business Finance and Accounting, 21, 309-330.

Clare, A.D. and S.H. Thomas, 1995, The overreaction hypothesis and the UK stock market, Journal of Business Finance and Accounting, 22, 961-973.

Clare, A.D., M.S.B. Ibrahim and S.H. Thomas, 1998, The impact of settlement procedures on day-of-the-week effects: Evidence from the Kuala Lumpur Stock Exchange, Journal of Business Finance and Accounting, 25, 401-418.

Clare, A.D., R. Priestley and S.H. Thomas, 1997, The robustness of the APT to alternative estimators, Journal of Business Finance and Accounting, 24, 645-655.

Clare, A.D., Z. Psaradakis and S.H. Thomas, 1995, An analysis of seasonality in the UK equity market, Economic Journal, 105, 398-409.

Clark, R.A., J.J. McConnell and M. Singh, 1992, Seasonalities in NYSE bid-ask spreads and stock returns in January, Journal of Finance, 47, 1999-2014.

Cochrane, J.H. and L.P. Hansen, 1992, Asset pricing lessons for macroeconomics, in Olivier J. Blanchard and Stanley Fischer, eds., NBER Macroeconomics Annual, MIT Press, Cambridge.

Cochrane, J.H., 1991a, Production-based asset pricing and the link between stock returns and economic fluctuations, Journal of Finance, 46, 209-237.

Cochrane, J.H., 1991b, Volatility tests and efficient markets: A review essay, Journal of Monetary Economics, 27, 463-485.

Cochrane, J.H., 1996, A cross-sectional test of an investment-based asset pricing model, Journal of Political Economy, 104, 572-621.

Coghlan, H., 1988, Small firms versus large on the Irish stock exchange: An analysis of the performances, Irish Business and Administrative Research, 9, 10-20.

Cohen, K.J., G.A. Hawawini, S.F. Maier, R.A. Schwartz and D.K. Whitcomb, 1983, Frictions in the trading process and the estimation of systematic risk, Journal of Financial Economics, 12, 263-278.

Cohen, K.J., G.A. Hawawini, S.F. Maier, R.A. Schwartz and D.K. Whitcomb, 1983, Estimating and adjusting for the intervalling-effect bias in beta, Management Science, 29, 135-148.

Cohen, K.J., S.F. Maier, R.A. Schwartz and D.K. Whitcomb, 1978, The returns generation process, returns variance, and the effect of thinness in securities markets, Journal of Finance, 33, 149-167.

Cohen, K.J., S.F. Maier, R.A. Schwartz, and D.K. Whitcomb, 1979, On the existence of serial correlation in an efficient securities market, SIMS Studies in the Management Sciences, 11, 151-168.

Cohen, R.B. and C.K. Polk, 1996, Compustat selection bias in tests of the Sharpe-Lintner-Black CAPM, Working paper, University of Chicago.

Condoyanni, L., J. O'Hanlon and C.W.R. Ward, 1987, Day of the week effects on stock returns: International evidence, Journal of Business Finance and Accounting, 14, 159-174.

Connolly, R.A. and C.T. Stivers, 1997, Time-varying lead-lag of equity returns in a world of incomplete information, Working paper, University of North Carolina at Chapel Hill.

Connolly, R.A., 1989, An examination of the robustness of the weekend effect, Journal of Financial and Quantitative Analysis, 24, 133-169.

Connor, G. and R.A. Korajczyk, 1988, Risk and return in an equilibrium APT: Application of a new test methodology, Journal of Financial Economics, 21, 255-289.

Connor, G. and R.A. Korajczyk, 1993, A test for the number of factors in an approximate factor model, Journal of Finance, 48, 1263-1291.

Connor, G. and R.A. Korajczyk, 1995, The arbitrage pricing theory and multifactor models of asset returns, in R. Jarrow, V. Maksimovic and W. Ziemba (eds.), *Handbooks in OR and MS*, North Holland, 9, 87-144.

Conrad, J. and G. Kaul, 1989, Mean reversion in short-horizon expected returns, Review of Financial Studies, 2, 225-240.

Conrad, J. and G. Kaul, 1993, Long-term market overreaction or biases in computed returns?, Journal of Finance, 48, 39-64.

Conrad, J., A. Hameed and C. Niden, 1994, Volume and autocovariances in short-horizon individual security returns, Journal of Finance, 49, 1305-1330.

Constantinides, G.M., 1984, Optimal stock trading with personal taxes: Implications for prices and the abnormal January returns, Journal of Financial Economics, 13, 65-89

Cook, T. and M. Rozef, 1984, Size and earnings/price anomalies: One effect or two?, Journal of Financial and Quantitative Analysis, 13, 449-466.

Corhay, A., G.A. Hawawini, and P. Michel, 1987, Seasonality in the risk-return relationship: Some international evidence, Journal of Finance, 42, 49-68.

Corhay, A., G.A. Hawawini, and P. Michel, 1988, The pricing of equity on the London stock exchange: Seasonality and size premium, in E. Dimson (ed.), Stock Market Anomalies, Cambridge University Press.

Cornell, B., 1985, The weekly pattern in stock returns: Cash versus futures: A note Journal of Finance, 41, 583-588.

Corniolay, C. and J. Pasquier, 1991, CAPM, risk premium seasonality and the size anomaly: The Swiss case, Journal of French Finance Association, 12, 23-44.

Cross, F., 1973, The behaviour of stock prices on Fridays and Mondays, Financial Analysts Journal, November/December, 67-69.

da Costa, N.C.A., Jr., 1994, Overreaction in the Brazilian stock market, Journal of Banking and Finance, 18, 633-642.

Dahlquist, M. and P. Sellin, 1996, Stochastic dominance, tax-loss selling an seasonalities in Sweden, European Journal of Finance, 2, 1-19.

Damodaran, A., 1989, The weekend effect in information releases: A study of earnings and dividend announcements, Review of Financial Studies, 2, 607-23.

Daniel, K. and S. Titman, 1997, Evidence on the characteristics of cross sectional variation in stock returns, Journal of Finance, 52, 1-33.

Daniel, K., D. Hirshleifer and A. Subrahmanyam, 1998, Investor psychology and security market under and overreactions, Journal of Finance, 53, 1839-1885.

Daniel, K., Titman, S. and K.C.J. Wei, 1997, Explaining the cross-section of stock returns in Japan: Factors or characteristics?, working paper, Kellogg School of Management at Northwestern University.

Dark, F. and K. Kato, 1986, Stock market overreaction in the Japanese stock market, Working paper, Iowa State University.

Davis, J.L., 1994, The Cross-Section of realized stock returns: The Pre-Compustat evidence, Journal of Finance, 49, 1579-1593.

Davis, J.L., 1996, The cross-section of stock returns and survivorship bias: evidence from delisted stocks, Quarterly Review of Economics and Finance, 36, 365-375.

Davis, J.L., E. Fama and K. French, 1998, Characteristics, covariances and average returns: 1929-1997, Working paper, University of Chicago.

De Bondt, W.F.W. and R. Thaler, 1985, Does the stock market overreact? Journal of Finance, 40, 793-805.

De Bondt, W.F.W. and R. Thaler, 1987, Further evidence on investor overreaction and stock market seasonality, Journal of Finance, 42, 557-581.

De Bondt, W.F.W. and R. Thaler, 1990, Stock market volatility: Do security analysts overreact? American Economic Review, 80, 52-57.

Dechow, P.W. and R.G. Sloan, 1997, Returns to contrarian investment strategies: Tests of naive expectations hypotheses, Journal of Financial Economics, 43, 3-27.

Defusco, R.A., G.M. McCabe and K.C. Yook, 1993, Day of the week effects: A test of the information timing Hypothesis, Journal of Business Finance and Accounting, 20, 835-842.

DeLong, J.B., A. Shleifer, L.H. Summers, and R.J. Waldmann, 1990, Positive feedback investment strategies and destabilising rational speculation, Journal of Finance, 45, 379-395.

Denis, D.J., 1994, Investment opportunities and the market reaction to equity offerings, Journal of Financial and Quantitative Analysis, 29, 159-177.

Denis, D.J., D.K. Denis and A. Sarin, 1994, The information content of dividend changes: Cash flow signalling, overinvestment, and dividend clienteles, Journal of Financial and Quantitative Analysis 29, 567-587.

Dhrymes, P.J., I. Friend and N.B. Gultekin, 1984, A critical re-examination of the empirical evidence on the arbitrage pricing theory, Journal of Finance, 39, 323-346.

Dichev, I.D., 1998, Is the risk of bankruptcy a systematic risk? Journal of Finance, 53, 1131-1147.

Dimson, E. and M. Mussavian, 1998, Professional forum: A brief history of market efficiency, European Financial Management, 4, 91-103.

Dimson, E. and P. Marsh, 1983, The stability of UK risk measures and the problem of thin trading, Journal of Finance, 38, 753-783.

Dimson, E., 1979, Risk measurement when shares are subject to infrequent trading, Journal of Financial Economics, 7, 197-226.

Dimson, E., 1988, Stock Market Anomalies, Cambridge University Press.

Dissanaike, G., 1994, On the computation of returns in tests of the stock market overreaction hypothesis, Journal of Banking and Finance, 18, 1083-1094.

Dissanaike, G., 1996, Do stock market investors overreact?, Journal of Business Finance and Accounting,

Dowen, R.J. and W.S. Bauman, 1986, The relative importance of size, P/E, and neglect, Journal of Portfolio Management, Spring, 30-34.

Draper, P. and K. Paudyal, 1995, Empirical irregularities in the estimation of beta: The impact of alternative estimation assumptions and procedures, Journal of Business Finance and Accounting, 22, 157-177.

Draper, P. and K. Paudyal, 1997, Microstructure and seasonality in the UK equity market, Journal of Business Finance and Accounting, 24, 1177-1204.

Dybvig, P.H. and S.A. Ross, 1985, Yes, the APT is testable, Journal of Finance, 40, 1173-1196.

Dyl, E.A. and E. Maberly, 1988, A possible explanation of the weekend effect, Financial Analysts Journal, May/June, 83-87.

Dyl, E.A. and S.A. Martin, 1985, Weekend effects on stock returns: A Comment, Journal of Finance, 40, 347-349.

Dyl, E.A., 1977, Capital gains taxation and year-end stock market behaviour, Journal of Finance, 32, 165-175.

Easton, S.A. and R.W. Faff, 1994, An investigation of the robustness of the day-of-the-week effect in Australia, Applied Financial Economics, 4, 99-110.

Efron, B., 1979, Bootstrap methods: Another look at the jacknife, Annals of Statistics, 7, 1-26.

Eleswarapu, V.R., 1997, Cost of transacting and expected returns in the Nasdaq market, Journal of Finance, 52, 2113-2127.

Elton, E.J., M.J. Gruber and J. Rentzler, 1983, A simple examination of the empirical relationship between dividend yields and deviations from the CAPM, Journal of Banking and Finance, 7, 135-146.

Epstein, L. and S. Zin, 1991, Substitution, risk aversion, and temporal behaviour of consumption and asset returns: An empirical analysis, Journal of Political Economy, 99, 263-286.

Fabozzi, F.J., C.K. Ma and J.E. Briley, 1994, Holiday trading in futures markets, Journal of Finance, 49, 307-324.

Fama, E.F. and G. Schwert, 1977, Asset returns and inflation, Journal of Financial Economics, 5, 115-146.

Fama, E.F. and J. MacBeth, 1973, Risk, return and equilibrium: Empirical tests, Journal of Political Economy, 71, 607-636.

Fama, E.F. and K.R. French, 1988a, Permanent and temporary components of stock prices, Journal of Political Economy, 96, 246-273.

Fama, E.F. and K.R. French, 1988b, Dividend yields and expected stock returns, Journal of Financial Economics, 22, 3-25.

Fama, E.F. and K.R. French, 1989, Business conditions and expected returns on stocks and bonds, Journal of Financial Economics, 25, 23-49.

Fama, E.F. and K.R. French, 1992, The cross section of expected stock returns, Journal of Finance, 47, 427-466.

Fama, E.F. and K.R. French, 1993, Common risk factors in the returns of stocks and bonds, Journal of Financial Economics, 33, 3-56.

Fama, E.F. and K.R. French, 1995, Size and book-to-market factors in earnings and returns, Journal of Finance, 50, 131-155.

Fama, E.F. and K.R. French, 1996a, Multifactor explanations of asset pricing anomalies, Journal of Finance, 51, 55-84.

Fama, E.F. and K.R. French, 1996b, The CAPM is wanted, dead or alive, Journal of Finance, 51, 1947-1958.

Fama, E.F. and K.R. French, 1998, Value versus growth: The international evidence, Journal of Finance, 53, 1975-1999.

Fama, E.F., 1965, The behaviour of stock market prices, Journal of Business, 38, 34-105.

Fama, E.F., 1970, Efficient capital markets: A review of the theoretical and empirical works, Journal of Finance, 25, 383-417.

Fama, E.F., 1976, Foundations of Finance, New York: Basic Books,.

Fama, E.F., 1981, Stock returns, real activity, inflation, and money, American Economic Review, 71, 545-565.

Fama, E.F., 1991, Efficient capital market: II, Journal of Finance, 46, 1575-1617.

Fama, E.F., 1998, Market efficiency, long-term returns, and behavioural finance, Journal of Financial Economics, 49, 283-306.

Fama, E.F., L. Fisher, M.C. Jensen and R. Roll, 1969, The adjustment of stock prices to new information, International Economic Review, 10, 1-12.

Fant, F. and D. Peterson, 1995, The effect of size, book-to-market equity, prior returns, and beta on stock returns: January versus the remainder of the year, Journal of Financial Research, 18, 129-142.

Fazzari, S., R.G. Hubbard and B.C. Petersen, 1988, Financing constraints and corporate investment, Brookings Papers on Economic Activity, 1, 141-195.

Ferson, W.E. and C.R. Harvey 1992, Seasonality and consumption-based asset pricing, Journal of Finance, 47, 511-552.

Ferson, W.E. and C.R. Harvey 1999, Conditioning variables and the cross section of stock returns, Journal of Finance, 54, 1325-1360.

Ferson, W.E. and C.R. Harvey, 1991, The variation of economic risk premiums, Journal of Political Economy, 99, 385-415.

Ferson, W.E. and R. Korajczyk, 1995, Do arbitrage pricing models explain the predictability of stock returns? Journal of Business, 68, 309-349.

Ferson, W.E., 1995, Theory and empirical testing of asset pricing models, in R. Jarrow, V. Maksimovic and W. Ziemba (eds.), Handbooks in OR and MS, North Holland, 9, 145-200.

Fields, M.J., 1934, Security prices and stock exchange holidays in relation to short selling, Journal of Business, 7, 328-338.

Fishe, R.P., T.F. Gosnell and D. Lasser, 1993, Good news, bad news, volume, and the Monday effect, Journal of Business Finance and Accounting, 20, 881-892.

Flannery, M. and A.A. Protopapadakis, 1988, From T-bills to common stocks: Investigating the generality of intra-week return seasonality, Journal of Finance, 43, 431-450.

Foerster, S., A. Prihar, and J. Schmitz, 1995, Back to the future, Canadian Investment Review, 7, 9-13.

Fong, W.M., 1992, The Size effect: A multiperiod analysis, Applied Financial Economics, 2, 87-92.

Fortin, R., 1990, Transaction costs and day of the week effects in the OTC/NASDAQ equity market, Journal of Financial Research, 243-248.

Fosback, N.G., 1976, Stock Market Logic, Ft. Lauderdale, Fla.: Institute for Econometric Research.

Fowler, D.J. and C.H. Rorke, 1983, Risk measurement when shares are subject to infrequent trading: Comment, Journal of Financial Economics 12, 279-283.

Fowler, D.J., C.H. Rorke and V.M. Jog, 1979, Heteroscedasticity, R2, and thin trading on the Toronto stock exchange, Journal of Finance, 34, 1202-1210.

Fowler, D.J., C.H. Rorke and V.M. Jog, 1989, A bias-correcting procedure for beta estimation in the presence of thin trading, Journal of Financial Research, 12, 23-32.

Frankfurter, G.M., 1995, The rise and fall of the CAPM empire: A review on emerging capital markets, Financial Markets, Institutions and Instruments, 4, 104-127.

Franks, J.R., J.E. Broyles and M.J. Hecht, 1977, An industry study of the profitability of mergers in the United Kingdom, Journal of Finance, 32, 1513-1525.

French, K., 1980, Stock returns and the weekend effect, Journal of Financial Economics, 8, 55-70.

Fung, W., R. Schwartz and D. Whitcomb, 1985, Adjusting for the intervalling effect bias in beta: A test using Paris Bourse data, Journal of Banking and Finance, 9, 443-460.

Galeotti, M., 1988, Tobin's marginal q and tests of the firm's dynamic equilibrium, Journal of Applied Econometrics, 3, 267-277.

Gamble, R.C.J., 1993, The January effect and intergenerational transfers, The Quarterly Review of Economics and Finance, 33, 295-304.

Gaver, J.J. and K.M. Gaver, 1993, Additional evidence on the association between the investment opportunity set and corporate financing, dividend and compensation policies, Journal of Accounting and Economics, 16, 125-140.

Ghysels, E., 1998, On stable factor Structures in the pricing of risk: Do time-varying betas help or hurt?, Journal of Finance, 53, 549-573.

Gibbons, M.R. and P. Hess, 1981, Day of the week effects and asset returns Journal of Business, 54, 579-596.

Gibbons, M.R. and W. Ferson, 1985, Testing asset pricing models with changing expectations and an unobservable market portfolio, Journal of Financial Economics, 14, 217-236.

Gibbons, M.R., 1982, Multivariate tests of financial models: A new approach, Journal of Financial Economics, 10, 3-27.

Gibbons, M.R., S.A. Ross and J. Shanken, 1989, A test of the efficiency of a given portfolio, 57, 1121-1152.

Gillan, S., 1990, An investigation into CAPM anomalies in New Zealand. The small firm and price earnings ratio effects, Asia Pacific Journal of Management, 7, 63-78.

Gilles, C. and S.F. LeRoy, 1991, Econometric aspects of the variance-bounds test: A survey, Review of Financial Studies, 4, 753-791.

Givoly, D. and A. Ovadia, 1983, Year-end tax induced 'sales' and stock market seasonality, Journal of Finance, 38, 171-185.

Gordon, R.H. and D.F. Bradford, 1980, Taxation and the stock market valuation on capital gains and dividends: Theory and empirical results, Journal of Public Economics, 14, 109-136.

Graham, B. and D. Dodd, 1940, Security Analysis: Principles and Technique, McGraw-Hill, New York.

Grauer, R., 1999, On the cross-sectional relation between expected returns, betas, and size, Journal of Finance, 54, 773-789.

Greene, W.H., 1997, Econometric Analysis, third edition, Macmillan.

Griffiths M.D. and R.W White, 1993, Tax-induced trading and the turn-of-the-year anomaly: An intraday study, Journal of Finance, 48, 575-598.

Grundy, K. and B.G. Malkiel, 1996, Reports of beta's death have been greatly exaggerated, Journal of Portfolio Management, 22, 36-44.

Gultekin, M.N. and N.B. Gultekin, 1983, Stock market seasonality: International evidence, Journal of Financial Economics, 469-481.

Hamon, J., 1986, The Seasonal character of monthly returns on the Paris Bourse, Journal of the French Finance Association, 7, 57-74.

Handa, P., S.P. Kothari and C. Wasley, 1989, The relation between the return interval and betas: Implications for the size-effect, Journal of Financial Economics 23, 79-100.

Handa, P., S.P. Kothari and C. Wasley, 1993, Sensitivity of multivariate tests of the capital asset-pricing model to the return measurement interval, Journal of Finance, 48, 1543-1551.

Hansen, L.P. and K. Singleton, 1982, Generalized instrumental variables estimation in non-linear rational expectations models, Econometrica, 50, 1269-1286.

Hansen, L.P. and R. Jagannathan, 1997, Assessing specification errors in stochastic discount factor models, Journal of Finance, 52, 555-590.

Harris, L., 1986, A transaction data study of weekly and intradaily patterns in stock returns, Journal of Financial Economics, 16, 99-117.

Harris, M. and A. Raviv, 1991, The theory of capital structure, Journal of Finance, 44, 297-355.

Harvey, A.C., 1991, The world price of covariance risk, Journal of Finance, 46, 111-157.

Harvey, C.R., 1989, Time-varying conditional covariances in tests of asset pricing models, Journal of Financial Economics, 24, 289-318.

Hasbrouck, J., 1985, The characteristics of take-over targets: q and other measures, Journal of Banking and Finance 9, 351-362.

Haugen, R.A. and J. Lakonishok, 1988, The Incredible January effect. Homewood, IL: Dow Jones-Irwin.

Haugen, R.A. and N.L. Baker, 1996, Commonality in the determinants of expected stock returns, Journal of Financial Economics, 41, 401-440.

Haugen, R.A. and P. Jorion, 1996, The January effect: Still there after all these years, Financial Analysts Journal, 27-31.

Haugen, R.A., 1995, The New Finance, Prentice-Hall, New Jersey.

Hawawini, G.A. and C. Viallet, 1987, Seasonality, size premium and the relationship between the risk and return of French common stocks, working paper, INSEAD, Fontainebleau, France.

Hawawini, G.A. and P.A. Michel 1979, An assessment of risk in thinner markets: The Belgian case, Journal of Economics and Business, 31, 196-201.

Hawawini, G.A., 1991, Stock market anomalies and the pricing on the Tokyo stock exchange," in W. Ziemba, W. Bailey, and Y. Hamao (eds.), Japanese Financial Market Research, North Holland.

Hawawini, G.A., P. Michel and A. Corhay, 1989, A look at the validity of the capital asset pricing model in light of equity market anomalies: The case of Belgian common stocks, in R.C. Guimaraes, B.G. Kingsman, and S. Taylor (eds.), A Reappraisal of the Efficiency of Financial Markets, Springer-Verlag, NATO ASI Series.

Hayashi, F. and T. Inoue, 1991, The relation between firm growth and q with multiple capital goods: Theory and evidence from panel data on Japanese firms, Econometrica, 59, 731-754.

Hayashi, F., 1982, Tobin's average q and marginal q: A neo-classical interpretation, Econometrica, 50, 215-224.

He, J. and L.K. Ng, 1994, Economic forces, fundamental variables, and equity returns, Journal of Business, 67, 599-609.

Hensel, C.R. and W.T. Ziemba, 1996, Investment results from exploiting turn-of-the-month effects, Journal of Portfolio Management, spring, 17-23.

Herrera, M. and L. Lockwood, 1994, The size effect in the Mexican stock market, Journal of Banking and Finance, 18, 621-632.

Heston, S.L., K.G. Rouwenhorst and R.E. Wessels, 1999, The role of beta and size in the cross-section of European stock returns, European Financial Management, 5, 9-27.

Hirschey, M., 1985, Market structure and market value, Journal of Business, 58, 89-98.

Horowitz, J.L., 1997, Bootstrap methods in econometrics: Theory and numerical performance, in D.M. Kreps and K.F. Walls, (eds.), Advances in Economics and Econometrics: Theory and Applications III, (Cambridge University Press), 188-222.

Howe, J.S. and B.G. Wood, Jr., 1994, An investigation of calendar anomalies in pacific rim and U.S. equity markets, Studies in the Financial Markets of the Pacific Basin, Bos, T. and T.A. Fetherston (eds), Research in International Business and Finance, Vol. 11B, 19-37.

Howe, K.M., J. He and G.W. Kao, 1992, One-time cash flow announcements and free cash flow theory: Share repurchases and special dividends, Journal of Finance, 47, 1963-1975.

Hsiao, C., 1986, Analysis of Panel Data, Econometric Society Monographs no. 11, Cambridge University Press, Cambridge.

Huberman, G., S. Kandel and Karolyi, 1987, A size-based stock returns model, CRSP Working paper, University of Chicago.

Ibbotson, R.G., 1975, Price performance of common stock new issues, Journal of Financial Economics, 2, 235-272.

Jacobs, B.I. and K.N. Levy, 1988, Disentangling equity return regularities: New insights and investment opportunities, Financial Analysts Journal, 44, 18-43.

Jacobs, B.I. and K.N. Levy, 1988a, Calendar anomalies: Abnormal returns at calendar turning points, Financial Analysts Journal, 28-39.

Jacobs, B.I. and K.N. Levy, 1988b, Disentangling Equity Returns Regularities: New Insights and Investment Opportunities, Financial Analysts Journal, 18-43.

Jaffe, J. and G. Mandelker, 1976, The Fisher effect for risky assets: An empirical investigation, Journal of Finance, 31, 447-458.

Jaffe, J. and R. Westerfield, 1985a, The week-end effect in common stock returns: The international evidence, Journal of Finance, 40, 433-454.

Jaffe, J. and R. Westerfield, 1985b, Patterns in Japanese common stock returns: Day of the week and turn of the year effect, Journal of Financial and Quantitative Analysis, 20, 261-272.

Jaffe, J. and R. Westerfield, 1989, Is there a monthly effect in stock market returns?: Evidence from foreign countries, Journal of Banking and Finance, 13, 237-244.

Jaffe, J., D.B. Keim and R. Westerfield, 1989, Earnings yields, market values, and stock returns, Journal of Finance, 45,135-148.

Jaffe, J., R. Westerfield. and C. Ma, 1989, A twist on the Monday effect in stock prices: Evidence from The U.S. and foreign stock markets." Journal of Banking and Finance, 13, 641-650.

Jagannathan R. and E.R. MaGrattan, 1995, The CAPM debate, Federal Reserve Bank of Minneapolis Quarterly Review, 2-17.

Jagannathan, R. and Z. Wang, 1993, The CAPM is alive and well, Staff report 165, Federal Reserve Bank of Minneapolis.

Jagannathan, R. and Z. Wang, 1996, The conditional CAPM and the cross-section of expected returns, Journal of Finance 51, 3-53.

Jagannathan, R. and Z. Wang, 1998, An asymptotic theory for estimating beta-pricing models using cross-sectional regression, Journal of Finance, 53, 1285-1309.

Jagannathan, R., K. Kubota and H. Takehara, 1998, Relationship between labour-income risk and average return: Empirical evidence from the Japanese stock market, Journal of Business, 71, 319-347.

Jegadeesh, N. and S. Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, Journal of Finance, 48, 65-91.

Jegadeesh, N. and S. Titman, 1995, Short-horizon return reversals and the bid-ask spread, Journal of Financial Intermediation, 4, 116-132.

Jegadeesh, N., 1990, Evidence of predictable behaviour of security returns, Journal of Finance, 45, 881-898.

Jegadeesh, N., 1992, Does market risk really explain the size effects? Journal of Financial and Quantitative Analysis, 27, 337-351.

Jensen, M.C. and W. Meckling, 1976, Theory of the firm: Managerial behaviour, agency costs, and ownership structure, Journal of Financial Economics, 4, 305-360.

Jensen, M.C., 1986, Agency costs of free cash flow, corporate finance and takeovers, American Economic Review, 76, 323-329.

Jeong, J and G.S. Maddala, 1993, A perspective on application of bootstrap methods in econometrics, in G.S. Maddala, C.R. Rao, and H.D. Vinod (eds.), Handbook of Statistics, 11, (North-Holland, Amsterdam), 573-600.

Jones, C.P., D.K. Pearce and J.W. Wilson, 1987, Can tax-loss selling explain the January effect? A note, Journal of Finance, 42, 453-461.

Jones, S.L. and W. Lee, 1995, Evidence on the behaviour of bid and ask prices at the turn of the year: Implications for the survival of stock return seasonality, Journal of Financial Research, 18, 383-400.

Jones, S.L., W. Lee and R. Apenbrink, 1991, New evidence on the January effect before personal income taxes, Journal of Finance, 46, 1909-1924.

Jung, K., Y. Kim and R. Stulz, 1996, Timing, investment opportunities, managerial discretion, and the security issue decision, Journal of Financial Economics, 42, 159-185.

Kan, R. and C. Zhang, 1999, Two-pass test of asset pricing models with useless factors, Journal of Finance, 54, 203-235.

Kandel, S. and R. Stambaugh, 1995, Portfolio inefficiency and the cross-section of expected returns, Journal of Finance, 50, 157-184.

Kato, K. and J.S. Schallheim, 1985, Seasonal and size anomalies in the Japanese stock market, Journal of Financial and Quantitative Analysis, 20, 243-260.

Kato, K., 1990, Weekly patterns in Japanese stock returns, Management Science, 36, 1031-1043.

Kaul, G. and M. Nimalendran, 1990, Price reversals: Bid-ask errors or market overreaction?, Journal of Financial Economics, 28, 67-93.

Keim, D.B. and R.F. Stambaugh, 1984, A further investigation of the weekend effect in stock returns, Journal of Finance, 39, 819-835.

Keim, D.B. and R.F. Stambaugh, 1986, Predicting returns in the stock and bond markets, Journal of Financial Economics, 17, 357-390.

Keim, D.B., 1983, Size-related anomalies and stock return seasonality: Further empirical evidence, Journal of Financial Economics, 12, 13-32.

Keim, D.B., 1985, Dividend yields and stock returns: Implications of abnormal January returns, Journal of Financial Economics, 14, 473-489.

Keim, D.B., 1986, Dividend yields and the January effect, Journal of Portfolio Management, 12, 54-60.

Keim, D.B., 1988a, Dividend yields and stock returns: Implications of abnormal January returns, Journal of Financial Economics, 473-489.

Keim, D.B., 1988b, Stock market regularities: A synthesis of the evidence and explanations, in Dimson, E. ed., Stock Market Anomalies, Cambridge University Press, Cambridge.

Keim, D.B., 1989, Trading patterns, bid-ask spreads, and estimated security returns: The case of common stocks at calendar turning points, Journal of Financial Economics, 25, 75-97.

Kim, C.-W. and J. Park, 1994, Holiday effects and stock returns: Further evidence, Journal of Financial and Quantitative Analysis, 29, 145-157.

Kim, D., 1995, The errors in the variables problem in the cross-section of expected stock returns, Journal of Finance 50, 1605-1634.

Kim, D., 1997, A reexamination of the firm size, book-to-market, and earnings price in the cross-section of expected stock returns, Journal of Financial and Quantitative Analysis, 32, 463-489.

Kim, M.J., C.R. Nelson and R. Startz, 1991, Mean reversion in stock prices? A reappraisal of the empirical evidence, Review of Economic Studies, 58, 515-528.

Kim, S.W., 1988, Capitalising on the weekend effect, Journal of Portfolio Management, 14, 59-63.

Kim, Y.G., K.H. Chung and C.S. Pyun, 1992, Size, price-earnings ratio and seasonal anomalies in the Korean stock market, in S.G. Rhee and R.P. Chang (eds.), Pacific-Basin Capital Markets Research, North Holland.

Knez, P.J. and M.J. Ready, 1997, On the robustness of size and book-to-market in cross-sectional regressions, Journal of Finance, 52, 1355-1382.

Kolb, R.W. and R.J. Rodriquez, 1987, Friday the thirteenth: Part VII-a note, Journal of Finance, 42, 1385-1387.

Koogler, P. and E. Maberly, 1994, Additional evidence of year-end tax-motivated trading by individual investors, 1962-1986, Journal of the American Taxation Association, 16, 122-137.

Kothari, S. and J. Warner, 1997, Measuring long-horizon security price performance, Journal of Financial Economics, 43, 301-339.

Kothari, S.P. and J. Shanken, 1997, Book-to-market, dividend yield, and expected market returns: A time-series analysis, Journal of Financial Economics, 44, 169-203.

Kothari, S.P., J. Shanken and R. Sloan, 1995, Another look at the cross-section of expected stock returns, Journal of Finance 50, 185-225.

Kryzanowski, L. and H. Zhang, 1992, The Contrarian investment strategy does not work in the Canadian markets, Journal of Financial and Quantitative Analysis, 27, 383-395.

Kubota, K. and H. Takehara, 1996, Cross-section risk and return of Tokyo stock exchange firms, in T., Bos, and T.A., Fetherston (eds.), Advances in Pacific Basin Financial Markets, 2B, (JAI Press Inc.), 273-305.

Kuhn, T.S., 1970, The Structure of Scientific Revolutions, University of Chicago Press.

Kupiec, P.H., 1993, Do stock prices exhibit excess volatility, frequently deviate from fundamental values, and generally behave inefficiently?, Financial Markets Institutions and Instruments, 2, 1-61.

La Porta, R., J. Lakonishok, A. Shleifer and R. Vishny, 1997, Good news for value stocks: Further evidence on market efficiency, Journal of Finance, 52, 859-874.

Lakonishok, J. and A.C. Shapiro, 1986, Systematic risk, total risk and size as determinants of stock market returns, Journal of Banking and Finance, 10, 115-132.

Lakonishok, J. and E. Maberly, 1990, The weekend effect: Trading patterns of individual and institutional investors, Journal of Finance, 45, 231-243.

Lakonishok, J. and M. Levi, 1982, Weekend effect on stock returns: A note, Journal of Finance, 37, 883-889.

Lakonishok, J. and S. Smidt, 1984, Volume and turn-of-the-year behaviour, Journal of Financial Economics, 13, 435-455.

Lakonishok, J. and S. Smidt, 1986, Volume for winners and losers: Taxation and other motives for stock trading, Journal of Finance, 41, 951-974.

Lakonishok, J. and S. Smidt, 1988, Are seasonal anomalies real? A ninety-year perspective, Review of Financial Studies, 1, 403-425.

Lakonishok, J., A. Shleifer and R.W. Vishny, 1994, Contrarian investment, extrapolation, and risk, Journal of Finance 49, 1541-1578.

Lang, L. and R. Litzenberger, 1989, Dividend announcements: Cash flow signalling vs. free cash flow hypothesis, Journal of Financial Economics 24, 181-192.

Lang, L. and R.M. Stulz, 1994, Tobin's q, corporate diversification, and firm performance, Journal of Political Economy 102, 1248-1280.

Lang, L., E. Ofek and R.M. Stulz, 1996, Leverage, investment, and firm growth, Journal of Financial Economics, 40, 3-29.

Lang, L., R.M. Stulz and R.A. Walking, 1989, Managerial performance, Tobin's q, and the gains from successful tender offers, Journal of Financial Economics 24, 137-154.

Lang, L., R.M. Stulz and R.A. Walking, 1991, A test of the free cash flow hypothesis: The case of bidder returns, Journal of Financial Economics 29, 315-336.

Lee, C.F., K.C. Chen and K.T. Liaw, 1995, Systematic risk, wage rates, and factor substitution, Journal of Economics and Business 47, 267-278.

Lee, C.F., K.T. Liaw and S. Rahman, 1990, Impacts of market power and capital labour ratio on systematic risk: A Cobb-Douglas approach, Journal of Economics and Business 42, 237-241.

Lee, I., 1992, Stock market seasonality: Some evidence from the Pacific-basin countries, Journal of Business Finance and Accounting, 19, 199-210.

Lehmann, B.N. and D. Modest, 1988, The empirical foundations of the arbitrage pricing theory, Journal of Financial Economics, 21, 213-254.

Lehmann, B.N., 1990, Fads, martingales and market efficiency, Quarterly Journal of Economics, 105, 1-28.

Lehmann, B.N., 1991, Asset pricing and intrinsic values, Journal of Monetary Economics, 28, 485-500.

Lehn, K., J. Netter and A. Poulsen, 1990, Consolidating corporate control: Dual-class recapitalizations versus leveraged buyouts, Journal of Financial Economics 27, 557-580.

Leland, H.E., 1994, Corporate debt value, bond covenants, and optimal capital structure, Journal of Finance, 49, 1213-1252.

Leland, H.E., 1998, Agency costs, risk management, and capital structure, Journal of Finance, 53, 1213-1243.

LeRoy, S., 1989, Efficient capital markets and martingales, Journal of Economic Literature, 27, 1583-1621.

LeRoy, S.F. and R.D. Porter, 1981, The present-value relation: Tests based on implied variance bounds, Econometrica, 49, 555-574.

Levis, M., 1985, Are small firms big performers?, Investment Analyst, 76, 21-27.

Levis, M., 1989, Stock market anomalies: A re-assessment based on the UK Evidence, Journal of Banking and Finance, 13, 675-696.

Levy, H., 1978, Equilibrium in an imperfect market: A constraint on the number of securities in the portfolio, American Economic Review, 643-658.

Lewellen, J., 1999, The time-series relations among expected return, risk, and book-to-market, Journal of Financial Economics, 54, 5-43.

Liano, K. and L.R. White, 1994, Business cycles and the pre-holiday effect in stock returns, Applied Financial Economics, 4, 171-174.

Liano, K., P.H. Marchand and G.C. Huang, 1992, The holiday effect in stock returns: Evidence from the OTC market, Review of Financial Economics, 2, 45-54.

Lindenberg, E.B. and S.A. Ross, 1981, Tobin's q ratio and industrial organisation, Journal of Business 54, 1-32.

Linn, S.C. and L.J. Lockwood, 1988, Short-term stock price patterns: NYSE, AMEX, OTC, Journal of Portfolio Management, winter, 30-34.

Lintner, J., 1965, The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets, Review of Economics and Statistics 47, 13-37.

Litzenberger, R. and K. Ramaswamy, 1979, The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence, Journal of Financial Economics, 7, 163-195.

Litzenberger, R. and K. Ramaswamy, 1980, Dividends, short selling restrictions, tax-induced investor clienteles and market equilibrium, Journal of Finance, 35, pp. 469-482.

Litzenberger, R. and K. Ramaswamy, 1982, The effects of dividends on common stock prices: Tax effects or information effects, Journal of Finance, 37, 429-433.

Lo, A.W. and A.C. MacKinlay, 1988, Stock market prices do not follow random walks: Evidence from a simple specification test, Review of Financial Studies, 1, 41-66.

Lo, A.W. and A.C. MacKinlay, 1990a, An econometric analysis of non-synchronous trading, Journal of Econometrics, 45, 181 -211.

Lo, A.W. and A.C. MacKinlay, 1990b, Data-snooping biases in tests of financial asset pricing models, Review of Financial Studies, 3, 431-467.

Lo, A.W. and A.C. MacKinlay, 1990c, When are contrarian profits due to stock market overreaction, Review of Financial Studies, 3, 175-205.

Loughran, T., 1993, NYSE vs NASDAQ returns: Market microstructure or the poor performance of IPOs?, Journal of Financial Economics, 33, 241-260.

Loughran, T., 1997, Book-to-market across firm size, exchange, and seasonality: Is there an effect? Journal of Financial and Quantitative Analysis, 32, 249-268.

Lucas, R., 1978, Asset prices in an exchange economy, Econometrica, 46, 1429-1445

Lyon, J.D., B.M Barber and C.L. Tsai, 1998, Improved methods for tests of long-run abnormal stock returns, Journal of Finance, 53, 165-201.

Ma, T. and T.Y. Shaw, 1990, The relationships between market value, P/E ratio, trading volume and the stock return of Taiwan stock exchange, in S.G. Rhee and R.P. Chang (eds.), Pacific Basin Capital Markets Research, North Holland.

MacDonald, R. and D.M. Power, 1992, Persistence in UK stock market returns: Some evidence using high frequency data, Journal of Business Finance and Accounting, 19, 505-514.

MacDonald, R. and D.M. Power, 1993, Persistence in UK stock market returns: Some evidence from disaggregated data, Applied Financial Economics, 3, 27-38.

MacKinlay, A.C., 1995, Multifactor models do not explain deviations from the CAPM, Journal of Financial Economics, 38, 3-28.

MacKinlay, A.C., 1997, Event studies in economics and finance, Journal of Economic Literature, 35, 13-39.

Maroney, N. and A.A. Protopapadakis, 1998, The information content of the book-to-market ratio and market value for pricing equities internationally: Evidence from seven national markets, working paper, University of Southern California.

Marsh, T., 1979, Equity rights issues and the efficiency of the UK stock market, Journal of Finance, 34, 839-862.

Mayers, D., 1972, Nonmarketable assets and capital market equilibrium under uncertainty, in M. Jensen, ed., Studies in the theory of capital markets (Praeger, New York, NY).

Maynes, E. and J. Rumsey, 1993, Conducting event studies with thinly traded stocks, Journal of Banking and Finance, 17, 145-157.

McConnell, J. and H. Servaes, 1990, Additional evidence on equity ownership and corporate value, Journal of Financial Economics 27, 595-612.

McElroy, M.B. and E. Burmeister, 1988, Arbitrage pricing theory as a restricted nonlinear multivariate regression model: ITNLSUR estimates, Journal of Business and Economic Statistics, 6, 29-42.

McEnally, R., 1976, Stock price changes induced by tax switching, Journal of Business and Economic Research, 47-54.

McGoun, E.G., 1992, The CAPM: A Nobel failure, Critical Perspectives on Accounting, 3, 155-177.

McInish, T.H. and R.A. Wood, 1990, A transactions data analysis of the variability of common stock returns during 1980-1984, Journal of Banking and Finance, 14, 99-112.

McQueen, G., 1992, Long-horizon mean-reverting stock prices revisited, Journal of Financial and Quantitative Analysis, 27, 1-18.

Mech, T., 1993, Portfolio return autocorrelation, Journal of Financial Economics, 34, 307-344.

Merrill, A. 1966, Behaviour of Prices on Wall Street, The Analysis Press, Chappaqua, NY.

Merton, R., 1973, An intertemporal capital asset pricing model, Econometrica 41, 867-887.

Miller, E.M., 1988, Why a weekend effect?, Journal of Portfolio Management, Summer, 43-48.

Miller, M. and M. Scholes, 1982, Dividend and taxes: Some empirical evidence, Journal of Political Economy, 90, 1118-1141.

Miller, M.H. and M. Scholes, 1972, Rates of return in relation to risk: A reexamination of some recent findings, in M.C. Jensen (eds.), Studies in the Theory of Capital Markets, (Praeger, New York), 47-78.

Mills, T.C. and J.A. Coutts, 1995, Calendar effects in the London stock exchange FT-SE indices, European Journal of Finance, 1, 79-93.

Morck, R., A. Shleifer and R. Vishny, 1988, Management ownership and market valuation: An empirical analysis, Journal of Financial Economics 20, 293-315.

Morck, R., A. Shleifer and R. Vishny, 1989, Alternative mechanisms for corporate control, American Economic Review, 79, 842-851.

Morck, R., A. Shleifer and R.W. Vishny, 1990, Do managerial objectives drive bad acquisitions?, Journal of Finance, 45, 31-48.

Morgan, I., 1982, Dividends and capital asset prices, Journal of Finance, 37, 1071-86

Mossin, J., 1966, Equilibrium in a capital asset market, Econometrica, 34, 768-783.

Myers, M.D., L.A. Gordon and M. Hamer, 1991, Postauditing capital assets and firm performance: An empirical investigation, Managerial and Decision Economics 12, 317-327.

Myers, S.C. and N. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, Journal of Financial Economics, 5, 187-221.

Myers, S.C., 1977, Determinants of corporate borrowing, Journal of Financial Economics, 5, 147-175.

Naranjo, A., M. Nimalendran and M. Ryngaert, 1998, Stock returns, dividend yields, and taxes, Journal of Finance, 53, 2029-2057.

Nawalkha, S.K., 1997, A multibeta representation theorem for linear asset pricing theories, Journal of Financial Economics, 46, 357-381.

Nelson, C.R. and M.J., Kim, 1993, Predictable stock returns: The role of small sample bias, Journal of Finance, 48, 641-661.

Nelson, C.R., 1976, Inflation and rates of return on common stocks, Journal of Finance, 31, 471-483.

Newey, W. and K. West, 1987, A simple, positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix, Econometrica, 55, 703-708.

Nicholson, F., 1960, Price-earnings ratios, Financial Analysts Journal, 43-50

Nohel T. and V. Tarhan, 1998, Share repurchases and firm performance: New evidence on the agency costs of free cash flow, Journal of Financial Economics, 49, 187-222.

O'Hanlon, J., 1988, Day of the week returns over trading and non-trading periods: U.K. evidence, The Investment Analyst, 3-15.

Ogden, J.P., 1990, Turn-of-month evaluations of liquid profits and stock returns: A common explanation for the monthly and January effects, Journal of Finance, 45, 1259-1272.

Oldfield, G.S., Jr. and R.J. Rogalski, 1980, A theory of common stock returns over trading and non-trading periods, Journal of Finance, 35, 729-751.

Opler, T., L. Pinkowitz, R. Stulz and R. Williamson, 1999, The determinants and implications of corporate cash holdings, Journal of Financial Economics, 52, 3-46.

Patell, J.M. and M.A. Wolfson, 1982, Good news, bad news, and the interday timing of corporate disclosures, Accounting Review, 57, 509-527.

Peavy, J. and D. Goodman, 1983, Industry-relative price-earnings ratios as indicators of investment returns, Financial Analysts Journal, 39, 60-66.

Peel, D.A. and P.F. Pope, 1988, Stock returns and expected inflation in the U.K: Some new evidence, Journal of Business Finance and Accounting, 15, 459-467.

Penman, S.H., 1987, The distribution of earnings news over time and seasonalities in aggregate stock returns, Journal of Financial Economics, 18, 199-228.

Penman, S.H., 1989,

Perfect, S., D. Peterson and P. Peterson, 1995, Self-tender offers: The effects of free cash flow, cash flow signalling, and the measurement of Tobin's q, Journal of Banking and Finance, 19, 1005-1023.

Perfect, S.B. and K.W. Wiles, 1994, Alternative constructions of Tobin's q: An empirical comparison, Journal of Empirical Finance 1, 313-341.

Pettengill, G.N. and B.D. Jordan, 1990, The overreaction hypothesis, firm size, and stock market seasonality, Journal of Portfolio Management, 16, 60-64.

Pettengill, G.N., 1989, Holiday closing and security returns, Journal of Financial Research, 12, 57-67.

Pettengill, G.N., S. Sundaram and I. Mathur, 1995, The conditional relation between beta and returns, Journal of Financial and Quantitative Analysis, 30, 101-116.

Peyser, P.S., 1994, Beta, market power and wage rate uncertainty, Journal of Industrial Economics 23, 217-226.

Phillips-Pattrick, F.J. and T. Schneweis, 1988, The weekend effect for stock indexes and stock index futures: Dividend and interest rate effects, Journal of Futures Markets, 115-121.

Pillote, E., 1992, Growth opportunities and the stock price response to new financing, Journal of Business, 65, 371-394.

Pogue, G.A. and B.H. Solnik, 1974, The market model applied to European stocks: Some empirical results, Journal of Financial and Quantitative Analysis, 9, 917-944.

Pontiff, J. and L.D. Schall, 1998, Book-to-market ratios as predictors of market returns, Journal of Financial Economics, 49, 141-160.

Poon, S.H. and S.J. Taylor, 1991, Macroeconomic factors and the UK stock market, Journal of Business Finance and Accounting, 18, 619-635.

Poon, S.H., 1996, Persistence and mean reversion in UK stock returns, European Financial Management, 2, 169-196.

Poret, P. and R. Torres, 1989, What does Tobin's q add to modelling of investment behaviour?, in: M. Funke, ed., Factors in Business Investment, Springer, Berlin.

Poterba, J.M. and L.H. Summers, 1983, Dividend taxes, corporate investment, and q, Journal of Public Economics, 22, 135-167.

Poterba, J.M. and L.H. Summers, 1988, Mean reversion in stock prices: Evidence and implications, Journal of Financial Economics, 22, 27-59.

Prabhala, N.R., 1997, Conditional methods in event studies and an equilibrium justification for standard event study procedures, Review of Financial Studies, 10, 1-38.

Reinganum, M.R. and A.C. Shapiro, 1987, Taxes and stock return seasonality: Evidence from the London stock exchange, Journal of Business, 60, 281-295.

Reinganum, M.R., 1981, A new empirical perspective on the CAPM, Journal of Financial and Quantitative Analysis, 16, 439-462.

Reinganum, M.R., 1981, Empirical tests of multi-factor pricing model; the arbitrage pricing theory: Some empirical results, Journal of Finance, 36, 313-350.

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., 1982, A direct test of Roll's conjecture on the firm size effect, Journal of Finance, 37, 27-35.

Reinganum, M.R., 1983, The anomalous stock market behaviour of small firms in January: Empirical tests for tax-loss selling effects, Journal of Financial Economics, 12, 98-104.

Richardson, M. and J.H. Stock, 1989, Drawing inferences from statistics based on multi-year asset returns, Journal of Financial Economics, 25, 323-348.

Ritter, J.R. and N. Chopra, 1989, Portfolio rebalancing and the turn-of-the-year effect, Journal of Finance, 44, 149-166.

Ritter, J.R. and W.T. Ziemba, 1988, The buying and selling behaviour of individual investors at the turn of the year: Discussion, Journal of Finance, 43, 701-719.

Ritter, J.R., 1988, The Buying and selling behaviour of individual investors at the turn of the year, Journal of Finance, 43, 701-717.

Rogalski, R., 1984, New findings regarding way-of-the-week returns overtrading and non-trading period: A note, Journal of Finance, 39, 1603-1614.

Rogers, R.C., 1988, The relationship between earnings yield and market values: Evidence from the American stock exchange, Financial Review, 23, 65-80.

Roll, R. and S.A. Ross, 1980, An empirical investigation of the arbitrage pricing theory, Journal of Finance, 35, 1073-1103.

Roll, R. and S.A. Ross, 1994, On the cross-sectional relation between expected returns and betas, Journal of Finance, 49,101-121.

Roll, R., 1977, A critique of the asset pricing theory's tests: Part I: One past and potential testability of the theory, Journal of Financial Economics, 4, 129-176.

Roll, R., 1978, Ambiguity when performance is measured by the securities market line, Journal of Finance, 33, 1051-1069.

Roll, R., 1981, A possible explanation of the small firm effect, Journal of Finance, 36, 879-888.

Roll, R., 1983a, On computing mean returns and the small firm premium, Journal of Financial Economics, 12, 371-386.

Roll, R., 1983b, Vas ist das? The turn of the year effect and the return premium of small firms, Journal of Portfolio Management, 9, 18-28.

Rosenberg, B. and V. Marathe, 1979, Tests of the capital asset pricing hypotheses, in H. Levy ed., Research in Finance, JAI Press.

Rosenberg, B., K. Reid and R. Lanstein, 1985, Persuasive evidence of market inefficiency, Journal of Portfolio Management 11, 9-17.

Ross, S.A., 1976, The arbitrage theory of capital asset pricing, Journal of Economic Theory, 13, 341-360

Ross, S.A., 1978, The current status of the capital asset pricing model (CAPM), Journal of Finance, 33, 885-901.

Rouwenhorst, K.G., 1998, International momentum strategies, Journal of Finance, 53, 267-284.

Rouwenhorst, K.G., 1999, Local return factors and turnover in emerging stock markets, Journal of Finance, 54, 1439-1464.

Rozeff, M.S. and M.A. Zaman, 1998, Overreaction and insider trading: Evidence form growth and value portfolios, Journal of Finance, 53, 701-716.

Rozeff, M.S. and W.R. Kinney, 1976, Capital market seasonality: The case of stock returns, Journal of Financial Economics, 3, 379-402.

Rozeff, M.S., 1984, Dividend yields are equity risk premiums, Journal of Portfolio Management, 11, 68-75.

Rubio, G., 1988, Further international evidence on asset pricing: The case of the Spanish capital market, Journal of Banking and Finance, 12, 221-242.

Rystrom, D.S. and E.D. Benson, 1989, Investor psychology and the day-of-the-week effect, Financial Analysts Journal, September-October, 75-78.

Salinger, M. 1984, Tobin's q, Unionisation, and the concentration-profits relationship, Rand Journal of Economics, 15, 159-170.

Salinger, M. and L. Summers, 1983, Tax reform and corporate investment: A microeconomics simulation study, in M. Feldstein, ed., Behavioural simulation methods in tax policy analysis (University of Chicago Press Chicago, IL).

Salinger, M.A. and L.H. Summers, 1983, Tax reform and corporate investment: A microeconometric simulation study, in: M. Feldstein, ed., Behavioural simulation methods in tax policy analysis, University of Chicago Press, Chicago, IL, 247-273.

Santesmases, M., 1986, An investigation of the Spanish stock market seasonalities, Journal of Business Finance and Accounting, 13, 267-276.

Schaller, H., 1990, A re-examination of the Q theory of investment using US firm data, Journal of Applied Econometrics, 5, 309-325.

Scholes, M. and J. Williams, 1977, Estimating betas from nonsynchronous data, Journal of Financial Economics, 5, 309-327.

Schultz, P., 1983, Transaction costs and the small firm effect: A comment, Journal of Financial Economics, 12, 81-88.

Schultz, P., 1984, Personal income taxes and the January effect: Small firm stock returns before the War Revenue Act of 1917, Journal of Finance, 40, 333-343.

Schwartz, R.A. and D.K. Whitcomb, 1977a, The time-variance relationship: Evidence on autocorrelation in common stock returns, Journal of Finance, 32, 41-55.

Schwartz, R.A. and D.K. Whitcomb, 1977b, Evidence on the presence and causes of serial correlation in market model residuals, Journal of Financial and Quantitative Analysis, 12, 291-313.

Schwert, G.W., 1977, Stock exchange seats as capital assets, Journal of Financial Economics, 4, 51-78.

Schwert, G.W., 1983, Size and stock returns, and other empirical regularities, Journal of Financial Economics, 12, 3-12.

Scott, L., 1991, Financial market volatility: A survey, International Monetary Fund Staff Papers, 38, 582-624.

Senchack, A.J., Jr. and J.D. Martin, 1987, The relative performance of the PSR and the PER investment strategies, Financial Analysts Journal, 43, 46-56.

Servaes, H., 1991, Tobin's q and the gains from takeovers, Journal of Finance 36, 409-419.

Seyhun, H.N., 1988, The January effect and aggregate insider trading, Journal of Finance, 43, 129-141.

Seyhun, H.N., 1990, Overreaction or fundamentals: Some lessons from insiders' response to the market crash of 1987, Journal of Finance, 45, 1363-1388.

Seyhun, H.N., 1993, Can omitted risk factors explain the January effect? A stochastic dominance approach, Journal of Finance and Quantitative Analysis, 28, 195-212.

Shanken, J., 1982, The arbitrage pricing theory: Is it testable? Journal of Finance, 40, 1189-1196.

Shanken, J., 1987, Nonsynchronous data and the covariance-factor structure of returns, Journal of Finance, 42, 221-232.

Shanken, J., 1992, On the estimation of beta-pricing models, Review of Financial Studies 5, 1-33.

Shanken, J., 1996, Statistical methods in tests of portfolio efficiency: A synthesis, in G.S. Maddala and C.R. Rao, eds., Handbook of Statistics, 14, 693-711.f

Sharpe, W.F., 1964, Capital asset price: A theory of market equilibrium under conditions of risk, Journal of Finance 19, 425-442.

Sharpe, W.F., 1982, Factors in NYSE stock returns, Journal of Portfolio Management, 5-19.

Shefrin, H. and M. Statman, 1995, Making sense of beta, size, and book-to-market, Journal of Portfolio Management, 26-34.

Shiller, R.J., 1981, Do stock price move too much to be justified by subsequent changes in dividends?, American Economic Review, 71, 421-436.

Shiller, R.J., 1984, Stock prices and social dynamics, Brookings Papers on Economic Activity, 2, 457-510.

Shiller, R.J., 1989, Market Volatility, Cambridge, Mass., USA, MIT Press.

Shumway, T., 1997, The delisting bias in CRSP data, Journal of Finance, 52, 327-340.

Sias, R.W. and L.T. Starks, 1997a, Institutions and individuals at the turn-of-the-year, Journal of Finance, 52, 1543-1562.

Sias, R.W. and L.T. Starks, 1997b, Return autocorrelation and institutional investors, Journal of Financial Economics, 46, 103-131.

Skinner, D.J., 1993, The investment opportunity set and accounting procedure choice, Journal of Accounting and Economics 16, 407-445.

Smirlock, M. and L. Starks, 1986, Day of the week and intraday effects in stock returns, Journal of Financial Economics, 17, 197-210.

Smirlock, M., T. Gilligan and W. Marshall, 1984, Tobin's q and the structure-performance relationship, American Economic Review 74, 1051-1060.

Smith, C.W. and R.L. Watts, 1992, The investment opportunity set and corporate financing, dividend and compensation policies, Journal of Financial Economics, 32, 263-292.

Solnik, B. and L. Bousquet, 1990, Day-of-the-week effect on the Paris Bourse Journal of Business and Finance, 14, 461-468.

Stambaugh, R., 1982, On the exclusion of assets from the two-parameter model: A sensitivity analysis, Journal of Financial Economics, 17, 237-268.

Stattman, D., 1980, Book values and stock returns, The Chicago MBA: A Journal of Selected Papers, 4, 25-45.

Stehle, R., 1992, The size effect in the German stock market, Unpublished manuscript, University of Augsburg.

Stoll, H.R. and R.E. Whaley, 1983, Transactions costs and the small firm effect, Journal of Financial Economics, 12, 57-79.

Strong, N., 1992, Modelling abnormal returns: A review article, Journal of Business Finance and Accounting, 19, 533-553.

Strong, N., and X.G. Xu, 1997, Explaining the gross-section of UK expected stock returns, British Accounting Review 29, 1-23.

Stulz, R.M., 1991, Managerial discretion and optimal financing policies, Journal of Financial Economics, 26, 3-27.

Subrahmanyam, M.G. and S.B. Thomadakis, Systematic risk and the theory of the firm, Quarterly Journal of Economics, 94, 437-451.

Summers, L.H., 1981, Taxation and corporate investment: A Q-theory approach, Brookings Papers on Economic Activity, 1, 67-141.

Summers, L.H., 1986, Does the stock market rationally reflect fundamental Values?, Journal of Finance, 41, 591-601.

Sun, L., 1993, Market power, wage rate, and systematic risk: A homogeneous production function approach, Journal of Economics and Business 45, 99-108.

Thaler, R.H., 1987a, Anomalies, Seasonal movements in security prices II: Weekend, holiday, turn of the month, and intraday effect, Journal of Economic Perspectives, 1, 169-177.

Thaler, R.H., 1987b, Anomalies: The January effect, Journal of Economic Perspectives, 1, 197-201.

Theobald, M. and V. Price, 1984, Seasonality estimation in thin markets, Journal of Finance, 39, 377-392.

Theobald, M., 1980, An analysis of the market model and beta factors Using U.K. equity share data, Journal of Business Finance and Accounting, 7, 49-64.

Theobald, M., 1983, An analytic relationship between intervaling and non-trading effects in continuous time, Journal of Financial and Quantitative Analysis, 18, 199-209.

Tinic, S.M. and R. West, 1984, Risk and return: January vs the rest of the year, Journal of Financial Economics 13, 561-574.

Tinic, S.M. and R.J. Rogalski, 1986, The January size effect: Anomaly or risk mismeasurement, Financial Analysts Journal, 42, 63-70.

Tinic, S.M., G. Barone-Adesi and R. West, 1987, Seasonality in Canadian stock prices: A test of the 'tax-loss-selling' hypothesis, Journal of Financial and Quantitative Analysis, 22, 51-63.

Titman, S. and R. Wessels, 1988, The determinants of capital structure choice, Journal of Finance, 43, 1-20.

Tobin, J. and W.C. Brainard, 1977, Asset markets and the cost of capital , in Bela Belassa and Richard Nelson, eds., Economic Progress, Private Values and Public Policy, Amsterdam: North-Holland, 235-262.

Tobin, J., 1969, A general equilibrium approach to monetary theory, Journal of Money, Credit and Banking 2, 15-29.

Van den Bergh, W.M. and R.E. Wessels, 1985, Stock market seasonalities and taxes: An examination of the tax-loss selling hypothesis, Journal of Business Finance and Accounting, 12, 515-530.

Vermaelen, T. and M. Versringe, 1986, Do Belgians overreact?, working paper, Catholic University of Louvain, Belgium.

Vinod, H.D., 1993, Bootstrap methods: Applications in econometrics, in G.S. Maddala, C.R. Rao, and H.D. Vinod (eds), Handbook of Statistics, 11, (North-Holland, Amsterdam), 629-661.

von Furstenberg, G.M., 1977, Corporate investment: Does market valuation matter in the aggregate, Brookings Papers on Economic Activity, 2, 347-408.

Wachtel, S., 1942, Certain observations on seasonal movements in stock prices, Journal of Business, 15, 184-193.

Wahlroos, B. and T. Berglund, 1986, Anomalies and equilibrium returns in a small stock market, Journal of Business Research, 14, 423-440.

Wang, K., Y. Li and J. Erickson, 1997, A new look at the Monday effect, Journal of Finance, 52, 2171-2186.

West, K.D., 1988, Bubbles, fads, and stock price volatility tests: A partial evaluation, Journal of Finance, 43, 639-655.

Wilson, J.W. and C.P. Jones, 1993, Comparison of seasonal anomalies across major equity markets: A note, Financial Review, 28, 107-115.

Wilson, P., 1986, The relative information content of accruals and cash flows: Combined evidence at the earnings announcement and annual report release data, Journal of Accounting Research, Supplement, 165-200.

Wong, K.A. and M.S. Lye, 1990, Market values, earnings yields and stock returns: Evidence from Singapore, Journal of Banking and Finance, 14, 311-326.

Wong, K.P., 1995, Cournot oligopoly and systematic risk, Journal of Economics and Business 47, 385-395.

Yadav, P.K. and P.F. Pope, 1992, Intraweek and intraday seasonalities in stock market risk premia: Cash and futures, Journal of Banking and Finance, 16, 233-270.

Yermack, D., 1996, Higher market valuation of companies with a small board of directors, Journal of Financial Economics 40, 185-211.

Yoon, P. and L. Starks, 1995, Signalling, investment opportunities, and dividend announcements, Review of Financial Studies, 8, 995-1018.

Zarowin, P., 1989a, Does the stock market overreact to corporate earnings information?, Journal of Finance, 44, 1385-1399.

Zarowin, P., 1989b, Short-run market overreaction: Size and seasonality effects, Journal of Portfolio Management, 15, 26-29.

Zarowin, P., 1990, Size, seasonality, and stock market overreaction, Journal of Financial and Quantitative Analysis, 25, 113-125.

Zellner, A., 1962, An efficient method of estimating seemingly unrelated regressions and tests of aggregations bias, Journal of the American Statistical Association, 57, pp. 500-509.

Ziemba, W.T. 1993, Comment on 'why a weekend effect?, Journal of Portfolio Management, 19, 93-99.

Ziemba, W.T., 1991, Japanese security market regularities: Monthly, turn-of-the-month and year, holiday and golden week effects, Japan and the World Economy, 3, 119-146.

Ziemba, W.T., 1994, World wide security market regularities, European Journal of Operational Research, 74, 198-229.

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