Asset Pricing Dynamics in Karachi Stock Exchange: A Comparative Study of CAPM, ICAPM, Fama – French and Momentum Factor Models

By

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Abstract

Asset pricing models provide a meaningful measure of the expected return of an asset which the investor gets by taking on a certain level of risk. Financial theorists have proposed various asset pricing models that describe the relationship between risk and expected return. The paradoxes revealed in the statistical results of various empirical tests have influenced the development of modified asset pricing models, with the aim to improve the ability of the asset pricing model to explain the relationship between risk and expected return of an investment in risky assets. It is important for an investor to be able to quantify an appropriate rate of return that would compensate for taking on risk. An exhaustive literature exists in support and against the validity of various asset pricing models and the empirical evidence has shown that the relevance of these asset pricing models differs in developed and emerging markets. KSE is an emerging market where literature based on the asset pricing proposition is rare as compared to developed markets.

This research study is a comparative study of four most widely used asset pricing models, being applied to KSE: Capital asset pricing model (CAPM) , Fama and French-three factor model(FF, 1992), Intertemporal capital asset pricing model (ICAPM), and Carhart-four factor model. The purpose of this study is to explore the asset pricing dynamics in an emerging stock. The four models that are tested in this study have shown explanatory power in developed economies. However, the emerging markets have special features that are distinct from developed markets. These include market making activities by few large investors, non-synchronous trading, loose monitoring controls and small market size.

The research evidence highlights the fact that in emerging markets, the market index is misrepresented due to thin trading. Active trading exists in only a few stocks. Moreover the market index is value weighted and is therefore dominated by the stocks which are actively traded in the market. These factors lead to an insignificant market risk premium. The failure of CAPM in emerging markets may be due to the fact that the market index does not reflect the overall market's dynamics. This is the reason why market risk premium is insignificant in all of the four models tested in this study.

Fama and French three factor model performs better in emerging markets because this model takes into account the factors based on firm characteristics, i.e. size and value premium. Carhart's four factor momentum model is also relevant because this model takes into account the trading strategies related to loser and winner stocks in addition to the stocks firm characteristics. ICAPM performs well due to the fact that it takes into account the changing investment opportunity set and the affects of business and financial risks on the stocks.

This research would facilitate financial managers and investors to make appropriate analyses of the risk and return relationship of their investment strategies, enabling them to make rational investment decisions and maximize their returns as asset pricing propositions are an important input for estimation of investment appraisals, project feasibility and cost of equity valuations.

Index of Abbreviations

AGSM	Australian Graduate School of Management
ASX	Australian Stock Exchange
BH	Big High
BHD	Big High Down
BHU	Big High Up
BJS	Black Jensen and Scholes
BL	Big Low
BLD	Big Low Down
BLU	Big Low Up
BM	Big Medium
BM ratio	Book to Market ratio
BMD	Big Medium Down
BMU	Big Medium Up
CAPM	Capital Asset Pricing Model
E/P ratio	Earnings to Price ratio
EMH	Efficient Market Hypothesis
FF	Fama and French
HML	High minus Low
ICAPM	Intertemporal Capital Asset Pricing Model
KSE	Karachi Stock Exchange
LSE	Lahore Stock Exchange
MSCI	Morgan Stanley Capital Index
PACAP	Pacific Basin Capital Markets
Repo	Repurchase Agreement
SEHK	Stock Exchange of Hong Kong
SH	Small High
SHD	Small High Down
SHU	Small High Up
SL	Small Low
SLD	Small Low Down
SLU	Small Low Up
SM	Small Medium
SMB	Small minus Big
SMD	Small Medium Down
SMU	Small Medium Up
T-bill	Treasury bill
UMD	Up minus Down
WML	Winners minus Losers

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Chapter 1

Introduction

The theory on asset pricing can be traced back to the seventeenth century when Bernoulli (1738) proposed that the value of an asset can be determined by assessing the utility that it yields rather than determining its value based on its price. Since then, research based on asset pricing has been influenced by contributions published in the twentieth century[1]. The modern financial theory is based on three central assumptions: 1). markets are efficient, 2). investors exploit potential arbitrage opportunities, whereby arbitrage opportunity is the opportunity to buy an asset at a low price and then immediately sell it for a higher price in a different market, and 3). investors are rational.

[1] Bachelier(1900), Markowitz (1952), Treynor (1961, 1973), Sharpe (1964), Lintner (1965) and Mossin (1966), Fama and French (1992), Merton (1973), Jegadeesh and Titman (1993).

Based on these assumptions, financial theorists have proposed various asset pricing models that describe the relationship between risk and expected return. Theoretical asset pricing models were formed by the mid of the twentieth century. Later on, the rapid growth of computer technology and the relatively easy access to stock and bond price data, enabled researchers to empirically test the asset pricing models to examine whether the theoretical asset pricing models were supported by rigorous statistical testing. Moreover the paradoxes revealed in the statistical results of various empirical tests have influenced the development of modified asset pricing models, with the aim to improve the ability of the asset pricing model to explain the relationship between risk and expected return of an investment in risky assets. Majority of Asset pricing models propose that the expected return on an investment in the risky asset was influenced by two types of risks: Systematic risk (also known as market risk and non-diversifiable risk) refers to the risk common to all assets which cannot be diversified and unsystematic risk (also known as specific risk) is associated with individual assets and can be diversified. However, no matter how much diversification is done, an investor cannot get rid off all the risk associated with the investment. Therefore, it is all the more important for an investor to be able to quantify an appropriate rate of return that would compensate for taking on risk.

Markowitz (1952) laid the foundation of the development of asset pricing models with his proposition of "Portfolio Selection". He proposed the idea of a tradeoff between risk and return. "Mean-variance efficient" or "Optimal portfolios" are those portfolios which minimize the variance of portfolio return given expected return, and maximize expected return, given the variance. He suggested that the investors choose such portfolios. Therefore, the Markowitz approach is often called a "mean-variance model." Before his research was published, it was assumed that the investors would prefer to maximize their returns while minimizing the risk associated with the potential return gained. He argued that there is a rate at which the investors could get expected return by being exposed to a certain level of risk, or the investors could reduce the exposure of risk by giving up some level of expected return.

While making an investment, if an investor is certain about the payment of the cash flows when promised, in this case the investor would discount the asset at the risk-free rate. However as the uncertainty regarding the returns would increase, the investor would expect a higher return to justify the risk taken, which would lower the price the investor would be willing to pay in order to acquire the asset, due to the higher required rate of return. He suggested that if two risky assets were combined, their standard deviations (risk) does not increase, provided those two risky assets did not have perfectly correlated returns. Moreover he proposed that when a portfolio was formed, the standard deviation risk of the portfolio turned out to be less than the sum of standard deviations of its constituents. He proposed that given appropriate input data and computing power, a set of optimal portfolios could be identified. These set of portfolios formed the efficient frontier. Markowitz suggested that for investors who focused on the trade off between risk and return, it would be efficient to select the portfolios that fall on the efficient frontier.

Tobin (1958) proposed the Separation Theorem which simplified the task of portfolio selection. According to the Separation theorem, an investor could separate the problem of portfolio selection into two parts, identifying the optimal combination of risky assets (securities) and then deciding whether to borrow or lend according to their risk preference. In the end there would be only one portfolio plus borrowing and lending, and that portfolio would be the market portfolio. He showed how an individual investor could identify which efficient portfolio should be held in order to gain the expect level of return by being exposed to a certain level of risk. According to him, if an investor could hold risky asset and is able to borrow, i.e. buying stocks on margin, or lend, i.e. buying risk-free-assets, and the investor could do so at the same rate, in this case the efficient frontier would be a single portfolio of risky assets plus borrowing and lending, and this combination would dominate any other combination. However the data and computational requirements of this approach were cumbersome.

Treynor (1961) showed that while accounting for all the investments in the market, the risk premium per share for the ith investment is proportional to the covariance of the total investment in the market[2].

Sharpe (1964) proposed a Simplified Model for Portfolio Analysis. He devised a computationally efficient method for capital asset pricing. According to this method, the return on an individual security is related to the return on a common index. Any variable that had a dominant influence on the stock returns could be considered the common index. This model could also be extended to portfolios because the expected return of a portfolio is a weighted average of the expected return on individual securities.

[2] Although Treynor did extensive work on the theory of asset pricing, yet this most important paper was never published. His work has been occasionally cited in academic literature as an unpublished manuscript.

Building on the research work of Markowitz, Treynor (1961, 1963), Sharpe (1964), Linter (1965) and Mossin (1966), independently constructed the first asset pricing model, The Capital Asset Pricing Model (CAPM). Given an asset's non-diversifiable risk (market risk/systematic risk represented by the quantity beta), if an investor forms well-diversified portfolio, then CAPM can be used to quantify the relationship between the beta of an asset and its corresponding expected return. When the investor is exposed to the systematic risk while investing in the portfolio, the beta of the portfolio is the defining factor in terms of the expected return. The CAPM assumes that market beta is the only risk factor which is priced in stock returns. The empirical evidence was in favor of the CAPM till 1962 as suggested by Fama and French (1962). However, the empirical results of the tests of CAPM post 1962 have not been very impressive. The poor empirical results may be because of the shortcomings of the theoretical framework of the model, the result of the assumptions used in the model. For example, CAPM assumes that an investor can borrow and lend at risk free rate of interest. In reality this is not always the case and in today's age the investors have to face a lot of barriers while borrowing and lending. Moreover CAPM is not testable because the market index used for research purpose is synthetic and does not include all possible assets. In order to refine the original CAPM, four most important extensions of CAPM have been proposed by renowned researchers.

One of the key assumptions of CAPM is that investors make decisions for only one time period i.e. CAPM is a single period model. This assumption seemed too stringent because investors can and do rebalance their portfolios from time to time. Moreover daily movements in the prices of many assets could not be explained by the single factor CAPM. This limitation was taken into account by the introduction of intertemporal portfolio choice and asset pricing models of Samuelson (1969), Hakansson (1970) and Fama (1970), which assumed that the investors make portfolio and consumption decisions at discrete time periods. Merton (1973) developed an Intertemporal CAPM (ICAPM) by assuming that time flows continuously. This facilitated the construction of a framework that was more realistic and at same time, more tractable than the discrete time model.

Fama and French (1992) proposed an extension of the CAPM, known as the Fama and French Three Factor Model (FF three factor model). Fama and French questioned the validity of the CAPM in explaining the cross-section of expected returns from certain investments based on firm characteristics. They observed that two types of stocks performed better than the market. These include the glamour/growth and value stocks. The stocks with high book to market value were termed as value stocks and the stocks with low book to market value stocks were termed as growth stocks. They observed that the high book value to market value firms tend to be persistently financially distressed and low book value to market value firms were associated with sustained profitability and future growth. Moreover the stocks with small market capitalization (small size firms) tend to be less profitable than large stocks. However, the returns of the investors holding the high book to market value stocks and the stocks with small market capitalization were compensated for holding less profitable, riskier stocks.

Fama and French stated that this trend is observed due to the existence of the size and value premium. They constructed two more risk factors that account for the size and value premium. The first factor size represented by SMB, stands for Small minus Big, which measures the additional returns the investors receive by taking on greater exposure to risk while investing in the stocks of companies with relatively small market capitalization. This type of additional return is called size premium. The second factor Value represented by HML stands for High minus Low, which measures the additional returns the investors receive by taking on greater exposure to risk while investing the stocks of companies with a high book value to market value ratio, i.e. value stocks. This type of additional return is termed as value premium. Fama and French (1996) criticized the proposition of Sharpe that the market risk is the only risk factor that can explain the cross-sectional variation of the expected returns of an asset and declared that the single risk factor (market risk) was dead[3]

Jegadeesh and Titman (1993) introduced behavioral innovations in asset pricing and suggested that the investment strategies that involve taking a long or short position in well or poorly performing stocks on the basis of the past performance over the period of past three to twelve months tend to produce significantly positive abnormal returns of

[3] Sharpe (1998) responded to his declaration and commented that it was premature to consider beta dead. However he stated that this does not mean that the data could be confirmed. According to him a lot of noise in the data exists because of the limitations of the data. He commented that instead of expected returns; realized returns are used in empirical testing. Moreover, instead of ex-ante measures of beta; we see realized beta. Sharpe argued that Fama and French got that very strong empirical results by applying the FF three factor model on the USA stock markets for the period of mid-1970s because it was a very good period for value stocks, which in the end drove up those results. He pointed out that in United States, value stocks did much better than growth during that time period. There was a bearish trend in the market in 1973 and 1974. Latter the price of the stocks that had been beaten down by the market, started to raise a lot more than some of the growth stocks. Furthermore he suggested that in an efficient market, small stocks might do better because they tend to be illiquid, and people demand a premium for illiquidity. However, according to him, this phenomenon becomes less compelling if mutual funds are considered because mutual funds package a number of small stocks and therefore make the illiquid liquid. When investors would consider this, they would start investing in such mutual, which would drive up the price of small stocks, reducing the size premium. However Sharpe did not dismiss Fama and French's proposition at hand and stated that it was too early to rush into conclusions.

about one percent per month for the following year. These return continuation strategies which lead to an existence of momentum return in individual stocks, influenced by the positive correlation between past and future stock returns, have been tested extensively. Fama and French (1996) and Jegadeesh and Titman (1999) tested the four factor model and provided empirical evidence in favor of the four factor model for the United States. The four factor model can also be applied to developed markets. Rouwenhorst (1998), Chui, Titman and Wei (2000) applied the four factor model on Asian markets. Carhart (1997) and Liew and Vassalou (2000) augmented the Fama and French three-factor model with a momentum factor WML, Winners minus losers[4]. Winners are the stocks with the highest last year's average returns, excluding the most recent month, and the losers are the stocks with the lowest last year's average returns. WML is a risk factor which measures the momentum premium.

1.1 Research Rationale

An exhaustive literature exists in support and against the validity of various asset pricing models and the empirical evidence has shown that the relevance of these asset pricing models differs in developed and emerging markets. Investment behavior and market dynamics can be differentiated between the emerging and developed markets.

The relevance of the asset pricing models has provided motivation to analyze the application of the asset pricing models in KSE, to support rational investment decisions. This research study is a comparative study of four most widely used asset pricing models, being applied to KSE: Capital asset pricing model (CAPM) , Fama and French-three

[4] Winner stocks are also termed as "up". Similarly loser stocks are also termed as "down". For the purpose of this research winner stocks represent up and loser stocks represent down.

factor model(FF, 1992), Intertemporal capital asset pricing model (ICAPM), and Carhart-four factor model. The asset pricing propositions under study are an important input for estimation of investment appraisals, project feasibility and cost of equity valuations. The research findings would have policy and academic implications. Moreover, this research would facilitate financial managers and investors to make appropriate analyses of the risk and return relationship of their investment strategies, enabling them to make rational investment decisions and maximize their returns.

Asset pricing models provide a meaningful measure of the expected return of an asset which the investor gets by taking on a certain level of risk. Once the expected return is calculated by using an asset pricing model, the future cash flows of the asset can be discounted to their present value employing the same rate of expected return in order to estimate the price of the asset. Furthermore, it can be concluded that an asset is correctly priced if the observed price of an asset is equal to the price estimated by using the asset pricing model's derived discount rate (expected rate of return), the asset is correctly priced. If the observed price of an asset is greater than the estimated price, the asset is overvalued and if the observed price of an asset is less than the estimated price, the asset is undervalued. In this way, asset pricing models enable the investors to wisely price the risky assets and make their investment decisions according to their attitude towards risk.

Pakistan has three stock exchanges[5]. The largest is Karachi Stock Exchange that was established in 1947. It has the largest market capitalization, trading volume and it is also the most liquid market in Pakistan. The other two exchanges by and large follow the

[5] These include Karachi Stock exchange (KSE), Lahore Stock Exchange (LSE) and Islamabad Stock Exchange (ISE).

trading patterns of KSE. Table 1 depicts the correlation between three stock exchanges of Pakistan.

[Insert table 1 about here]

Over the past decade KSE has experienced tremendous growth and was awarded as the best performing emerging stock market of the world in 2002 by Business week. Table 2 reports the decade wise performance of KSE.

[Insert table 2 about here]

KSE was generally following an upward trend from the period 2003- April 2008. The biggest rally[6] was witnessed in 2005. This was due to the fact that during this period the macro economic conditions were at record best, mutual fund industry was growing, foreign reserves were improving and investor confidence was very high. Most of the rallies were backed by foreign inflows. However in 2008 KSE took several nose dive corrections and the major reason behind them were deteriorating law and order with political instability. In early 2008 the prices of crude oil along with other commodities were at a record high which led the beginning of recession. In April 2008 KSE was generally following a downward trend due to several reasons: poor economic situation which led to an increase in inflation following by a rise in the interest rates, liquidity crunch in the KSE, poor political and law situation in Pakistan.

[Insert Figure 1 about here]

KSE started to recover in 2010. According to the international analytical report, KSE secured a third position among the 19 best markets of the world on the basis of

[6] Rally: A constant bullish trend in the market without the market corrections.

performance during the period of January-March 2010. During the period of 2006 – 2010, the total number of listed companies remained almost the same, there was a decline in the average value of daily turnover and the KSE 100 index was highly volatile.

[Insert Table 3 about here]

KSE is an emerging market where literature based on the asset pricing proposition is rare as compared to developed markets. The purpose of this study is to explore the asset pricing dynamics in an emerging stock. The four models that are proposed to be tested have shown explanatory power in developed economies. However, the emerging markets have special features that are distinct from developed markets. These include market making activities by few large investors, and loose monitoring controls. Most emerging economies face political instability, high foreign debt and strong currency turbulence. Countries with emerging economies have small financial markets with the presence of thin trading (low level of active trading), informational inefficiency, lack of transparency, and have a severe reaction to panics. Subsequently, the overall investor activity revolves around a few stocks causing non-synchronous trading [Fuss (2002)]. Therefore, it would be interesting to analyze the relevance of these asset pricing models in KSE.

Chapter 2

Literature Survey on CAPM, Fama and French Three Factor Model, Carhart Four Factor Model and ICAPM

Black et al (1972) performed the earliest empirical tests of the CAPM. They formed portfolios that comprised of all the stocks of the New York Stock Exchange over the period of 1931-1965 to empirically test the CAPM, a researcher would regress security or portfolio returns (the dependent variable) on their betas (the independent variable). However, beta was not known and could only be estimated with error, and this violated the assumptions underpinning regression. To solve this problem BJS (Black, Jensen and Scholes) and Fama-MacBeth constructed a test involving two steps, which is known as the "two-pass" methodology. At the first pass they run a time series regression of portfolio returns on the market return, which gave estimates of the portfolio betas. To gain maximum efficiency the portfolios were pre-sorted into various groups based on their beta. At the second pass, BJS regress, in cross-section, average returns on the estimated betas from the first pass. The findings revealed that a linear relationship existed between the average excess portfolio returns and the beta. For beta greater than or less than 1, the intercept tends to be negative or positive. Moreover they concluded that "the intercept and the slope of the cross-sectional relation varied with different sub periods and were not consistent with the traditional form of the capital asset pricing model."

Roll (1977) criticized the results of the empirical tests of the CAPM**.** According to him the previous tests of the CAPM examined the relationship between equity returns and beta which was measured relative to a broad equity market index such as the S&P500. However, Roll criticized that the market defined in the theoretical CAPM, was not a single equity market, instead it should include all possible assets. He argued that the market index should include bonds, property, foreign assets, human capital and anything else, tangible or intangible, which adds to the wealth of mankind. Moreover, Roll showed that unless the market portfolio was known with certainty the CAPM could never be tested. Finally, he argued that tests of the CAPM were simply the tests of the mean-variance efficiency of the portfolio that was taken as the market proxy. He suggested that within any sample, there would always be a portfolio that is mean-variance efficient; therefore finding evidence against the efficiency of a given portfolio does not provide much insight about the validity of CAPM. Roll and Ross, (1994); Kandel and Stambaugh,

(1995) reported that even a slight deviation from efficiency could produce an insignificant risk and expected returns.

Mateev. M (2004) investigated the relationship between average return and beta in the Bulgarian stock market. The sample data set consisted of 160 common stocks traded on the Bulgarian stock exchange during January 1998 to December 2002. The effects of infrequent trading on betas were also examined, measured from daily, weekly and monthly return intervals in order to access whether the stability of systematic risk estimates can be explained by thin trading. Moreover, the impact of beta and size, book-to-market equity, asset-to-market equity, asset-to-book equity and price on the cross-sectional variations in average returns over the sample period was also examined. The stocks included in the sample were ranked in an ascending order of the logarithm of size, and sorted into four size quartiles from the smallest (ME1) to the largest (ME4) group, each of the quartiles contained 36-40 stocks. The stocks within each sub-group (size quartile) were ranked in an ascending order of their pre-ranking beta estimates based on weekly return interval, and sorted into four risk quartiles (sub-groups) from the lowest risk ($\beta 1$) to the highest risk ($\beta 4$). 16 portfolios were formed based on size and beta. Each portfolio contained around 8 to 11 sample stocks. Value-weighted approach was used to compute the market index. Two market indices were used in the empirical tests, index that included all stocks in the sample and an official market index.

The market index returns over the sample period 1998-2000 was computed by using the prices of the same stocks that were a part of the official index and were weighted by the market capitalization of the companies when the stock entered the index, this computation was done because the official index of Bulgarian stock exchange (BSE)-Sofia was introduced for the first time in October 2000, where as the sample period for the empirical tests was from January 1998 to December 2002. The prices were corrected for splits, paid dividends and new issues. For each stock, the Fama and Macbeth cross-sectional regressions were run using time-series data for the whole sample period. OLS technique was used to estimate betas.

The overall results revealed a significant trading frequency effects on the beta estimates. This was due to the effects of non-synchronous trading bias when different time intervals were used to measure stock returns. The evidence showed that thin trading leads to the underestimation of betas of infrequently traded stocks. The effect of thin trading was strongest when daily return intervals were used in the estimation of beta. Moreover, the betas based on daily and weekly returns were more stable than the betas based on monthly returns. These findings were in contrast to evidence from other countries, which reported beta coefficients much less than unity. This was due to the thin trading effect and the value-weighted market index used in the empirical tests. The results from the second part of the study indicated that beta, size, market and book leverages were priced, whereas book to market equity and price effects were insignificant. The observed anomalies on the BSE-Sofia implied traditional CAMP might be misspecified because it failed to describe price behavior in the Bulgarian stock market, or the market was inefficient.

Chui et al (1998) examined the relationship between expected stock returns, market beta, book-to-market equity, and size in five Pacific-Basin emerging markets:

Hong Kong, Korea, Malaysia, Taiwan, and Thailand. Based on the data availability constraints for these five countries, sample period from July 1977 to June 1993 was covered. The data included the monthly stock returns and the accounting data for the five emerging markets under investigation, was collected from the PACAP databases complied by the University of Rhode. All stocks in the sample were sorted into three equal groups at the end of June of year t, based on their size at the end of June in year t from small to large. The stocks were also independently sorted into three equal groups according to their BM at the end of year t-1 from low to high. Nine Size-BM, value-weighted portfolios in each of the countries were constructed at the intersection of the three size groups and the three BM groups of that individual country.

For all the five countries under study the findings revealed a weak relationship between the average stock returns and market beta. However, the research findings revealed that the book-to-market equity could explain the cross-sectional variation of expected stock returns in Hong Kong, Korea, and Malaysia, while the size effect was found to be significant in all markets except Taiwan. Due to substantial differences in terms of investor composition among these five emerging stock markets, the results varied for the individual countries. It was also noted that the degree of the relation between average return and book-to-market equity coincided with the magnitude of the average book-to-market ratio in a country. It was identified that Korea had the highest book-to-market ratio, followed by Hong Kong, Malaysia, Taiwan, and Thailand, while Taiwan and Thailand had BM ratios below one for all nine size-BM portfolios. The research confirmed that market beta is not the only risk factor to explain the cross-sectional variation of expected returns. The research supported the three factor model and the research findings revealed that the size and value premium factors raised the explanatory power of the risk and return relationship.

Lam, S.K,. (2002) used the Fama and French (1992) approach to examined the relationship between stock returns and a number of variables including β, size, book to market equity ratio, leverage and earnings–price ratio (E/P) in Hong Kong stock market over the period of July 1980–June 1997. The data was taken from the Pacific Basin Capital Markets (PACAP) Databases, which was compiled by the University of Rhode Island. The data set contained 100 firms that were continuously listed on the Stock Exchange of Hong Kong (SEHK) for the entire sample period. Financial firms, being highly leveraged, were not excluded in the tests mainly because the result did not change significantly by excluding financial firms. FF approach was followed to define the explanatory variables. The tests employed the Fama and MacBeth (1973) (FM approach) approach by performing cross-sectional regression on monthly returns against the explanatory variables. 25 size-β portfolios were formed.

The findings revealed that β was unable to explain the relationship between risk and return for the stocks that were continuously listed in Hong Kong Stock Exchange for the period July 1984–June 1997. However three variables, size, book-to-market equity, and E/P ratios, were identified which were able to capture the cross-sectional variation in average monthly returns over the sample period. The other two variables, book leverage and market, were also able to capture the cross-sectional variation in average monthly returns. However their effects were seemed to be dominated by size, book-to-market equity, and E/P ratios, and were relatively less significant. The results were found to be consistent across sub-periods, across months, and across size groups which suggested that the results were not driven by abnormal return or extreme observations in some of the months or by size groups.

Maroney and Protopapadakis (2002) tested the FF three factor model on International markets as well as US. They studied the stock markets of Australia, Canada, Germany, France, Japan, UK and US. Well diversified equally weighted portfolios were constructed for each country based on market value of equity and book to market in order to reduce random noise in returns. Seven portfolios were formed for tests with one way sorts and nine portfolios were formed for tests involving two way sorts. MSCI world index was used as market portfolio and the test results highlighted the survival of size and value premium in all of countries under study and they concluded that the three factor model has international presence. Furthermore, stochastic discount factor model along with macroeconomic and financial variables were used to test the impact of these variables on the performance of the FF three factor model. It was concluded that these additional variables and the discount factor do not decrease the explanatory power of the FF three factor model.

Beltratti and DI Tria (2002) analyzed the cross section of stock returns in Italian stock market. The aim of their research was to examine the extent to which financial variables can be used as proxies for macroeconomic risk and their relation with the business risk. They compared four asset pricing models including simple CAPM, FF three factors model, a multifactor model including changes in short term interest rates and a multifactor model including sectors. During the 90s the Italian market was undergoing many structural changes therefore they selected sample period was from 1991 – 2000. Two sets of samples were used for the analysis. The first set of sample was comprised of a *fixed basket* with 170 stocks for the sample period. These were the stocks that were included in General Comit Index since 1990. The second set comprised a *changing basket* with more stocks added in April of every year using the Comit Index as reference point.

The results showed that the FF three factors model, among others, best explains the cross section of returns in Italian markets. Furthermore, the time series estimates resulted in constants were significant while for cross section regressions none of the coefficients were significant. However, the theory suggests that the average risk premiums should be significantly positive. The authors suggested that these discrepancies were due to the instability in Italian markets which generated unexpected returns for the investors and commented that time series is the best approach to be used for Italian case and time series analysis revealed FF three factors model to be most appropriate. However, they also pointed out some issues regarding the FF three factors model. The results were not able to establish a robust relationship between SMB, HML and some important macroeconomic variables. They proposed an existence of some other local factors that could have better explained the variability in returns. Lastly, they raised the issue of strong non normality in returns of the factor portfolios.

Leledakis et al (2003) investigated the cross sectional returns in Athens stock exchange. The sample period for this study was from 1990 to 2000. The sample included stocks of the non financial that survived the whole sample period to eliminate the survivor bias issue. The variables that were tested were reported significant in previous empirical research studies. These variables included firm beta, book to market, market value of equity, earning yield, total asset to market value of equity, and total assets to book value of equity. A dummy variable was used for earning yield with firms that had consistent negative earnings. For the research methodology, maximum likelihood estimator approach was used to estimate betas. These betas constituted the cross sectional regression analysis with other firm specific characteristics.

The results revealed a negative significant coefficient for size highlighting the existence of size effect. The size factor remained robust even when other factors were added in the regressions. Similar results were reported for book to market ratio with excess returns for value firms. This observation was consistent with the proposition of FF three factor model. However, when size was included the book to market factor became insignificant. The variables for leverage (total assets to market equity and total assets to book equity) were statistically non zero when tested separately but were insignificant when size was incorporated. These results remained robust for sub periods. They concluded that the book to market factor lacked explanatory power as compared to the observed explanatory power in most of the US based studies. However, the size factor remained relevant even after controlling for January returns.

Drew et al (2003) examined the impact of firm size and book to market ratios on stock returns of Shanghai stock exchange for the period 1993 - 2000. Fama and French (1993) methodology was used to form six portfolios based on market, size and book to market ratios. Positive monthly returns were reported for all of the portfolios. The regression results showed insignificant coefficients depicting the existence of a relationship between expected returns and the explanatory variables. The observed market factor was statistically significant and greater than one. The size factor was significant and the results on size coefficients were consistent with the FF proposition having positive slopes for small firms and negative for large firms. However, contrary results were found for the six book to market portfolios. The negative coefficients of these portfolios posed a challenge to Fama and French (1993) and depicted a risk premium for growth firms rather than value portfolios as proposed by Fama and French. It was concluded that these results could be a consequence of large non traded state and institutional holdings in China.

Drew et al (2003) investigated the impact of seasonality on stock the returns by testing for possible biases due to January and Chinese New Year by including dummies for the two events. The result showed that the coefficients were insignificant for all of the six portfolios. They concluded that the multifactor explanations of asset returns are not driven by the seasonal factors.

Gaunt (2004) extended the only comprehensive research based on the Australian stock market (Halliwel et al., 1999) and tested Fama - French three factor model on the Australian stock market over a period 10 years, from July 1991 – June 2000. The author collected the accounting data from the Australian Stock Exchange (ASX) data analysis files for the period 1991–1997 and from IRESS for the period 1998–2000. Stock market returns and market capitalization data was collected from the AGSM price relative files. After eliminating the thinly traded stocks the final sample comprised of 6814 companies with the smallest contribution from 1992, i.e. 531 companies and the largest from 1997, i.e. 876 companies. For each year the final sample was ranked by market capitalization in December and broken into five (quintile) size groups with an equal number of stocks in each group. Quintile 1 comprised the smallest stocks and quintile 5 the biggest. The sample was also ranked by book to market ratio. Book to market ratio was calculated as shareholder equity divided by market capitalization six months prior to year end, i.e. June. To account for the book to market risk factor, the sample was broken into five groups with an equal number of stocks in each group with quintile 1 being the smallest book to market (glamour) stocks and quintile 5 being the largest (value) stocks. At the end of each year in the sample period, each individual stock was assigned one of five size groups and one of five BM groups. Using this methodology the author constructed 25 portfolios representing stocks at the intersection of each of the size and BM portfolios. The results revealed that risk (beta) tends to be greater for smaller companies and those with lower BM ratios.

However it was noted that there existed a relatively strong abnormal performance of the smallest size quintile and there was absence of the size effect across the remaining four quintiles. Relatively little evidence of the increase in abnormal returns across BM quintiles was observed in the one factor CAPM, suggesting that gap may be captured by the HML factor. The findings revealed that the HML factor did possess some explanatory power and, within size quintiles, a positive relationship between BM and the HML factor was observed. However the overall results suggested that the BM risk factor may not contribute significantly to explaining observed returns, overall the three factor model performed well.

The results showed that for Australian stock market, the three factor model does provide a better explanation of returns than CAPM. However, contrary to Fama -french three factor model, which states the relevance of two additional risk factors associated with the two firm characteristics i.e. size and book to market, the findings based on this research revealed that the additional explanatory power comes from just one of the two additional factors, namely size.

Malin and Veeraraghavan (2004) investigated the robustness of the Fama and French multifactor model in selected European markets during different time periods. The authors examined the relationship between expected stock returns, market risk, firm size and book to market equity ratio in French, German, and UK markets. For France and Germany the sample period was from 1992 – 2001, and for UK it was 1991-2001.The methodology used by Fama and French (1993, 1996) was applied by the authors to test these markets. Moreover the seasonal effects were also tested in these markets, as earlier empirical evidence suggested that the small firms have larger risk adjusted returns in January as compared to the risk adjusted returns other months. Monthly stock returns and accounting data i.e. market value, Data stream data type MV, and book value of shareholder's equity, Data stream data type Equity capital and reserves, was obtained from Data stream Advance 3.5 maintained by Primark International. France Benchmark Bond 10-year yield, Germany Benchmark Bond 10-year yield, and the 1-month interbank rate were used as risk free rates for France, Germany, and the UK respectively. Both financial and non-financial firms were included in the sample, as opposed to Fama and French (1992) who excluded the financial firms from their sample. Fama and French (1993, 1996) portfolio construction methodology was used to form portfolios based on firm size and book-to-market equity. Six intersection portfolios were formed, S/L, S/M, S/H, B/L, B/M, and B/H. Each month, the returns of each of the six portfolios were regressed against the three factors to determine whether there are excess returns above the risk free rate.

The results revealed an existence of a small firm effect in France and Germany and a big firm effect in the UK. However the book-to-market equity generated a negative return which indicated an existence of growth effect and not a value effect as advocated by Fama and French (1996). These findings challenged the evidence provided by Fama and French (1996) who suggested that the value firms were distressed. For all of the three countries it was found that the intercept was indistinguishable from zero for all six portfolios. Moreover, the market factor was positive and highly significant for all six portfolios. The research findings for France, Germany and UK for the test of seasonal effects lead to the rejection of the argument that seasonal effects could explain the multifactor model results, as the coefficients were close to zero and statistically insignificant for all six portfolios.

Jarjir (2007) examined the comparison between the three factor model with characteristics model for the French market. The sample period used for this study was from 1976 – 2001. Six size and to market portfolios were formed and for the purpose of estimation value weighted returns were used. Moreover, for the characteristic model, 12 portfolios were formed by subdividing each portfolio into two portfolios on the basis of slope of the value portfolios. The research evidence revealed no significant relationship between factor loadings and excess returns. However a negative relation was found between low book to market portfolios and excess returns and medium book to market portfolios showed a positive relation. Furthermore, the comparative analysis of the characteristic model and the factor model revealed mixed results. The factor model with loadings on size, value and market factor was rejected by the characteristic returns. However, the insignificant regression slopes was strong evidence in support of the three factor model. It was concluded that the characteristic model lacks explanatory power and factor model provide better estimates for the French data.

Durand et al (2007) investigated the three factor model for Australian firms. The sample period for this research was from 1990 – 2001. Stock portfolios were sorted on market value to take into account the size proxy (where by top 30% was taken as Big and lowest 30% as small). Research evidence showed that firms outperformed big firms highlighting the existence of size premium in Australian market. Moreover, the higher standard deviation of small firms implied that small firms were exposed to higher risks as compared to big firms. In order to test whether behavioral factors affect size premium, the authors formed four value weighted portfolios by using four market metrics as a proxy for momentum and investor arousal. These four portfolios included two momentum portfolios with winners and losers and two turnover spanning portfolios (high and low) for investor arousal. The regression results highlighted that both small and big firms showed sensitivity towards turnover ratio. The loadings for high turnover were significant for small and big firms. The loadings for low turnover were negative for small firms and positive for large firms. Moreover, coefficient for winners was positive for small firms and was insignificant for big firms. However, the coefficient for losers remained positive for both small and big firms. The overall results suggested that size premium is a consequence of investor arousal and inconsistent reactions. The authors applied robustness tests for subsample and reported consistent results. It was concluded that the existence of size premium should be attributable to behavioral factors.

Bundoo (2007) examined an augmented version of three factor model and introduced the concept of time varying betas in an emerging stock market i.e. Mauritius stock exchange. He studied the returns of the stocks listed on Mauritius stock exchange over the period of 1998 - 2004. The research methodology was based on three estimation steps. The first step was the estimation of conditional market volatility using a MA (1) GARCH (1,1) model. Second step was the estimation of size and book to market effects using four value weighted size and book to market portfolios. Lastly, the robustness of size and value effects was tested by introducing the variations in beta over time. The research results suggested that market volatility estimates were well specified. The loadings on market risk were positive and significant. The coefficient of size was positive for small stocks and negative for large firms highlighting the existence of a size effect. Moreover, research evidence revealed that low book to market firms have negative coefficients and positive premium for high book to market, highlighting the presence of value premium. Furthermore, the respective coefficient along with market, size and value factor remained significant with the addition of the variable for time varying beta. The author concluded that when time varying betas are priced, the factor model remained robust.

Mirza and Shahid (2008) tested the validity of the Fama and French Three Factor Model on Karachi stock exchange, over a period of five years, from Jan 2003 – Dec

2007. The six month Pakistan's T bill yield was used as a proxy for risk free rate. The sample included 81 companies that were listed on the KSE, from all the industrial sectors. For the estimation of intra-day returns, the daily closing prices were used. KSE index 100 was used as a synthetic market portfolio. Moreover, six months Pakistan's T Bill yield was taken as a proxy for risk free rate. The sample's sorting on the basis of market capitalization. The selected sample was also compared across different sectors. The stocks were ranked and categorized into three B/M groups based on the break points of bottom 30% - Low (L), middle 40% - Medium (M) and top 30% - High (H). Using this portfolio construction methodology, six portfolios were constructed on the intersection of two size and three book to market portfolios. The six portfolios formed were: B/L, B/M, B/H, S/L, S/M and S/H in order to estimate market premium, the difference between return on KSE 100 index and the 6 Month T Bill Yield was taken. SMB was the difference between the simple average of the equal weighted returns on three small stocks portfolio and the three big portfolios. HML was the difference between the return on portfolio of high B/M stocks and return on a portfolio of low B/M. A multivariate regression model was used on the six portfolios sorted on size and book-to-market.

The research findings suggested that the size and value premium should be priced. The results revealed that except for two portfolios, S/M and S/L, the intercepts were insignificant. Moreover, the market risk premium explained the returns only in one of the six portfolios. The higher proportion of the banking stocks in the portfolio could have contributed towards significant results. To account for this problem the model was also tested by excluding the banking stocks from the sample. The results remained robust in the absence of the banking stocks. The over all findings confirmed the validity of the

Fama-French three factor model, which seemed to explain the returns for KSE, an emerging.

Does momentum lead to abnormal profits? Recently the question of certain trading strategies yielding abnormal profits has come under attention of many researchers. It is noted that there are two most prominent types of trading methodologies, momentum trading and contrarian strategies, which are used to take advantage of serial correlation in stock price returns. Momentum strategies rely on short term positive autocorrelation in returns. This trading strategy yields abnormal profits when past winners are bought and losers are sold. Liu, Strong and Xu (1999) reported that momentum strategies led to profitability in UK over the period 1977-96. However contrarian trading strategies rely on negative serial correlation in stock prices, where selling winners and buying losers yield abnormal profits. Efficient Market Hypothesis (EMH) states that time series returns are serially independent over any time horizon. Moreover, EMH predicts that portfolios based on winners and losers should yield zero profits. Therefore, it should be noted that positive or negative serial correlation in returns generating abnormal profit leads to the rejection of EMH.

Fama and French (1988), Porterba and Summers (1988), Lo and MacKinlay (1988) and Jagadeesh (1990) documented evidence of positive correlation at shorter intervals, whereas reported a negative serial correlation in long horizon stock returns. Jegadeesh and Titman (1993, 1995) also documented significant positive returns when stocks were bought and sold based on short-run historical returns.

A lot of empirical research has been done to capture the effect of momentum anomaly on returns. Rouwenhourst (1998) focused on the international equity markets to test the profitability of momentum strategies, over the period of 1980 to 1995. Portfolios were formed by using the monthly total returns data from 12 European countries. Findings revealed that winner portfolios outperformed loser portfolios by more than 1 percent per month. These findings were found to be consistent with Jegadeesh and Titman (1993) for the US market. Richards (1997) used the monthly returns from stock indices of 16 countries over the period of 1970 to 1995 and found out that the momentum effect was strongest at the 6-month time horizon with an annual excess return of 3.4 percent. Evidence highlighted that for horizons longer than one year, the losers begun to outperform winners with an average annualized excess returns of more than 5.8 percent.

Liu, Strong and Xu (1999) investigated the momentum effect in UK over the period of January 1977 to December 1996. The research findings revealed that even after controlling for systematic risk, size, book-to-market ratio, or cash earnings-to-price ratio, the momentum profits were not eliminated. Moreover the momentum effect was derived from market under reaction to firm specific information.

Francois et al. (2003) tested the Fama – French three factor pricing model augmented by a momentum factor on the Canadian Stock Market, over a period of July 1960-April 2001 period. The authors collected the data relative to financial statements from the Financial Post database (from 1959 to 1986; 1992 version) and from Research Insight Compustat (from 1987 to 2000; 2001 version). Monthly stock returns and firms' market equity data was collected from the TSE-Western tape (from July 1959 to

December 1986; 1998 version) and from Research Insight Compustat (from January 1987 to April 2001; 2001 version). The value weighted market return was computed from the sample. Returns from the risk-free asset were estimated from the Scotia Capital 91-day Canadian Treasury Bills series. All observations with a negative BE were excluded from the sample to reduce the bias in the results. The final sample included 12,526 observations, i.e. firms per year. The average annual number of firms turned out to be 298.

In the previous studies in which the four factor model was tested, authors like Liew and Vassalou (2000) constructed the portfolios based on three sequential sorts, where as the authors while testing the four factor model conducting this research constructed the portfolios based on three independent sorts, following the Fama – French methodology to form an orthoganationalization of HML and WML with SMB. The authors constructed SMB and HML in keeping with the research conducted by Fama and French (1992), and WML was constructed as UMD (Up minus Down) using Kenneth French's Website. For each month t from July of year y-1 to June of year y, the stocks were ranked based on their size and book-to-market ratio of June y-1. These two rankings were then used to calculate a 50 percent breakpoint for size, and 30 percent and 70 percent breakpoints for book-to-market. Moreover, the stocks were sorted into two size groups and three book-to-market groups based on these breakpoints. The stocks above the 50 percent size breakpoint were considered for big in size and the remaining 50 percent were considered small in size. In addition, the stocks above the 70 percent book-to-market breakpoint formed a group H (for high book-to-market), the middle 40 percent formed a group N (for neutral book-to-market) and the firms below the 30 percent book-to-market breakpoint formed a group L (for low book-to-market). Using this procedure, the authors constructed six value-weighted portfolios, S/L, S/N, S/H, B/L, B/N and B/H by intersecting the size and book-to-market groups. It was noted that the number of firms in each of the six portfolios varied. Findings of the research revealed that all of the risk factors, i.e. market, size, book to market and momentum were priced and momentum factor had the highest average annual premium.

Hon, M. T. and I. Tonks (2007), assessed the profitability of momentum strategies on the UK stock market and investigated whether the use of trading strategies that exploit the predictability of short run stock price movements lead to abnormal returns. The sample included the historical returns from January 1955 to December 1996 of all companies on the London Business School London Share Price Database (LSPD) tape. This tape consisted of all companies quoted on the London Stock Exchange since 1975. For the period before 1975 a file was made up of a number of random samples of 33% of the companies quoted (new issues) on the Exchange between 1955 and 1974. The data set included 6,600 securities over the entire sample period. In order to test the profitability of momentum trading strategies the methodology of decile portfolios applied by De Bondt and Thaler (1985, 1987) and Jegadeesh and Titman (1993) was used. The portfolios were formed on the basis of past returns. The top batch of the sorted and ranked stocks were labeled 'loser' portfolio and the bottom 'winner' portfolio. The empirical implications of forming winner-loser portfolios were tested, the losers were sold and the winners were purchased.

The results of the test showed that the returns on trading strategies did not account for by a simple adjustment for beta-risk, due to the generation of cognate beta estimations for the Winner and Loser portfolios. The result suggested that the returns from trading strategies exploiting both positive and negative serial correlation could not be explained by simple beta risk. The authors also examined the effect of size on returns by comparing the difference in market capitalization between winners and losers during the second sub-period of the full sample, because the momentum profits were most significant during this period. The stocks were sorted into ten equally-weighted deciles in ascending order. The top decile (decile 1) consolidated as the loser portfolio and the bottom decile (decile 10) formed the winner portfolio.

The results revealed that the difference in size between loser and winner portfolios did not explain momentum profits. Overall, a strong evidence of momentum effect over the short to medium-term horizons was found. However when the sample was split into two sub-periods from 1955-76 and 1977-96, the authors found that although the momentum strategy was profitable over the latter period, there was little evidence of momentum profits over the earlier period. Therefore the high profitability of momentum strategies over the latter half of the sub- sample led to the profitability of momentum strategies over the entire sample period. These results indicated that the positive serial correlation in UK stock prices was not a general feature of the whole sample and was only confined to sub-samples. The evidence indicated that the size effect in the UK stock market did not contribute to nor explain momentum and contrarian profits. Moreover, the positive serial correlation in the returns implied that the market was not efficient because according the defining feature of random walk in stock prices is that the successive changes should be uncorrelated, and deviations from this characteristic essentially imply that the market is not efficient. It is evident from the above studies that the momentum effect is relevant and has a significant impact on the returns of the investment.

Tai (2003) tested ICAPM in order to investigate whether the existence of the pricing anomalies represents compensation for bearing extra market risks. The conditional ICAPM was estimated using multivariate GARCH in mean modeling strategy. He studied the risk based explanations for pricing anomalies that arise because CAPM fails to capture all the systematic risks, which leaves part of the systematic risks correlated to firm characteristics, such as the size, book-to-market and the momentum effects. The rationale for using ICAPM was to incorporate the time-varying risk premium, because this model suggests that the investors, while making their decisions regarding investment, will use all available information to form their expectations about future economic performance, and in case the information used to form those expectations change over time, the investors will adjust their expectations and reconsider their risk preferences while holding different risky assets.

Five size quintiles and five book-to-market quintiles portfolios were formed to test ICAPM separately using MGARCH-M approach. In order to account for the data-snooping issues five industry portfolios were also formed and the robustness of the results was checked by using these five portfolios. The sample period was selected from June 1953 to May 2000 for a time series of 564 observations. The portfolio data was taken from the Kenneth French's website. The value-weighted return was tabulated on all NYSE, AMEX, and NASDAQ stocks minus the 1-month Treasury bill rate was considered as the excess return on the market. In addition to the portfolio data, information variables were used to perform conditional ICAPM tests. The six information variables were: the excess market return, the change in 1-month US Treasury bill rates, the US term premium, measured by the yield on the 10-year US Treasury notes in excess of the 1-month T-bill rates, the US default premium, measured by the yield difference between Moody's Baa-rated and Aaa-rated US corporate bonds, a January dummy and a constant (CONSTANT). The results showed that for all the four risk factors, i.e. market, size, book to market and momentum, were not only significantly priced but are also time-varying. However market premium was the dominant one in explaining the return dynamics of portfolios sorted based on size, book to market and industry.

Petkova, R. (2006) examined the correlation between the Fama–French factors HML, SMB and the innovations in variables that describe investment opportunities. The results revealed a significant correlation between HML and SMB and the innovations in the state variables that predict the excess market return and its variance. Moreover, the research results showed that HML proxy for a term spread surprise factor in returns, whereas SMB proxy for a default spread surprise factor. The author also tested ICAPM and attempted to establish a link between a set of variables which were associated with market return and shocks to the term spread, dividend yield, default spread, and 1-month T-bill yield. Twenty five portfolios were sorted by size and book-to-market. The ICAPM model based on the innovations in state variables that predicted the market return and the yield curve was robust to different specification tests. The results indicated that the FF model was not the best model to capture assets' covariance with time varying investment opportunities. It was proposed that the model based on innovations in the dividend yield, term spread, default spread, and short-term T-bill rated as a superior ICAPM model for the cross section of average return due to its ability to explain common time-varying patterns in stock returns.

Some empirical researches have also been conduct on the Pakistani market. Hussain and Uppal, (1998) found that the return distribution deviated from normality in the Pakistani equity market.

Ahmad and Zaman (1999) used GARCH-M model to investigate the risk and return relationship and highlighted the existence of strong volatility clusters and suggested that the stock returns followed a cyclical trend. Iqbal el al (2007) rejected the unconditional CAPM on account of non-linearity in the risk and return relationship that was revealed in the findings. Iqbal et al (2008) suggested that the unconditional Fama-French model with a cubic market factor improved the explanatory power of the model. Javiad and Ahmad (2009) investigated the conditional higher moment CAPM and suggested that the conditional coskewness was an important factor in asset pricing. Moreover, the findings revealed that the conditional covariance and the conditional cokurtosis also explained the risk and return relationship, but were not that significant.

Summary of Literature Review

Authors	Countries	Sample Period	Model Tested	Result
Beltratti and DI Tria	Italian stock market	1991 – 2000	CAPM, FF three factors model, a multifactor model including changes in short term interest rates and a multifactor model including sectors	Time series analysis revealed FF three factors model to be most appropriate
Black et al	USA	1931-1965	Market risk	Market risk insignificant
Bundoo	Mauritius stock exchange	1998 - 2004	Augmented version of three factor model and introduced the concept of time varying betas	The loadings on market risk were positive and significant. The coefficient of size was positive for small stocks and negative for large firms highlighting the existence of a size effect. Moreover, research evidence revealed that low book to market firms have negative coefficients and positive premium for high book to market, highlighting the presence of value premium. Furthermore, the respective coefficient along with market, size and value factor remained significant with the addition of the variable for time varying beta. The author concluded that when time varying betas are priced, the factor model remained robust.
Chui et al	Pacific-Basin emerging markets: Hong Kong, Korea, Malaysia, Taiwan, and Thailand	July 1977 to June 1993	market risk, size premium, value premium	The research findings revealed that the book-to-market equity could explain the cross-sectional variation of expected stock returns in Hong Kong, Korea, and Malaysia, while the size effect was found to be significant in all markets except Taiwan. Market risk insignificant.
Drew et al	Shanghai stock exchange	1993 - 2000	FF three factor model	The observed market factor was statistically significant and greater than one. The size factor was significant and the results on size coefficients were consistent with the FF proposition having positive slopes for small firms and negative for large firms. However, contrary results were found for the six book to market portfolios. The negative coefficients of these portfolios posed a challenge to Fama and French (1993) and depicted a risk premium for growth firms rather than value portfolios as proposed by Fama and French. It was concluded that these results could be a consequence of large non traded state and institutional holdings in China.

Authors	Countries	Sample Period	Model Tested	Result
Durand et al	Australian market	1990 – 2001	FF three factor model	The loadings for high turnover were significant for small and big firms. The loadings for low turnover were negative for small firms and positive for large firms. Moreover, coefficient for winners was positive for small firms and was insignificant for big firms. However, the coefficient for losers remained positive for both small and big firms. The overall results suggested that size premium is a consequence of investor arousal and inconsistent reactions.
Francois et al	Canada	July 1960-April 2001	Fama – French three factor pricing model augmented by a momentum factor	Findings of the research revealed that all of the risk factors, i.e. market, size, book to market and momentum were priced and momentum factor had the highest average annual premium.
Gaunt	Australia	July 1991 – June 2000	market risk, size premium, value premium	Size premium and value premium should be priced.
Hon, M. T. and I. Tonks	UK	January 1955 to December 1996	momentun and size effect	The size effect in the UK stock market did not contribute to nor explain momentum and contrarian profits. The results revealed that the difference in size between loser and winner portfolios did not explain momentum profits. Overall, a strong evidence of momentum effect over the short to medium-term horizons was found.
Jarjir	French market	1976 – 2001	FF three factor model with characteristics model	Insignificant regression slopes was strong evidence in support of the three factor model. It was concluded that the characteristic model lacks explanatory power and factor model provide better estimates for the French data.
Jegadeesh and Titman	USA		Momentum	Findings revealed that winner portfolios outperformed loser portfolios by more than 1 percent per month.
Lam, S.K	Hong Kong	July 1980–June 1997	market risk, size, book to market equity ratio, leverage and earnings–price ratio	Size, book-to-market equity, and E/P ratios, were able to capture the cross-sectional variation in average monthly returns. Book leverage and market were less significant.
Leledakis et al	Athens stock exchange	1990 to 2000	Augmented FF three factor model: variables included firm beta, book to market, market value of equity, earning yield, total asset to market value of equity, and total assets to book value of equity	The variables for leverage (total assets to market equity and total assets to book equity) were statistically non zero when tested separately but were insignificant when size was incorporated. They concluded that the book to market factor lacked explanatory power as compared to the observed explanatory power in most of the US based studies. However, the size factor remained relevant even after controlling for January returns.
Liu, Strong and Xu	UK	1977-96	Momentum	The research findings revealed that even after controlling for systematic risk, size, price, book-to-market ratio, or cash earnings-to-price ratio, the momentum profits were not eliminated. Moreover the momentum effect was derived from market under reaction to firm specific information.

Authors	Countries	Sample Period	Model Tested	Result
Malin, M. and Veeraraghavan, M	European markets: France, Germany, and UK	For France and Germany the sample period was from 1992 – 2001, and for UK it was 1991-2001.	market risk, size premium, value premium	The results revealed an existence of a small firm effect in France and Germany and a big firm effect in the UK. However the book-to-market equity generated a negative return which indicated an existence of growth effect and not a value effect.
Mateev. M	Bulgaria	January 1998 to December 2002	the impact of market risk and size premium, value premium, asset-to-market equity, asset-to-book equity and price	Beta, size, market and book leverages were priced, whereas book to market equity and price effects were insignificant. Market risk insignificant.
Mirza and Shahid	Pakistan	Jan 2003 – Dec 2007	market risk, size premium, value premium	Size premium and value premium should be priced. Market risk insignificant.
Petkova, R.	USA	1963-2001	Fama–French factors HML, SMB and the innovations in variables that describe investment opportunities (ICAPM)	The results indicated that the FF model was not the best model to capture assets' covariance with time varying investment opportunities. It was proposed that the model based on innovations in the dividend yield, term spread, default spread, and short-term T-bill rated as a superior ICAPM model for the cross section of average return due to its ability to explain common time-varying patterns in stock returns.
Richards	16 countries	1970 to 1995	Momentum	The momentum effect was strongest at the 6-month time horizon. Evidence highlighted that for horizons longer than one year, the losers begun to outperform winners
Rouwenhourst	12 European countries	1980 to 1995	Momentum	Findings revealed that winner portfolios outperformed loser portfolios by more than 1 percent per month.
Tai	USA	June 1953 to May 2000	ICAPM	The results showed that for all the four risk factors, i.e. market, size, book to market and momentum, were not only significantly priced but are also time-varying. However market premium was the dominant one in explaining the return dynamics of portfolios sorted based on size, book to market and industry.

Chapter 3

Research Methodology

3.1 Sample Selection and Criteria Limitation

As mentioned earlier, the aim of this study is to empirically test the validity of the four most widely used asset pricing models and its applicability in an emerging market like KSE. This research provides a comparative analysis on the four models under study, therefore the same sample is used to test each model from 1st July 1997 – 30th June 2007. The reason for choosing this sample period is the availability of the data during this time period. Moreover in August 2008 KSE index started to follow an extreme downward trend and the stock market was not able to normalize for about eight months. During this time period there was low trading. Therefore in order to avoid extreme results due to the market conditions, post June 2007 period was not included in the sample period. The sample firms include companies from all of the industrial sectors listed on KSE. The following are the list of criterion that is employed to select stocks from the individual sectors.

1. All selected stocks are listed on the KSE.
2. In order to avoid thinly traded stocks, only the stocks with non zero returns for at least 90% of the trading days, is included in the sample. The selected stocks comprises of stocks from all of the sectors
3. Daily price data, book value, market value of equity and market capitalization is be available for the stocks in the sample.

3.2 Sources of secondary data

The secondary data was collected from KSE website. In order to estimate the intra-day returns, the daily closing prices is used. The true market portfolio within the framework of various asset pricing models is not observable for the purpose of empirical testing. The use of synthetic market portfolio is common in empirical research of asset pricing models. Therefore, as a proxy for market portfolio, KSE 100 index is used as a synthetic market portfolio.

A risk free asset is an asset that yields certain return. However, in reality no such asset exists and as a risk free asset proxy investors use government issued securities and their returns as a risk free rate. However, even the government issued securities also face inflation risk. For the purpose of this study, daily stock prices are used because they provide a better estimation of results and over - night repos are taken as a proxy for risk free rate. The book to market ratio and market capitalization data was collected from the annual reports of the companies in the sample.

3.3 Portfolio Formation

Liew and Vassalou (2000) formed portfolios based on HML, SML and UMD, in an attempt to capture all three empirical anomalies, size, book to market and momentum risk factors. For this study Liew and Vassalou's portfolio formation methodology is followed with a slight modification.

In order to facilitate the comparative analysis based on the four asset pricing models, the same portfolios were used to empirically test each model. In order to construct the Book to Market Portfolios, the stocks were ranked and categorized into three groups based on the break points of bottom 30% - Low (L). Middle 40% - Medium (M) and top 30% - High (H). The stocks with High Book to Market ratio in time (t) were included in the top sub group in time (t+1), and so on. To form the Size Portfolios the selected sample stocks were ranked on market capitalization (price times no. of shares), in order to make two sub groups based on the break points of Top 50% - Big (B) and Bottom 50% - Small (S). The stocks with High Market Capitalization in time (t) were included in the top sub group in time (t+1), and so on. To form the Momentum sorted portfolios, the daily returns (Ri) of all the selected stocks were tabulated. Then those stocks were ranked on the basis of their returns in order to make two groups. The Up stocks (U) in time (t+1) were the stocks with the top 50% - highest average returns out of all the stocks in time (t) and Down stocks (D) in time (t+1) were the stocks with the Bottom 50% - lowest average returns out of all the stocks in time (t).

In this way twelve equally weighted size, book to market and momentum sorted portfolios were constructed:**,** HBU, HBD, HSU, HSD, MBU, MBD, MSU, MSD, LBU, LBD, LSU, LSU. All those stock with high book to market value, high market capitalization and were Up, were included in the HBU portfolio, so on.

Each year these 12 portfolios were rebalanced. For each year from 1st July 1997 – June 30th 2007, 30th June is taken as a date to rebalance the portfolios according to book to market, size and the momentum factor. All of the companies listed on KSE do not have the same financial year. Therefore keeping in mind the fiscal year of Pakistan, 30th June was chosen as a date to rebalance the portfolios. There were 12 portfolios in each model; therefore 12 regressions were run for each model. Table 4 represents the year wise sample composition.

[Insert table 4 about here]

Table 5 depicts the portfolio construction methodology. All those stock with high book to market value, high market capitalization and were down, were included in the HBD portfolio, so on.

[Insert table 5 about here]

In the following section, the model specification, dependent and independent variables, estimation of variables and the hypotheses of each model are stated.

3.4 Model Specification (CAPM-Single Factor Model)

According to the Capital Asset Pricing Model (CAPM), given an asset's non-diversifiable risk (market risk/systematic risk represented by the quantity beta), if an investor forms well-diversified portfolio, then CAPM can be used to quantify the relationship between the beta of an asset and its corresponding expected return. When the investor is exposed to the systematic risk while investing in the portfolio, the beta of the portfolio is the defining factor in terms of the expected return. The CAPM assumes that market beta is the only risk factor which is priced in stock returns.

The single factor CAPM can be expressed as follows:

$$R_{it} = R_f + (R_{mt} - R_f)\beta_{1t} \qquad \ldots(1)$$

With t = 1, 2, 3…, T

Where R_{it} represents the expected return on a stock *i* in time *t,* R_f represent the risk free rate of return, R_{mt} - R_f represents the market risk premium. The coefficient β_{1t} is the risk sensitivity of returns for market risk.

In order to test the CAPM, a multivariate regression framework will be used by transforming the above equation into a simple time series model as follows:

$$R_{it} - R_f = \alpha_i + (R_{mt} - R_f)\beta_{1t} + \in_t \qquad \ldots(2)$$

$$ER_{it} = \alpha_i + (R_{mt} - R_f)\beta_{1t} + \in_t \qquad \ldots(3)$$

Where $ER_{it} = R_{it} - R_f$ represents the excess return on stock in time *t,* α_i is the intercept of the regression equation representing the non-market return component, $\in_t$

represents the error term which is the random return component due to unexpected events related to a particular stock *i*. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time.

The above model represents the single factor model for an individual stock. This model can be used for portfolios of stocks as well. By replacing the *i* with a p to represent a portfolio of stocks, the single factor model CAPM can be expressed as follows:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + \in_t \qquad \ldots(4)$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio.

3.4.1 Dependent Variable

The dependent variable for the single factor CAPM is the excess portfolio return represented by ER_{pt}. The excess return is the return over and above the risk free rate required by the investor to substantiate the risk exposure. Moreover, the portfolio return is the weighted average of all the stocks included in a portfolio.

3.4.2 Independent Variable

The independent variable in this model is the market risk premium, which is measured as a difference between the return on market portfolio and risk free rate. Thus market risk premium represents the excess return, which the investor could earn if the investment is made in the market portfolio instead of investing in a risk free asset.

3.5 Variable Estimation

3.5.1 Daily Portfolio and Market Returns

The returns for an individual stock *i* where estimated as follows:

$$R_{it} = LN[\frac{P_t}{P_{t-1}}]$$

Where P_t *and* P_{t-1} are the closing prices on day *t* and *t – 1* respectively. R_{pt}, portfolio returns are the weighted average returns of individual stocks.

$$R_{pt} = \sum_{i=1}^{N} W_i R_{it}$$

Similarly the market portfolio returns can be estimate as follows:

$$R_{mt} = LN[\frac{KSE(100)_t}{KSE(100)_{t-1}}]$$

Where $KSE(100)_t$ and $KSE(100)_{t-1}$ are the closing index values on day *t* and *t – 1* respectively.

The portfolio and market returns are used to estimate the excess portfolio returns $(R_{pt} – R_f)$ and market risk premium $(R_{mt} - R_f)$.

3.6 Hypotheses

The following Hypotheses are tested:

$$H_1 : \alpha_p \neq 0$$
$$H_2 : \beta_{1t} \neq 0$$

For CAPM to hold H_1 should be rejected and α_p should be non- significant because if α_p is significant then this might lead to a conclusion that the model is not well specified and there is an existence of omitted variable bias. H_2 should be accepted and β_{1t} should be significant because if it is not significant then this might lead to a conclusion that the market risk factor fails to explain the variation in the returns of the portfolio.

3.7 Model Specification (Intertemporal Capital Asset Pricing Model - ICAPM)

ICAPM assume that the investors make portfolio and consumption decisions at discrete time periods. Merton (1973) developed an Intertemporal CAPM (ICAPM) by assuming that time flows continuously. ICAPM is an augmented CAPM, with the innovation factors. ICAPM can be expressed as follows:

$$R_{it} = R_f + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{rf})\beta_{4t} \qquad ...(5)$$

With $t = 1, 2, 3..., T$

Where R_{it} represents the expected return on a stock i, $R_{mt} - R_f$ represents the market risk premium, $\hat{u}_{divYld}$ represents the innovation in Dividend Yield of the Index (KSE100), $\hat{u}_{term}$ represents the innovation in the term factor and $\hat{u}_{rf}$ represents the innovation in the risk free rate i.e. daily repo. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities for the independent variables.

In order to test the ICAPM, a multivariate regression framework is used by transforming the above equation into a simple time series model as follows:

$$R_{it} - R_f = \alpha_i + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{rf})\beta_{4t} + \in_t \qquad ...(6)$$

Where $ER_{it} = R_{it} - R_f$ represents the excess return on stock in time t, α_i is the intercept of the regression equation representing the non-market return component, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i.

ICAPM for an individual stock can also be expressed for a portfolio by replacing i with p:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{rf})\beta_{4t} + \in_t \qquad ...(7)$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio.

3.7.1 Dependent Variable

The dependent variable for the ICAPM is the excess portfolio return represented by ER_{pt}.

3.7.2 Independent Variables

The independent variables in this model are the excess market return and a set of state variables, which include *DIV, TERM*, R_f that help to forecast future market returns. The innovations in these state variables are able to account for common time varying patterns in the returns and capture uncertainty about investment opportunities in the future. Moreover, these state variables are chosen to model two aspects of the investment opportunity set, the yield curve and the conditional distribution of asset returns. Yield curve is an important part of the investment opportunity set. Therefore, daily repo *(RF)* and the term spread *(TERM)* were used to capture the variations in the level and slope of the yield curve. Furthermore, the conditional distribution of asset returns is also an integral part of the investment opportunity set. Prior research evidence shows that the conditional distribution of asset returns, as characterized by its mean and variance, changes over time. The time-series literature has highlighted a set of variables that proxy for variation in the mean and variance of returns. The aggregate dividend yield *(DIV)*, and interest rates are among the most common. Subsequently, these state variables are most likely to capture the hedging concerns of the investors related to the changes in interest rates and variations in risk premia (Petkova, 2006).

Research evidence shows that the innovations in the slope of the yield curve are closely related with the real business cycle. The yield curve is steeper near the trough of the real business cycle (with negative shocks signaling a possible shift to good times) and relatively flat near the peak of the real business cycle (with positive shocks signaling a possible shift to bad times). From an ICAPM perspective, the negative sign of the *TERM* premium implies that stocks constitute a hedge against future negative shocks to consumption growth (Viale et al. 2009).

Fama and French (1989) advocated that the values of the term spread indicate that the expected market returns are high during recessions and low during expansions. Furthermore, Fama and French documented that the term spread tracks the short-term shocks and fluctuations in the business cycle. Whereas, positive shocks to the term premium are associated with bad times with respect to the business conditions, while negative shocks are associated with good times.

According to Petkova and Zhang (2004), in bad times value stocks are more risky than growth stocks, whereas, they are less risky during good times. Cornell (1999) and Campbell and Vuolteenaho (2004) highlighted another aspect of the shocks to the term spread and the HML portfolio, which is the context of cash flow maturities of assets. The authors proposed that value stocks are low duration assets as compared to growth stocks, which makes them similar to short term bonds and therefore are more sensitive to shocks in the short term, i.e. short end of the yield curve. Similarly, growth stocks are high duration assets, which makes them similar to long-term bonds, and are more sensitive to shocks in the long run, i.e. the long end of the yield curve or term structure.

Chan and Chen (1991) argued that small size firms tend to lose their market value due to poor performance, they are likely to have cash flow constraints and have high financial leverage, and they are less likely to survive during poor economic conditions. Subsequently, small firms are more sensitive to news about the state of the business cycle. This model is tested to find out whether the unexpected changes in the state variables improve the explanatory power of the standard CAPM.

3.8 Variable Estimation

Daily portfolio and market returns would be estimated by applying the same methodology that is used to estimate these two variables for testing the single factor model CAPM. Market premium is estimated as the difference between return on KSE 100 index and the daily repo i.e. the risk free rate.

3.8.1 Estimation of the Innovation Factors

The innovation factor is the difference between the Actual *(Daily Value)* and the Expected *(Monthly average)* of a variable.

$\hat{u}_{divYld}$ = Daily dividend yield of the index (KSE 100) – Monthly average dividend yield of the index (KSE 100)

$\hat{u}_{term}$ = Actual term value – Expected term value

Where, *Term= 6 months repos – overnight repo*

$\hat{u}_{R_f}$ = Actual risk free rate – Expected risk free rate

3.9 Hypotheses

In a multivariate regression model, following Hypotheses are tested.

$H_1 : \alpha_p \neq 0$
$H_2 : \beta_{1t} \neq 0$
$H_3 : \beta_{2t} \neq 0$
$H_4 : \beta_{3t} \neq 0$
$H_5 : \beta_{4t} \neq 0$

For ICAPM to hold H_1 should be rejected and α_p should be non- significant. Moreover H_2, H_3, H_4, and H_5 should be accepted and β_{1t}, β_{2t}, β_{3t} and β_{4t} should be significant.

3.10 Model Specification (Fama and French-Three Factor Model)

Fama and French proposed that Size and Value premium should be priced and stated that market risk is not the only risk factor that affects the returns of the stocks.

Augmented CAPM with Size and Value factor can be expressed as follows:

$$R_{it} = R_f + (R_{mt} - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} \qquad \ldots(8)$$

With $t = 1, 2, 3 \ldots, T$

Where R_{it} represents the expected return on a stock i in time t, R_f represents the risk free rate of return, R_{mt} - R_f represents the market risk premium, *SMB* is the size premium and *HML* is the value premium. The coefficients β_{1t}, β_{2t} and β_{3t} are the risk sensitivities of returns for market risk, size and value.

In order to test the FF three factor model, a multivariate regression framework will be used by transforming the above equation into a simple time series model as follows:

$$ER_{it} = \alpha_i + (R_{mt} + R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \in_t \qquad \ldots (9)$$

Where $ER_{it} = R_{it} - R_f$ represents the excess return on stock i in time t, α_i is the intercept of the regression equation representing the non-market return component, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. FF three factor model for an individual stock can also be expressed for a portfolio by replacing i with p:

$$ER_{pt} = \alpha_p + (R_{mt} + R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \in_t \quad \ldots (10)$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio.

3.10.1 Dependent Variable

The dependent variable for the FF three factor model is the excess portfolio return represented by ER_{pt}. The excess return reflects the return over and above the risk free rate required by the investor to justify the risk exposure. Moreover, the portfolio return is the weighted average of all the stocks included in a portfolio.

3.10.2 Independent Variables

The independent variables in this model are the market risk premium, size premium and the value premium. Due to the narrow scope of the business of small companies, they are less diversified and have less financial flexibility to respond to unexpected events that affect the market. Subsequently, the small size companies are greatly affected by various risk factors. Therefore, the investors require a size premium while making an investment in small companies because of their higher exposure to risk associated with the nature of business of the small companies. Whereas, investors require a value premium because a high book to market ratio depicts a variation in the book value of firm from its market value signifying that the market will not place a high value for stocks with high book-to-market due to present distress or investors' expectations about the future predictability of returns of such stocks.

3.11 Variable Estimation

Daily Portfolio and Market Returns are estimated by applying the same methodology that is used to estimate these two variables for testing the single factor model CAPM and ICAPM. Market premium is estimated as the difference between return on KSE 100 index *(R_m)* and the daily repo i.e. the risk free rate *(R_f)*.

3.11.1 Small Minus Big

SMB capture the risk factor in returns related to firm size. It is the difference between the average returns on portfolios of small stocks and average returns on portfolios of big stocks, constructed to be neutral vis-à-vis book to market and momentum.

$$SMB = [\frac{HSU + HSD + MSU + MSD + LSU + LSD}{6} - \frac{HBU + HBD + MBU + MBD + LBU + LBD}{6}]$$

3.11.2 High Minus Low

HML accounts for the risk factor that is related to firm value. It is the difference between the average returns on portfolios of high book to market stocks and average returns on portfolios of low book to market, constructed to be neutral vis-à-vis size and momentum. The stocks with high book to market are called value stocks where as the stocks with low book to market are called growth stocks.

$$HML = [\frac{HSU + HSD + HBU + HBD}{4} - \frac{LBU + LBD + LSU + LSD}{4}]$$

3.12 Hypotheses

In a multivariate regression model, following Hypotheses is tested.

$$H_1 : \alpha_p \neq 0$$
$$H_2 : \beta_{1t} \neq 0$$
$$H_3 : \beta_{2t} \neq 0$$
$$H_4 : \beta_{3t} \neq 0$$

For the FF three factor model to hold, H_1 should be rejected and α_p should be non-significant. H_2, H_3, and H_4, should be accepted and β_{1t}, β_{2t} and β_{3t} should be significant.

3.13 Model Specification (Carhart - Four Factor Model)

Carhart (1997) and Liew and Vassalou (2000) augmented the Fama and French three-factor model with a momentum factor WML, Winners minus losers. Winners are the stocks with the highest last year's average returns, excluding the most recent month, and the losers are the stocks with the lowest last year's average returns. Winner stocks are also termed as "up". Similarly loser stocks are also termed as "down". For the purpose of this research winner stocks represent up and loser stocks represent down. WML/UMD is a risk factor which measures the momentum premium.

Augmented CAPM with Size, Book to Market and Momentum Factor, can be expressed as follows:

$$R_{it} = R_f + (R_{mt} - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} \quad \dots (11)$$

With $t = 1, 2, 3 \dots, T$

Where R_{it} represents the expected return on a stock i in time t, R_f is the risk free rate of return, R_{mt} - R_f represents the market risk premium, *SMB* is the size premium, *HML* is the value premium and *WML* is the momentum premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, size, value and momentum.

In order to test the Carhart four factor model, a multivariate regression framework is used by transforming the above equation into a simple time series model as follows:

$$ER_{it} = \alpha_i + (R_{mt} - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} + \in_t \qquad \ldots (12)$$

Where $ER_{it} = R_{it} - R_f$ represents the excess return on stock in time t, α_i is the intercept of the regression equation representing the non-market return component, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i.

Carhart four factor model for an individual stock can also be expressed for a portfolio by replacing i with p:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} + \in_t \qquad \ldots (13)$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio.

3.13.1 Dependent Variable

The dependent variable for the Carhart four factor model is the excess portfolio return represented by ER_{pt}.

3.13.2 Independent Variables

The independent variables in this model are the market risk premium, size premium, value premium, and the momentum premium.

3.14 Variable Estimation

Daily portfolio, market returns, market premium, size premium and the value premium would be estimated by applying the same methodology that was used to estimate these variables for testing the FF three factor model.

3.14.1 Up Minus Down

Up in time *(t+1)* are the stocks with the top 50% - highest average returns out of all the stocks in time *(t)* and Down in time *(t+1)* are the stocks with the Bottom 50% - lowest average returns out of all the stocks in time (t). *UMD* is the average of all the equally weighted portfolios that are Up minus the average of all the equally weighted portfolios that are Down.

$$UMD = [\frac{HSU + HBU + MSU + MBU + DSU + DBU}{6} - [\frac{HSD + HBD + MSD + MBD + LSD + LBD}{6}]$$

3.15 Hypotheses

In a multivariate regression model, following Hypotheses are tested.

$H_1 : \alpha_p \neq 0$
$H_2 : \beta_{1t} \neq 0$
$H_3 : \beta_{2t} \neq 0$
$H_4 : \beta_{3t} \neq 0$
$H_5 : \beta_{4t} \neq 0$

For Carhart - Four Factor Model to hold, H_1 should be rejected and α_p should be non significant. H_2, H_3, H_4, and H_5 should be accepted and β_{1t}, β_{2t} , β_{3t} and β_{4t} should be significant.

3.16 Econometric Limitations

Whenever beta is estimated there are certain conceptual problems associated with the estimation. The two most basic econometric issues related with betas are as follows:

1. The systematic risk or beta estimates are based on ex-ante risk premiums, which are not directly observable. These estimates are based on rational expectations for an investor. Under rational expectations, the realised rates of return on assets in a given time period are drawings from the ex-ante probability distributions of returns on those assets. However, no logical justification can be given that investors will be rational over time.[7]
2. The second major problem relates to the observation of the proxy of market portfolio. In fact, many assets are not marketable and the proxies used for return on market portfolios exclude major classes of assets such as human capital, private businesses and private real

[7] For criticism on rational behavior in financial markets please see Mandelbrot (2008) and Taleb (2010).

estate. The most common assumption used to overcome this problem is by assuming that the disturbance terms from regressing the asset returns, on the return of the market proxy portfolio, are uncorrelated with the true market portfolio and that the proxy portfolio has a unit beta. If the market proxy is a portfolio constructed from the individual assets or portfolios contained in the test sample, this assumption is equivalent to assuming that the market proxy is the minimum variance unit beta portfolio of the set of all feasible portfolios constructed from the assets in the test sample.

Chapter 4

Empirical Results and Analysis

Table 6 reports the individual CAPM regressions on twelve size, book to market and momentum sorted portfolios. The CAPM assumes that market beta is the only risk factor that can explain the cross-sectional variation of the expected stock returns. However, the empirical results of the tests of CAPM revealed a weak relationship between the average portfolio returns and market beta. The coefficients of all of the twelve portfolios are insignificant with an exception of only one portfolio, BHD, which was significant at 10% significance level. The regression intercept (α) of eight out of twelve portfolios were significant. This implies that for these eight portfolios, the CAPM significantly understates the returns of the portfolios. The portfolios for which the CAPM understates the returns are generally smaller in size. Only one (out of six) small portfolio, SLD, has a significant regression intercept. The three big portfolios having an insignificant regression intercept were also winners. However for the CAPM model to hold, the regression intercepts should be zero. The results suggest that there might be some other factors affecting the returns. This is contrary to the proposition of Sharpe that the market risk is the only risk factor that can explain the cross-sectional variation of the expected returns of an asset. Moreover the R^2 of all of the portfolios is very low. The overall research findings confirmed that market risk is not the only risk factor that can explain the cross-sectional variation of expected returns.

[Insert Table 6 about here]

Table 7 presents the empirical results of the individual Fama-French regressions on twelve size, book to market and momentum sorted portfolios. As was the case with the CAPM regressions, market beta is insignificant and for all twelve portfolios. The loadings on SMB (β_2) are significant for five (out of six) portfolios with small size companies and are significant for all six portfolios with big size companies. The loadings on SMB (β_2) are positive for each of six (out of twelve) portfolios that are small in size and these loadings are negative for each of six (out of twelve) portfolios that are big in size. This evidence indicates an existence of size premium. The loadings on HML (β_3) for four portfolios that include companies with low and medium book to market and big size companies are significant and negative, whereas the loadings on HML (β_3) are significant and negative for only two out of six portfolios with low book to market and small size companies. Moreover the loadings on HML (β_3) on all of the portfolios (four out of twelve) that include companies with high book to market are significant and positive, showing an existence of value premium. Hence, HML is a significant explanator of returns on high book-to-market portfolios, but not as significant for low book to market portfolios and medium book to market portfolios with small size companies. The results supported Fama and French's proposition and confirmed that even in Pakistan the small companies due to the narrow scope of their business, are less diversified and have less financial flexibility to respond to unexpected events that affect the overall performance of the market. Subsequently, the small size companies are greatly affected by various risk factors. Therefore, the investors require a size premium while making an investment in small companies because of their higher exposure to risk associated with the nature of the small companies. Whereas, investors require a value premium because a high book to market ratio depicts a variation in the book value of firm from its market value signifying that the market will not place a high value for stocks with high book-to-market due to present distress or investors' expectations about the future predictability of returns of such stocks.

Moreover the research findings revealed that the size and value premium increase the explanatory power of the model as compared to CAPM, because with the addition of SMB and HML factors the results showed an increase in the Adjusted R^2 of the portfolios as well. The research findings suggested that the size and value premium should be priced. The overall findings confirmed the validity of the Fama-French three factor model, which seemed to explain the returns for KSE, an emerging. These findings suggest that the Fama-French model does a good job of explaining equity returns and that it is vastly superior to the CAPM in this regard. However regression intercept (α) is insignificant for all of the twelve portfolios.

[Insert Table 7 about here]

Table 8 reports the empirical results of the individual four-factor regressions on the twelve size, book to market and momentum sorted portfolios. The four-factor model in this table is the Fama-French model augmented with the momentum factor, UMD. With regard to the market betas, the loadings on SMB and the loadings on HML, the results are very similar to those of the Fama-French regressions in table 4. The market risk factor is insignificant for all of the twelve portfolios with an exception of SHD portfolio which is significant at 10% level of significance. This evidence depict that the market risk premium alone fails to explain the risk and return relationships for the portfolios even for the momentum four factor model. SMB is significant for all of the big (six out of twelve) and five out of six small sized portfolios, and HML is significant for all (four out of twelve) high book-to-market portfolios. The loadings on all of the portfolios with big size companies and small size companies had similar signs as well, highlighting the existence and validity of size premium and value premium. The loadings on UMD (β_4) on all of the twelve portfolios are significant at 1% level of significance. Moreover the loadings on UMD (β_4) for six out of twelve portfolios with companies that are Up are positive. Whereas the loadings on UMD (β_4) for the remaining six portfolios that are Down are negative. This finding supports the existence of momentum premium. The adjusted R^2 for all of the portfolios also showed significant improvement.

Moreover out of twelve portfolios only two portfolios, i.e. SLD and SMD had a significant regression intercept. Moreover the R^2 of the model is higher than CAPM and FF three factor model. Given these regression results it can be conclude that the momentum factor significantly increases the explanatory power of the model and explains the risk and return relationship better than CAPM and FF three factor model. The research evidence confirmed that investment strategies that involve taking a long or short position in well or poorly performing stocks on the basis of the past performance over the period of twelve months tend to produce significantly positive abnormal returns for the following year. These return continuation strategies lead to an existence of momentum return in individual stocks, influenced by the positive correlation between past and future stock returns. It should be noted that the number of firms in each of the twelve portfolios varied each year during the sample period due to the rebalancing of the portfolios each year. Findings of the research revealed that all of the risk factors, i.e. market risk, size, book to market and momentum were priced and momentum factor had the highest average annual premium. It can be concluded that CAPM fails to capture all the systematic risks, which leaves part of the systematic risks correlated to firm characteristics, such as the size, book-to-market and the momentum effects.

[Insert Table 8 about here]

Table 9 presents the empirical results of the individual ICAPM regressions on twelve size, book to market and momentum portfolios. Market risk premium is insignificant for all of the twelve portfolios. The intercept is significant for five out of twelve portfolios i.e. BHU, BLU, BMU, SHU and SMU, which makes the coefficients of the independent variables of these portfolios irrelevant. The loadings on the innovation of dividend yield of the index (β_2) are significant for five portfolios i.e. BHD, SHD, SLD, SLU and SMD. Dividends depend on the earnings of the firm and if there is a change in the dividend policy of the firm then that would imply that there has been a change in the earnings of the firm. A decrease in the earnings of a firm reflects a business risk. Since an innovation in the dividend yield of the index reflects the business risk of the overall market. Even if the index is dominated by the leading stocks, the innovation in the dividend yield of these stocks would lead to a similar trend in the innovation of the dividend yield in the overall market. Small firms tend to be more sensitive towards such business risk due to lack of financial flexibility and their narrow scope of business. Therefore an innovation in Dividend yield of the index is dominating mostly in small stocks. Therefore investors would require a premium while investing in small stocks.

Daily repo (*RF*) and the term spread (*TERM*) capture the variations in the level and slope of the yield curve. The loadings on innovation in term (β_3) are significant for six portfolios, i.e. BHD, BMD, SHD, SLD, SLU and SMD. Moreover the loadings in innovation of risk free (β_4) are significant for six portfolios, i.e. BHD, BLD, BMD, SLD, SLU and SMD. Research evidence shows that the innovation in term and risk free rate is significant in majority of the portfolios with small firms. Change in interest rates is either because of the change in capital structure of the firm or due to the change in the yield curve. This reflects the financial risks. Yield curve is an important part of the investment opportunity set because the innovation in the slope of the yield curve is closely related to the business cycle. As small firms are likely to have cash flow constraints and have high financial leverage, they are less likely to survive during poor economic conditions (Viale et al 2009). Subsequently, small firms are more sensitive to news about the state of the business cycle and have a high financial risk. Moreover, small firms have a low capacity to absorb additional risk, be it financial or business risk. Therefore, investors require a premium while investing in small firms. During the sample period 1st July 1997 - 30th June 2007 the firms have been exposed to high business risk due to the increase in competition, there had been deregulation as well. Moreover, since 2003 the interest rates have increased which has increased the financial risk for small firms listed on the Karachi Stock Exchange.

Big firms have a high capacity to absorb business and financial risk. Therefore if only the size factor is considered, big firm are relatively less affected by the innovations in term and risk free rate. However, value stocks are low duration assets as compared to growth stocks, which makes them similar to short term bonds and therefore are more sensitive to shocks in the short term, i.e. short end of the yield curve. Moreover, in bad times value stocks are more risky than growth stocks, whereas, they are less risky during good times (Petkova 2006). Subsequently, big firms that have high or medium book to market ratio tend to be sensitive towards the innovation in term.

The overall research result shows that the coefficients with respect to the innovations in the state variables used to test ICAPM in this study are important determinants of average returns, and there should be a significant price of risk associated with these state variables.

[Insert Table 9 about here]

In emerging markets, the market index is misrepresented due to thin trading. Active trading exists in only a few stocks. Moreover the market index is value weighted and is therefore dominated by the stocks which are actively traded in the market. These factors lead to an insignificant market risk premium. The failure of CAPM in emerging markets may be due to the fact that the market index in does not reflect the overall market's dynamics. This is the reason why market risk premium is insignificant in all of the four models tested in this study.

On the other hand, Fama and French three factor model perform better in emerging markets because this model takes into account the factors based on firm characteristics, i.e. size and value premium. Carhart's four factor momentum model is also relevant because this model takes into account the trading strategies related to Up and Down stocks in addition to the stocks firm characteristics. ICAPM performs well due to the fact that it takes into account the changing investment opportunity set and the affects of business and financial risks on the stocks.

In order to test the robustness of the results the sample period was divided into two sub periods i.e. July 1997- June 2003 and July 2003 – June 2007. The results of the tests of all of the models remained robust for both of the sub periods.

Chapter 5

Conclusion

Asset pricing models provide a meaningful measure of the expected return of an asset which the investor gets by taking on a certain level of risk. Financial theorists have proposed various asset pricing models that describe the relationship between risk and expected return. The paradoxes revealed in the statistical results of various empirical tests have influenced the development of modified asset pricing models, with the aim to improve the ability of the asset pricing model to explain the relationship between risk and expected return of an investment in risky assets. It is all the more important for an investor to be able to quantify an appropriate rate of return that would compensate for taking on risk. An exhaustive literature exists in support and against the validity of various asset pricing models and the empirical evidence has shown that the relevance of these asset pricing models differs in developed and emerging markets. KSE is an emerging market where literature based on the asset pricing proposition is rare as compared to developed markets. The purpose of this study is to explore the asset pricing dynamics in an emerging stock. The four models that are proposed to be tested have shown explanatory power in developed economies. However, the emerging markets have special features that are distinct from developed markets. These include market making activities by few large investors, non-synchronous trading, loose monitoring controls and small market size. Therefore, it would be interesting to analyze the relevance of these asset pricing models in KSE. Lastly, these asset pricing propositions are an important input for estimation of investment appraisals, project feasibility and cost of equity valuations. This research study is a comparative study of four most widely used asset pricing models, being applied to KSE: Capital asset pricing model (CAPM) , Fama and French-three factor model(FF, 1992), Intertemporal capital asset pricing model (ICAPM), and Carhart-four factor model. This research would facilitate financial managers and investors to make appropriate analyses of the risk and return relationship of their investment strategies, enabling them to make rational investment decisions and maximize their returns.

As this study provides a comparative analysis on all of these models, therefore the same sample is used to test each model. The sample period is from 1st July 1998 – 30th June 2008. The sample consists of companies from all the industrial sectors listed on KSE. The following are the list of criterion that will be employed to select stocks from the individual sectors: 1. All selected stocks are listed on the KSE. 2. In order to avoid thinly traded stocks, only the stocks with non zero returns for at least 90% of the trading days, is included in the sample. The selected stocks comprises of stocks from all the sectors. 3. Daily price data, book value, market value of equity and market capitalization is available.

The secondary data from KSE is used for this study. In order to estimate the intra-day returns, the daily closing prices is used. The true market portfolio within the framework of various asset pricing models is not observable for the purpose of empirical testing. Therefore, as a proxy for market portfolio, KSE 100 index is used as a synthetic market portfolio.

A risk free asset is an asset that yields certain return. However, in reality no such asset exists and as a risk free asset proxy investors use government issued securities and their returns as a risk free rate. Although, even these government issued securities also face inflation risk. For the purpose of this study, Daily stock prices are used and over - night repos are taken as a proxy for risk free rate. The book to market ratio and market capitalization data was collected from the annual reports of the companies in the sample.

In an attempt to capture all three empirical anomalies, size, book to market and momentum risk factors portfolios based on HML, SML and WML were formed. In order to facilitate the comparative analysis based on the four asset pricing models, the same portfolios were used to empirically test each model. In order to construct the Book to Market Portfolios, the stocks were ranked and categorized into three groups based on the break points of bottom 30% - Low (L). Middle 40% - Medium (M) and top 30% - High (H). The stocks with High Book to Market ratio in time (t) were included in the top sub group in time (t+1), and so on. To form the Size Portfolios the selected sample stocks were ranked on market capitalization (price times no. of shares), in order to make two sub groups based on the break points of Top 50% - Big (B) and Bottom 50% - Small (S). The stocks with High Market Capitalization in time (t) were included in the top sub group in time (t+1), and so on. To form the Momentum sorted portfolios, the daily returns (Ri) of all the selected stocks were tabulated. Then those stocks were ranked on the basis of their returns in order to make two groups. The winners (W) in time (t+1) were the stocks with the top 50% - highest average returns out of all the stocks in time (t) and losers (Ls) in time (t+1) were the stocks with the Bottom 50% - lowest average returns out of all the stocks in time (t). In this way twelve equally weighted size, book to market and momentum sorted portfolios were constructed:**,** HBW, HBLs, HSW, HSLs, MBW, MBLs, MSW, MSLs, LBW, LBLs, LSW, LSLs. All those stock with high book to market value, high market capitalization and were winners, were included in the H/B/W portfolio, so on. Each year these 12 portfolios were rebalanced. For each year from 1st July 1998 – June 30th 2008, 30th June is taken as a date to rebalance the portfolios according to size, book to market and the momentum factor. There will 12 portfolios in each model; therefore 12 regressions are run for each model.

The CAPM assumes that market beta is the only risk factor that can explain the cross-sectional variation of the expected stock returns. However, the empirical results of the tests of CAPM revealed a weak relationship between the average portfolio returns and market beta. The coefficients of all of the twelve portfolios are insignificant with an exception of only one portfolio, BHD, which was significant at 10% significance level. The regression intercept (α) of eight out of twelve portfolios were significant. This implies that for these eight portfolios, the CAPM significantly understates the returns of the portfolios. The portfolios for which the CAPM understates the returns are generally smaller in size. Only one (out of six) small portfolio, SLD, has a significant regression intercept. The three big portfolios having an insignificant regression intercept were also winners. However for the CAPM model to hold, the regression intercepts should be zero. The results suggest that there might be some other factors affecting the returns. This is contrary to the proposition of Sharpe that the market risk is the only risk factor that can explain the cross-sectional variation of the expected returns of an asset. Moreover the R^2 of all of the portfolios is very low. The overall research findings confirmed that market risk is not the only risk factor that can explain the cross-sectional variation of expected returns.

As was the case with the CAPM regressions, market beta is insignificant and for all twelve portfolios. The loadings on SMB (β_2) are significant for five (out of six) portfolios with small size companies and are significant for all six portfolios with big size companies. The loadings on SMB (β_2) are positive for each of six (out of twelve) portfolios that are small in size and these loadings are negative for each of six (out of twelve) portfolios that are big in size. This evidence indicates an existence of size premium. The loadings on HML (β_3) for four portfolios that include companies with low and medium book to market and big size companies are significant and negative, whereas the loadings on HML (β_3) are significant and negative for only two out of six portfolios with low book to market and small size companies. Moreover the loadings on HML (β_3) on all of the portfolios (four out of twelve) that include companies with high book to market are significant and positive, showing an existence of value premium. Hence, HML is a significant explanator of returns on high book-to-market portfolios, but not as significant for low book to market portfolios and medium book to market portfolios with small size companies. The results supported Fama and French's proposition and confirmed that even in Pakistan the small companies due to the narrow scope of their business, are less diversified and have less financial flexibility to respond to unexpected events that affect the overall performance of the market. Subsequently, the small size companies are greatly affected by various risk factors. Therefore, the investors require a size premium while making an investment in small companies because of their higher exposure to risk associated with the nature of the small companies. Whereas, investors require a value premium because a high book to market ratio depicts a variation in the book value of firm from its market value signifying that the market will not place a high value for stocks with high book-to-market due to present distress or investors' expectations about the future predictability of returns of such stocks.

Moreover the research findings revealed that the size and value premium increase the explanatory power of the model as compared to CAPM, because with the addition of SMB and HML factors the results showed an increase in the Adjusted R^2 of the portfolios as well. The research findings suggested that the size and value premium should be priced. The overall findings confirmed the validity of the Fama-French three factor model, which seemed to explain the returns for KSE, an emerging. These findings suggest that the Fama-French model does a good job of explaining equity returns and that it is vastly superior to the CAPM in this regard. However regression intercept (α) is insignificant for all of the twelve portfolios.

The four-factor model in this study is the Fama-French model augmented with the momentum factor, UMD. With regard to the market betas, the loadings on SMB and the loadings on HML, the results are very similar to those of the Fama-French regressions. The market risk factor is insignificant for all of the twelve portfolios with an exception of SHD portfolio which is significant at 10% level of significance. This evidence depict that the market risk premium alone fails to explain the risk and return relationships for the portfolios even for the momentum four factor model. SMB is significant for all of the big (six out of twelve) and five out of six small sized portfolios, and HML is significant for all (four out of twelve) high book-to-market portfolios.

The loadings on all of the portfolios with big size companies and small size companies had similar signs as well, highlighting the existence and validity of size premium and value premium. The loadings on UMD (β_4) on all of the twelve portfolios are significant at 1% level of significance. Moreover the loadings on UMD (β_4) for six out of twelve portfolios with companies that are Up are positive. Whereas the loadings on UMD (β_4) for the remaining six portfolios that are Down are negative. This finding supports the existence of momentum premium. The adjusted R^2 for all of the portfolios also showed significant improvement.

Moreover out of twelve portfolios only two portfolios, i.e. SLD and SMD had a significant regression intercept. Moreover the R^2 of the model is higher than CAPM and FF three factor model. Given these regression results it can be conclude that the momentum factor significantly increases the explanatory power of the model and explains the risk and return relationship better than CAPM and FF three factor model. The research evidence confirmed that investment strategies that involve taking a long or short position in well or poorly performing stocks on the basis of the past performance over the period of twelve months tend to produce significantly positive abnormal returns for the following year. These return continuation strategies lead to an existence of momentum return in individual stocks, influenced by the positive correlation between past and future stock returns. It should be noted that the number of firms in each of the twelve portfolios varied each year during the sample period due to the rebalancing of the portfolios each year. Findings of the research revealed that all of the risk factors, i.e. market risk, size, book to market and momentum were priced and momentum factor had the highest average annual premium. It can be concluded that CAPM fails to capture all the systematic risks, which leaves part of the systematic risks correlated to firm characteristics, such as the size, book-to-market and the momentum effects.

In individual ICAPM regression results market risk premium is insignificant for all of the twelve portfolios. The intercept is significant for five out of twelve portfolios i.e. BHU, BLU, BMU, SHU and SMU, which makes the coefficients of the independent variables of these portfolios irrelevant. The loadings on the innovation of dividend yield of the index (β_2) are significant for five portfolios i.e. BHD, SHD, SLD, SLU and SMD. Dividends depend on the earnings of the firm and if there is a change in the dividend policy of the firm then that would imply that there has been a change in the earnings of the firm. A decrease in the earnings of a firm reflects a business risk. Since an innovation in the dividend yield of the index reflects the business risk of the overall market. Even if the index is dominated by the leading stocks, the innovation in the dividend yield of these stocks would lead to a similar trend in the innovation of the dividend yield in the overall market. Small firms tend to be more sensitive towards such business risk due to lack of financial flexibility and their narrow scope of business. Therefore an innovation in

Dividend yield of the index is dominating mostly in small stocks. Therefore investors would require a premium while investing in small stocks.

Daily repo (*RF*) and the term spread (*TERM*) capture the variations in the level and slope of the yield curve. The loadings on innovation in term (β_3) are significant for six portfolios, i.e. BHD, BMD, SHD, SLD, SLU and SMD. Moreover the loadings in innovation of risk free (β_4) are significant for six portfolios, i.e. BHD, BLD, BMD, SLD, SLU and SMD. Research evidence shows that the innovation in term and risk free rate is significant in majority of the portfolios with small firms. Change in interest rates is either because of the change in capital structure of the firm or due to the change in the yield curve. This reflects the financial risks. Yield curve is an important part of the investment opportunity set because the innovation in the slope of the yield curve is closely related to the business cycle. As small firms are likely to have cash flow constraints and have high financial leverage, they are less likely to survive during poor economic conditions (Viale et al 2009).

Subsequently, small firms are more sensitive to news about the state of the business cycle and have a high financial risk. Moreover, small firms have a low capacity to absorb additional risk, be it financial or business risk. Therefore, investors require a premium while investing in small firms. During the sample period 1st July 1997 - 30th June 2007 the firms have been exposed to high business risk due to the increase in competition, there had been deregulation as well. Moreover, since 2003 the interest rates have increased which has increased the financial risk for small firms listed on the Karachi Stock Exchange.

Big firms have a high capacity to absorb business and financial risk. Therefore if only the size factor is considered, big firm are relatively less affected by the innovations in term and risk free rate. However, value stocks are low duration assets as compared to growth stocks, which makes them similar to short term bonds and therefore are more sensitive to shocks in the short term, i.e. short end of the yield curve. Moreover, in bad times value stocks are more risky than growth stocks, whereas, they are less risky during good times (Petkova 2006). Subsequently, big firms that have high or medium book to market ratio tend to be sensitive towards the innovation in term.

The overall research result shows that the coefficients with respect to the innovations in the state variables used to test ICAPM in this study are important determinants of average returns, and there should be a significant price of risk associated with these state variables.

In emerging markets, the market index is misrepresented due to thin trading. Active trading exists in only a few stocks. Moreover the market index is value weighted and is therefore dominated by the stocks which are actively traded in the market. These factors lead to an insignificant market risk premium.

The failure of CAPM in emerging markets may be due to the fact that the market index in does not reflect the overall market's dynamics. This is the reason why market risk premium is insignificant in all of the four models tested in this study. On the other hand, Fama and French three factor model perform better in emerging markets because this model takes into account the factors based on firm characteristics, i.e. size and value premium. Carhart's four factor momentum model is also relevant because this model takes into account the trading strategies related to Up and Down stocks in addition to the stocks firm characteristics. ICAPM performs well due to the fact that it takes into account the changing investment opportunity set and the affects of business and financial risks on the stocks.

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Appendix

Figures and Tables

Figure 1

Created with Amibroker – advanced charting and technical analysis software

Table 1: Correlation Matrix (July 2007 - June 2008)

	Index		**Turnover**		**Trading Value**	
	LSE	**ISE**	**LSE**	**ISE**	**LSE**	**ISE**
KSE	53.60%	84.59%	72.05%	60.38%	70.41%	63.57%

Source: Reproduced from "Speculative bubbles in KSE", CREB working paper series

Table 2: Decade Wise Performance of KSE

Year	No of Listed Companies	Listed Capital (PKR in Million)	Market Cap (PKR in Million)
1950	15	117.3	-
1960	81	1007.7	1871.4
1970	291	3864.6	5658.1
1980	314	7630.2	9767.3
1990	487	28056	61750
2000	762	236458.5	382730.4

Source: KSE Website

Table 3:
Years Progress Report
In millions except companies, index and bonds data

	30-12-2006	29-12-2007	31-12-2008	31-12-2009	18-08-2010
Total No. of Listed Companies	652	654	653	651	651
Total Listed Capital - Rs.	519,270.17	671,255.82	750,477.55	814,478.74	909,968.03
Total Market Capitalization - Rs.	2,771,113.94	4,329,909.79	1,858,698.90	2,705,879.83	2,721,604.94
KSE-100™ Index	10040.5	14075.83	5865.01	9386.92	9705
KSE-30™ Index	12521.54	16717.1	5485.33	9849.92	9641.55
KSE All Share Index	6770.06	9956.76	4400.76	6665.55	6783.7
New Companies Listed during the year	9	14	10	4	6
Listed Capital of New Companies - Rs.	14,789.76	57,239.92	15,312.12	8,755.73	32,538.44
New Debt Instruments Listed during the year	3	3	7	1	4
Listed Capital of New Debt Instruments - Rs.	3,400.00	6,500.00	26,500.00	3,000.00	5,650.18
Average Daily Turnover - Shares in million	260.69	268.23	146.55	179.88	144.16
Average value of daily turnover - Rs.	31,610.71	25,262.97	14,228.35	7,450.75	4,778.90
Average Daily Turnover (Future™) YTD	82.68	61.69	30.76	1.03	5.17
Average Value of Daily Turnover - YTD	13,587.63	9,077.61	5,229.97	89.66	416.1
Foreign Investment in Securities Market					
Inflow – Rs	-	-	-	-	-
Outflow – Rs	-	-	-	-	-
Net Inflow/(Outflow) – Rs	-	-	-	-	-

Source: KSE Website

Table 4: Year wise Sample Composition

Years	No. of Firms in the Sample
1998	120
1999	131
2000	131
2001	135
2002	138
2003	140
2004	140
2005	145
2006	150
2007	150

Table 5:
Portfolio Construction Methodology

Book to Market	Market Capitalization	Momentum	Portfolios
High B/M (Top 30%)	Big MV (Top 50%)	Up (Top 50%)	HBU
		Down (Bottom 50%)	HBD
Medium B/M (Middle 40%)		Up (Top 50%)	HSU
		Down (Bottom 50%)	HSD
Low B/M (Bottom 30%)		Up (Top 50%)	MBU
		Down (Bottom 50%)	MBD
High B/M (Top 30%)	Small MV (Bottom 50%)	Up (Top 50%)	MSU
		Down (Bottom 50%)	MSD
Medium B/M (Middle 40%)		Up (Top 50%)	LBU
		Down (Bottom 50%)	LBD
Low B/M (Bottom 30%)		Up (Top 50%)	LSU
		Down (Bottom 50%)	LSD

TABLE 6
CAPM: Single Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual CAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 1997 to 30th June 2007** according to:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_m - R_f represents the market risk premium. The coefficient β_{1t} is the risk sensitivity of returns for market risk, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1 and 2 reports the estimates of α_p and β_{1t} . Column 2 and 3 reports the t statistics of the estimates of α_p and β_{1t} . Whereas Column 5 reports the R^2 .

	α	β_1	$t(\alpha)$	$t(\beta_1)$	R^2
BHD	-0.000541	-0.042992	-1.406005	-1.877207	0.001447
BHU	0.004725	-0.012977	12.54184***	-0.579174	0.000138
BLD	-0.000352	-0.017944	-1.137062	-0.975529	0.000391
BLU	0.001591	-0.002504	5.193214***	-0.137396	0.000008
BMD	-0.0005	0.000728	-1.598541	0.039123	0.000001
BMU	0.001607	0.014995	5.110243***	0.80192	0.000264
SHD	-0.000898	0.020155	-3.287359***	1.240932	0.000633
SHU	0.001528	-0.00569	4.018142***	-0.251605	0.000026
SLD	-0.000338	-0.026453	-0.821494	-1.081084	0.00048
SLU	0.001786	0.02045	4.58947***	0.883665	0.000321
SMD	-0.000597	0.005838	-2.078563**	0.341958	0.000048
SMU	0.001575	-0.006484	5.168736***	-0.357892	0.000053

*** Significant at 90%**
**** Significant at 95%**
***** Significant at 99%**

TABLE 7

Fama and French: Three Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the period 1st July 1997 to 30th June 2007 according to:

$$ER_{Pt} = \alpha_P + (R_m - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time *t*, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t} and β_{3t} are the risk sensitivities of returns for market risk, size and value. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock *i*. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3 and 4 reports the estimates of α_p, β_{1t}, β_{2t} and β_{3t}. Column 5,6 and 7 reports the *t* statistics of the estimates of α_p and β_{1t}, β_{2t} and β_{3t}. Whereas Column 8 reports the *Adj* R^2.

	α	***β₁***	***β₂***	***β₃***	***t(α)***	***t(β₁)***	***t(β₂)***	***t(β₃)***	***Adj R2***
BHD	0.000464	-0.03159	-0.873827	0.378647	0.19607	-1.588728	-23.34167***	11.00823***	0.24735
BHU	-0.00352	-0.002414	-0.778903	0.443453	-1.3282	-0.12329	-21.12855***	13.09216***	0.236407
BLD	0.001604	-0.009201	-0.891626	-0.381885	0.64219	-0.594482	-30.59953***	-14.26403***	0.292411
BLU	-0.0017	0.006286	-0.902185	-0.401615	-0.6613	0.414618	-31.60438***	-15.31225***	0.307818
BMD	0.004716	0.010356	-0.891509	-0.14654	1.91363	0.649588	-29.70166***	-5.31358***	0.265505
BMU	-0.00166	0.023568	-0.809378	-0.177835	-0.6468	1.424019	-25.97484***	-6.211502***	0.216875
SHD	0.002888	0.021094	0.003358	0.259728	1.08218	1.322183	0.1118	9.410884***	0.035789
SHU	-0.00019	-0.005897	0.254819	0.718042	-0.0729	-0.281183	6.453112***	19.79083***	0.13985
SLD	0.000219	-0.032381	0.271141	-0.752593	0.5815	-1.449493	6.446474***	-19.47438***	0.166919
SLU	-0.00203	0.016488	0.128116	-0.664036	-0.8147	0.763163	3.149579***	-17.76708***	0.128728
SMD	0.001459	0.005524	0.056369	0.08764	0.5246	0.324049	1.756405*	2.972102***	0.003024
SMU	-0.00487	-0.007822	0.138767	0.065443	-1.8168	-0.433118	4.081255***	2.094823**	0.00634

***   Significant at 90%**

****   Significant at 95%**

***** Significant at 99%**

TABLE 8

Momentum: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 1997 to 30th June 2007** according to:

$$ER_{Pt} = \alpha_P + RP_t\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, size, value and momentum premium. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p and β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	β_4	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	$t(\beta_4)$	Adj R2
BHD	0.000246	-0.025371	-0.840364	0.429072	-0.561891	0.726538	-1.328602	-23.33107***	12.91962***	-14.38695***	0.306164
BHU	0.002646	-0.009911	-0.819243	0.382666	0.677354	0.98219	-0.538617	-23.60412***	11.95769***	17.99865***	0.325985
BLD	-0.000109	-0.006886	-0.879171	-0.363118	-0.209127	-0.400341	-0.448768	-30.37687***	-13.60721***	-6.6639***	0.304829
BLU	0.000415	0.002677	-0.921606	-0.430881	0.326102	1.581475	0.180645	-32.96926***	-16.71757***	10.75886***	0.339031
BMD	-0.000423	0.0125	-0.879974	-0.129158	-0.19368	-1.509105	0.789437	-29.46475***	-4.690375***	-5.9809***	0.275866
BMU	0.000334	0.019828	-0.829499	-0.208156	0.337856	1.163277	1.222843	-27.12102***	-7.381255***	10.18757***	0.248656
SHD	6.91E-05	0.025684	0.028057	0.296945	-0.414715	0.252897	1.665421	0.964499	11.07125***	-13.14823***	0.099483
SHU	-0.000435	-0.013092	0.216106	0.659705	0.650048	-1.23035	-0.655667	5.737892***	18.99714***	15.91772***	0.220778
SLD	0.002151	-0.024343	0.314396	-0.687412	-0.726305	5.739569***	-1.150588	7.878397***	-18.68228***	-16.78529***	0.253199
SLU	-0.000341	0.005862	0.070936	-0.7502	0.960125	-0.990873	0.3021	1.93822*	-22.23125***	24.19423***	0.297632
SMD	0.000766	0.011253	0.087199	0.134097	-0.517669	2.660221***	0.691989	2.842768***	4.741354***	-15.56443***	0.093065
SMU	0.000489	-0.012527	0.113449	0.027291	0.42513	1.572706	-0.713046	3.423551***	0.893195	11.83174***	0.0601

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

TABLE 9
ICAPM: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual ICAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 1997 to 30th June 2007** according to:

$$ER_{pt} = \alpha_P + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{Rf})\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, innovation in dividend yield of the index (KSE100), innovation in the term factor and the innovation in the risk free rate. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p and β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	β_4	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	$t(\beta_4)$	Adj R2
BHD	0.000448	-0.027089	-0.111428	0.352939	-0.363339	1.226919	-1.281405	-4.555941***	16.06064***	-15.54302***	0.150832
BHU	0.004665	0.001962	0.301166	0.295827	-0.53496	13.76362***	0.099987	13.26758***	14.50455***	-24.65744***	0.234652
BLD	-0.000469	-0.008034	0.0269	0.02752	-0.247933	-1.527326	-0.451641	1.307114	1.488289	-12.60462***	0.066758
BLU	0.000963	0.006246	0.205916	-0.023659	-0.301867	3.237845***	0.362803	10.3378***	-1.321924	-15.85604***	0.109173
BMD	-0.000395	0.013302	0.023861	0.12061	-0.320903	-1.298105	0.755365	1.171167	6.58857***	-16.47938***	0.105335
BMU	0.00121	0.024333	0.189426	0.052285	-0.317455	3.948205***	1.372035	9.23206***	2.836081***	-16.18756***	0.10246
SHD	-0.000367	0.022624	0.107566	0.122653	-0.021064	-1.324707	1.411644	5.801088***	7.361967***	-1.188553	0.028669
SHU	0.001762	-0.004334	0.147087	0.210972	-0.131708	4.637801***	-0.19711	5.781973***	9.230102***	-5.41696***	0.05555
SLD	-0.000527	-0.033352	0.22429	0.289673	0.308581	-1.31798	-1.440598	8.373541***	12.03616***	12.05338***	0.10691
SLU	0.00029	0.013195	0.306259	0.34087	0.064533	0.770398	0.605121	12.13991***	15.03821***	2.67638***	0.114211
SMD	-6.70E-05	0.007054	0.162021	0.070702	0.041539	-0.230408	0.418837	8.314443***	4.038094***	2.230248**	0.028409
SMU	0.001272	-0.006873	0.102212	0.029978	-0.036825	4.077093***	-0.380646	4.892711***	1.597076	-1.844271*	0.008462

*** Significant at 90%**
**** Significant at 95%**
***** Significant at 99%**

SUB-SAMPLE 1: JULY 1997-JUNE 2003

TABLE 10

CAPM: Single Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual CAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 1997 to 30th June 2003** according to:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time *t,* α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_m - R_f represents the market risk premium. The coefficient β_{1t} is the risk sensitivity of returns for market risk, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock *i*. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1 and 2 reports the estimates of α_p and β_{1t} . Column 2 and 3 reports the *t* statistics of the estimates of α_p and β_{1t}. Whereas Column 5 reports the R^2 .

	α	***β1***	***t(α)***	***t(β1)***	***R²***
BHD	-0.001015	-0.055067	-1.812989	-1.78649*	0.002286
BHU	0.006851	-0.009142	12.67926***	-0.30746	0.000068
BLD	-0.000852	-0.007881	-2.13887**	-0.359317	0.000098
BLU	0.001121	0.001215	2.669834***	0.052596	0.000002
BMD	-0.000743	0.00954	-1.738156	0.405254	0.000118
BMU	0.001147	0.021634	2.728828***	0.935154	0.0000627
SHD	-0.001214	0.014573	-3.216759***	0.701468	0.000353
SHU	0.000709	0.000791	1.325286	0.02688	0.000001
SLD	-0.000499	-0.017311	-0.849447	-0.535791	0.000206
SLU	0.001144	0.03767	2.014971**	1.205319	0.001042
SMD	-0.000963	0.005258	-2.328887**	0.230949	0.000038
SMU	0.001216	-0.004946	2.761126***	-0.203998	0.00003

***   Significant at 90%**

****   Significant at 95%**

***** Significant at 99%**

TABLE 11

Fama and French: Three Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the period 1st July 1997 to 30th June 2003 according to:

$$ER_{Pt} = \alpha_P + (R_m - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time *t*, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t} and β_{3t} are the risk sensitivities of returns for market risk, size and value. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock *i*. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3 and 4 reports the estimates of α_p, β_{1t}, β_{2t} and β_{3t}. Column 5,6 and 7 reports the *t* statistics of the estimates of α_p, β_{1t}, β_{2t} and β_{3t}. Whereas Column 8 reports the *Adj* R^2.

	α	β_1	β_2	β_3	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	*Adj* R^2
BHD	-0.00237	-0.037323	-0.797119	0.491341	-4.932386***	-1.421603	-16.91649***	11.36516***	0.276332
BHU	0.005586	0.007533	-0.67853	0.518717	11.86917***	0.292913	-14.70116***	12.24951***	0.25226
BLD	-0.001314	-0.002717	-0.75937	-0.282795	-3.841681***	-0.145381	-22.6397***	-9.189569***	0.274246
BLU	0.000606	0.006889	-0.895893	-0.36039	1.775105*	0.369631	-26.78122***	-11.74229***	0.349086
BMD	-0.001489	0.018515	-0.874942	-0.13234	-4.152137***	0.945014	-24.88157***	-4.101999***	0.307492
BMU	0.000532	0.028968	-0.765167	-0.148702	1.44172	1.438115	-21.16524***	-4.483224***	0.242495
SHD	-0.0015	0.01878	0.088945	0.340889	-4.088507***	0.936881	2.472272***	10.32745***	0.069549
SHU	0.000177	0.008806	0.269671	0.730368	0.359748	0.326989	5.579222***	16.46973***	0.163132
SLD	0.000655	-0.033006	0.355752	-0.716668	1.232687	-1.136838	6.827149***	-14.99049***	0.192802
SLU	0.001947	0.026629	0.182479	-0.558832	3.602916***	0.90184	3.443286***	-11.49338***	0.108462
SMD	-0.001043	0.006578	0.103429	0.167916	-2.521416***	0.290923	2.548612***	4.509845***	0.014022
SMU	0.001314	-0.005923	0.228705	0.122157	2.992728***	-0.2468	5.309998***	3.09131***	0.020352

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

TABLE 12

Momentum: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1[st] July 1997 to 30[th] June 2003** according to:

$$ER_{Pt} = \alpha_P + RP_t\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, size, value and momentum premium. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p and β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	β_4	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	$t(\beta_4)$	*Adj* R^2
BHD	-0.000817	-0.028117	-0.776865	0.530571	-0.541135	-1.698267*	-1.117119	-17.19273***	12.76281***	-11.18609***	0.335619
BHU	0.003541	-0.004589	-0.705198	0.467062	0.71252	7.806392***	-0.193303	-16.5457***	11.91111***	15.61507***	0.363394
BLD	-0.000764	0.000545	-0.752195	-0.268897	-0.19171	-2.159042**	0.029414	-22.6324***	-8.794081***	-5.387878***	0.288581
BLU	-0.000405	0.000903	-0.909063	-0.385898	0.351857	-1.176339	0.050198	-28.1354***	-12.98182***	10.17183***	0.393745
BMD	-0.001152	0.020514	-0.870545	-0.123824	-0.11747	-3.084618***	1.049753	-24.81462***	-3.836409***	-3.12763***	0.311836
BMU	-0.000536	0.022639	-0.779089	-0.175669	0.371974	-1.440805	1.162125	-22.27636***	-5.459532***	9.934434***	0.292205
SHD	-0.000461	0.02494	0.102498	0.36714	-0.362097	-1.241396	1.284488	2.940454***	11.44813***	-9.70281***	0.127944
SHU	-0.001709	-0.002372	0.245078	0.682733	0.657067	-3.528556***	-0.093592	5.385729***	16.30777***	13.48723***	0.259444
SLD	0.002701	-0.020879	0.382431	-0.664992	-0.712816	5.178014***	-0.764709	7.801985***	-14.74591***	-13.58321***	0.286878
SLU	-0.000978	0.009293	0.144338	-0.632707	1.019023	-1.976005**	0.358695	3.103306***	-14.78594***	20.46445***	0.314389
SMD	0.00036	0.014893	0.121721	0.203347	-0.488736	0.871968	0.690141	3.141956***	5.705271***	-11.7837***	0.102927
SMU	-0.000045	-0.01398	0.210979	0.087823	0.473595	-0.102146	-0.605392	5.089201***	2.302631**	10.67066***	0.093873

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

TABLE 13

ICAPM: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual ICAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 1997 to 30th June 2003** according to:

$$ER_{pt} = \alpha_P + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{Rf})\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, innovation in dividend yield of the index (KSE100), innovation in the term factor and the innovation in the risk free rate. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β1	β2	β3	β4	t(α)	t(β1)	t(β2)	t(β3)	t(β4)	Adj R2
BHD	-0.000784	-0.035346	-0.110333	0.398067	-0.364801	-1.458666	-1.263792	-3.092032***	14.41443	-11.88193	0.180066
BHU	0.004683	0.007521	0.434877	0.314373	-0.537813	9.635417***	0.297221	13.46953***	12.58159	-19.36027	0.277089
BLD	-0.001534	0.001376	0.060987	0.047918	-0.217943	-3.745982***	0.064557	2.242508**	2.276683	-9.313946	0.057303
BLU	-0.000738	0.011562	0.292826	0.000938	-0.340512	-1.801764*	0.542043	10.76004***	0.044519	-14.54221	0.148856
BMD	-0.001685	0.023578	0.095393	0.121695	-0.332609	-3.970941***	1.067206	3.384242***	5.578561	-13.71427	0.12083
BMU	-0.00048	0.031504	0.275125	0.060984	-0.324022	-1.158482	1.460844	9.999305***	2.863915	-13.68701	0.133081
SHD	-0.000382	0.015917	-0.136198	0.145694	0.029133	-0.979019	0.78357	-5.255235***	7.263856	1.306459	0.046025
SHU	0.000065	0.002907	0.232314	0.231843	-0.148714	0.119776	0.10327	6.468522***	8.341206	-4.812568	0.087118
SLD	0.001097	-0.02925	-0.349824	-0.284174	0.403001	1.919159*	-0.98309	-9.215481***	-9.672914	12.33867	0.153616
SLU	-0.00054	0.027399	0.369042	-0.299908	0.055913	-0.954176	0.92960	9.813902***	-10.30525	1.728105	0.113113
SMD	0.000063	0.005874	-0.190598	0.105559	0.068504	0.146151	0.26289	-6.686161***	4.784735	2.792978	0.038798
SMU	0.000625	-0.007403	0.159734	-0.013115	-0.018741	1.352431	-0.30790	5.207163***	-0.552426	-0.710041	0.018156

*** Significant at 90%**
**** Significant at 95%**
***** Significant at 99%**

SUB-SAMPLE 1: JULY 2003-JUNE 2007

TABLE 14

CAPM: Single Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual CAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 2003 to 30th June 2007** according to:

$$ER_{pt} = \alpha_p + (R_{mt} - R_f)\beta_{1t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time *t,* α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_m - R_f represents the market risk premium. The coefficient β_{1t} is the risk sensitivity of returns for market risk, $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock *i*. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1 and 2 reports the estimates of α_p and β_{1t} . Column 2 and 3 reports the *t* statistics of the estimates of α_p and β_{1t}. Whereas Column 5 reports the R^2 .

	α	β_1	$t(\alpha)$	$t(\beta_1)$	R^2
BHD	0.000080	-0.019912	0.16089	-0.591552	0.000337
BHU	0.00187	-0.01438	3.820181***	-0.434781	0.000182
BLD	0.000336	-0.039867	0.686904	-1.208079	0.001405
BLU	0.00223	-0.011463	5.015275***	-0.381621	0.00014
BMD	-0.000161	-0.017884	-0.352622	-0.581159	0.000326
BMU	0.002234	0.000145	4.720107***	0.004525	0.00002
SHD	-0.000479	0.030533	-1.227272	1.156963	0.001289
SHU	0.002639	-0.021298	5.017622***	-0.599481	0.000346
SLD	-0.00011	-0.045488	-0.197298	-1.212135	0.001415
SLU	0.002672	-0.016418	5.357849***	-0.487221	0.000229
SMD	-0.000104	0.005912	-0.273879	0.230882	0.000051
SMU	0.002059	-0.010679	5.154095***	-0.395771	0.000151

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

Table 15

Fama and French: Three Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the period 1st July 2003 to 30th June 2007 according to:

$$ER_{Pt} = \alpha_P + (R_m - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t} and β_{3t} are the risk sensitivities of returns for market risk, size and value. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3 and 4 reports the estimates of α_p, β_{1t}, β_{2t} and β_{3t}. Column 5,6 and 7 reports the t statistics of the estimates of α_p, β_{1t}, β_{2t} and β_{3t}. Whereas Column 8 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	Adj R2
BHD	-0.096902	-0.01767	-1.076676	0.099203	-1.83377	-0.6319	-17.02756***	1.692702*	0.222855
BHU	-0.037155	0.003761	-1.001877	0.213459	-0.62755	0.148611	-16.0205***	3.682693***	0.212469
BLD	-0.057472	0.000688	-1.254749	-0.606338	-1.03104	0.032279	-22.36154***	-11.65866***	0.363951
BLU	-0.023762	0.005781	-0.918313	-0.504564	-0.41379	0.271022	-16.53879***	-9.80435***	0.247257
BMD	-0.01752	0.011789	-0.948254	-0.164065	-0.31849	0.533603	-16.18261***	-3.020848***	0.201456
BMU	-0.027816	0.015752	-0.945209	-0.225317	-0.48492	0.730422	-15.39933***	-3.960558***	0.188413
SHD	-0.021957	0.007959	0.224482	0.061944	-0.36859	0.391785	4.022499***	1.197577	0.016083
SHU	-0.041194	0.001454	0.187662	0.724215	-0.70966	0.051635	2.616966***	10.89627***	0.102773
SLD	-0.001603	-0.01463	0.047405	-0.838938	-0.02665	-0.49155	0.633273	-12.09169***	0.124636
SLU	-0.044003	0.0137	0.010284	-0.95134	-0.79034	0.46480	0.159812	-15.94984***	0.196694
SMD	-0.090672	0.002937	0.056088	-0.124182	-1.4605	0.131445	1.029928	-2.460296***	0.003622
SMU	-0.0612	-0.0037	0.109859	-0.059321	-1.02214	-0.15395	1.912402*	-1.114143	0.00165

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

TABLE 16

Momentum: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual Fama and French three factor regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 2003 to 30th June 2007** according to:

$$ER_{Pt} = \alpha_P + RP_t\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + (UMD)\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, size, value and momentum premium. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	β_4	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	$t(\beta_4)$	Adj R2
BHD	-0.013858	-0.014813	-1.006309	0.17282	-0.574011	-0.466637	-0.514900	-16.27413***	3.007714***	-8.305638***	0.270755
BHU	-0.011417	-0.010443	-1.07366	0.13836	0.585561	-0.388708	-0.367823	-17.59361***	2.43991**	8.585122***	0.264159
BLD	-0.016897	-0.017235	-1.229853	-0.580292	-0.203082	-0.64115	-0.656919	-21.80934***	-11.07416***	-3.222164***	0.369665
BLU	0.006689	0.007137	-0.951369	-0.539147	0.269646	0.256483	0.276027	-17.11821***	-10.43979***	4.341006***	0.260015
BMD	-0.00701	-0.007713	-0.896401	-0.109817	-0.422985	-0.254697	-0.285830	-15.45477***	-2.037526**	-6.524861***	0.232294
BMU	0.012346	0.012784	-0.977511	-0.25911	0.263494	0.428251	0.446367	-15.87921***	-4.529667***	3.829692***	0.19899
SHD	0.030885	0.029985	0.158157	0.131333	-0.541038	1.17831	1.186519	2.911705***	2.602001***	-8.911957***	0.085385
SHU	-0.0387	-0.037601	0.106684	0.639496	0.660569	-1.14901	-1.153606	1.522826	9.823435***	8.436354***	0.159742
SLD	-0.027357	-0.028616	0.140238	-0.741816	-0.757275	-0.778093	-0.847077	1.931371**	-10.99437***	-9.331242***	0.191844
SLU	0.004475	0.005842	0.090458	-1.056736	0.821792	0.148059	0.206378	1.486764	-18.69118***	12.08491***	0.295432
SMD	0.009079	0.008109	0.01538	-0.049414	-0.582986	0.354954	0.331639	0.292629	-1.011797	-9.924671***	0.089402
SMU	-0.008531	-0.008003	0.148789	-0.100049	0.317562	-0.316176	-0.299953	2.594676***	-1.877586*	4.954821***	0.023861

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**

TABLE 17

ICAPM: Four Factor Regressions on 12 Portfolios Sorted for Size, Book and Momentum

This table reports the results of individual ICAPM regressions on 12 size, book-to-market and momentum sorted portfolios for the **period 1st July 2003 to 30th June 2007** according to:

$$ER_{pt} = \alpha_P + (R_{mt} - R_f)\beta_{1t} + (\hat{u}_{divYld})\beta_{2t} + (\hat{u}_{term})\beta_{3t} + (\hat{u}_{Rf})\beta_{4t} + \in_t$$

Where ER_{pt} is the excess return of the portfolio in time t, α_p is the average of all individual alphas of the stocks included in the portfolio. α_p is the intercept of the regression equation representing the non-market return component, R_{mt} - R_f represents the market risk premium. The coefficients β_{1t}, β_{2t}, β_{3t} and β_{4t} are the risk sensitivities of returns for market risk, innovation in dividend yield of the index (KSE100), innovation in the term factor and the innovation in the risk free rate. $\in_t$ represents the error term which is the random return component due to unexpected events related to a particular stock i. For the purpose of simplification, it is assumed that $\in_t$ has a multivariate normal distribution and is independently and identically distributed over time. Column 1, 2, 3, 4 and 5 reports the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Column 6, 7 and 8 reports the t statistics of the estimates of α_p, β_{1t}, β_{2t}, β_{3t} and β_{4t}. Whereas Column 9 reports the $Adj\ R^2$.

	α	β_1	β_2	β_3	β_4	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	$t(\beta_4)$	Adj R2
BHD	0.001992	-0.012488	-0.064993	0.257047	-0.415618	3.929684***	-0.394023	-2.009826**	6.763604***	-10.5669***	0.114433
BHU	0.003965	-0.00822	0.129731	0.236659	-0.541975	8.202324***	-0.272012	4.207152***	6.530389***	-14.45048***	0.165719
BLD	0.001295	-0.030859	0.022528	0.012501	-0.394139	2.605763***	-0.993126	0.710536	0.335498	-10.22068***	0.114911
BLU	0.002661	-0.006241	0.139502	-0.071183	-0.300248	5.806543***	-0.217872	4.772829***	-2.072263**	-8.445668***	0.091286
BMD	0.001235	-0.010105	-0.036615	0.143055	-0.376732	2.654756***	-0.347614	-1.234465	4.103911***	-10.44274***	0.108345
BMU	0.003411	0.006133	0.124482	0.065628	-0.410791	7.052982***	0.20286	4.035424***	1.810263*	-10.94875***	0.107053
SHD	0.000178	0.034108	-0.053906	0.084626	-0.149319	0.427326	1.309987	-2.029084**	2.710458***	-4.621042***	0.028377
SHU	0.003754	-0.021892	0.085125	0.18501	-0.191745	6.705508***	-0.625579	2.383982**	4.408736***	-4.415003***	0.028157
SLD	-0.001506	-0.042412	0.086177	0.294125	0.162499	-2.573979***	-1.159764	2.30953**	6.707132***	3.580493***	0.052414
SLU	0.000958	-0.016222	0.257841	0.440333	0.04279	1.916514**	-0.519373	8.090484***	11.75647***	1.103882	0.141778
SMD	-0.000116	0.009149	0.112453	0.015809	-0.009074	-0.285841	0.361197	4.351000***	0.520477	-0.288668	0.022293
SMU	0.00216	-0.007829	0.05241	0.05361	-0.129445	5.059313***	-0.293388	1.924978**	1.675422*	-3.908888***	0.023001

*** Significant at 90%**

**** Significant at 95%**

***** Significant at 99%**