Systematic Risks and Asset Pricing

An Integrated Multifactor Model for Asset Pricing
In Pakistani Equity Market

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Abstract

This study examines the asset pricing mechanism in Pakistani equity market for the period 6/1998 to 6/2008 under general equilibrium framework and proposes an efficient multifactor model for asset pricing. CAPM Tests indicate that historical beta is unable to predict expected returns. However, market risk premium is priced and has significant positive relationship with returns. Size, book to market, illiquidity and P/E ratio factors are priced by market. However, momentum factor is not priced by market. Small stocks earn higher return in comparison to big stocks. Small P/E stocks earn higher return in comparison to high P/E stocks. High B/M stocks earn higher return in comparison to low B/M stocks. In Pakistan, high turnover stocks earn more than low turnover stocks. So it can be concluded that value stocks in general outperform growth stocks. Fama and French's Three Factor model is valid model and size and value premium have significant positive relationship with equity returns. Its explanatory model is 15% higher than conventional CAPM. Carhart's Four Factor model does not provide additional insight as momentum factor is not priced. The proposed liquidity based Four Factor model reveals that illiquidity factor can explain the equity returns and high liquidity stocks earn more than low liquidity stocks. It means Pakistani investors prefer liquidity. Proposed Five Factor model extends Carhart's Four Factor model by considering illiquidity premium and it confirms the presence of significant negative relationship between ILLIQP and equity returns. The explanatory power of the model touches 80% in this case. The proposed Six Factor model further extends Five Factor model by adding P/E premium and reports that P/E premium has significant positive relationship with equity returns but

does not add value to model. The comparison of explanatory powers of models reveals that Five Factor model best explains the returns in Pakistani equity market.

This study also provides evidence about existence of long term causal and dynamic relationship between macroeconomic variables and equity returns by using multivariate cointegration analysis. Unidirectional causality is also observed flowing from X Rate, T Bill, Money Supply, and CPI to equity market returns. However, no Granger Causality is observed in industrial production and equity market returns. ARDL Approach also confirms that industrial production, oil prices, inflation and foreign portfolio investment are not found statistically significant while interest rates, exchange rates and money supply have significant long run effect on equity prices. The error correction model based upon ARDL approach also reports the same behavior in short term. It is worth mentioning that foreign portfolio investment is not significant in long term but it is statistically significant in short term. Study further indicates that adjustment process is quite fast and 39% of the disequilibrium in equity prices from its equilibrium path is corrected in subsequent time period.

List of Research Papers

- "An Empirical Investigation of the Causal Relationship among Monetary Variables and Equity Market Returns " *Lahore journal of economics* 14 : 1 (Summer 2009): pp. 115-137

- "Macroeconomic Factors and Equity Prices *An empirical investigation by using ARDL Approach "Pakistan development review 47(4) 2008 :pp501-513*

- "Impact of Ownership Structure and Corporate Governance on Capital Structure of Pakistani Listed Companies" *International Journal of Business and Management Vol 4 No 2 Feb 2009 pp 50-57*

- "Macroeconomic influences and equity market returns: *A study of an emerging equity Market" Journal of economics and Economic education research* 10(2) 2009 pp 47-68

- "Long-Run Relationships between an Emerging Equity Market and Equity Markets of the Developed World An Empirical Analysis of Karachi Stock Exchange", *International Research Journal of Finance And Economics, vol 16 June 2008*

- "Testing of Random Walks and Market Efficiency in an Emerging Market- An empirical Analysis of Karachi Stock Exchange*", Business Review Cambridge; Dec 2007 Vol 9 pp 271-281.*

- "Impact of Macroeconomic Announcements on the Stock Prices: An Empirical Study on the Pakistani Stock Market" *Business Review Cambridge; Dec 2007 Vol 9 pp 281-290*

- "Corporate Governance and Earnings Management -An Empirical Evidence Form Pakistani Listed Companies" *European Journal of Scientific Research* Vol.26 No.4(2009), pp.624-638

- "Role of Trade, External Debt, Labor Force and Education in Economic Growth empirical evidence from Pakistan by using ARDL Approach*" European Journal of Scientific Research, Vol. 20 July 2008*

- "Human capital, Exports and Economic Growth: A causality analysis 1975-2005" *Business Review Cambridge* Vol 11 2008

- "Causal and Dynamic relationship among South Asian Equity Markets" *Jinnah Business Review* VOL1, 2008

- "Corporate governance and firms performance" *Business Review Cambridge* Vol 10, 2008

- Testing CAPM and Conditional CAPM –An evidence from emerging market *International Journal of Economics and Finance* (accepted)
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Conference papers

- "Macro Economic Influences and Equity Market Returns" at Ist GBA conference held at Houstan USA in 2009

- "Macro Economic Influences and Equity Market Returns" at 24th annual conference of Pakistan Society of Development Economics held at Islamabad in 2009

- "Dynamic Linkages between Oil Price Shocks and Equity Markets of Asia Pacific Rim" at International Business & Economics Research Conference Las Vegas 2008

- "Stock price volatility in Pakistani stock markets " in a seminar conducted by Association of Management Development Institution of Pakistan in 2005

- "Earning management" at seminar conducted at APCOMS in 2006

Research Papers under review

- "Impact of Gold and Oil Prices on Stock Market Indices"

- "Accounting and Valuation of Redeemable Capital –an Islamic Perspective"

- "Illiquidity premium and equity returns"

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List of Abbreviations

APT	Arbitrage Pricing Theory
ARDL	Autoregressive Distribution Lag
BMR	Book to Market Ratio
CAPM	Capital Asset Pricing Model
CCAPM	Conditional Capital Asset Pricing Model
CPI	Consumer Price Index
CRR	Chen, Roll and Ross
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
ECM	Error Correction Model
EPS	Earning per Share
FER	Foreign Exchange Rate
FPI	Foreign Portfolio Investment
HML	High minus Low
ICAPM	Intertemporal Capital Asset Pricing Model
IIP	Index of Industrial Production
ILLIQP	Illiquidity Premium
KSE	Karachi Stock Exchange
M_1	Narrow Money
M_2	Broad Money
MKT	Market
MOM	Momentum

MVT	Mean Variance Theory
P/E Ratio	Price Earning Ratio
SMB	Small minus Big
TB	T Bill Rate
VAR	Vector Autoregressive
VECM	Vector Error Correction Model

Chapter 1

INTRODUCTION

1.1 Introduction

During the last 60 years finance has emerged as a complete science. It is based on theories that can generate meaningful and persuasive results about observed events. Modern finance is based on seven seminal and internally consistent theories which include (i) Utility Theory, (ii) State Preference Theory, (iii) Mean-Variance Theory, (iv) Capital Market Theory, (v) Arbitrage Pricing Theory, (vi) Option Pricing Theory, and(vii) Miller and Modigliani theorems. Utility theory provides the basis for resource allocation in the presence of risky alternative. It tries to answer the question," *How do people make choices*?" Other theores such as the State Preference Theory, Mean Variance Theory, Capital Market Theory, Arbitrage Pricing Theory, and Option Pricing Theory focus on describing the objects of choices. Miller and Modigliani study the effect that method of financing has on the value of a firm. When theory of choice is integrated with object of choice, it facilitates the process of valuation of risky securities. Therefore, an efficient pricing mechanism of securities may help in efficient allocation of resources in the economy.

Research in financial economics has historically been focused on the behavior of asset returns, and especially the forces that determine the prices of risky assets. There are number of competing theories of asset pricing. These include the capital asset

pricing models (CAPM) of Sharpe (1964), Lintner (1965), and Black (1972), the intertemporal models of Merton (1973), Rubinstein (1976), and Cox (1985), and the arbitrage pricing theory (APT) of Ross (1976). The capital asset pricing model (CAPM) is the dominant asset pricing model in the literature. However, some multi-factor asset pricing models have also been discussed in literature.

The importance of asset pricing attracts the attention of academicians at the begning of second half of last century; it is the time when Markowitz (1952) and Tobin (1958) are working on portfolio structure and valuation of firms. The historical break through is the publication of the Markowitz article on Portfolio Selection in 1952 that transforms the entire finance theory. Markowitz's model of portfolio choice (1958) lays down the foundations of the capital asset pricing model. The capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965) marks the birth of asset pricing theory. The capital asset pricing theory is based on mean variance analysis and analyzes the process of construction of efficient portfolios by investors. The arbitrage pricing theory (APT) does not deal with the issue of portfolio efficiency but it assumes that equity's return depends partly on macroeconomic influences and partly on noise. The APT has been empirically studied in several markets. Antoniou (1998) uses the APT to identify the factors that influence asset returns and asset prices in the London Stock Exchange. Dhankar & Esq (2005) applies it to the Indian stock market, Berry (1988) examines S&P 500 by using APT. The New York Stock Exchange, Japanese stock market, and Russian stock market have also been examined by Chen (1986), Azeez & Yonezawa (2003), and Anatolyev (2005) through APT. Nawazish

and Saima (2008) use the Fama and French three factor model to see its applicability in the Pakistani equity market.

Since the inception of the Capital Asset Pricing Model by Sharpe (1964), Lintner (1965), and Mossin (1966), many anomalies have been identified in CAPM. Basu (1977, 1983) finds high earning-to-price (E/P) ratio companies outperform low earning-to-price (E/P) ratio companies. Banz(1981) finds small stocks outperform large stocks. Stattman (1980), Rosenberg, Reid, and Lanstein (1985)find that companies with high book-to-market-value (B/M) out perform companies with low book-to-market-value (B/M). Jacobs and Levy (1988) report that high cash-to-price (CF/P) ratio companies outperform low cash-to-price (CF/P) ratio companies. Jegadeesh and Titman (1993, 2001) report that stocks with high returns in the past (the winners) outperform the stocks with low returns (the losers) over a 12 month period.

These CAPM anomalies have motivated the development of a number of alternative theoretical models like the Arbitrage Pricing Theory (APT) proposed by Ross (1976). However, the APT does not specify the names and number of factors. In the spirit of the Arbitrage Pricing Theory, Fama and French (1993, 1996) propose their famous Three Factor model. The model includes market premium, value premium, and size premium that explain anomalies related to the B/M ratio and size. Carhart (1997) expands the Fama and French model by adding momentum that address the CAPM anomalies related to the price momentum effect.

These factors have been examined in various markets of the world but no in-depth study exists for the Pakistani equity market. The Pakistani equity market is of special interest for several reasons. Pakistan is an important emerging market of south Asia and is located at cross roads of central Asia, Middle East, and emerging giants India and China. Its geopolitical situation, suggests that it has a great potential for economic growth and it can become the hub of economic activities if it achieves political stability and allocates it resources optimally. The increasing role of the equity markets in the economy has always attracted the researcher to investigate the relationship between pricing mechanism and resource allocation. An efficient performance of pricing mechanism of stock market is a driving force for channeling saving into profitable investment and hence, facilitate in an optimal allocation of capital. Therefore, pricing mechanism ensures a suitable return on investment and exposes viable investment opportunities to the potential investors. Thus, in equity market, the pricing function has been considered important and remained a subject of extensive research. Secondly, the Pakistani equity market is one of the rapidly growing markets so it is desirable to be able to apply this widely accepted factor approach to the Pakistani equity market. Thirdly, Fama and French (1998), and Griffin (2002) report that size, value, and momentum factors are country-specific and application of international factors to individual countries may lead to inadequate results. Therefore, it becomes important to explore the factors priced by Pakistani equity market.

Despite the number of studies on identification of factors that explain equity returns and lead to anomalies in the Capital Asset Pricing Model, there is no in-depth study known to examine the combined effect of all these factors in one asset pricing model. To the best of my knowledge, this study is the pioneering effort that analyses these risk factors simultaneously for the Pakistani equity market by constructing and investigating monthly factor premiums for the period 7/1998 to 6/2008.

Similarly, asset prices respond to economic information. Sometimes macroeconomic events affect asset prices significantly, and other times we see that macroeconomic changes do not have significant affect. Therefore, it, becomes necessary to identify those economic factors that have significant effects on the asset pricing mechanism. A variety of macroeconomic variables have been successfully used as pricing factors in empirical asset pricing models. These include, the term spread, the default spread, IP growth, CPI growth (Chen, Roll, and Ross (1986)), labor income growth (Jagannathan and Wang (1996)), the dividend yield, the short rate (Campbell (1996)), returns to physical investment (Cochrane (1996)), and the log consumption-wealth ratio (Lettau and Ludvigson (2001)). This evidence suggests that macro variables of different economic categories contain information useful for pricing the cross-section of equity.

This study is also an effort to examine the relationship between macroeconomic factors and asset pricing dynamics in the Pakistani equity market.

1.2 Research Questions

There are five main questions that need detailed empirical examination in the context of the Pakistani equity market

- Whether existing asset pricing models are appropriate for valuation of equity in the Pakistani equity market?
- What kind of company specific risk factors influences the equity returns of the Pakistani capital market?
- Do value stocks outperform growth stocks in the Pakistani equity market?
- What kind of macroeconomic variables affect asset prices in the Pakistani equity market?
- What should be an appropriate model for asset pricing in the Pakistani equity market on the basis of its unique risk characteristics and macro economic dynamics of the economy?

1.3 Objectives of Study

The first objective of this study is to assess the pricing ability of the existing models which include CAPM, Fama and French Three Factor Model and Carhart Mode and develop an efficient multifactor model for asset pricing in Pakistan.The role of macroeconomic factors in determination of asset prices cannot be denied so this study also examines the impact of macroeconomic variables on asset prices. . Specifically, the following objectives of study are identified.

- To test the capital asset pricing model in the Pakistani Equity Market and explore its anomolies
- To identify the factors that influence equity prices at Karachi stock exchange.
- To test Arbitrage Pricing Theory by using the Fama and French Three Factor Model.
- To test Arbitrage Pricing Theory by using the Carhart Four Factor Model.
- To test the multifactor model based on the macroeconomic variables
- To develop and test an integrated asset pricing mechanism that captures various dimensions of asset pricing dynamics

This study explores the field of asset pricing in the context of the Pakistani market. The emphasis is on the interplay between theory and empirical work. Theorists develop models with testable predictions, while empirical researchers document "puzzles" this process stimulates the development of new theories. This process is part of the normal development of any science. Asset pricing faces one special challenge. Here, data is generated naturally rather than experimentally so researchers cannot control the quantity of data or the random shocks that affect the data. An integrated multifactor model consisting of company characteristic and macroeconomic variables is designed by using multivariate regression analysis and cointegration analysis. This model not only prices the assets efficiently, but also helps to resolve the anomalies like value effect, size effect, momentum effect, and liquidity effect of equity pricing.

1.4 Limitation of study

The scope of the study is limited to Pakistan, which is an emerging south Asian market and results are not compared with other emerging markets. Another limitation of the study is data constraint, as long term data needed for the study is not available electronically. Hence, the study period is limited to 10 years. This limitation put constraint on the selection of statistical analysis and the ability to perform a more in-depth analysis, such as time varying behaviour of CAPM anomalies.

1.5 Contribution of Study

This study contributes in many directions. First of all, it identifies factors that affect equity returns in Pakistan. The relationship between equity returns and factors like price earning ratio , momentum, and illiquidity have never been investigated in Pakistan. This study, therefore, contributes by examining whether the six factors – market premium, P/E premium, value premium, size premium, illiquidity premium, and momentum can be incorporated into the multifactor model to improve the explanatory power of the asset pricing model.

In Pakistan, only two studies have been conducted to test the Fama and French Three Factor Model. This is the first study that explores a range of factors that can explain cross-section of equity returns. Internationally, empirical studies look at these factors separately but none has attempted to incorporate all these factors into an asset pricing model. Basu (1977, 1983) studies the role E/P ratio , Banz(1981) explores the role of size , Stattman (1980) investigates the role of B/M ratio, Jacobs and Levy (1988)

investigates the role of CF/P ratio in explaining cross sectional returns.Fama and French (1992, 1993) consider size and book to market ratio simultaneously whereas Carhart(1997) exmines four factors.

This study compares the performance of value stocks versus growth stocks in Pakistan. This is important not only from the theoretical perspective, but it also has practical implications for investors in the Pakistani market.

The study tests the performance of existing models like the CAPM, the Fama and French Three Factor model, and the Carhart's Four Factor model and compares it with proposed new models. Finally, the study recommends the most appropriate model for asset pricing in the Pakistani equity market.

1.6 Organization of study

Chapter 1 lays down foundation of the study. It introduces the research topic, identifies the research questions, sets objectives of study, and explains the significance of the study along with its limitations.

Chapter 2 incorporates the overview of theoretical background of asset pricing framework and various models developed. Special focus is on general equilibrium models.

Chapter 3 presents the literature review starting from applicability of CAPM followed by findings of the CAPM anomalies. Evidence of interaction among various anomalies has also been explored.

Chapter 4 deals with data description and methodology. It provides details of data used in the study and explains the methodology for formation of portfolios and construction of variables. It also explains the regression models, and statistical tests to evaluate the regression results. The steps taken to minimize potential biases are also discussed.

Chapter 5 consists of a detailed data analysis and discussion on empirical findings of the study.

Chapter 6 concludes the results and throws light on policy implications of the study and opens the avenues for further research.

Chapter 2

THEORETICAL BACKGROUND

During the last 50 years, theoretical and empirical developments in asset pricing have taken place within a well-established paradigm. This paradigm assumes that financial asset markets do not permit the presence of arbitrage opportunities to make risk less profits on an arbitrarily large scale.

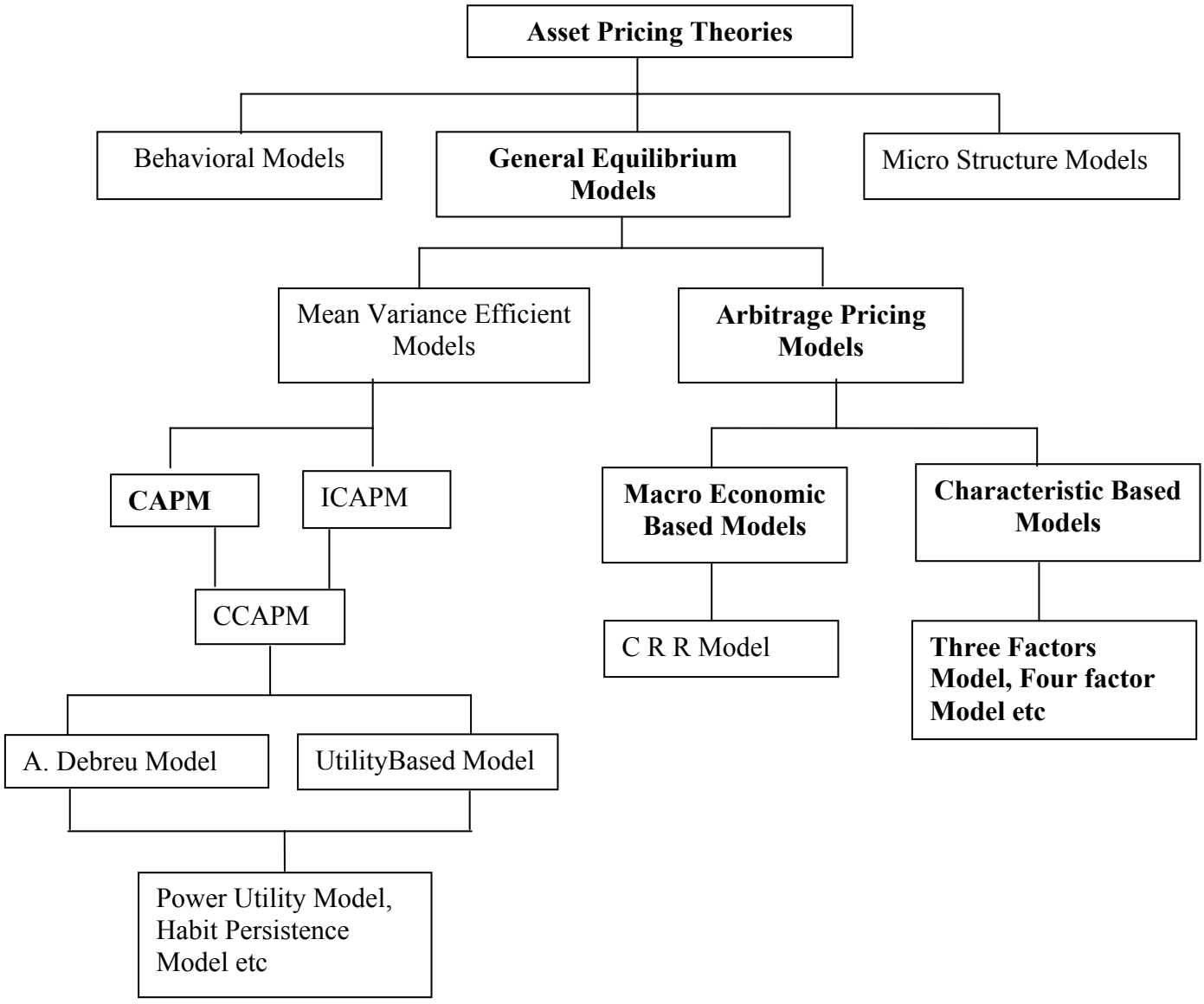
If we examine the taxonomy of asset pricing theories we can find various asset pricing models are being used to estimate equity returns. These asset pricing models can be divided into three main groups:

- General Equilibrium Models
- Behavioral Models
- Micro Structure Models

General equilibrium models of asset prices usually have a limited choice of factors and parameters. These factors are more restricted and do not have the same interpretation. These models assume that investors are concerned with future consumption, and in particular, consumption in the next period. Under general equilibrium framework , different theories have been proposed ranging from Mean Variance Theory to Arbitrage Pricing Framework. An overview of various theories that offer multidimensional explanations to asset pricing mechanism is presented below.

Fig. 1

Taxonomy of Asset Pricing



2.1 General Equilibrium Models

2.1.1 Mean Variance Theory

Markowitz (1952) and Tobin (1958) lay down the foundations for the development of asset pricing models. Early theories suggest that the risk of an individual security is the standard deviation of its returns. Thus, the larger the standard deviation of security returns the greater the risk. However, an investor is more concerned with the risk and return of an entire portfolio, which consists of numerous securities. Markowitz (1952) observes that (i) when two risky assets are combined their standard deviations are not additive, provided the returns from the two assets are not perfectly positively correlated and (ii) when a portfolio of risky assets is formed, the standard deviation risk of the portfolio is less than the sum of standard deviations of its constituents. It is worth mentioning that the standard deviation of the portfolio will be less than the smallest individual standard deviation when the correlation coefficient is negative and $-1 < r < +1$ Markowitz develops a specific measure of portfolio risk and derives the expected return and risk of a portfolio. The Markowitz model generates the efficient frontier of portfolios. This frontier consists of set of optimal portfolios.

It is quite logical, that individuals will prefer to increase their wealth, and also to minimize the risk associated with any potential gain. But could these two criteria be combined? Markowitz considers and rejects the idea that there might be a portfolio which gives both the maximum expected return and the minimum variance. He

explains that, "*the portfolio with maximum expected return is not necessarily the one with minimum variance. There is a rate at which the investor can gain expected return by taking on variance, or reduce variance by giving up expected return*".

In Markowitz's model, an investor selects a portfolio at time t-1 that produces a stochastic return at t. The model assumes investors are risk averse, and, when choosing among portfolios, they care only about the mean and variance of their one-period investment return. As a result, investors choose "*Mean-Variance-Efficient*" portfolios, the main features of these portfolios are:

- Minimize the variance of portfolio return, given expected return, and
- Maximize expected return, given variance.

Thus, the Markowitz approach is often called a "mean-variance model." Tobin (1958) moves one step further by showing how to identify which efficient portfolio should be held by an individual investor. He considers how an investor should divide his or her funds between a safe liquid asset and a risky asset . He shows that *"the proportionate composition of the non-cash assets is independent of their aggregate share of the investment balance. This fact makes it possible to describe the investor's decisions as if there was a single non-cash asset, a composite formed by combining the multitude of actual non-cash assets in fixed proportions."*

2.1.2 Capital asset pricing model

The Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner 1965) is considered to be the origin of asset pricing theory. The Capital Asset Pricing Model suggests that securities are priced so that the expected returns will compensate investors for the risks assumed. CAPM is the most widely used model in real life applications, such as estimating the cost of capital for firms, evaluating the performance of portfolios and evaluating mergers and acquisitions. It has been, a centerpiece of asset pricing since its inception. The CAPM builds on the model of portfolio choice developed by Markowitz(1959). The Markowitz Portfolio model provides an algebraic condition on asset weights in mean variance efficient portfolios. The Capital Asset Pricing Model transforms the algebraic statement into a testable prediction about the relation between risk and expected return. This objective is achieved by identifying a portfolio that must be efficient.

The CAPM model is the first successful attempt to show how to:

- assess the risk of the cash flow from a potential investment project,
- estimate the project's cost of capital
- estimate the expected rate of return that investors will demand if they are to invest in the project.

CAPM can be explained in three simple steps. The first step would be defining risk in CAPM. Then we divide the risk between market risk /systematic/non diversifiable

risk and firm specific /diversifiable/unsystematic risk. The measure used to quantify market risk is known as “beta”. The beta is then incorporated in the model to get the hurdle rate.

$$E(Ri) = RFR + \beta(RM - RFR) + \varepsilon$$

The above equation explains investor returns as the sum of:

- The zero risk return
- The market premium
- A return for individual security risk proportional to its volatility relative to the market (β)
- Random Error

The Capital Asset Pricing Model is based on the following two fundamental relationships:

- The capital market line
- The security market line

The capital market line (CML) specifies the return an individual investor expects to receive on a portfolio. The linear relationship between risk and return on efficient portfolios is as follows.

$$E(Ri) = R_f + \sigma_P (R_m - R_f)/\sigma_m$$

The security market line (SML) expresses the return an individual investor can expect in terms of a risk-free rate and the relative risk of a security or portfolio

$$E(Ri) = R_f + \beta\ (R_m - R_f)$$

CAPM is one of the most debated topics of finance and has faced a lot of criticism. CAPM has been criticized since its inception.

The number of anomalies has been identified in the capital asset pricing model. These are divided into two major categories.

- Fundamental anomalies
- Calendar anomalies

The fundamental anomalies include P/E premium, size premium, value premium, dividend premium, liquidity premium, etc. The calendar anomalies include day of the week effect, week of the month effect, month of the year effect , January effect, Ramadan effect, Eid effect, etc.

The first blow to the Capital Asset Pricing Model is Basu's (1977) evidence that for P/E sorted portfolios , expected returns on high E/P stocks are higher than predicted by the CAPM. Banz (1981) documents a size effect that reports that average returns on small stocks are higher than predicted by the CAPM. Bhandari (1988) finds that high debt-equity ratios are associated with returns that are too high relative to their market betas. Statman (1980) and Rosenberg, Reid, and Lanstein (1985) document

that stocks with high book-to-market equity ratios have high average returns that are not captured by their betas.

The contradictions of the CAPM summarized above suggest that earnings-price, debt-equity, and book-to-market ratios indeed play this role. Fama and French (1992) also confirms the evidence that the relationship between average return and beta for common stocks is flatter after the sample periods used in the early empirical work on the CAPM. The synthesis of the evidence on the empirical problems of the CAPM provided by Fama and French (1992) serves as a catalyst, marking the point when it is generally acknowledged that the CAPM has potentially fatal problems. On the other hand Kothari, Shanken, and Sloan (1995) try to revive the CAPM by arguing that the weak relation between average return and beta is not due to fundamental problems. Some other finds that problems of CAPM are the result of data dredging.

2.1.3 Intertemporal Capital Asset Pricing Model (ICAPM)

Merton's (1973) Intertemporal Capital Asset Pricing Model is a logical extension of the CAPM. The Intertemporal Capital Asset Pricing Model has different assumptions about investor objectives. In the CAPM, investors focus only on the wealth at the end of the current period. In the ICAPM, investors are concerned not only about end of period wealth but also expected opportunities regarding consumumption or investment of the payoffs. Thus, ICAPM investors are not only concerned about current wealth but also consider how their wealth may vary with future state

variables. These variables include labor income, the price of consumption goods, and the nature of portfolio opportunities, and expectations about the labor income, consumption, and investment opportunities.Like CAPM investors, ICAPM investors prefer high expected return and low return variance. But, ICAPM investors are also concerned with the covariance of portfolio returns with state variables. As a result, optimal portfolios are "multifactor efficient".

2.1.4 The Arbitrage Pricing Theory (APT)

The Capital Asset Pricing Model provides a structured and attractive explanation of the relationship between risk and expected return; however, a number of empirical anomalies still exist which compelled the financial economists to seek other answers. Ross (1976) subsequently devises an alternative asset pricing model known as arbitrage pricing theory (APT) that makes fewer assumptions than the CAPM and does not specifically require the designation of a market portfolio. Instead, the APT assumes that expected security returns are related in a linear fashion to multiple common risk factors.

The main difference between the CAPM and the APT is that the latter specifies several risk factors, thereby allowing for a more expansive definition of systematic investment risk than that implied by the CAPM's single market portfolio.

$$Ri = \lambda_0 + b_{i1}\lambda_1 + b_{i2}\lambda_2 + \ldots + b_{ik}\lambda_k + \varepsilon_i \qquad \text{for } i = 1 \text{ to } n$$

Where b_{ik} is the sensitivity of asset i's returns to movements in a common risk factor j. $\lambda_{k.}$ λ_k is a set of common factors with a zero mean that influences the returns on all assets and ε_i is an error term.

The Arbitrage Pricing Theory of Ross (1976) postulates that the cross sectional distribution of expected returns of financial assets can be approximately measured by their sensitivities to k unknown economic factors. These sensitivities are called factor loadings. Chamberlain and Rothschild (1983) extend the Arbitrage Pricing Theory of Ross (1976)) and hypothesize that the mean returns are approximately linear functions of the factor loadings. This leads to a unique approach often known as principal components analysis. This approach indicates that when κ eigenvalues of the population covariance matrix increase without bound as the number of securities in the population increases, elements of the corresponding κ eigenvectors of the covariance matrix can be treated as the factor sensitivities.

A wide variety of factor models are currently in use. These models differ primarily in how they define the risk factors and can be grouped broadly into those models that use macroeconomic factor definitions and those that specify microeconomic factors. The Arbitrage Pricing Theory of Ross (1976) provides a theoretical framework to determine the expected returns on stocks, but it neither specifies the number of factors nor their identity. Hence, the implementation of this model follows two avenues: factors can be extracted by means of statistical procedures, such as factor analysis or

principal component analysis, or be pre-specified using mainly company specific or macroeconomic variables.

APT is considerably newer than the CAPM but it has undergone numerous empirical studies. Multifactor models of risk and return attempt to bridge this gap between theories and practice by specifying a set of variables that are thought to capture the essence of the systematic risk exposures that exist in the capital market. During the last two decades, the number of alternative risk factors have been suggested and tested by financial researchers. An equally successful second approach to identifying the risk exposures in a multifactor model has focused on the characteristics of the securities themselves. Some authors have focused on firm specific characteristics as risk factors. Fama and French's (1992) Three Factor Model, Carhart's (1993) Four Factor Model and Barra's(1997) Model fall in this category.

Other studies have directly linked asset returns to macroeconomic variables like unexpected inflation, changes in consumer confidence, unanticipated shifts in the yield curve, or unexpected changes in real GDP. These variables are studied on the basis of exposure of assets to different sources of fundamental risk as the reason for return differences. Chen, Roll, and Ross (1986) study one such model by hypothesizing that security returns are governed by a set of economic factors that include market return, industrial production, inflation, term structure of interest rate, and credit spread. Burmeister, Roll, and Ross(1994) analyze the predictive ability of a model based on a different set of macroeconomic factors, which include confidence

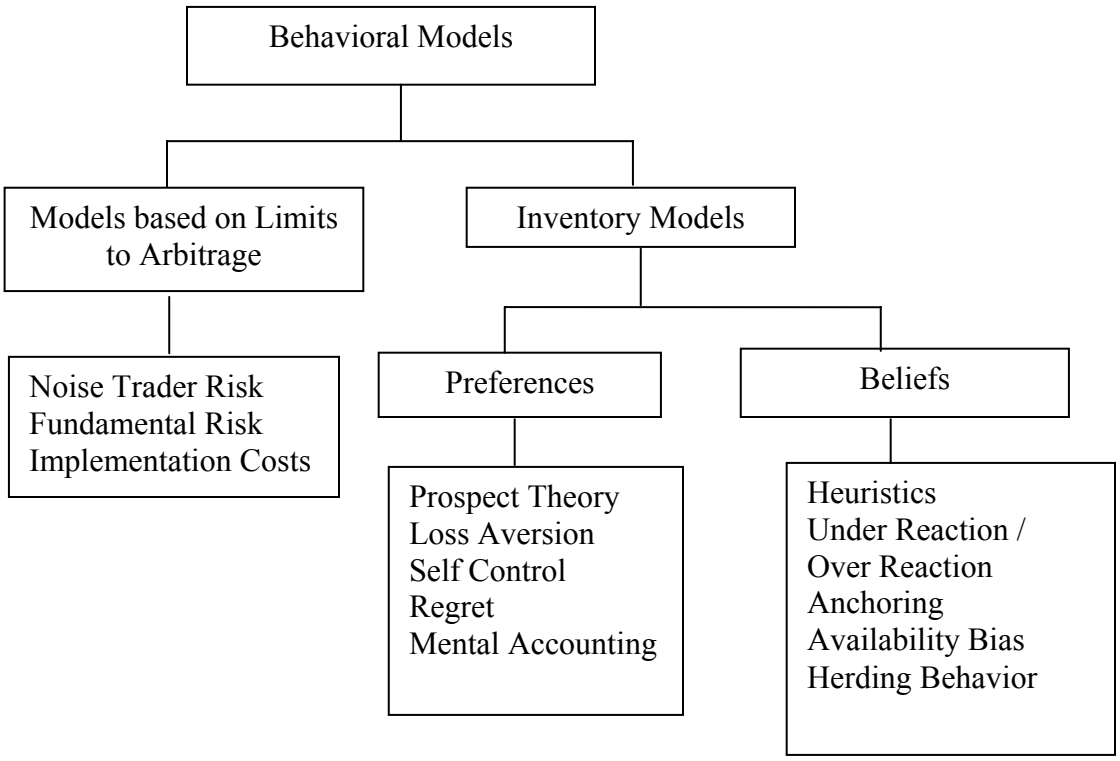
risk, time horizon risk, inflation risk, business cycle risk, and market-timing risk. One immediate advantage of this specification is that it accounts directly for some of the anomalies that plagued the CAPM take the small firm effect for example. Another advantage of the characteristic-based approach to forming factor models is the flexibility to modify the equation to changing market conditions. For instance, the Fama-French model has been expanded to include a factor accounting for stock return momentum, while the BARRA model incorporates almost 70 different risk and industry factors.

2.2 Behavioral Models

Multifactor models are successful in explaining certain anomalies but still there are issues which are unexplained .Behavioral finance deals with effects of psychology on financial decision making and financial markets. Many studies try to explain anomalies by considering the investor behavior and stock market microstructure. Different methods are used to capture the impact that behaviors have on asset pricing decision. These models are divided into two broader categories (i) models based on limits to arbitrage; and (ii) models based on human psychology.

Fig. 2

Behavioral Models



Proponents of behavioral asset pricing emphasize that asset prices reflect their sentiments which are beliefs about future cash flows and risks. Models based on psychology are further divided into models based on preference and models based on beliefs. These models are generally subjective and use indirect measures as proxy for sentiments. These measures include closed-end fund discounts, odd-lot sales, and mutual fund redemptions. Gemmill and Thomas (2002); Shleifer and Summers (1990); DeLong, Shleifer, Summers and Waldman (1990); and Lee, Shleifer and Thaler (1991) use these measures to examine investor sentiments. Bandopadhyaya (2006)states investor sentiment has become the focus of many studies on asset

pricing. Research has demonstrated that changes in investor sentiment may trigger changes in asset prices, and that investor sentiment may be an important component of the market pricing process. Some authors suggest that in some instances, shifts in investor sentiment may better explain short-term movement in asset prices.

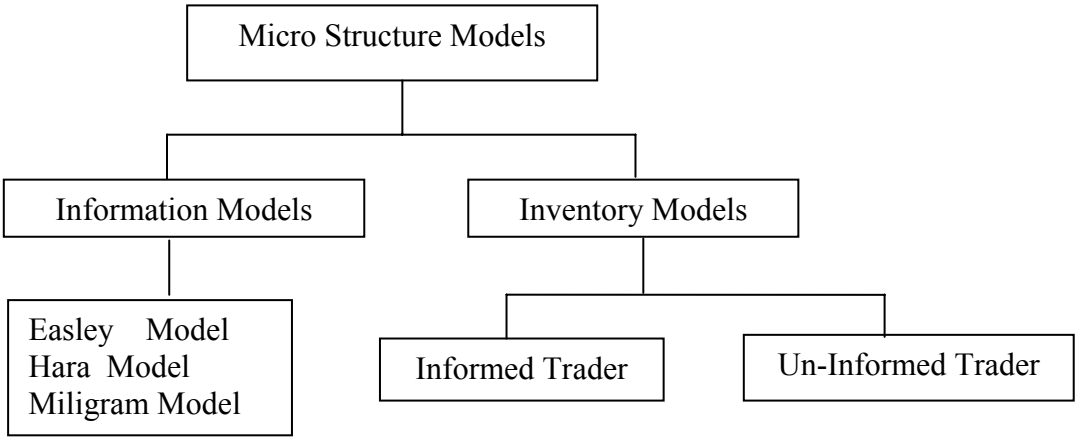
2.3 Micro Structure Models

The market microstructure literature studies how the actual transaction process can affect price formation and trading volumes in a market. It focuses on the mechanism through which buyers and sellers interact and determine price. The microstructure literature challenges the hypothesis of efficient markets by studying how prices can deviate from or converge towards informationally efficient equilibrium prices as a result of rational participants behaving strategically.

There are two main groups of model. The inventory models studies how an intermediary can solve the problem of buyers and sellers not being present in the market simultaneously. The information models analyses how information which is asymmetrically distributed between participants in the market is reflected in the prices of securities

Fig. 3

Micro Structure Models



The first microstructure model assumes optimal dealer behavior. Garman (1976) looks at how a risk neutral monopolistic dealer will set bid and asking prices in order to maximize expected profit per unit of time. The dealer wants to set prices to avoid bankruptcy; but must also ensure that prices are not set in such a way that his inventory empties. In Garman's model, the dealer sets prices once; after which buyers and sellers arrive in the form of two independent Poisson processes. Garman shows that it is optimal for the dealer to set different bid and asking prices, and that both prices will be functions of the frequency at which buyers and sellers arrive. Thus, his model explains why there is a positive spread in a dealer market.

Amihud and Mendelson (1980) expand Garman's model into a multi-period model where the dealer balances his inventory over time by changing his prices in each period. This model shows that optimal bid and asking prices fall monotonically with the size of the dealer's inventory. In other words, the dealer lowers both bid and

asking price in response to a growing inventory (and vice versa when his inventory shrinks). This behaviour is known as quote shading. Thus, Amihud and Mendelson's model also means that the dealer sets a positive spread.This model requires that the optimal pricing strategy also takes into account the dealer desire to keep his inventory of shares at a given level.

The information models are to a great extent inspired by the insight of Bagehot (1971) that trading also entails a cost associated asymmetry of information. Some investors may have better information than others. Like all others, informed investors can choose whether they want to trade or not, unlike the dealer who must always trade at the prices he sets. This means, in cases where an informed investor wishes to trade, the dealer will always lose money. Copeland and Galai (1983) show that a dealer who cannot distinguish between informed and uninformed investors will always set a positive spread to compensate for the expected loss he will incur if there is a positive probability of some investors being informed. Glosten and Milgrom (1985) show how private information will be incorporated into prices over time. In their model, the dealer and other uninformed investors learn what the correct price is by observing the order flow. Thus, the dealer takes into account the information in the order flow when setting his prices. In this way, prices converge towards informationally efficient prices. However, the model says little about how quickly prices will converge on informational efficiency. Easley and O'Hara (1987) expand this framework to take account of a strategic element in the dealer's dilemma. In this model, both informed and uninformed investors can choose between trading large or

small volumes. If informed investors compete with one another, they will always want to trade large volumes in order to maximize their profit. The dealer can therefore set a different spread based on the behaviour of informed investors: investors placing small orders pay no spread, while investors wanting to make large trades have to pay a positive spread. If the informed investors know the dealer's strategy, they will want to mix their orders with those of uninformed investors (known as stealth trading). However, they will still tend towards large orders as they are also competing to exploit their private information before it is revealed and reflected in prices. In this case investors wanting to make small trades will also have to pay a positive spread, but this spread will be lower than that for large orders. A more recent group of information models assumes that liquidity providers can also behave strategically as a result of having market power or access to private information. The development of these models coincides with the emergence of order-based trading systems.

This study only discusses the general equilibrium stream of the asset pricing model so a detailed literature review of said stream has been conducted and incorporated in the next chapter.

Chapter 3

LITERATURE REVIEW

The literature review covers the studies conducted by using asset pricing models such as the Capital Asset Pricing Model (CAPM), Intertemporal CAPM, and the Arbitrage Pricing Theory (APT). Asset pricing theories assume that systematic risks are represented by market wide factors and expected returns are linear functions of their betas, with the factors. The Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) is the first example of a beta pricing model which considers the return on the market portfolio as a single factor. The Inter-temporal Capital Asset Pricing Models (ICAPM) of Merton (1973) and the Arbitrage Pricing Theory (APT) of Ross (1976) extend the CAPM to multi-period and multi-factor settings. Asset pricing is one of the most explored areas of finance and number of studies have been conducted; some of the important ones include Black, Jensen and Scholes (1972); Fama and Macbeth (1973); Fama (1981, 1990); Geske and Roll (1983); Rozeff (1984); Chen, Roll, and Ross (1986); Campbell (1987); Campbell and Shiller (1988); Cutler, Poterba, and Summers (1989); Fama and French (1988, 1992, 1995.1996,1998); Shanken and Weinstein (1990); Chen (1991); Ferson and Harvey (1991, 1999); Boyd, Hu, and Jagannathan (2002).

3.1 Capital Asset Pricing Model

Black, Jensen and Scholes (1972) examine the relationship between equity returns and beta for the U.S. equity market by employing cross sectional regression analysis on monthly data for the period 1931 to 1965. A two step Procedure is adopted for an investigation of the relationship. In the first step, beta coefficients are estimated for all stocks for five year periods and ten portfolios are structured on basis of the beta ranking. In the second step, average returns of these portfolios are regressed against beta of portfolios. Results of the cross sectional regression analysis support CAPM and provide that a significant positive relationship exists between equity returns and beta coefficients. Fama and MacBeth (1973) investigate the relationship between equity returns and beta for the U.S. equity market by analyzing all common stocks listed at the NewYork Stock Exchange for the period of 1926 to 1968 by employing the three step approach. This approach involves following steps:

- Portfolio formation on the basis of beta ranking
- Estimation of portfolio beta
- Testing of the relationship between portfolio returns and beta of portfolio unconditionally.

Fama and MacBeth (1973) divide the whole time frame into nine periods for investigation. Each investigation period is further divided into portfolio formation period, beta estimation period, and testing period. Betas are calculated for each portfolio formation period consisting of four years and then beta- sorted portfolios are

formed. In the second step, Portfolio betas are worked out for the subsequent beta estimation period consisting of five years. Finally, Portfolio returns are calculated for the testing period and these are regressed against the betas calculated in the estimation period. Results provide evidence about the existence of a significant positive relationship between betas and equity returns in general. Roll (1977) questions the testability of the Capital Asset Pricing Model. The main problem lies within the market portfolio which is indescribable. It is not theoretically clear, which assets can justifiably be disqualified from the market portfolio. The availability of data also considerably restricts the assets that are included. Therefore, proxies for the market portfolio are used to test the CAPM. Roll(1977) states that as tests use proxies, not the true market portfolio, so we learn nothing about the CAPM. The relation between expected return and market beta of the CAPM is just the minimum variance condition; whicht holds in any efficient portfolio, applied to the market portfolio. Thus, if we can find a market proxy that is on the minimum variance frontier, it can be used to describe differences in expected returns, and we would be happy to use it for this purpose. The strong rejections of the CAPM described above, however, say that researchers have not uncovered a reasonable market proxy that is close to the minimum variance frontier. Pettengill, Sundaram, and Mathur (1995) test the CAPM in the presence of a positive and negative market and portfolio risk premiums separately. Study argues that if up market premiums and down market premiums are simultaneously drawn on scatter diagram. The slope of regression line will be approximately zero indicating that no significant relationship exists between risk premium and beta. This situation weakens the ex-post relationship between betas

and risk premiums. However, when regression lines for up market and down market are drawn separately the results reveal a different scenario. Here, regression lines with up markets and down markets offer estimates which are consistent with SML estimates. Pettengill *et al*(1995) investigates 660 observations and identifies 280 negative market risk premiums and 380 positive market risk premiums. The modified Fama and Macbeth model is employed to investigate the relationship in an up market and down market independently. The sample period is divided into the following sub periods; (i) portfolio formation period; (ii) portfolio beta estimation period, and (iii) testing period. Beta sorted portfolios are created for intitial period. In step two, portfolio betas are calculated for the portfolio beta estimation period. Finally, returns of beta sorted portfolios are regressed against the portfolio betas for up market and down markets. Results of unconditional CAPM tests indicate the existence of a systematic relationship between portfolio beta and risk premiums in whole period but these results are found insignificant for the sub periods. However, significant positive association is observed between risk and return in up-market and significant negative association is documented for down-markets. Jagannathan and Wang (1996) examine the static relationship between risks and return for the securities listed at American equity markets for the period 1962-1990 under the assumption of time varying beta. In first step ten portfolios are formed on the basis of size captured by using market value of firm. Then beta is calculated for each firm and ten beta sorted portfolios are identified in each size decile. Thus 100 portfolios are formed. Study also uses human capital to capture the effect of return on wealth. Results support conditional Capital Asset Pricing Model in time varying betas assumption.

Fletcher (1997) examines the relationship between portfolio returns and beta for stocks listed at FTSE for the period 1975 to 1994 by employing Pettengill (1995) methodology. The conditional relationship is examined by using cross sectional regression analysis that includes size as conditional variable. Results provide evidence about existence of significant positive relationship between portfolio returns and beta in periods of up-market. However, in a period of down market, a significantly negative relationship has been observed. Size is not found affecting returns in equity market of UK as evident from insignificant relationship between returns and beta. Hodoshima, Garza and Kunimura (2000) examine the relationship between monthly equity return and beta of stocks listed at first section of Japanese equity market by employing cross sectional regression analysis. Results reveal that no significant relationship is observed between equity retunes and beta when regression analysis is performed on excess returns of all months. However when regression analysis is performed on positive excess market returns and negative excess market returns separately, a significant conditional relationship is observed between equity returns and beta. This conditional association between equity return and beta are better fit for the period when the market excess return is negative as evident from higher R^2 and S.E of estimate. Pedro and Ocampo (2003) tests capital asset pricing model in traditional and conditional setting by employing modified Fama and Macbeth approach for equity market of Philippine. Cross sectional regression analysis provides evidence about the existence of significant relationship between portfolio returns and beta in case of conditional CAPM. However, weak relationship is observed between equity returns and beta under unconditional CAPM test. Zhang

and Wihlborg (2004) investigate the relationship between equity return and risk for emerging equity markets of Russia, Hungary, Czech Republic, Turkey, Poland, Greece and Cyprus by employing conditional as well as unconditional approach proposed by Fama and McBeth (1973) and Pettengill (1995) respectively . Results reveal that there exist a significant relationship between risk and return in domestic market under conditional framework. Results also show that unconditional positive relationship is observed between risk in return in equity markets of Russia and Czech Republic. A comparison between DCAPM and ICAPM is also made to investigate the comparative explanatory potential of CAPM. Sandoval and Saens (2004) test conditional and unconditional Capital Asset Pricing Model for equity markets of Latin American countries i.e Argentine, Brazil, Chile and Mexico for the period 1995 to 2002 by using Black (1972) approach and Pettengill (1995) Model. Control variable include book to market ratio , size and the momentum. Betas of securities are worked out by regressing equity returns against lagging, matching and leading market returns of LASMI and S&P 500. In step 2, Portfolios are formed on the basis of beta ranking of securities. Then, portfolio betas are calculated for estimation periods. These portfolio beta are used as independent variables in subsequent period. Finally, cross sectional Regression analysis is performed as proposed by Black (1972). Results reveal that there exists significant positive relationship between beta and equity premium during up-markets. However the direction of relationship is reversed in down markets. It is worth mentioning that no significant relationship is observed between size, book to market ratio and momentum and equity risk premium. Level of integration is also investigated and it is found that degree of integration

decrease in down markets. Ang and Chen (2005) examine the relationship between risk premium and beta for all securities listed at NYSE, NASDAQ and AMEX for the period 1926 to 2001 by using conditional single factor model. The conditional variable investigated is book to market ratio. A brief overview of previous studies show that when portfolios are sorted on the basis of book to market then betas of portfolios may fluctuate over time and regression analysis may lead to inconsistent estimates of conditional alphas and betas. Therefore, this study employs conditional Capital Asset Pricing Model that uses portfolios structured by considering time varying betas, market risk premium and stochastic systematic volatility to capture the role of book to market ratio in explaining the equity returns in the long run. Results show that proposed model significantly explains the relationship between risk and return. Similarly, proposed model does not provide evidence that conditional alpha for a BMR trading strategy is statistically different from zero.

3.2 Arbitrage pricing Theory

The APT has been widely discussed in literature e.g Chen (1983); Connor & Korajczyk (1986); Berry (1988); Groenewold and Fraser (1997); Sharpe (1982). The APT has been empirically studied in several markets, e.g., Antoniou et al (1998) studies it in the London Stock Exchange, Dhankar & Esq (2005) in the Indian stock market, Berry (1988) in the S&P 500 and Chen (1986) in the New York Stock Exchange, and Anatolyev (2005) in the Russian stock market. The original APT of Ross (1976) hypothesizes that the cross sectional distribution of expected returns of

financial assets can be measured by their sensitivities to k unknown economic factors. These sensitivities are termed as the factor loadings. Asset pricing models based on arbitrage theory choose explanatory variables that are macroeconomic, firm-specific factors or sector specific factors. There are three Types of Factor Models which include

- Multifactor models based on company specific factors
- Multifactor models based on macroeconomic factors
- Multifactor models based on statistical factors

3.3 Arbitrage pricing Theory –Company Specific Factors

Fundamental Factor Models include factors which have specific characteristics and *priori* reasons to have relationship on the basis of historical evidence. For development of characteristic based model for Pakistani equity market six variables have been identified. The variables include market premium, P/E premium, size premium, value premium, momentum and liquidity premium.

3.3.1 Price Earnings Ratio and Equity Returns

Price earnings ratio (P/E) is first used in finance literature by Graham and Dodd in 1934 as a benchmark for equity valuation. The price-earnings ratio is defined as the ratio of current price to expected earnings. Since 1930's, P/E Ratio is reported regularly in literature but no common understanding exist about said ratio. For

example, Cragg and Malkiel (1982) and Litzen-berger and Rao (1971) interpret price earning ratio as an indicator of earning growth. Ball (1978) considers it a risk measure and Graham, Dodd, and Cottle (1962), Boatsman and Baskin (1981), and Alford (1992) perceives it an earnings capitalization rate. Price Earnings ratio is indicator of the future investment performance of a security. In an efficient market, earnings should be capitalized in an unbiased manner. If prices of securities are biased then P/E ratio is an indicator of this bias. P/E effect is one of the earliest identified anomalies. Nicholson (1960) identifies P/E effect in U.S market and argues that investors seek the greater yield embodied in stocks with low P/E ratio . However, first major empirical evidence about existence of P/E anomaly can be traced back to late1970's. Proponents of P/E ratio hypothesis assert that low P/E securities outperform high P/E stocks. This assertion is in contravention to efficient market hypothesis and questions the validity of traditional capital asset pricing models. Basu (1977) examines the relationship between equity returns and their P/E ratios for the period 4/1957 to 3/1971 and finds the low P/E securities have earned higher absolute and risk adjusted rates of return than the high P/E securities These findings are in line with the perception that P/E ratio information is rapidly priced and disequilibrium persists in market. These results are inconsistent with semi strong form of the efficient market hypothesis. So, investors can take advantage of the market inefficiency and can earn higher returns on risk adjusted basis by investing in low P/E securities. Therefore, EMH hypothesis is rejected and the propositions of the price earning ratio hypothesis on the relationship between equity returns and their P/E ratios appear valid. Basu (1983) again confirm that market can be outperformed on

the basis of P/E sorted portfolios can be used to construct portfolios which outperform the market. Beaver and Morse (1978) finds that difference of P/E ratio among stocks can not be explained significantly through earnings and negative correlation exists between P/E and current earnings growth but a strong positive correlation is observed among these variables in subsequent years

Ball (1978) admits the existence of P/E effect and offers various possible explanations about this anomaly ranging from systematic experimental error, transaction and processing costs to failure of Sharpe's CAPM. Fuller, Huberts and Levinson (1993) re visit Ball's (1978) argument by employing a comprehensive multi factor Model. This model incorporates 69 factors ranging form systematic risk (beta) to industry factors. Results indicate that low P/E ratio stocks earn higher returns during 1973–1990. However, these factors do not explain superior low P/E returns

Banz and Breen (1986) criticize previous studies on the basis of two parameter; (i) ex-post-selection bias and (ii) look-ahead bias. Study controls these biases and concludes that size effect still persists whereas P/E effect is no longer significant. It means data biases are responsible for P/E effect. Jaffe, Keim and Westerfield (1989) investigates January effect, size effect and P/E effects and finds conflicting results. Study further provides anomalies identified in earlier work can be attributed to time variations in the power of the various effects. Fama and French (1992) provide that no significant statistical relationship exist between beta and cross-sectional average stock returns. However, firm size, book-to-market, and earnings-to-price have

significant explanatory power for average returns. Lakonishok et al. (1994) examines role of E/P ratio as an indicator of expected earnings and finds that investors prefer stocks with exceptional historical performance as historical success pattern may continue in the future. However, gradually these stocks become overvalued and may fail to meet investor's expectations so may be abandoned. Stocks with low E/P ratio are less overestimated. These stocks are expected to generate exceptional returns in the future due to temporary, short term decline in earnings. Results indicate that portfolios with higher E/P ratios offer higher average and cumulative return in comparison to portfolios formed at different criteria i.e B/M, Cash flows/P and sales growth. Moreover, results provide evidence about existence of significant explanatory power of E/P ratio. However, no size effect is observed. Nancy Beneda (1992) investigates investment performance of growth stocks in comparison to value stocks for the period 1983 - 2001. Findings of the study reveal that returns of growth stock are found less than value stocks during next 5 years and then value stocks appears to outperform the growth stocks for all portfolio formation years except 1983. A change in patterns is again observed in tenth year after portfolio formation when growth stocks start outperforming the value stocks for all portfolio formation years except 1987. Similarly, a changing pattern is observed in year 14 and onwards when growth stocks outperform the value stocks. These findings suggest that P/E ratios reflect the investor's perception about the future growth opportunities and long term investors can add a diverse group of growth stocks along with value stocks within average P/E range into their portfolios to improve long-term performance.

Empirical work related to P/E anomaly in not limited to the U.S., this phenomenon has been investigated in various parts of world during last two decade. Levis (1989) and Gregory et al.(2001) study the UK market, Doeswijk (1997) examine the Dutch market, Aggarwal et al. (1990), Chan et al (1991), Cai (1997); and Park and Lee (2003) study the Japanese market. Booth et al. (1994) study the Finnish market , Chou and Johnson(1990) studies the Taiwanese market and Chin et al.(2002) provides evidence about existence of P/E anomaly from the equity market of the New Zealand.

Rapach and Wohar (2005) analyses annual data for the period 1872–1997 and explore the predictive power of P/E Ratio and Price dividend ratio. Results are in broad agreement with the existing literature and indicate that P/E ratio can explain the real stock returns in long run. Anderson and Brooks (2006) reports that a P/E computed based on multiple years of earnings is a superior predictor of returns than the conventional P/E ratio based on one year. Results indicate that an eight year average P/E ratio is twice efficient than one year P/E ratio. In UK, difference in average annual returns between the value and glamour deciles is approximately 6%. However, the difference does not increase linearly.

Huang, Tasi and Chen (2007) decompose P/E ratios into fundamental component and a residual component. Then after excluding fundamental component from observed P/E ratios, portfolios based on residual P/E ratios are formed and these portfolios report reversal in performance of over valued glamour stocks. So over optimism

appears to be more prevalent in comparison to over pessimism. When P/E ratios grow abnormally high or low levels and do not characterize fundamentals, and a correction, or a mean-reverting process is in order. Dudney, Jirasakuldech, and Zorn (2008) study the relationship between P/E ratio and equity returns after controlling the effect factors such as risk, time preferences, inflation, and market expectations and fsind P/E ratios provide a reliable signal of future market behavior.

3.3.2 Size Premium and Equity Returns

This empirical evidence about the existence of the size effect can be traced back to 1981 when Banz (1981) analyses the equity returns for U.S for the period 1936- 1975 and finds that small firms have considerably higher risk adjusted returns than large firms. This phenomenon is termed as "the size effect." However, study did not provide the genesis of size effect and conclude that "It is not known whether size *per se* is responsible for the effect or whether size is just a proxy for one or more true unknown factors correlated with size". Therefore it is recommended that size effect should be used with caution. Since then a number of studies has been conducted to explore phenomenon.

Banz (1981) examines common stocks listed at the New York Stock Exchange for the period 1936-1975 and reports that the smallest 20% of the firms earn 0.4 % per month higher risk-adjusted return in comparison to other firms. Study employs two pass regression procedure proposed by Fama Macbeth (1973) to explain the returns of

25 size- beta sorted portfolios. Results indicate that there exists significant negative relationship between returns and size measured by market value. It indicates that small firms have higher risk-adjusted returns than large firms. However, it is observed that size effect is dynamic and varies over time. It is found insignificant and negative during 1946-1955. Moreover, is observed that the size effect is non linear and is more prominent in smallest firms. However, study does not explain the reasons for its existence. Banz (1981) argues that higher uncertainty associated with inadequate information about small companies may lead to the size effect. Reinganum (1981) examine the phenomenon in U.S. market for the period 1975-1977 by using a large sample of 566 firms listed at NYSE and AMEX and confirms that portfolio of smallest 10% firms outperform the portfolio of largest 10% firms by 1.6% per month. The smallest size sorted portfolios has 1% per month excess return in comparison to return on the equally-weighted market index. It is worth noting that the beta of portfolio of smallest is approximately 1 which is same as market. On the other hand, largest size portfolio has a beta of 0.83 and underperforms the market by 0.6% per month. Brown, Kleidon , and Marsh (1983) revisit the same data for a longer period and report linear relationship between the daily return on 10 size-sorted portfolios and mean size of all firms in the portfolio but size effect is found unstable and a reversal is reported during 1967-1975. Keim (1983) reports that small stocks listed at NYSE and AMEX earn 2.4% per month more than average returns during 1963-1979. However, market beta is found unable to explain the difference of returns between small firms and large firms. Chan and Chen (1991) assume that small and large firms have different risk and return characteristics. Small firms on the New York Stock

Exchange are firms that have not been doing well, are less efficiently managed and are highly levered. As a result small firms tend to be riskier than large firms and that risk is not captured by the market index. After introducing multiple risk exposures to the market index; a leverage index and a dividend-decrease index to mimic the marginal firms, the size effect loses its explanatory power. Risk exposures to these indices are as powerful as size in explaining average returns of size-ranked portfolios.

Fama and French (1992) investigate the size and value anomalies and asserts that the smallest size sorted portfolio outperforms the largest size sorted portfolio by 0.74% per month. Then, each size-sorted portfolio is further subdivided into 10 beta-sorted portfolios. In each size-sorted portfolio, no relationship between beta and return is observed, however, it reported that average returns and post-ranking betas decrease with the firm size. It indicates that variation in the beta can be divided into two components. Variation in beta associated with size and variation in beta not related to size. Study provides variation in beta that is associated with size is positively related to average return but variation in beta that is not associated to size is not rewarded. The study provides that beta alone can not explain the cross-section of returns whereas size and book-to-market ratio have significant explanatory power.

Since the early 1990s, a large number of studies have been conducted in different parts of the world to examine size effect in an international perspective. International evidence on the size premium is surprisingly consistent. Jacobs and Levy (1989) suggest that small cap stocks earn higher average returns in comparison to the large

cap stocks. This size effect may be result of various factors which include transaction cost, liquidity, informational uncertainty and year end tax loss selling. However size premium is found time varying. Aggarwal, Rao, and Hiraki (1990) explore the relationship between E/P and size and equity returns in Tokyo Stock Exchange and find evidence about presence of E/P and size effects and these results are in line with size and E/P effects documented in U.S. Further, E/P effect integrated with size effect is more evident in smaller firms. Chan, Hamao, and Lakonishok (1991) also confirm the presence of a size effect in Japanese equity market. Dimson and Marsh(1999) and Horowitz et al.(1999) contradict the above results and state that size anomaly have disappeared and size premium have reversed and large-cap firms show have higher returns than small cap firms.

Researchers have suggested the following possible explanations for the size effect. Small firms stocks are more illiquid and trading in them attract greater transaction costs; there is also less information available about small firms and therefore the cost of monitoring a portfolio of small stocks will generally be greater than that of a portfolio of large firms, and also given that small shares trade less frequently, their beta estimates might be less reliable. However, all these remain hypothetical explanations for the size effect, as there is no rigorous theory explaining convincingly why the size effect should be present.

In Pakistani equity markets no significant recent work is found so it is need of time to investigate size effect as presence of a size premium in equity returns has vital

implication. If higher returns of small stocks are based on larger exposure to underlying risk factors which is not captured by standard asset pricing models then decision makers should compute cost of equity by employing such asset pricing model that considers and account for such risk factors. This risk based explanation of size effect makes the validity of traditional asset pricing models debatable.

3.3.3 Book to Market Ratio and Equity Returns

Value premium is one of the most debated puzzles in a asset pricing anomalies. Analysts believe that magnitude of deviation between book value of stock and market value of stock is an sign of expected return. Stattman (1980) and Rosenberg et al. (1985) document the relationship between expected returns and book-to-market ratio in early 80's. Rosenberg *et al* (1985) report the presence of significant and positive relationship between book to market ratio and equity returns. Stocks with high book to market ratio outperform stocks with low book to market ratio. Debondt and Thaler (1987), Keim (1988) and Fama and French (1992) also confirm the presence of positive relationship between book to market value and average returns. This phenomenon is later termed as the book to market effect.

In a landmark study, Fama and French (1992) examine relationship between size, leverage, book-to-market ratio, earning yield and average stock returns in U.S equity market for the period 1962-1989 and finds that the cross-section of average equity returns has no significant relationship with conventional beta and CAPM is unable to fully explain the cross section of equity returns. This study further, identifies that

overall market factor, firm size and book-to-market ratio can explain the cross-section of returns. Fama and French (1992) reports that on average effect of size is found less powerful in comparison to book-to-market ratio, study concludes that stocks with high book to market ratio earn lower returns than low book to market stocks. This study conclude that ME and BE/ME are superior to E/P ratio and leverage in explaining the cross section of stock returns. Fama and French (1993) extends the study to both stocks and bonds and provides evidence about the presence of explanatory power of size, book-to-market, earnings-price ratios, and other characteristics. Fama and French (1993) report the presence of distinct distress factor which is captured through book to market ratio. They , they again confirm strong association between a stock's book-to-market ratio expected returns(1996,1998).

However, Daniel and Titman (1997) contradict and argue that after controlling for size effect and BMR effect, returns are not strongly related to betas computed on the basis Fama and French (1993) model. Fama and French (1995) examine behavior the equity prices and reports that weak firms with persistent low earnings tend to have high BE/ME and positive slope on HML, where as strong firms with persistent high earning have low BE/ME and negative slope on HML and in book-to-market groups small stocks are less profit able than big stocks. These findings are consistent across different size-BMR portfolios.High B/M ratio corresponds to low relative market valuation of equity, which indicates that the market is on average unconvinced about company future prospects which lead to higher required rate of return. Kothari (1995), MacKinlay (1995) and Loughran (1997) see the matter from a different

perspective. Kothari (1995) and MacKinlay (1995) argue that a substantial part of the premium is due to survivor bias and data mining. The data source for book equity contains a disproportionate number of high-BE/ME firms that survive distress so the average return for high-BE/ME firms is overstated. The data snooping hypothesis posits that researcher's desire to search for variables that are related to average return, may lead to identification of anomalies that are present only in the sample used to identify them. However, number of studies consider it a weak argument and dismiss the survivorship-bias and the data snooping hypothesis. Loughran (1997) further extends the findings of Fama and French (1992) and investigates relationship of book-to-market, firm size, exchange listing, and calendar seasonality and returns. This study documents that size and the book-to-market ratio "*provide a simple and powerful characterization of the cross-section of average returns for the 1963-1990 period*." The study argues that this relationship is a result of January effect and if January is excluded from sample then size and the book-to- market ratio can not explain cross-sectional variation in returns. Kothari and Shanken (1997) examine the relationship of book-to-market ratio and dividend yield for the period 1926-1991 of US equity market and find that book-to-market has significant positive relationship with returns during 1926-1991 and dividend yield is dominant during 1941-1991. Study further reports that in the period of great economic instability the smaller firms are found more influenced than the larger firm.

Daniel and Titman (1997) are of the view that three factor model is unable to explain average returns without considering factor loadings. The study reveals the

presence of stronger relationship between expected returns and book-to-market ratio than the relationship between expected return and factor loadings. Chui and Wei (1998) investigate the Asian markets i.e. Hong Kong, Korea, Malaysia, Taiwan and Thailand for the period 1977-1993 by employing Fama-Macbeth (1973) procedure and report a weaker relationship between stocks returns and betas, whereas book-to-market ratio and size explains the cross-sectional variation of stock returns. The study also confirms the presence of January effect. Specially, large firms in Hong Kong and small firms in Korea experienced higher returns in January. Lewellen (1999) examine the relationship among expected returns, risk, and book to market at the portfolio level and reports that there exist statistically significant relationship between book to market ratio and expected stock returns. Lewellen (2001) again confirms the financial ratios can predict the returns and book-to-market is an economically and statistically significant determinant of expected returns. Akdeniz, Altay and Aydogan (2000) investigates the firm specific factors for the stocks listed at Turkish Stock Exchange for the period 1992-1998 and report that book-to-market ratio and firm size explain stock returns and no significant earnings yield effect is observed . Harris and Marston (2001) empirically investigate the relationship between book to market ratio, growth and beta for value and growth stocks and conclude that a higher B/MV seems to be linked to higher subsequent returns on stock. However, if growth is controlled for, beta has a significant positive link with B/MV, which means the higher betas lead to higher B/MVs as share prices are penalized for beta risk. Such a link supports a significant role for beta in market pricing and suggests that beta should not be discarded, in hurry, as a tool to understand equity prices.

Fan and Liu (2005) examine the ability of size and the book-to-market equity ratio to determine expected returns for US equity market for the period 1965-1998, by using Fama-MacBeth (1973) regressions. The study reports that size and the book-to-market ratio contain distinct and significant components of financial distress, growth options, the momentum effect, liquidity, and firm characteristics. Guan *et al*.(2007) re-examine the role of book-to-market, size and price-earning ratios to explain the cross sectional variation in average stock returns for the U.S. equity market for the period 1967-1997, by using the more advance statistical procedures to control for beta shifts. The study reveals that CAPM generates expected returns. However above mentioned variables may be correlated with expected returns. Further, measurement error in beta may lead to to situation where other variables may involve as explanatory variables and if measurement error in beta is reduced, then beta's power to explain cross sectional returns improves and part of other variables reduces.

3.3.4 Momentum and Equity Return

Momentum anomaly identified by Jegadeesh and Titman (1993) is one of the most debated anomalies of asset pricing in recent years. This study for the first time establishes that a statistically significant abnormal return can be earned by employing momentum strategy. The momentum effect is defined as a positive relation between the returns of a security and its lagged return in certain period of time in a cross sectional setting. Jegadeesh and Titman (1993) provide evidence that past winners outperform the past losers over a horizon of 3-12 months. Study reveals that portfolio

of top 10% winners outperformed the portfolio of top 10% losers by 6.8% during 1965-1989. These portfolios are constructed on the basis of 12 months historical returns. However, Kothari, Shanken and Sloan (1995) did not support the result and provided evidence that momentum effect is not reliable as winner stocks failed to outoutperform the losers in the post 1962 period. Study indicate that positive abnormal returns have been earned by losers and winners are ended up with negative abnormal return during above stated period. Despite of mixed evidence, Jegadeesh and Titman (1993) study is considered as a benchmark in recent empirical work on momentum as most of the studies conducted in various parts of the world employ same methodological frame work and time horizon.

Fama and French (1996) admit that Fama and French (1993) factors do not explain momentum profits and these profits evaporate despite of adjusting for the FF factors. Conrad and Kaul (1998) present that stocks with high realized returns have out performed the stocks with low realized returns. He argues that profitability of momentum strategy is based on cross sectional variability in expected return. It is a direct out come of dispersion in unconditionally expected returns. But Jegadeesh and Titman (2001) rejects that claim of Conrad and Kaul(1998) on the basis of reversals in the post holding period returns and argues that such outcome may be a result of estimation errors in the measurement of expected return and volatility.

Moskowitz and Grinblatt (1999) provide evidence about existence of strong industry momentum effect which is responsible for momentum anomaly in most of the

individual securities. Grundy and Martin (2001) reports that the expected returns calculated by employing FF three factor model fails to explain the profitability of momentum strategy. It is also provided that results are robust as time-invariant expected return model also confirms the about results.

Lee and Swaminathan (2000) find that trading volume can be used to predict the degree and persistence of price momentum. Hong, Lim, and Stein (2000) support the gradual information diffusion model of Hong and Stein (1999) and state that when one moves in past, the momentum profits decrease sharply with size. Chordia and Shivakumar (2002) report that lag macroeconomic variables can explain the profitability of momentum strategies and these profits disappear on adjustment of stock returns. It suggests that time-varying expected returns may explain momentum payoffs.Empirical report the presence of predictability in stock returns, but there is a general disagreement about the underlying explanation for such phenomenon. Daniel, Hirshleifer and Subrahmanyam (1998) offer the explanation on the basis of theory of investor *overconfidence.* Jegadeesh and Titman (1993) think that positive feedback traders tend to force prices of equities to overreact and move away from their long-run values temporarily as these traders continue to move equity price without any support from fundamental information. Berk, Green, and Naik (1999) points out that when firms exploit advantageous investment opportunities, their non-systematic risks changes in a predictable manner and it leads to predictable pattern in returns. Hong and Stein's (1999) explanation is based on externalities and it provides that momentum anomaly is a result of interactions among heterogeneous agents and it is

not based on the psychological structure of representative agent. Boudoukh, Richardson, and Whitelaw (1994) and Conrad and Kaul (1989) think that it generates from data biases ranging from microstructure issues to data snooping biases. Conrad and Kaul (1998), Berk, Green, and Naik (1999), Chordia and Shivakumar (2002), Bansal, Dittmar, and Lundblad (2002)) link it to rational risk based theories. De Bondt and Thaler (1985, 1987), Jegadeesh and Titman (1993), Daniel, Hirshleifer, and Subrahmanyam (1998), Barberis and Vishny (1998), Hong and Stein (1999), Lee and Swaminathan (2000), Hong, Lim, and Stein (2000), Grinblatt and Han (2002)) provide justification from behavioral theories. However, Moskowitz (2003) rejects the risk-based explanation for momentum as no relationship is observed between covariance risk and momentum. Similarly, Liew and Vassalou (2000) suggest that momentum is not based on risk as WML factor does not predict future economic activity.

The evidence about presence of momentum anomaly is not limited to the U.S. Richards (1997) analyses the monthly returns of 16 countries and reports the presence of momentum effect during 1970 -1995. Study reveals that momentum effect is strongest at the 6-month horizon with an excess return of 3.4% per annum. However, in long term losers start to outperform winners. The average annual excess returns\ that loser portfolio secure is more than 5.8% Rouwenhourst (1998) examine the presence of momentum anomaly in European equity markets by using monthly returns from 12 countries during 1980-1995. Study provides that after controlling for risk, winner portfolios outperform loser portfolios by more than 1% per month. Liu,

Strong, and Xu (1999) provide evidence about existence of profitability of momentum strategies in UK by using weekly data for the period 1/1977 -12/96. Study provides momentum profit exist despite of controlling systematic risk, size, price, B/M ratio, E/P ratio and C/P price ratio. It further argues that momentum effect is derived from market under reaction to firm specific attributes. Grinblatt and Moskowitz (2004) provide that the magnitude of historical pattern plays vital role in explaining the cross-section of expected returns. A consistent winner in a top momentum sorted portfolio can earn twice the return premium.

3.3.5 Liquidity and Equity Returns

Liquidity is one of the main characteristics of securities in capital markets. Investors want a certain level of liquidity so that they can buy and sell securities without incurring significant losses. Therefore, investors want risk premium for securities that do not fulfill adequate liquidity criteria. Economic theory suggests that liquidity and equity returns have an inverse relationship. Investors demand higher returns from securities where liquidity risk is high whereas investors are ready to receive lower return from securities which have higher level of liquidity. Therefore it can be said that importance of liquidity stems from the aspirations of shareholder to yield higher reward for the higher risk. It is generally agreed that liquidity can influence asset returns. In recent years, liquidity has attracted significant attention as a component of asset pricing models. Liquidity is considered as a risk factor with reference to asset pricing and expected returns, the return related with this risk factor is a risk premium

and investor expect to receive it as a result to assuming that specific amount of risk. It is incorporated in CAPM as an extension to capture the impact of missing risk factors.

Amihud and Mendelson (1986) are pioneers in explaining liquidity as risk factor in academic research under asset pricing framework. This study examines the cross-sectional relationship between equity and illiquidity. Amihud and Mendelson (1986) provide evidence about existence of significant positive relationship between returns and illiquidity. Eleswarapu and Reinganum (1993) examines investigates the relationship between liquidity and equity returns by employing the same measures as proposed by Amihud and Mendelson (1986) and find that the relationship between liquidity and equity returns is restricted to the January effect. Brennan and Subrahmanyam (1996) disagree with Eleswarapu and Reinganum (1993) and provide evidence in support of inverse relationship between liquidity and equity returns. These results are consistent with Amihud and Mendelson (1986). Amihud and Menedelson (1989) re-examine liquidity return relationship and conduct a joint test of important risk factors i.e beta, residual risk, size and liquidity. Study reports expected returns are a function of beta and liquidity. The findings also provide returns are not significantly related to residual risk and firm size in the presence of liquidity,.

Eleswarapu (1997), Datar, Naik and Radcliffe (1998), Brennan, Chordia and Subrahmanyam (1998), Chordia, Subrahmanyam and Anshuman (2001), Chordia, Roll and Subrahmanyam (2002) and Pastor and Stambaugh (2003) also explore the

relationship between liquidity and equity returns . Results of these studies are, in general, consistent and conclude that there exist a statistically significant relationship between liquidity and expected future performance of common stock. Subrahmanyam and Anshuman (2001) find that liquidity should be considered independently after controlling the effect of size, book-to- market and momentum. Study reveals that liquidity plays a vital role in determination of returns and there exist a significant negative relationship between average stock returns and liquidity. Holmstrom and Tirole (2001) explain a Liquidity-based Asset pricing Model (LAPM) which measures the impact of liquidity on equity stock prices and bond prices. Study reveals that when liquidity of overall market increases then price of bond will decrease and the prices of stock will increase.

Amihud (2002) investigates the effect of illiquidity on returns of stocks listed on NYSE for the period 1963 -1997 by employing Fama and MacBeth (1973) methodology . Illiquidity is measured by ratio of absolute value of equity return to its dollar volume. Cross sectional model is estimated for each month for every year. Then monthly regressions are used to generate 408 estimates of every characteristic coefficient. Finally, these coefficients are averaged and tested for statistical significance. These results indicate that illiquidity is a priced by market and there exist significant positive relationship between returns and illiquidity. Moreover, there exist significant positive relationship between beta and returns and a significant positive relation between momentum and returns. However, the relationship between size and equity returns is found significantly negative. Similarly, significantly

negative relationship is reported between the volatility and returns in the absence of January data. The dividend yield is found significantly negatively related to returns. It is worth mentioning that Amihud (2002) considers only one liquidity proxy which may not be able to capture all aspects of liquidity. Acharya and Pedersen (2005) reports that equity returns are related to liquidity risk. Study identifies three effects of liquidity risk on expected price. Firstly, return increases with the covariance between asset illiquidity and market illiquidity. It means when an asset becomes illiquid due to illiquidity of market then investor demand higher return. Secondly, return varies due to covariance between security's return and the market liquidity. Investors will be ready to accept a low return on the security which can give a high return when the market is illiquid. Finally, returns vary due to covariance between security's illiquidity and the market return. Again investors will be ready to accept a low expected return for a security which can give them good return when the market is down. Sadka (2006) also relates liquidity risk to pricing anomalies and finds that liquidity risk can partially explain the cross-sectional variation in returns of portfolios formed on past 12-month price performances and standardized unexpected earnings

A set of variables has been used as proxy for liquidity. Amihud and Mendelson (1986) use bid and ask spread measure for liquidity. Putyatin and Dewynne (1991) also support the same point of view and assert that if one knows its bid and ask prices than it is providing an efficient liquidity service in trading. Datar, Naik, and Radcliffe (1998) employs turnover ratio as a proxy for liquidity. Brennan and Subrahmanyam (1995) use the log of the daily return variance and the log of the

number of analysts following a stock as measure of proxy. Chordia, Roll and Subrahmanyam (2000) employ the quoted spread, proportional quoted spread, quoted depth, effective spread and proportional effective spread as liquidity measures Chordia, Subrahmanyam and Anshuman (2001) use the natural log of dollar volume traded, the standard deviation of dollar volume traded, the coefficient of variation of dollar volume traded, share turnover, the standard deviation of share turnover, the coefficient of variation of share turnover and the reciprocal of the share price as measures of liquidity. These proxies consider liquidity in a cross sectional framework.

In a recent study, Chollete et al (2008) employs illiquidity perspective to explain liquidity risk premium. Study provides that assets that offer higher return in illiquid market are more valuable to the investors. Investors may be willing to accept even low returns for such stocks that offer higher return during illiquidity phases of market. Study further suggests that different liquidity alternative reflect different impact of liquidity risk on asset prices as each alternative captures only some aspects of liquidity. So these proxies should be selected and employed with caution.

3.3.6 Interaction of Anomalies and Asset Prices

Fama and French (1992) studies the joint roles of market beta, size, Earnings/Price (E/P) ratio, leverage and book-to-market equity ratio in the cross-section of average stock returns for NYSE, Amex and NASDAQ stocks over the period 1963 to 1990. In that study, the authors finds that beta has almost no explanatory power. On the other

hand, Size, E/P, leverage and book to market equity have significant explanatory power in explaining the cross-section of average returns. However when beta is included, size and book-to-market equity are significant and they seem to absorb the effects of leverage and E/P in explaining the cross-section average stock returns. FF (1992) therefore argues that if stocks are priced rationally, risks must be multidimensional. Chan, Hamao, and Lakonishok (1992) empirically investigate the cross-sectional differences in returns in Japanese stocks to explore the underlying behavior of four variables: earnings yield, size, book to market ratio, and cash flow yield. Their findings reveal a significant positive relationship between to market ratio and cash flow yield and expected returns. The Fama and French (1993) three factor asset pricing model is a result of increasing empirical evidence that the Capital Asset Pricing Model performed poorly in explaining realized returns. Fama and French (1993) extend its study to both stocks and bonds by using a time-series regression approach. Monthly returns on stocks and bonds are regressed on five factors: returns on a market portfolio, a portfolio for size and a portfolio for the book-to-market equity effect, a term premium and a default premium. For stocks, the first three factors returns on a market portfolio, a portfolio for size and a portfolio for the book-to-market equity effect are found to be significant and for bonds term premium and default premium are significant. As a result, Fama and French (1993) construct a three-factor asset pricing model for stocks that includes the conventional market factor and two additional risk factors related to size and book to market equity. They find that this expanded model captures much of the cross section of average returns amongst US stocks. The model says that the expected return on a portfolio in excess

of the risk free rate is explained by the sensitivity of its return to three factors: (i) the excess return on a broad market portfolio, (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB) and (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to- market stocks (HML). It can be seen that the Fama and French three-factor model is more like an extension of the CAPM. In fact, the model augments the CAPM model by the size effect and the book-to- market equity effect. The size effect provides that firms with small market capitalization exhibit returns that on average significantly exceed those of large firms. The book-to-market equity effect shows that average returns are greater the higher the book value to market-value ratio (BV/MV) and vice versa. It is also referred to as the value premium. The high book value firms are under-priced by the market and are therefore good buy and hold targets, as their price will rise later. This anomaly undermines the semi-strong form efficiency of the market. These two variables explain average return differences across portfolios that cannot be accounted for by beta.

Fama and French (1995) analyses the characteristics of firms with high book-to-market and those with low book-to-market equity. They find that firms with high BE/ME tend to be persistently distressed and those with low BE/ME are associated with sustained profitability. They conclude that the returns to holders of high BE/ME stocks are therefore a compensation for holding less profitable and riskier stocks. They show that book-to-market equity and slopes on HML in the three factor model proxy for relative distress. Weak firms with persistently low earnings tend to have high BE/ME and positive slopes on HML; strong firms with high earnings have low

BE/ME and negative slopes on HML. Dennis, Perfect, Snow, and Wiles (1995) provide support to Fama and French's results, during the 1963-89 period, beta is not an important explanatory variable for expected nominal stock returns but a firm's size and book-to-market value of equity ratio are important, and incorporates the effect of transaction costs and rebalancing periods. Study also confirm prior findings that for any given size category, average annual portfolio returns increase as the BE/ME increases and, for any given BE/ME category, average returns decrease as size increases. The BE/ME effect is found significant for different holding periods and transaction costs levels, thus indicating that during the sample period, a trading strategy based on BE/ME and size could have been profitable. The implication of their study is that investors can significantly outperform the market if they select small-size-high-BE/ME securities for their portfolios during the period. Another important implication of their results is that the greatest benefits from purchasing optimal portfolios (high BE/ME-small size) and shorting non optimal portfolios (low BE/ME-large size) are generated by rebalancing portfolios every four years. Fama and French (1998) provide additional valuable out-of-sample evidence by testing the FF three factor models in thirteen different markets over the period 1975 to 1995. Study reports that 12 of the 13 markets record a premium of at least 7.68 percent per annum to value stocks. Seven markets show statistically significant BM/ME betas. Faff (2001) uses Australian data over the period 1991 to 1999 to examine the power of the Fama French three-factor model and finds strong support for the Fama and French three factor model. Study provides evidence about existence of significant negative relationship which is in contravention to expected positive, premium for

small size stocks. Faff (2001) concludes that his results appear to be consistent with other recent evidence of a reversal of the size effect.

3.3.7 Asset pricing in Pakistani Equity Market

Iqbal and Brook (2007) test capital asset pricing model in KSE for the period 11/1992 to 4/2006 by using monthly, weekly and daily data and finds that risk return relationship is non-linear and strong in recent years. This study further provides that the relationship is similar for individual stocks as well as size sorted portfolios. These findings may be a result of high liquidity stocks as study controls the effect for thin trading by employing Dimson (1979) procedure. Javid and Ahmad (2008) find that explanatory power of standard CAPM is not adequate, and conditional CAPM has better explanatory power. The conditional higher moments model indicate that conditional coskewness is an important factor in determination of asset prices and explanatory power of conditional covariance and conditional cokurtosis is limited extent. Attiya (2009) again test CAPM in KSE by using daily and monthly prices of stocks listed for the period 1993 to 2004 and report that CAPM does not explain equity returns. Further, study also tests conditional and unconditional three moment CAPM and four moment CAPM and report that performance of three moment CAPM is relatively better in compararison to standard CAPM. However, the results of higher-moment model indicate that systematic covariance and systematic cokurtosis have marginal role in explaining the asset price Iqbal and Haider (2005) test the applicability of the APT by using monthly data for 24 stocks listed at KSE for

the period 1/1997 to 12/2003 and find evidence of two priced factors in a sub-period. These factors are identified as anticipated and unanticipated inflation and market index and dividend yield. Iqbal and Haider (2005) use a very small sample so generalization of these results will not be justified as it may be an out come of data bias. Ataullah (2005) uses Iterative Non-Linear Seemingly Unrelated Regressions to test APT in the Pakistani equity market. Results reveal that macroeconomic factors - unexpected inflation, exchange rate, trade balance, and oil prices - are a source of systematic risk in the Pakistani equity. In another study,Nawazish and Saima (2008) use daily data to test the validity of Fama and French Three Factor model through double sorted portfolios for the period 1/2003 to 12/2007 and provide evidence that size and book to market are priced and FF model explains the portfolio returns. The study also confirms the robustness of the model by using a reduced model. Durrani et al (2009) investigate the determinants of size effect in textile industry of Pakistan for the period and finds that operating efficiency, financial leverage, institutional neglect and distress level of small firms is significantly different large firms. However, no significant difference is observed with reference stock liquidity.

Above review indicates that asset pricing mechanism in Pakistani equity markets has not been investigated in detail. Only few studies are available and these too are restricted to conditional and uncondiytional CAPM and Fama and French three factor model. These studies are based on very limited sample so it is need of time to investigate this important market of south Asia with a large set of sample that

captures the current dynamics of equity market. This study is an effort to fill that gap in empirical literature.

3.4. Arbitrage Pricing Theory –Macroeconomic Factors

The APT presented by Chen, Roll and Ross (1986) requires identification of macro-factors which influence stock returns. As macroeconomic behavior influences the returns of securities so by considering macro factors in the return generating process we can get better estimates of asset returns. The basic theory of asset pricing requires discounting of future cash flows to get intrinsic value. Therefore variables that affect the future cash flows or the risk adjusted discount rate of a company must be considered. A comprehensive review of literature reveals that industrial production, inflation, interest rates, term structure, foreign exchange rate, market indices, oil price, money supply, labor force, exports and imports, population, inventories, have been studied in several countries.

Macroeconomic Factor Models include factors which have *priori* reasons to have relationship on the basis of theory. For development of macroeconomic factor based model for Pakistani equity market seven variables have been identified. The variables include interest rates, money supply, industrial production, oil prices, foreign exchange rate, foreign portfolio investment, and inflation.

Fama (1981) argues that growth in nominal money supply, due to its positive association with inflation, would adversely affect stock prices. If firms are not able to increase prices in response to higher costs, despite a rise in the growth rate of return, growth rate of dividends would be constant and stock prices would then decline; and the factors that influence interest rate to move up might also have negative impacts on earnings, resulting in an ultimate decline in stock prices. The relationship between nominal money supply and stock price, therefore, needs to be empirically tested. Chen, Roll & Ross (1986) hypothesizes and tests a set of macroeconomic data series to explain the U.S. stock returns. They investigate the sensitivity of macroeconomic variables to stock returns. They employed 7 macro series; term structure, industrial production, risk premium, inflation, market return, consumption and oil prices. They assume that the underlying variables are serially uncorrelated and all innovations are unexpected. In their research, they found a strong relationship between the macroeconomic variables and the expected stock returns. They note that industrial production, changes in risk premium, twist in the yield curve, and measure unanticipated inflation and changes in expected inflation during period when these variables are highly volatile, are significant in explaining expected returns. Their evidence suggests that consumption, oil prices and market index are not priced by the financial market. They conclude that stock returns are exposed to systematic news that are priced by the market

Beenstock and Chan (1988) identifies four risk factors - namely, interests rates, money supply (M3), fuel and material cost, and the retail price index to test the

relationship with equity prices.They find that unanticipated increase in interest rate and fuel and material costs depress security returns. However, unanticipated increase in the money supply and the retail price index raise security returns. They also considered export volume and relative export prices as risk factors, but these were not significant

Mukherjee and Naka (1995) investigate the relation between Tokyo stock prices and six macroeconomic variables using a vector error correction model (VECM). Their study covered 240 monthly observations for each variable in the period from January 1971 to December 1990. The results of the study show that the relationship between Tokyo stock prices, the exchange rate, money supply, and industrial production is positive, whereas the relationship between Tokyo stock prices and inflation and interest rates is mixed.

Jones and Kaul (1996) investigates the effect of oil prices on stock markets and concluded that in oil importing economies, like UK and Japan changes in oil prices appear to cause larger change in stock prices than changes in future real cashflows. However, in USA or Canada the effect changes in oil prices can be completely accounted for by changes in future real cash flows. Zhao (1999) studies the relationships among inflation, industrial production and stock prices in the Chinese economy. The study employs monthly values covering the period from January 1993 to March 1998. The results indicate a significant and negative relation between stock

prices and inflation. The findings also indicate that output growth negatively and significantly affect stock prices

Maysami and Koh (2000) examine the dynamic relations between macroeconomic variables and Singapore stock markets using the vector error correction model. The macroeconomic variables are exchange rate, long and short term interest rates, inflation, money supply, domestic exports, and industrial production. The data were seasonally adjusted and cover the period from 1988 to 1995. The study shows that inflation, money supply growth, change in short and long term interest rates, and variation in exchange rates do form a co-integrating relation with the changes in Singapore's stock market levels. This study also examined the association between the American and Japanese stock markets and the Singapore stock market. Results show that the three markets are highly co-integrated. Mishra (2004) examines the relationship between stock market and foreign exchange markets using Granger causality test and Vector Auto Regression technique. They employ monthly data for stock return exchange rate, interest rate and demand for money for the period 1992 to 2002. The study found that there exist a unidirectional causality between the exchange rate and interest rate and also between the exchange rate return and demand for money. The study also suggests that there is no Granger causality between the exchange rate return and stock return. From above literature review we can say that the academic world is still deeply divided between beta defenders [Sharpe (1964, 1998), Cheng (1995), Grundy and Malkiel (1996)], APT advocates [Chen (1983), Chen, Roll and Ross (1986), Fama and French (1992), Groeneworld and Fraser

(1997)] and researchers questioning the testability of both methods [(Roll (1977), Shanken (1983), Dhrymes, Friend and Gultekin(1984)].

A detailed and comprehensive literature review indicates that asset pricing has always attracted academician and practitioners in various parts of the world. But this important subject could not much attention in Pakistani capital market so only few papers are available as mentioned above. This study is an effort to explore the dynamics of Pakistani equity market so that a compressive set of risk factor influencing KSE are identified and an integrated model can be developed that can be helpful in optimal resource allocation by stakeholders.

3.5 Arbitrage Pricing Theory – Statistical Factor

Statistical Factor Models include factors which are purely empirical and have no *a priori* reason to have a relationship with return. Here factors are determined by Factor Analysis or Principal Component Analysis. Chamberlain and Rothschild (1983) extend Ross's (1976) APT and finds that mean returns are approximately linear functions of the factor loadings. Their Study suggests a unique approach for testing for number of factors known as the principal components analysis. Gehr (1978) tests the efficacy of APT models without attempting to identify the risk factors. In these studies, factor analysis is used to decompose the portfolio returns. To test the ability of the factors to explain mean returns, the factor loadings are derived from factor analysis and then these are used as independent variables in a cross-sectional

regression with mean portfolio rates of return. As this study is focused on company based factor and macroeconomic factor so only such studies are reviewed in detail.

Chapter 4

DATA DESCRIPTION AND METHODOLOGY

4.1 Data Description and Methodology for Testing Capital Asset Pricing Model

This study uses monthly closing prices of stocks listed at Karachi stock exchange for the period 6/98 to 6/2007. The criteria for selection of stocks is as under

- Only those stocks are included in sample which are continuously listed at KSE during 6/98 to 6/2007
- Stock from non financial sector are selected
- Only those stocks are included which have evidence of reasonable liquidity i.e stock which have an evidence of trading in at least 8 months during a year.

On the basis of above criteria, 130 stocks are chosen that are from non financial sector and have continuous history of listing and trading as stated above.

A careful review of empirical literature provides three different procedures to test the CAPM. These include:

- Black, Jensen and Scholes Test
- Fama and MacBeth Test
- Pettengill Test

Capital asset pricing model is tested by using a two pass regression procedure that has been widely used in the research. In this process, the data set is divided into two sets: the estimation and the testing periods. In the estimation period, the beta is estimated

by running a regression of realized returns of an asset against market returns. The resulting beta of the first regression is used to proxy for the true beta of the asset and is regressed against the excess return of the asset. Generally, this regression takes the following form:

$$R_{it} - R_{ft} = \lambda_{ot} + \lambda_{1t} \beta_i + \mu_{it}$$

Where the left-hand side is the return of the asset in excess of the risk-free rate and β_i is the estimated beta from the first regression. The literature on the subject argues that creating portfolios reduces idiosyncratic volatility and enables more precise estimation of factor loadings and risk premium so this studycreates and uses portfolios for testing capital asset pricing models.

Black, Jensen and Scholes test is based on two step procedure. In first step, beta coefficients are estimated for all stocks. These are calculated by regressing excess actual returns against the excess market returns.

$$E(R_i) = R_F + \beta_i (R_M - R_F)$$

Where $E(R_i)$ are expected returns of individual securities and β_I is beta of individual securities. Stocks are arranged in descending order and portfolios are created on the basis of beta ranking. In second step, average returns of these portfolios are calculated and regressed against beta of portfolios.

$$R_{it} = \lambda_{ot} + \lambda_{1t} \beta_{it} + \varepsilon_{it}$$

Where R_{it} is the return on portfolio "i" in month t, β_i is the beta of portfolio "i" and ε_{it} is error term. It is worth mentioning that beta of portfolio is adjusted each month to new information about securities prices.

Fama and MacBeth approach is based on three step procedure. In the first step, beta for each individual security is calculated for portfolio formation period. Beta is calculated by using following relationship;

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

Securities are then grouped into ten portfolios on the basis of ranking of the estimated betas. In the second step, betas of ten portfolios are calculated for initial estimation period consisting of next three years. These betas can either be calculated by taking average of betas of the securities assigned to each portfolio or by regressing the excess returns of each portfolio against excess market returns for initial estimation period. This study uses second approach. In third step, realized returns of each portfolio are regressed against time varying betas of portfolios in testing period. Realized returns of portfolios are taken as dependent variable and time varying beta is taken as explanatory variable.

$$R_{it} = \lambda_{ot} + \lambda_{1t} \beta_{it} + \varepsilon_{it}$$

Where R_{it} is the return on portfolio "i" in month t, β_i is the beta of portfolio "i" and ε_{it} is error term.

Above equation provides estimates of the average values of monthly coefficients λ_{ot} and λ_{it}. These values of monthly coefficients are finally examined to see the significance of relationship. Results of cross sectional regression analysis provide evidence about the relationship between equity risk premium and beta.

It is hypothesized that the intercept equals to zero and the slope of SML equals the average risk premium. It is also hypothesized that there exist a linear relationship between portfolio returns and portfolio betas. A significant positive relationship exhibits applicability of Capital Asset Pricing Model in equity market.

This study uses three years portfolio formation period, three years portfolio betas estimation period and three years testing period as shown below in Table 4.1

Table 4.1 Estimation and Testing Periods

Description	Time Periods
Portfolio Formation Period	1998-2001
Initial estimation Period	2001-2004
Testing Period	2004-2007

It is further hypothesized that β_i should be the only variable that explains the relationship between risk and returns.If any other variable is included in model than it should have insignificant association with portfolio returns.

Pettengill approach is a modification and extension of Fama and MacBeth approach that investigates the relationship between risk premium and beta in up-market and down-market separately. An up-market is period with positive risk premium and a down-market is period with negative risk premium. The sample period is divided into

sub periods (i) portfolio formation period; (ii) portfolio beta estimation period; and (iii) testing period. In step one, beta sorted portfolios are created for portfolio formation period. In step two, portfolio betas are calculated for portfolio beta estimation period. Finally, returns of beta sorted portfolios are regressed against the portfolio betas. Dummy variables are used for up-market and down-markets. Thus the traditional regression equation is modified as

$$R_{pt} = \lambda_{0t} + \lambda_{1t} D\beta_{it} + \lambda_{2t} (1- D) \beta_{it} + \varepsilon_{it}$$

where D = 1 if $R_{mt} - R_{ft}$ is positive , and D = 0 if $R_{mt} - R_{ft}$ is negative. Where R_{mt} is the market portfolio return and R_{ft} is the risk-free rate. The null and alternative hypothesis are :

$$H_o : \quad \lambda_{1t} = 0$$

$$H_1 : \quad \lambda_{1t} > 0$$

and

$$H_o : \quad \lambda_{2t} = 0$$

$$H_1 : \quad \lambda_{2t} < 0 .$$

In nutshell, it is hypothesized that there exist a negative relationship between market risk premium and beta in down-markets and there exist a positive relationship between risk and return in up-markets.

Finally one more aspect is analyzed by incorporating additional variables in the traditional regression equation. Linearity assumption has been tested for CAPM by using the following equation

$$R_{p,t} - R_f = \lambda_{ot} + \lambda_{1t}\beta_{p,t-1} + \lambda_{2t}\beta^2_{p,t-1} + \varepsilon_{it}$$

If λ_{2t} is not significant at $\alpha = .05$ then we can say that there exist a linear relationship exists between beta and portfolio risk premium.

4.2. Data Description and Methodology for Testing Arbitrage Pricing Theory (APT)

A detailed review of literature reveals that a large number of variables have been identified to explain the expected returns in various parts of the world, these include book-to market ratio, dividend yields, earning yield, spread of long and short-runs bond yield, price-earnings ratio,firm size, momentum, cash to sale ratio etc. Current research literature also discusses the importance of liquidity and behavioral aspects in determining the asset prices. So this study develops comprehensive characteristic based model by investigating the impact of market premium, size premium, momentum, value premium and liquidity premium and PE premium independently and jointly.

Arbitrage pricing theory has been tested by using various methods which include (i)Standard, Cross-Section and Time Series Regression Analyses; (ii) Cointegration analysis; (iii) Factor Analysis; (iv) Generalised Method of Moments and; (v) Generalized Autoregressive Conditional Heteroskedasticity

Importance of asset pricing mechanism always fuelled the curiosity of the researchers to design such methods that can analyze and estimate the relationship between prices of financial assets and various characteristic and macroeconomic variables. From review of literature, following testing methods have been identified.

Table 4.2 Methods Used for Investigating Asset Pricing

Analytical Methods	Recorded Studies
Standard, Cross-Section and Time Series Regression Analyses	• Ross (1976, 1977) • Gehr (1978) • Ross and Roll (1980) • Beenstock and Chan (1983, 1984) • Chen, Roll and Ross (1983,1986) • Connor and Korajezyk (1989) • Fama and French (1992, 1993) • Brailsford and Heaney (1998)
Cointegration Analysis	• Pesaran and Timmerman (1995) • Mukharjee and Naka (1995) • Cheung and Ng (1998) • Roca (1998) • Mukharjee and Hoh (2000) • Maysomi and Kho (2000) • Paul and Mallik (2001) • McMillan (2001)
Generalised Method of Moments	• Zhou (1999) • Velu and Zhou (1999)
Autoregressive Conditional Heteroskedasticity	• Brailsford and Faff (1996)
	• Ross (1976, 1977)

Factor Analysis	• Gehr (1978) • Ross and Roll (1980) • Chen, Roll and Ross (1983,1986) • Beenstock and Chan (1983, 1984) • Connor and Korajezyk (1989) • Fama and French (1992, 1993) • Brailsford and Heaney (1998) • Bai and Ng (2002)
Principal Component Analysis	• Chamberlain and Rothschild (1983) • Connor and Korajczyk (1986, 1988, 1989) • McGowan and Francis (1991) • Faff (1988, 1992)

This study employs the methodology proposed by Fama and French (1992) based on standard multivariate regression analysis and cointergration analysis proposed by Johansson and Jusilius (1991).

4.3. Two Factor Model - Size Premium and Equity Returns

The study uses monthly closing prices of all stocks listed at KSE for the period 6/2000 to 6/2007 which satisfy the following criteria.

- Sample consists of stocks from non financial sector.
- Stocks with negative book value of equity are excluded from sample.
- Only those stocks are included which have evidence of reasonable liquidity.i.e stock which have an evidence of trading in at least 8 months during a year.
- Returns of the stocks have been calculated by using ln (P_t / P_{t-1}) and then adjustment for cash dividend has been made in the returns of relevant month. Dividend yield has calculated by dividing cash dividend with average market price of the stock.

Accounting data has been collected from various bulletins of "Balance Sheet Analysis" published by State Bank of Pakistan. Stock prices and turnover has been obtained form websites of business recorder and Karachi Stock Exchange which are reliable sources of information. On the basis of above criteria, following sample is finally selected.

Table 4.3

Details of Sample

years	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
No. of Stocks	193	218	271	274	272	274	274

Since the seminal work of Black, Jensen and Scholes (1972) and Fama and Macbeth (1973) portfolio returns are preferred on individual stock returns as creating portfolios reduces idiosyncratic volatility and enables more precise estimation of factor loadings and risk premium.

For size sorted portfolios, market capitalization of each stock is calculated at the end of June for year t-1 and then stocks are arranged in descending order. Now, median is calculated and sample is divided in two portfolios. First, portfolio comprises of stocks that have market capitalization less than median. This portfolio is called "Small". Other portfolio comprises of stocks that have market capitalization more than median. This portfolio is named as "Big". This process is repeated each year.

Now for the portfolios created at the end of June for year "t-1", monthly portfolio returns are calculated for year "t". Portfolio returns are average returns of all stocks in the portfolio. Then returns of "Big" portfolio are subtracted each month from returns of "Small" portfolio to find size premium as shown below

$$SMB = R_{Small} - R_{Big}$$

Market premium is calculated by subtracting risk free rate from market returns as shown below

$$MKT = (R_{mt} - R_{ft})$$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

R_{ft} is risk free rate. Monthly T. bill rate has been used as proxy for risk free rate.

Two factor models explore the relationship between expected portfolio returns and size premium in the presence of market premium. The relation ship examined is presented algebraically.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t$$

where

R_{it} = Return of portfolio"i" for period "t"

R_{ft} = Risk Free Rate

MKT = R_{mt} - R_{ft}

SMB = $R_{Small} - R_{Big}$

ε_t = error term

It is hypothesized that there exist a positive relationship between size premium and expected returns. In other words small stocks earn higher than large stocks.

4.4 Two Factor Model - Value Premium and Equity Returns

For B/M sorted portfolios, book to market ratio of each stock is calculated at the end of June for year t-1 and then stocks are arranged on ascending order. Now these stocks are divided in three portfolios. First portfolio comprises of 30% stocks that have smallest book to market ratio. This portfolio is called "Low". Second comprises of next 40% stocks in the above list. This portfolio is named as "Middle". Third portfolio comprises of stocks that have highest book to market ratio. This portfolio is named as "High ". This process is repeated each year.

Now for the portfolios created at the end of June for year "t-1", monthly portfolio returns are calculated for year "t". Portfolio returns are average returns of all stocks in the portfolio. Then returns of "Low" portfolio are subtracted each month from returns of "High" portfolio to find value premium as shown below

$$HML_t = R_{high\ BMR,\ t} - R_{low\ BMR,t}$$

Market premium is calculated by subtracting risk free rate from market returns as shown below

$$MKT = R_{mt} - R_{ft}$$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

R_{ft} is risk free rate. Monthly T. bill rate has been used as proxy for risk free rate.

Two factor models explore the relationship between expected portfolio returns and value premium in the presence of market premium. The relation ship examined is presented algebraically

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 HML_t$$

where

R_{it} = Return of portfolio"i" for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$HML_t = R_{high\ BMR,\ t} - R_{low\ BMR,t}$

ε_t = error term

It is hypothesized that there exist a positive relationship between HML and expected returns. In other words high book to market stocks earn higher than low book to market stocks.

4.5 Two Factor Model - P/E premium and Equity Returns

For P/E sorted portfolios, price earning ratio of each stock is calculated at the end of June for year t-1 and then stocks are arranged on ascending order. Now these stocks are divided in three portfolios. First, portfolio comprises of 30% stocks that have smallest book to market ratio. This portfolio is called "Low P/E Stocks". Second, comprises of next 40% stocks in the above list. Third, portfolio comprises of stocks that have highest price earning market ratio. This portfolio is named as "High P/E stocks ". This process is repeated each year.

Now for the portfolios created at the end of June for year "t-1", monthly portfolio returns are calculated for year "t". Portfolio returns are average returns of all stocks in the portfolio. Then returns of "High P/E Stocks" portfolio are subtracted each month from returns of "Low P/E Stocks" portfolio to find PE premium as shown below

$$\text{PE Premium}_t = R_{\text{low P/E stocks, t}} - R_{\text{high P/E stocks,t}}$$

Market premium is calculated by subtracting risk free rate from market returns as shown below

$$MKT = R_{mt} - R_{ft}$$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

R_{ft} is risk free rate. Monthly T bill rate has been used as proxy for risk free rate.

Two factor models explore the relationship between expected portfolio returns and P/E premium in the presence of market premium. The relation ship examined is presented algebraically

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 \text{ PE Premium}_t$$

where

R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$\text{PE Premium}_t = R_{\text{low P/E stocks, t}} - R_{\text{high P/E stocks,t}}$

ε_t = error term

It is hypothesized that there exist a positive relationship between PE premium and expected returns. In other words low PE stocks earn higher than high PE stocks.

4.6 Two Factor Model - Momentum and Equity Returns

For momentum sorted portfolios, average return of each stock is calculated at the end of June for year t-1 then stocks are arranged in ascending order on the basis of returns. Now these stocks are divided in three portfolios. First portfolio comprises of 30% stocks that have earned lowest average return during last 12 months. This portfolio is called "Loser". Second comprises of next 40% stocks in the above list. Third portfolio comprises of stocks that have earned highest average return during last 12 months. This portfolio is named as "Winner". This process is repeated each year.

Now for the portfolios created at the end of June for year "t-1", monthly portfolio returns are calculated for year "t". Portfolio returns are average returns of all stocks in the portfolio. Then returns of "Loser" portfolio are subtracted each month from returns of "Winner" portfolio to find Momentum as shown below

$$MOM = R_{\text{Winner stocks, t}} - R_{\text{Loser stocks,t}}$$

Market premium is calculated by subtracting risk free rate from market returns as shown below

$$MKT = R_{mt} - R_{ft}$$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

R_{ft} is risk free rate. Monthly T. bill rate has been used as proxy for risk free rate.

Role of momentum in explaining cross section of expected return is examined in the presence market premium by using following equation

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 MOM_t$$

where

R_{it} = Return of portfolio'i' for period "t"

R_{ft} = Risk Free Rate

MKT = $R_{mt} - R_{ft}$

MOM= $R_{\text{Winner stocks, t}} - R_{\text{Loser stocks,t}}$

ε_t = error term

It is hypothesized that there exist a positive relationship between momentum and expected returns. In other words past winner stocks earn higher than past loser stocks.

4.7 Two Factor Model - Illiquidity premium and Equity Returns

For liquidity sorted portfolios, turnover ratio of each stock is calculated for at the end of June for year t-1 by using following formula

Turnover ratio = Total turnover during last 12 month/Total outstanding shares

Then stocks are arranged in ascending order on the basis of turnover ratio. Now these stocks are divided in three portfolios. First, portfolio comprises of 30% stocks that have lowest turn over ratio. This portfolio is called “Low Liquidity Stocks”. Second, comprises of next 40% stocks in the above list. Third, portfolio comprises of stocks that have highest turn over ratio. This portfolio is named as “High Liquidity stocks”. This process is repeated each year.

Now for the portfolios created at the end of June for year “t-1”, monthly portfolio returns are calculated for year “t”. Portfolio returns are average returns of all stocks in the portfolio. Then returns of “High Liquidity Stocks” portfolio are subtracted each month from returns of “Low Liquidity Stocks ” portfolio to find Illiquidity premium as shown below

$$\text{Illiquidity Premium}_{t} = R_{\text{low Liquidity stocks, t}} - R_{\text{high Liquidity stocks,t}}$$

Market premium is calculated by subtracting risk free rate from market returns as shown below

$$MKT = R_{mt} - R_{ft}$$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

R_{ft} is risk free rate. Monthly T bill rate has been used as proxy for risk free rate.

Role of illiquidity premium in explaining cross section of expected return is examined in the presence market premium by using following equation

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 ILLIQP_t$$

where

R_{it} = Return of portfolio'i' for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

ILLIQP= Illiquidity Premium $_t = R_{\text{low Liquidity stocks, t}} - R_{\text{high Liquidity stocks,t}}$

ε_t = error term

It is hypothesized that there exist a positive relationship between illiquidity premium and expected returns. In other words low liquidity stocks earn higher than high liquidity stocks.

4.8 Fama and French Three Factor Model

CAPM uses a single factor to compare a portfolio with the market as a whole. Fama and French observe that certain classes of assets perform better than others so in order to capture the effect of size and market to book ratio. They then added two factors

size premium and value premium to CAPM to reflect a portfolio's exposure to these two attributes.

For size sorted portfolios, market capitalization of each stock is calculated at the end of June for year t-1 and then stocks are arranged on descending order. Now median is calculated and sample is divided in two portfolios. First portfolio comprises of stocks that have market capitalization less than median. This portfolio is called “Small”. Other portfolio comprises of stocks that have market capitalization more than median. This portfolio is named as “Big”.

Size sorted portfolios are further subdivided into three portfolios on the basis of book to market ratio. The first portfolio contains 30% stocks with lowest book to market ratio, second portfolio contains next 40% stocks on the basis of book to market ratio, third portfolio comprises of 30% stocks with highest book to market ratio. When “Small” is further subdivided three portfolios on the basis of book to market ratio, it forms three portfolios namely S/L, S/M, S/H. When “Big” is further subdivided in three portfolios on the basis of book to market ratio, it forms three portfolios namely B/L, B/M, B/H.

To isolate the factor premiums from each other, the two factors are constructed as zero-investment portfolios from six sub portfolios as under:

$$SMB = 1/3 * [(S/H – B/H) + (S/M – B/M) + (S/L – B/L)]$$

$$HML =1/2 * [(S/H – S/L) + (B/H – B/L)]$$

$MKT = R_{mt} - R_{ft}$

where

$$R_m = \ln (I_t / I_{t-1})$$

R_m is market return for month 't' and I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively. R_{ft} is risk free rate. Monthly T. bill rate has been used as proxy for risk free rate.

The algebraic relationship among variables is presented below.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + e_{it}$$

Where

R_{it} = Return of portfolio 'i' for period "t"

R_{ft} = Risk Free Rate

This formula captures the following dimensions

- The Zero Risk return
- The Market Premium
- Size Premium
- Value Premium
- The impact of management (Alpha)
- Random Error

4.9 Carhart Four Factor Models

Carhart (1997) expands the Fama and French three factor model by adding a fourth risk factor that captures the propensity of firms with positive (negative) past returns to produce positive (negative) future returns. This risk element is described as a momentum factor and approximates it by taking the average return to a set of stocks with the best performance over the prior year minus the average return to stocks with the worst returns. Study reveals that the factor sensitivity for the momentum variable is positive and its inclusion into the Fama-French model increases explanatory power.

This study creates portfolios for Carhart model by further dividing the portfolios created in section 4.8 for testing Fama and French three Factor Model

Each portfolio created in section 4.8 is now further subdivided into two portfolios on the basis of average return for last 12 months. The portfolio comprising of high return stocks is defined as winner and it is represented by "U". The portfolio comprising of low return stocks is defined as loser and it is represented by "D". This results in creation of 12 portfolios namely S/H/U , S/H/D, S/M/U , S/M/D , S/L/U , S/L/D, , B/H/U , B/H /D , B/M/U , B/M/D , B/L/U , B/L/D . It may be noted that "S" is portfolio of small stocks. "B" is portfolio of big stocks. "H" is portfolio of high book to market stocks. "M" is portfolio comprising of mid book to market ratio, and "L" represent portfolio of small book to market stocks.

To isolate the factor premiums from each other, variables market premium, size premium, value premium and momentum are constructed as under:

$MKT = R_{mt} - R_{ft}$

$SMB = 1/6 * [(S/H/U – B/H/U) + (S/H/D – B/H/D) + (S/M/U – B/M/U) +$

$(S/M/D – B/M /D) + (S/L/U – B/L/U) + (S/L/D – B/L/D)]$

$HML =1/4 * [(S/H/U – S/L/U) + (S/H/D – S/L/D) + (B/H/U – B/L/U) +$

$(B/H/D – B/L/D)]$

$UMD= 1/6 * [(S/H/U – S/H/D) + (S/M/U – S/M/D)+ (S/L/U – S/L/D) + (B/H/U –$

$B/H /D) + (B/M/U – B/M/D) + (B/L/U – B/L/D)]$

The algebraic relationship among variables is presented below

$$R_{it} – R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + e_{it}$$

where

R_{it} = Return of portfolio ‘i’for period “t”

R_{ft} = Risk Free Rate

This formula captures

- The Zero Risk return
- The Market Premium
- Size Premium
- Value Premium
- Momentum premium
- The impact of management (Alpha)
- Random Error

4.10 Liquidity based Four Factor Models

Fama and French three factor model is expanded by adding a fourth risk factor that captures the propensity of firms with low (high) liquidity to earn high (low) future returns. This risk element is defined as illiquidity factor and approximated by taking the average return to a set of stocks with low liquidity over the prior year minus the average return to stocks with high liquidity. The liquidity is measured through turnover ratio for the last year.

This study creates portfolios for Carhart model by further dividing the portfolios created in section 4.8 for testing Fama and French three Factor Model

Each portfolio created in section 4.8 is now further subdivided into two portfolios on the basis of total turnover ratio for last 12 months. The portfolio comprising of high turnover stocks is defined as high liquidity stocks and it is represented by "HL". The portfolio comprising of low turnover stocks is defined as low liquidity stocks and it is represented by "LL". This results in creation of 12 portfolios namely S/H/LL, S/H/HL, S/M/LL , S/M/HL , S/L/LL , S/L/HL, B/H/LL , B/H /HL , B/M/LL , B/M/HL , B/L/LL , B/L/HL.

To isolate the factor premiums from each other, variables market premium, size premium, value premium and illiquidity premium are constructed as under

$MKT = R_{mt} - R_{ft}$

SMB = 1/6 * [(S/H/HL – B/H/HL) + (S/H/LL – B/H/LL) + (S/M/HL – B/M/HL) + (S/M/LL – B/M /LL) + (S/L/HL – B/L/HL) + (S/L/LL – B/L/LL)]

HML = 1/4 * [(S/H/HL – S/L/HL) + (S/H/LL – S/L/LL) + (B/H/HL – B/L/HL) + (B/H/LL – B/L/LL)]

ILLIQP = 1/6 * [(S/H/LL – S/H/HL) + (S/M/LL – S/M/HL) + (S/L/LL – S/L/HL) + (B/H/LL – B/H /HL) + (B/M/LL – B/M/HL) + (B/L/LL – B/L/HL)]

The algebraic relationship among variables is presented below.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 ILLIQP_t + e_{it}$$

Where

R_{it} = Return of portfolio ‘’for period “t”

R_{ft} = Risk Free Rate

ε_t = error term

This formula captures

- The Zero Risk return
- The Market Premium
- Size Premium
- Value Premium
- Illiquidity premium

- The impact of management (Alpha)
- Random Error

4.11 Proposed Five Factor Model

Carhart four factor model is expanded by adding a fourth risk factor that captures the effect of illiquidity on expected returns This factor is derived by taking the average return to portfolio of stocks with low liquidity over the prior year minus the average return of portfolio of stocks with high liquidity during same period. The liquidity is measured through turnover ratio for the last year and portfolios are adjusted every year.

This study creates portfolios for five factor model by further dividing the portfolios created in section 4.9 for testing Carhart four factor Model

Now each of the portfolios created in section 4.9 is further subdivided into two portfolios on the basis of turnover ratio. One comprising of stocks with low liquidity over the prior year and other comprising of stocks with high liquidity over the prior year. The portfolio comprising of high turnover is defined as high liquidity and it is represented by "HL". The portfolio comprising of low turnover stocks is defined as low liquidity stock and it is represented by "LL". This results in creation of 24 portfolios namely S/H/U/LL , S/H/D/LL, S/M/U/LL , S/M/D/LL , S/L/U/LL , S/L/D/LL, , B/H/U/LL , B/H /D/LL , B/M/U/LL , B/M/D/LL , B/L/U/LL ,

B/L/D/LL S/H/U/HL , S/H/D/HL, S/M/U/HL , S/M/D/HL , S/L/U/HL , S/L/D/HL, ,

B/H/U/HL , B/H /D/HL , B/M/U/HL , B/M/D/HL , B/L/U/HL , B/L/D/HL

To isolate the factor premiums from each other, variables market premium, size premium, value premium, momentum, and illiquidity premium are constructed as under

$MKT = R_{mt} - R_{ft}$

$$SMB = 1/12 * [(S/H/U/HL – B/H/U/HL) + (S/H/U/LL – B/H/U /LL) + (S/H/D/HL – B/H/D/HL) + (S/H/D/LL – B/H/D/LL) + (S/M/U/HL – B/M/U/HL) + (S/M/U/LL – B/M/U /LL) + (S/M/D/HL – B/M /D/HL) + (S/M/D/LL – B/M/D/LL) + (S/L/U/HL – B/L/U/HL) + (S/L/U/LL – B/L/U /LL) + (S/L/D/HL – B/L/D/HL) + (S/L/D/LL – B/L/D/LL)]$$

$$HML = 1/8 * [(S/H/U/HL – S/L/U/HL) + (S/H/U/LL – S/L/U /LL) + (S/H/D/HL – S/L/D/HL) + (S/H/D/LL – S/L/D/LL) + (B/H/U/HL – B/L/U/HL) + (B/H/U/LL – B/L/U /LL) + (B/H/D/HL – B/L/D/HL) + (B/H/D/LL – B/L/D/LL)$$

$$UMD = 1/12 * [(S/H/U/HL – S/H/D/HL) + (S/H/U/LL – S/H/D /LL) + (S/M/U/HL – S/M/D/HL) + (S/M/U/LL – S/M/D/LL) + (S/L/U/HL – S/L/D/HL) + (S/L/U/LL – S/L/D /LL) +$$

$$(B/H/U/HL – B/H /D/HL) + (B/H/U/LL – B/H/D/LL) +$$

$$(B/M/U/HL – B/M/D/HL) + (B/M/U/LL –B/M/D /LL) +$$

$$(B/L/U/HL – B/L/D/HL) + (B/L/U/LL – B/L/D/LL)]$$

$$ILLIQP = 1/12 * [(S/H/U/LL – S/H/U/HL) + (S/H/D/LL – S/H/D /HL) +$$

$$(S/M/U/LL – S/M/U/HL) + (S/M/D/LL – S/M/D/HL) +$$

$$(S/L/U/LL – S/L/U/HL) + (S/L/D/LL – S/L/D /HL) +$$

$$(B/H/U/LL – B/H /U/HL) + (B/H/D/LL – B/H/D/HL) +$$

$$(B/M/U/LL – B/M/U/HL) + (B/M/D/LL –B/M/D /HL) +$$

$$(B/L/U/LL – B/L/U/HL) + (B/L/D/LL – B/L/D/HL)]$$

The algebraic relationship among variables is presented below.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 ILLIQP_t + \varepsilon_t$$

where

R_{it} = Return of portfolio "i"for period "t"

R_{ft} = Risk Free Rate

ε_t = error term

This formula captures

- The Zero Risk Return
- The Market Premium
- Size Premium
- Value Premium

- Momentum premium
- Illiquidity premium
- The impact of management (Alpha)
- Random Error

4.12 Proposed Six Factor Model

Finally, study develops comprehensive characteristic based model by investigating the impact of all identified factors jointly. The new factor incorporated is PE premium. It is calculated by subtracting the average returns of portfolio of high PE Stocks from average returns of portfolio of low PE Stocks. Decision regarding PE ratio is taken at the end of June for year"t-1".

This study creates portfolios for six factor model by further dividing the portfolios created in section 4.10 for testing Carhart four Factor Model

Now each of the portfolios created in section 4.10 is further subdivided into two portfolios on the basis of P/E ratio. One comprising of stocks with low P/E ratio at the end of prior year and other comprising of stocks with high P/E ratio at the end of prior year. The portfolio comprising of high P/E stocks is represented by "HPE". The portfolio comprising of low P/E stocks is represented by "LPE". This results in creation of 48 portfolios namely S/H/U/LL/LPE , S/H/D/LL/LPE, S/M/U/LL/LPE , S/M/D/LL/LPE , S/L/U/LL/LPE , S/L/D/LL/LPE , B/H/U/LL/LPE , B/H/D/LL/LPE , B/M/U/LL/LPE , B/M/D/LL/LPE , B/L/U/LL/LPE ,

B/L/D/LL/LPE , S/H/U/HL/LPE , S/H/D/HL/LPE , S/M/U/HL/LPE , S/M/D/HL/LPE , S/L/U/HL/LPE , S/L/D/HL/LPE , B/H/U/HL/LPE , B/H /D/HL/LPE , B/M/U/HL/LPE , B/M/D/HL/LPE , B/L/U/HL/LPE , B/L/D/HL/LPE , S/H/U/LL/HPE , S/H/D/LL/HPE , S/M/U/LL/HPE , S/M/D/LL/HPE , S/L/U/LL/HPE , S/L/D/LL/HPE, , B/H/U/LL/HPE , B/H/D/LL/HPE, B/M/U/LL/HPE , B/M/D/LL/HPE , B/L/U/LL/HPE , B/L/D/LL/HPE , S/H/U/HL/HPE , S/H/D/HL/HPE , S/M/U/HL/HPE , S/M/D/HL/HPE , S/L/U/HL/HPE , S/L/D/HL/HPE, B/H/U/HL/HPE , B/H/D/HL/HPE , B/M/U/HL/HPE , B/M/D/HL/HPE , B/L/U/HL/HPE , B/L/D/HL/HPE

To isolate the factor premiums from each other, variables market premium, size premium, value premium, Momentum, illiquidity premium and PE premium are constructed as under

$MKT = R_{mt} - R_{ft}$

SMB = 1/24 * [(S/H/U/HL/LPE – B/H/U/HL/LPE) +(S/H/U/LL/LPE – B/H/U/LL/LPE)

+ (S/H/D/HL/LPE – B/H/D/HL/LPE) + (S/H/D/LL/LPE – B/H/D/LL/LPE)

+ (S/M/U/HL/LPE – B/M/U/HL/LPE) + (S/M/U/LL/LPE – B/M/U /LL/LPE)

+ (S/M/D/HL/LPE – B/M /D/HL/LPE) + (S/M/D/LL/LPE – B/M/D/LL/LPE)

+ (S/L/U/HL/HPE – B/L/U/HL/HPE) + (S/L/U/LL/HPE – B/L/U /LL/HPE)

+ (S/L/D/HL/HPE – B/L/D/HL/HPE) + (S/L/D/LL/HPE – B/L/D/LL/HPE)

+ (S/H/U/HL/HPE – B/H/U/HL/HPE) + (S/H/U/LL/HPE – B/H/U /LL/HPE)

+ (S/H/D/HL/HPE – B/H/D/HL/HPE) + (S/H/D/LL/HPE – B/H/D/LL/HPE)

+ (S/M/U/HL/HPE – B/M/U/HL/HPE) + (S/M/U/LL/HPE – B/M/U /LL/HPE)

+ (S/M/D/HL/HPE – B/M /D/HL/HPE) + (S/M/D/LL/HPE – B/M/D/LL/HPE)

+ (S/L/U/HL/HPE – B/L/U/HL/HPE) + (S/L/U/LL/HPE – B/L/U /LL/HPE)

+ (S/L/D/HL/HPE – B/L/D/HL/HPE) + (S/L/D/LL/HPE -B/L/D/LL/HPE)]

HML = 1/8 * [(S/H/U/HL/LPE – S/L/U/HL/LPE) + (S/H/U/LL/LPE – S/L/U /LL/LPE)

+ (S/H/D/HL/LPE – S/L/D/HL/LPE) + (S/H/D/LL/LPE – S/L/D/LL/LPE)

+ (B/H/U/HL/LPE – B/L/U/HL/LPE) + (B/H/U/LL/LPE – B/L/U /LL/LPE)

+ (B/H/D/HL /LPE– B/L/D/HL/LPE) + (B/H/D/LL/LPE – B/L/D/LL/LPE)

+ (S/H/U/HL/HPE – S/L/U/HL/HPE) + (S/H/U/LL/HPE – S/L/U /LL/HPE)

+ (S/H/D/HL/HPE– S/L/D/HL/HPE) + (S/H/D/LL/HPE – S/L/D/LL/HPE)

+ (B/H/U/HL/HPE – B/L/U/HL/HPE) + (B/H/U/LL/HPE – B/L/U /LL/HPE)

+ (B/H/D/HL /HPE– B/L/D/HL/HPE) + (B/H/D/LL/HPE – B/L/D/LL/HPE)]

UMD =1/12 * [(S/H/U/HL/LPE – S/H/D/HL/LPE) +(S/H/U/LL/LPE – S/H/D /LL/LPE)

+ (S/M/U/HL/LPE – S/M/D/HL/LPE) + (S/M/U/LL/LPE – S/M/D/LL/LPE)

+ (S/L/U/HL/LPE – S/L/D/HL/LPE) + (S/L/U/LL/LPE – S/L/D /LL/LPE)

+ (B/H/U/HL/LPE – B/H /D/HL/LPE) + (B/H/U/LL/LPE – B/H/D/LL/LPE)

+ (B/M/U/HL/LPE – B/M/D/HL/LPE) + (B/M/U/LL/LPE –B/M/D /LL/LPE)

+ (B/L/U/HL/LPE – B/L/D/HL/LPE) + (B/L/U/LL/LPE – B/L/D/LL/LPE)

+ (S/H/U/HL/HPE – S/H/D/HL/HPE) + (S/H/U/LL/HPE – S/H/D /LL/HPE)

+ (S/M/U/HL/HPE – S/M/D/HL/HPE) + (S/M/U/LL/HPE – S/M/D/LL/HPE)

+ (S/L/U/HL/HPE – S/L/D/HL/HPE) + (S/L/U/LL/HPE – S/L/D /LL/HPE)

+ (B/H/U/HL/LPE – B/H /D/HL/LPE) + (B/H/U/LL/LPE – B/H/D/LL/LPE)

+ (B/M/U/HL/LPE – B/M/D/HL/LPE) + (B/M/U/LL/LPE –B/M/D /LL/LPE)

+ (B/L/U/HL/LPE – B/L/D/HL/LPE) + (B/L/U/LL/LPE – B/L/D/LL/LPE)]

ILLIQP =1/24 * [(S/H/U/LL/LPE – S/H/U/HL/LPE)+(S/H/D/LL/LPE – S/H/D /HL/LPE)

+ (S/M/U/LL/LPE – S/M/U/HL/LPE) + (S/M/D/LL/LPE – S/M/D/HL/LPE)

+ (S/L/U/LL/LPE – S/L/U/HL/LPE) + (S/L/D/LL/LPE – S/L/D /HL/LPE)

+ (B/H/U/LL/LPE – B/H /U/HL/LPE) + (B/H/D/LL/LPE – B/H/D/HL/LPE)

+ (B/M/U/LL/LPE – B/M/U/HL/LPE) + (B/M/D/LL/LPE –B/M/D /HL/LPE)

+ (B/L/U/LL/LPE – B/L/U/HL/LPE) + (B/L/D/LL/LPE – B/L/D/HL/LPE)

+ (S/H/U/LL/L/HPE– S/H/U/HL/HPE) + (S/H/D/LL/HPE – S/H/D /HL/HPE)

+ (S/M/U/LL/HPE – S/M/U/HL/HPE) + (S/M/D/LL/HPE – S/M/D/HL/HPE)

+ (S/L/U/LL/HPE – S/L/U/HL/HPE) + (S/L/D/LL/HPE – S/L/D /HL/HPE)

+ (B/H/U/LL/HPE – B/H /U/HL/HPE) + (B/H/D/LL/HPE – B/H/D/HL/HPE)

+ (B/M/U/LL/HPE – B/M/U/HL/HPE) + (B/M/D/LL/HPE –B/M/D /HL/HPE)

+ (B/L/U/LL/HPE – B/L/U/HL/HPE) + (B/L/D/LL/HPE – B/L/D/HL/HPE)]

PE Pre = 1/24*[(S/H/U/HL/LPE– S/H/U/HL/HPE)+(S/H/U/LL/LPE–S/H/U /LL/HPE)

+ (S/H/D/HL/LPE– S/H/D/HL/HPE) + (S/H/D/LL/LPE – S/H/D /LL/HPE)

+ (B/H/U/HL/LPE– B/H/U/HL/HPE) + (B/H/U/LL/LPE–B/H/U /LL/HPE)

+ (B/H/D/HL/LPE– B/H/D/HL/HPE) + (B/H/D/LL/LPE – B/H/D /LL/HPE)

+ [(S/M/U/HL/LPE– S/M/U/HL/HPE) + (S/M/U/LL/LPE–S/M/U /LL/HPE)

+ (S/M/D/HL/LPE– S/M/D/HL/HPE) + (S/M/D/LL/LPE – S/M/D /LL/HPE)

+ (B/M/U/HL/LPE– B/M/U/HL/HPE) + (B/M/U/LL/LPE–B/M/U /LL/HPE)

+ (B/M/D/HL/LPE– B/M/D/HL/HPE) + (B/M/D/LL/LPE – B/M/D /LL/HPE)

+ [(S/L/U/HL/LPE– S/L/U/HL/HPE) + (S/L/U/LL/LPE–S/L/U /LL/HPE)

+ (S/L/D/HL/LPE– S/L/D/HL/HPE) + (S/L/D/LL/LPE – S/L/D /LL/HPE)

+ (B/L/U/HL/LPE– B/L/U/HL/HPE)+(B/L/U/LL/LPE–B/L/U /LL/HPE)

+ (B/L/D/HL/LPE– B/L/D/HL/HPE) + (B/L/D/LL/LPE – B/L/D /LL/HPE)

The algebraic relationship among variables is presented below

$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 ILLIQP_t +$

β_6 PE Premium $_t + e_{it}$

Where

R_{it} = Return of portfolio "i"for period "t"

R_{ft} = Risk Free Rate

This formula captures

- The Zero Risk Return
- The market premium
- Size Premium
- Value Premium
- Momentum premium
- Liquidity premium
- P/E Premium
- The impact of management (Alpha)
- Random Error

4.13 Tests for Arbitrage Pricing Theory by using Macro Economic Factors

4.13.1 Data Description –Macroeconomic Variables

This study explores the long term relationship among macro economic variables and Pakistani capital market for the period 6/1998 to 6/2008 by using monthly data. The macroeconomic variables include industrial production index, broad money, oil prices, foreign exchange rate, inflation and interest rate. Monthly time series has been chosen as it is consistent with earlier work done by Chan and Faff (1998) to explore the long run relation ship between macroeconomic variables and equity markets. Variables have been constructed and measured by using following proxies.

Equity Market Returns

Equity market returns has been calculated by using following equation

$$= \ln (P_t / P_{t-1})$$

Where: R_t is Return for month 't';and P_t and P_{t-1} are closing values of KSE- 100 Index for month 't' and 't-1' respectively.

Industrial Growth Rate

Industrial production index has been used as proxy to measure the growth rate in real sector and it has been calculated by using log difference of industrial production index.

$$\text{Growth Rate} = \ln (IIP_t / IIP_{t-1})$$

Studies that explore the relationship among industrial production and equity market returns include Chan, Chen and Hsieh (1985), Chen, Roll and Ross (1986), Burnmeister and Wall (1986), Beenstock and Chan (1988), Chang and Pinegar (1990), Kryzanowski and Zhang (1992), Chen and Jordan (1993), Sauer (1994), Rahman, Coggin and Lee (1998). It is hypothesized that an increase in growth rate is positively related to equity market returns.

Money Supply

Two alternatives proxies has been used for money supply (i) narrow money(M_1) and (ii) broad money (M_2). Money growth rate has been calculated by using log difference of these proxies

$$\text{Money growth rate} = \ln (M_t / M_{t-1})$$

Studies that explore the relationship among money supply and equity market returns include Beenstock and Chan (1988), Sauer (1994). It is hypothesized that an increase in money supply is positively related to equity market returns.

Inflation Rate

Consumer Price Index is used as a proxy of inflation rate. CPI is chosen as it is a broad base measure to calculate average change in prices of goods and services during a specific period.

$$\text{Inflation Rate} = \ln (CPI_t / CPI_{t-1})$$

Studies that explore the relationship among inflation and equity market returns include Chan, Chen and Hsieh (1985), Chen, Roll and Ross (1986), Burnmeister and Wall (1986), Burmeister and MacElroy (1988), Chang and Pinegar (1990), Defina (1991) Kryzanowski and Zhang (1992), Chen and Jordan (1993), Sauer(1994), Rahman, Coggin and Lee (1998). It is hypothesized that an increase in inflation is negatively related to equity market returns.

Change in oil prices

Brent oil prices has been used as proxy for oil prices and change in oil prices has been measured by using log difference i.e

$$\text{Change in oil prices} = \ln (\text{Brent}_t / \text{Brent}_{t-1})$$

Chan, Chen and Hsieh (1985), Chen and Jordan (1993) investigate the relationship among oil prices and equity markets for U.S. market.It is hypothesized that an increase in oil rates is negatively related to equity market returns.

Change in Foreign Exchange Rate

Change in foreign exchange rate is measured by employing end of month US$ / Rs exchange rate and change in value is worked out through log difference. i.e.

$$\text{Change in foreign Exchange Rate} = \ln (FER_t / FER_{t-1})$$

where FER is foreign exchange rate US $/Rs

Kryzanowski and Zhang (1992), Sauer (1994) also explore the relationship between foreign exchange rate and equity market returns. It is hypothesized that depreciation in home currency is negatively related to equity market returns.

Change in Interest Rate

Treasury bill rates have been used as proxy of Interest rate. Change in interest rate has been measured by using log difference to T. bill rates.

$$\text{Change in Interest Rate} = \ln (TB_t / TB_{t-1})$$

Burmeister and MacElroy (1988) study the relationship between short term interest rates and equity market return. It is hypothesized that an increase in interest rate is negatively related to equity market returns.

Change in Foreign Portfolio Investment

Foreign portfolio investment has been used as proxy of Investor confidence. Change in foreign portfolio investment has been measured by using log difference to foreign portfolio Investment.

Change in foreign Portfolio Investment = $\ln (FPI_t / FPI_{t-1})$

It is hypothesized that an increase in foreign portfolio investment is positively related to equity market returns.

4.13.2 Model Specification

A proposed six factor model to study the relationship is expressed below

$$Ri = b_{i0} + b_{i1} F_{i1} + b_{i1} F_{i1} + b_{i2} F_{i2} + b_{i3} F_{i3} + b_{i4} F_{i4} + b_{i5} F_{i5} + b_{i6} F_{i6} + b_{i7} F_{i7} + e_{it}$$

Where, Ri is the realized return on index portfolio and bi is the systematic risk coefficient measuring the change in portfolio returns for a change in factor and Fi is the macroeconomic factor under study.

In the study following factors are identified for examination;

F1 : Interest Rates

F2 : Money Supply

F3 : Industrial Production

F4 : Oil prices

F5 : Exchange Rate

F6 : Inflation

F7: Foreign Portfolio Investment

4.13.3 Cointegration Analysis- JJ Approch

There are a number of techniques for testing the long term causal and dynamic relationship amongst equity prices and macroeconomic variables ranging from VAR, ARDL to GARCH. However this study uses vector autoregressive framework if time series is integrated of same order. If data is not found integrated of same order, then long term relationship will be tested by using autoregressive distributed lag approach (ARDL).

In this study the emphasis is given to test the relationship among macroeconomic variables and Karachi Stock Exchange by employing via; (i) Descriptive Statistics ,(ii) Correlation Matrix, (iii) JJ cointegration Tests, (iv) Granger Causality Test, (v) Impulse Response Analysis, and (vi) Variance Decomposition Analysis

Stationarity of data is examined by using unit root tests. Null hypothesis of a unit root is tested with Augmented Dickey-Fuller Test and Phillips-Perron Test. The ADF test examines the presence of unit root in an autoregressive model. A basic autoregressive model is $Zt = \alpha Z_{t-1} + u_t$, where Z_t is the variable studied, t is the time period, α is a coefficient, and u_t is the disturbance term. The regression model can be written as $\Delta Z_t = (\alpha - 1)Z_{t-1} + u_t = \delta Z_{t-1} + u_t$, where Δ is the first difference operator. Here testing for a unit root is equivalent to testing. $\delta = 0$.

The Dickey-Fuller tests assume that the error terms are statistically independent and have a constant variance. This assumption may not be true in some of the data used

so Phillip Perron test is also used that relaxes above assumptions and permits the error disturbances to be heterogeneously distributed and it can be represented mathematically by

$$Z_t = \alpha_o + \alpha_1 Z_{t-1} + \alpha_t \{t - T/2\} + u_t$$

Test statistics for the regression coefficients under the null hypothesis that the data are generated by $Z_t = Z_{t-1} + u_t$, where $E(u_t) = 0$.

If a time series is non stationary, but it becomes stationary after differencing, then such time series is said to be integrated of order one. i.e. I (1). If two series are integrated of order one, there may exist a linear combination that is stationary without differencing. If such linear combination exists then such streams of variables are called cointegrated.

Cointegration tests are divided into two broader categories ; (i). Residual based test ; (ii). Maximum likelihood based tests. Residual based test include the Engle-Granger (1987) test whereas maximum likelihood based tests include Johansen (1988; 1991) and Johansen-Juselius (1990) tests. During this study we apply Johansen and Juselius test to determine the presence of cointegrating vectors in a set of non stationary time series. The null hypothesis is that there is no cointegration among the series. Vector Autoregressive (VAR) approach is employed to test multivariate cointegration. This assumes all the variables in the model are endogenous. The Johansen and Juselius procedure is employed to test for a long run relationship between the variables.

Johansen and Juselius suggest two likelihood ratio tests for the determination of the number of cointegrated vectors. Maximal eigenvalue test evaluates the null hypothesis that there are at most r cointegrating vectors against the alternative of r + 1 cointegrating vectors. The maximum eigen value statistic is given by,

$$\lambda max = - T \ln (1 - \lambda r+1)$$

where λ r+1,…,λn are the n-r smallest squared canonical correlations and T = the number of observations.

Trace statistic tests the null hypothesis of r cointegrating vectors against the alternative of r or more cointegrating vectors. This statistic is given by

$$\lambda trace = -T \Sigma \ln (1 - \lambda i)$$

In order to apply the Johansen procedure, lag length is selected on the basis of the Akaike Information Criterion (AIC).

If co-integration in the long run is present, then the system of equations is restructured by inserting an error correction term to capture the short-run deviation of variables from their relevant equilibrium values. This investigation is necessary as impact of financial development is generally more apparent in the short-run and disappears in the long run as economy expands and matures. According to Granger

(1988) presence of cointegrating vectors indicates that granger causality must exist in at least one direction. A variable granger causes the other variable if it helps forecast its future values. In cointegrated series, as variables may possibly share common stochastic trends so dependent variables in the VECM must be Granger-caused by lagged values of the error-correction terms. This is possible because error-correction terms are functions of the lagged values of the level variables. Thus an evidence of cointegration between variables itself provides the basis for construction of error correction model. ECM permits the introduction of past disequilibrium as explanatory variables in the dynamic behavior of existing variables thus facilitates in capturing both the short-run dynamics and long-run relationships between the variable. The chronological Granger Causality between the variables can be explored by using a joint F-test to the coefficients of each explanatory variable in the VECM. The variance decomposition of the equity returns is based on the analysis of responses of the variables to shocks. When there is a shock through the error term we study the influence of this shock to the other variables of the system and thus get information about the time horizon and percentage of the error variance F test is in fact a within-sample causality tests and does not allow us to gauge the relative strength of the of causality among variables beyond the sample period.

In order to examine the out of sample causality, we use variance decomposition analysis which partitions the variance of the forecast error of a certain variable into proportions attributable to shocks in each variable in the system. Variance decomposition analysis present a factual breakup of the change in the value of the

variable in a particular period resulting from changes in the same variable in addition to other variables in preceding periods. The impulse response analysis investigates the influence of random shock in a variable on other variables of interest. Impulse responses of returns in various markets to a shock in oil innovations are also examined. Impulse responses show the effect of shocks for different days separately whereas variance decomposition analysis exhibits the cumulative effect of shocks.

4.14 Cointegration Analysis -Autoregressive Distributed Lag Approach

To examine the relationship among macroeconomic factors and equity market returns following model has been tested

$$\text{Ln } I_t = \beta 0 + \beta_1 \text{LnIIP}_t + \beta_2 \text{lnOil}_t + \beta_3 \text{ lnXRate}_t + \beta_4 \text{TBill}_t + \beta_4 \text{CPI}_t + \beta_4 \text{FPI}_t + \beta_4 \text{MS}_{t+} \mu_t$$

Where

I= KSE -100 Index

Oil = Oil prices in $

XRate= Foreign Exchange Rates $/ Rs.

TBill = Six Month Treasury Bill Rate

CPI = Consumer Price Index

FPI= Foreign Portfolio Investment

IIP= Index of Industrial Production

MS= Money Supply

There are several methods available to test for the existence of the long-run equilibrium relationship among time-series variables. The most widely used methods include Engle and Granger (1987) test, fully modified OLS procedure of Phillips and Hansen's (1990), maximum likelihood based Johansen (1988,1991) and Johansen-Juselius (1990) tests. These methods require that the variables in the system are integrated of order one I(1). In addition, these methods suffer from low power, and do not have good small sample properties. Due to these problems, a newly developed autoregressive distributed lag (ARDL) approach to cointegration has become popular in recent years. This study employs autoregressive distributed lag approach (ARDL) to cointegration following the methodology proposed by Pesaran and Shin (1999). This methodology is chosen as it has certain advantages on other cointegration procedures. For example, it can be applied regardless of the stationary properties of the variables in the sample. Secondly, it allows for inferences on long-run estimates which are not possible under alternative cointegration procedures. Finally, ARDL Model can accommodate greater number of variables in comparison to other Vector Autoregressive (VAR) models.

First, of all data has been tested for unit root. This testing is necessary to avoid the possibility of spurious regression as Ouattara (2004) reports that bounds test is based on the assumption that the variables are I(0) or I(1) so in the presence of I(2) variables the computed F-statistics provided by Pesaran et al. (2001) becomes invalid. Similarly other diagonistic tests are applied to detect serial correlation, heterosidisticity, conflict to normality.

If data is found I(0) or I(1) then the ARDL approach to cointegration is applied which consists of three stages. In the first step the existence of a long-run relationship between the variables is established by testing for the significance of lagged variables in an error correction mechanism regression. Then the first lag of the levels of each variable are added to the equation to create the error correction mechanism equation, and a variable addition test is performed by computing an F-test on the significance of all the lagged variables

The second stage is to estimate the ARDL form of equation where the optimal lag length is chosen according to one of the standard criteria such as the Akaike Information or Schwartz Bayesian. Then the restricted version of the equation is solved for the long-run solution. An ARDL representation of above equation is as below:

$$\text{Ln } I_t = \beta_0 + \Sigma \psi_i \text{ Ln } I_{t-1} + \Sigma \beta_i \text{ Ln IIP}_{t-i} + \Sigma \lambda_i \text{ lnOil}_{t-i} + \Sigma \delta_i \text{ LnXRate}_{t-i} + \Sigma \varphi_i \text{ LnTBill}_{t-i} + \Sigma \eta_i \text{ LnCPI}_{t-i} + \Sigma \gamma_i \text{ LnFPI}_{t-i} + \Sigma \zeta_i \text{ LnMI} + \mu_t$$

where i ranges from 1 to p.

The third stage entails the estimation of the error correction equation using the differences of the variables and the lagged long-run solution, and determines the speed of adjustment of returns to equilibrium. A general error correction representation of equation is given below:

$$\Delta \text{ Ln } I_t = \beta_0 + \Sigma\, \beta_i \Delta \text{ Ln IIP}_{t-i} + \Sigma\, \lambda_i \Delta \text{ Ln Oil}_{t-i} + \Sigma\, \delta_i \Delta \text{ LnXRate}_{t-i} + \Sigma\, \varphi_i \Delta \text{ LnTBill}_{t-i} + \Sigma\, \eta_i \Delta \text{CPI}_{t-i} + \Sigma\, \gamma_i \Delta \text{FPI}_{t-i} + \Sigma\, \zeta_i \Delta \text{M1}_{t-i} + \text{ECM} + \mu_t$$

Interest rates, inflation, and oil prices are expected to have negative impact on returns so the coefficients λ, φ and η are expected to be negative $\lambda < 0$, $\varphi < 0$ and $\eta < 0$.

As industrial production , foreign portfolio investment , and money supply are expected to have a positive effect on equity returns so the coefficients β, γ and ζ are expected to be positive, i.e. $\beta > 0$, $\gamma > 0$, $\zeta > 0$.

Finally, stability of short-run and long-run coefficients is examined by employing cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points. If the plots of CUSUM and CUSUMSQ statistics stay with in the critical bonds of 5% level of significance, the null hypothesis of all coefficients in the given regression are stable can not be rejected.

Chapter 5

DATA ANALYSIS AND EMPIRICAL RESULTS

5.1 Capital Asset Pricing Model

Table 5.1 reports the beta and monthly returns for each beta sorted portfolio. It is evident that portfolios betas have no apparent relationship with portfolio returns. Portfolio I has highest portfolio beta and portfolio 10 has lowest beta portfolio. According to theory, portfolio 1 should have highest returns and portfolio 10 should have lowest returns, but results are not consistent with theory. Portfolios with small beta like port 10 and port 7 offer the highest average return in comparison to average returns offered by high beta portfolios. These results are not consistent with established theory and empirical literature on the subject.

Table 5.1

Average Return and Systematic Risk Beta of Beta Sorted Portfolios

	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Port 9	Port 10
Returns										
2001-2002	0.012	0.024	0.014	0.014	0.007	0.020	0.013	0.013	0.008	0.015
2002-2003	0.050	0.045	0.044	0.038	0.047	0.050	0.043	0.036	0.050	0.039
2003-2004	0.041	0.030	0.025	0.045	0.045	0.033	0.036	0.026	0.021	0.038
2004-2005	-0.018	-0.010	-0.008	-0.021	-0.009	-0.013	0.001	-0.020	0.009	-0.008
2005-2006	0.026	0.000	0.009	0.009	0.004	0.003	0.016	0.012	0.011	0.021
2006-2007	0.003	0.017	0.023	0.011	0.012	0.014	0.004	-0.024	0.008	0.021
Average	0.019	0.018	0.018	0.016	0.018	0.018	0.019	0.007	0.018	0.021
Beta										

2001-2004	1.56	0.87	0.72	0.55	0.68	0.61	0.48	0.65	0.68	0.46
2002-2005	1.26	0.96	0.66	0.69	0.75	0.64	0.69	0.83	0.69	0.68
2003-2006	1.15	0.94	0.61	0.65	0.71	0.60	0.76	0.83	0.58	0.73
2004-2007	0.87	0.67	0.41	0.41	0.41	0.40	0.50	0.65	0.39	0.62

Table 5.2 reports the results of Fama and Macbeth procedure that explores the validity of capital asset pricing Model by testing that $\lambda_{ot} = 0$ and $\lambda_{1t} \neq 0$. This model uses three step procedures to avoid the problems associated with errors in variable.

Table 5.2 Fama and Macbeth Test

	2004-2007
λ_o	0.021
λ_{1t}	0.008
$t(\lambda_{ot})$	1.748
$t(\lambda_{1t})$	0.493
P value (λ_{ot})	0.081
P value (λ_{1t})	0.622
R^2	0.0007

A careful examination of findings reveals that no significant relationship is observed between portfolio risk premium and beta during testing period 2004-2007. The coefficient λ_{1t} is not significantly different from zero as the absolute *t*-value (0.493) is less than tabulated value (1.96) at 95% confidence level. According to CAPM, λ_{1t} should be equal to the average market risk premium, and it should be positively related to portfolio return, so result of the study is inconsistent with the CAPM hypothesis. However, market risk premium is found positive, as evident from λ_{1t}, and it may be a result of consistent positive monthly equity risk premiums during the period studied. R^2 also confirms the results that explanatory power of model is weak

and no relationship exists between portfolio risk premium and beta. Therefore, we can conclude that Fama and Macbeth procedure (1973) does not provide any evidence about existence of ex-post relationship between systematic risk and portfolio risk premiums. Therefore, multifactor models like Fama and French three factor model or Carhart four factor models may be explored to explain the portfolio returns in Pakistani equity market.

Table 5.3 displays the results of Pettengill procedure which is an extension of Fama and Macbeth methodology and examines the relationship between portfolio risk premium and beta in up market and down market separately.

Table 5.3

Pettengill Test

	2004-2007
λ_{ot}	0.024
λ_{1t}	0.058
λ_{2t}	-0.082
$t(\lambda_{ot})$	3.103
$t(\lambda_{1t})$	5.630
$t(\lambda_{2t})$	-7.546
P value (λ_{ot})	0.002
P value (λ_{1t})	0.000
P value (λ_{2t})	0.000
R^2	0.59
F- Statistics	256.86
F significance	0.00

Results indicate that there exist a significant positive relationship between risk and return in up- market as calculated value of t statistics is greater than tabulated value. Similarly significant negative relationship has also been observed between risk premium and beta in down-market. However, only 59% variations in portfolio risk premium can be explained with the help of beta of market and it opens the door for

active identification of factors that can enhance the explanatory power of model. This relationship has economic rationale that if up-market premiums and down-market premiums are simultaneously drawn on scatter diagram. The slope of regression line will be approximately zero, indicating that no significant relationship exists between risk premium and beta. This situation weakens the ex-post relationship between betas and risk premiums. However, when regression lines up market and down market are drawn separately the results reveal a different scenario. Here regression lines with up markets and down markets offer estimates which are consistent with SML estimates.

5.2 Two Factor Model

5.2.1 Size and Equity Returns

Risk and return of size sorted portfolios for the period 6/2000 to 6/2007 has been reported in Table 5.4. The results indicate big portfolio earn marginally higher rate of returns in comparison to returns of portfolio comprising of small stocks. However average risk of small stocks is on higher side.

Table 5.4 Average Risk and Returns

Size Sorted Portfolio

	Returns Small	Returns Big	Std Dev Small	Std Dev Big
2000-2001	-0.0155	-0.0099	0.0505	0.0658
2001-2002	0.0170	0.0132	0.0715	0.0919
2002-2003	0.0477	0.0347	0.0989	0.0612
2003-2004	0.0505	0.0295	0.1518	0.0889
2004-2005	-0.0030	0.0014	0.1034	0.0611
2005-2006	0.0047	0.0112	0.0962	0.0707
2006-2007	0.0090	0.0149	0.0621	0.0524
2000-2007	0.0158	0.0136	0.0952	0.0858

Above results clearly indicate that small stocks can be characterized as high risk and high stocks whereas large stocks are identified as low risk and low return stocks. These results are in line with most of the studies done in emerging equity markets. This relationship is presented graphically below

Statistical significance of difference of returns among size sorted portfolios and market has been tested by using t-statistics and results are reported in Table 5.5. Panel 1 exhibits difference between average returns of small and big portfolios and its statistical significance. Panel 2 compares of the return small portfolio to the market return and report its statistical significances. Panel 3 examines the performance of the big portfolios relative to the market returns and its statistical significances.

Table 5.5

Comparison between Return of Size Sorted Portfolios and Market Return

Time Period	**Return Small**	**Return Big**	**Difference**	**t statistics**
2000-2007	0.0157	0.0135	.0022	0.2370
Time Period	**Return Small**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0157	0.0262	-0.0104	-1.0065
Time Period	**Return Big**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0135	0.0262	-1.0127	-3.696*

Above table clearly indicates that returns of small portfolio and big portfolio are not statistically different. Small portfolio and big portfolio, both failed to out perform the market. However, there exist significant difference between returns of big portfolio and market returns. So in the absence of beta, some weak evidence exists about size

effect as big stocks have earned significantly different returns from market. Now, the role of market premium and size premium in explaining portfolio returns is examined simultaneously using following relationship

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t$$

Where
R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

MKT = (R_{mt} - R_{ft})

SMB = $R_{Small} - R_{Big}$

ε_t = error term

Results regression analysis are reported in Table 5.6

Table 5.6 Regression Analysis Two Factor Model

(Size Premium and Market Premium)

Dependent variable	**Intercept**	**MKT**	**SMB**	**Adj R^2**	**F Stat**	**F sig**	**VIF**
P	-0.004	0.580		0.55	100.75	0.00	
t-statistics	-0.749	10.037					
p-value	0.456	0.000					
P	-0.006	0.720	0.803	0.70	97.79	0.00	1.20
t-statistics	-1.466	13.958	6.565				
p-value	0.146	0.000	0.000				
S	-0.0052	0.7140	1.2878	0.75	125.28	0.00	
t-statistics	-1.3734	14.4245	11.5525				
p-value	0.1734	0.0000	0.0000				

B	-0.0052	0.7140	0.2878	0.72	109.14	0.00	
t-statistics	-1.3734	14.4245	2.5817				
p-value	0.1734	0.0000	0.0116				
LPE	-0.0037	0.8172	1.1547	0.70	97.47	0.00	
t-statistics	-0.8022	13.4989	8.4707				
p-value	0.4248	0.0000	0.0000				
HPE	-0.0096	0.6685	0.5366	0.69	93.18	0.00	
t-statistics	-2.5352	13.6451	4.8632				
p-value	0.0132	0.0000	0.0000				
HBMR	-0.0047	0.7869	1.2396	*0.69*	94.09	0.00	
t-statistics	-1.0131	12.9792	9.0796				
p-value	0.3140	0.0000	0.0000				
LBMR	-0.0060	0.6123	0.3692	0.60	64.11	0.00	
t-statistics	-1.4213	11.2352	3.0086				
p-value	0.1591	0.0000	0.0035				
Winner	-0.0047	0.6620	0.6155	0.58	59.37	0.00	
t-statistics	-0.9994	10.8916	4.4968				
p-value	0.3206	0.0000	0.0000				
Loser	-0.0053	0.7721	0.9879	0.65	78.95	0.00	
t-statistics	-1.1077	12.3217	7.0013				
p-value	0.2713	0.0000	0.0000				
LLIQ	0.0022	0.4788	0.6235	0.59	61.63	0.00	
t-statistics	0.6363	10.8636	6.2822				
p-value	0.5264	0.0000	0.0000				
HLIQ	-0.0113	0.9249	0.5829	0.67	86.02	0.00	
t-statistics	-2.0670	13.0342	3.6479				
p-value	0.0419	0.0000	0.0005				

Above results clearly state that model is valid and size premium is priced in the market and incorporation of size premium in conventional CAPM increase the explanatory power of the model by 15%. Both market premium and size premium have significant positive relationship with portfolio returns. The significant positive

relationship indicate that the portfolio of small stocks earn higher returns in comparison to portfolio of big stocks. It is worth mentioning that possibility of multi-colinearity is also exists among independent variable so tolerance test VIF is also applied. Variance inflationary index lies within a tolerance level of 5, so multicolinearity is in acceptable range. This behavior is found consistent in growth and value stocks. Size premium is also able to explain PE sorted and Book to Market sorted portfolios significantly. Size premium is significantly positively related to both high liquidity as well as low liquidity stocks. The same relationship is also observed in momentum sorted portfolios. Therefore, it can be concluded that size effect is present in Pakistani equity market and small stocks out big stocks.

5.2.2 P/E Premium and Equity Returns

Risk and return of P/E sorted portfolios are reported in Table 5.7. The results indicate portfolio of small P/E stocks earned marginally higher rate of returns in comparison to portfolio of high P/E stocks. Similarly, average risk portfolio of small P/E is on higher side in comparison to portfolio of high P/E stocks. Therefore, portfolio of small P/E stocks can be characterized as high risk and high return portfolio.

Table 5.7

Average Risk and Returns

(P/E Ratio Sorted Portfolios)

	Returns Small P/E Stocks	Std Dev Small P/E Stocks	Returns High P/E Stocks	Std Dev High P/E Stocks
2000-2001	-0.0006	0.0519	-0.0082	0.0494
2001-2002	0.0189	0.0820	0.0139	0.0571
2002-2003	0.0467	0.0571	0.0406	0.0682

2003-2004	0.0407	0.1076	0.0219	0.0702
2004-2005	-0.0022	0.0806	-0.0087	0.0686
2005-2006	0.0073	0.0782	-0.0020	0.0428
2006-2007	0.0079	0.0507	0.0052	0.0500
2000-20007	0.0170	0.0746	0.0090	0.0592

Statistical significance of the difference of returns among P/E sorted portfolios and market has been tested by using t statistics and results are reported in Table 5.8

Panel 1 exhibits the difference between average returns of portfolio of high P/E stocks and portfolio of low P/E stocks and its statistical significance. Panel 2 compares of the return of portfolio of small P/E stocks to the market return and report its statistical significances. Panel 3 examines the performance of the portfolio of high P/E stocks portfolios in comparison to the market returns and its statistical significances.

Table 5.8

Comparison between Return of P/E Sorted Portfolios and Market Return

Time Period	**Return Small P/E Stocks**	**Return High P/E Stocks**	**Difference**	**t statistics**
2000-2007	0.0170	0.0090	0.0080	1.983*
Time Period	**Return Small P/E Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0170	0.0262	-0.0092	-1.3234
Time Period	**Return High P/E Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0090	0.0262	-0.0172	-3.108

Above table clearly indicates that returns of portfolio of small P/E stocks are significantly higher than portfolio comprising of high P/E stocks. However, low P/E

stocks and high P/E stocks, both failed to out perform the market and there exist significant difference between returns of portfolio of high P/E stocks and market returns. Therefore without considering beta evidence of P/E effect exists. Now, in the presence market premium, role of P/E Premium in explaining portfolio returns is examined by using following equation

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 PE\ Premium_t$$

where

R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

MKT = (R_{mt} - R_{ft})

PE $Premium_t = R_{low\ P/E\ stocks,\ t} - R_{high\ P/E\ stocks,t}$

ε_t = error term

Results of regression analysis are reported in Table 5.9

Table 5.9 Regression Analysis Two Factor Model

(P/E Premium and Market Premium)

Dependent variable	Intercept	MKT	PE Pre	Adj R^2	F Stat	F sig	VIF
P	-0.0036	0.5798		0.54	100.75	0.00	
t-statistics	-0.7493	10.0373					
p-value	0.4558	0.0000					
P	-0.0078	0.5544	0.5860	0.66	81.32	0.00	1.01
t-statistics	-1.8332	11.0318	5.3216				
p-value	0.0704	0.0000	0.0000				
S	-0.0085	0.4584	0.8378	0.55	52.03	0.00	
t-statistics	-1.6443	7.4573	6.2209				

p-value	0.1040	0.0000	0.0000				
B	-0.0070	0.6505	0.3342	0.74	117.66	0.00	
t-statistics	-1.8626	14.5638	3.4148				
p-value	0.0661	0.0000	0.0010				
LPE	-0.0094	0.5712	1.1374	0.75	125.54	0.00	
t-statistics	-2.1849	11.1579	10.1404				
p-value	0.0318	0.0000	0.0000				
HPE	-0.0094	0.5712	0.1374	0.61	64.88	0.00	
t-statistics	-2.1849	11.1579	1.2249				
p-value	0.0318	0.0000	0.2241				
HBMR	-0.0086	0.5365	0.9059	*0.58*	59.15	0.00	
t-statistics	-1.5605	8.2079	6.3254				
p-value	0.1225	0.0000	0.0000				
LBMR	-0.0077	0.5343	0.3485	0.61	65.21	0.00	
t-statistics	-1.8105	10.6238	3.1627				
p-value	0.0739	0.0000	0.0022				
Winner	-0.0059	0.5417	0.3573	0.52	46.62	0.00	
t-statistics	-1.1673	8.9723	2.7012				
p-value	0.2465	0.0000	0.0084				
Loser	-0.0095	0.5660	0.8728	0.64	75.99	0.00	
t-statistics	-1.9144	9.6153	6.7674				
p-value	0.0591	0.0000	0.0000			Liquidity	
LLIQ	0.0014	0.3602	0.2855	0.45	34.50	0.00	
t-statistics	0.3535	7.5497	2.7314				
p-value	0.7246	0.0000	0.0077				
HLIQ	-0.0149	0.7964	0.6743	0.71	100.94	0.00	
t-statistics	-2.8347	12.7915	4.9429				
p-value	0.0058	0.0000	0.0000				

Table 5.9 exhibits that P/E premium is priced by market as there exist a statistically significant positive relationship between P/E premium and portfolio returns. It means low P/E stocks earn more in comparison to High P/E stocks. Above results also

indicate that CAPM is a valid model and explains 54% of the total variations in portfolio return but addition of P/E premium increases the explanatory power of the model to 65%. In order to see the impact of multicolinearity, VIF test has also performed. Variance inflationary index lies within a tolerance level of 5, so multicolinearity is in acceptable range. PE Premium has also been used to explain the stylized portfolios. Results reveal that PE premium has significant positive relationship with size sorted, liquidity sorted and book to market sorted portfolios and this behaviour is consistent in value as well as growth stocks. PE preium has also significant poitive relationship with returns of winners and loser portfolios. However, it fails to explain the returns of High PE stocks. From above results, it can be concluded that PE premium is significant factor in explaining returns in the Pakistani equity market.

5.2.3 B/M Premium and Equity Return

Table 5.10 reports risk and return of Book /Market sorted portfolios. The results indicate that portfolio comprising of small B/M stocks earns lower rate of returns in comparison to portfolio comprising of high B/M stocks. Average risk of portfolio of high B/M stocks is on higher side in comparison to portfolio of low B/M stocks.

Table 5.10 Average Risk and Return

Book/Market Ratio Sorted Portfolios

	Returns Small B/M Stocks	Std Dev Small B/M Stocks	Returns High B/M Stocks	Std Dev High B/M Stocks
2000-2001	-0.0100	0.0409	0.0013	0.0486
2001-2002	0.0214	0.0604	0.0210	0.0794
2002-2003	0.0392	0.0629	0.0464	0.0703

2003-2004	0.0259	0.0757	0.0427	0.1007
2004-2005	-0.0093	0.0537	-0.0068	0.0894
2005-2006	0.0102	0.0541	-0.0010	0.0570
2006-2007	0.0102	0.0541	-0.0010	0.0570
2000-2007	0.0116	0.0583	0.0152	0.0737

Statistical significance of difference of returns among P/E sorted portfolios and market has been tested by using t- statistics and results are reported in Table 5.11.

Panel 1 exhibits the difference between average returns of portfolio of high B/M stocks and portfolio of low B/M stocks and its statistical significance. Panel 2 compares of the return portfolio of high B/M stocks to the market return and report its statistical significances. Panel 3 examines the performance of the portfolio of low B//M stocks in comparison to the market and its statistical significances.

Table 5.11

Comparison among Return of B/M Sorted Portfolios and Market Return

Time Period	**Return High B/M Stocks**	**Return Low B/M Stocks**	**Difference**	**t statistics**
2000-2007	0.0152	0.0116	0.0036	0.8419
Time Period	**Return High B/M Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0152	0.0262	-0.0110	-1.4906
Time Period	**Return Low B/M Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0116	0.0262	-0.0146	-2.5062*

Above table clearly indicates that returns of portfolio comprising of high B/M stocks is higher than portfolio comprising of small B/M stocks but this difference is

statistically insignificant. Small portfolio and big portfolio, both failed to out perform the market and there exist significant difference between returns of portfolio of low B/M stocks and market returns. Therefore it can be safely said that in the absence of beta there exist a weak evidence about value effect. In order to see the impact of HML on portfolio returns following relationship is tested.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 HML_t$$

where

R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$HML_t = R_{high\ BMR,\ t} - R_{low\ BMR,t}$

ε_t = error term

Results of regression analysis are reported in Table 5.12

Table 5.12 Regression Analysis Two Factor Model

(B/M Premium and Market Premium)

Dependent variable	Intercept	MKT	HML	Adj R^2	F Stat	F sig	VIF
P	-0.0036	0.5798		0.5458	100.74	0.00	
t-statistics	-0.7493	10.0373					
p-value	0.4558	0.0000					
P	-0.0065	0.5273	0.6889	0.6753	87.31	0.00	1.034
t-statistics	-1.5921	10.6145	5.8049				
p-value	0.1153	0.0000	0.0000				

S	-0.0054	0.4703	0.9242	0.63	71.39	0.00	
t-statistics	-1.1573	8.4401	7.9846				
p-value	0.2505	0.0000	0.0000				
B	-0.0055	0.6573	0.2908	0.73	114.27	0.00	
t-statistics	-1.4719	14.6016	3.1096				
p-value	0.1449	0.0000	0.0026				
LPE	-0.0041	0.5964	0.9132	0.66	82.19	0.00	
t-statistics	-0.8329	10.0453	7.4049				
p-value	0.4073	0.0000	0.0000				
HPE	-0.0097	0.5662	0.4153	0.67	86.61	0.00	
t-statistics	-2.5084	12.1843	4.3028				
p-value	0.0141	0.0000	0.0000				
HBMR	-0.0055	0.5464	1.1150	*0.73*	111.35	0.00	
t-statistics	-1.2613	10.3500	10.1685				
p-value	0.2108	0.0000	0.0000				
LBMR	-0.0055	0.5464	0.1150	0.56	54.87	0.00	
t-statistics	-1.2613	10.3500	1.0489				
p-value	0.2108	0.0000	0.2973				
Winner	-0.0048	0.5454	0.4460	0.56	52.88	0.00	
t-statistics	-0.9818	9.3814	3.6931				
p-value	0.3291	0.0000	0.0004				
Loser	-0.0057	0.5834	0.7759	0.62	68.85	0.00	
t-statistics	-1.1202	9.6314	6.1669				
p-value	0.2659	0.0000	0.0000				
LLIQ	0.0022	0.3614	0.4259	0.52	46.43	0.00	
t-statistics	0.5858	8.1791	4.6411				
p-value	0.5596	0.0000	0.0000				
HLIQ	-0.0115	0.8137	0.4523	0.66	82.52	0.00	
t-statistics	-2.0662	12.2259	3.2717				
p-value	0.0420	0.0000	0.0016				

Table 5.12 exhibits that B/M premium is priced by market as there exist a statistically significant positive relationship between B/M premium and portfolio returns. Results

indicate that portfolio of high book stocks earn significantly high returns in comparison to portfolio comprising of low book to market returns. Result further shows that capital asset pricing model is a valid model and explains 54% of the total variations in portfolio return but addition of HML as an explanatory variable improves the model as new two factor model can explain 67.5% of total variation in portfolio return. This 13% increase in explanatory power in reasonably high and suggests that HML should be considered for determination of required rate of return. Variance inflationary index lies within a tolerance level of 5 so multicolinearity is in acceptable range. This behavior is found consistent in growth and value stocks.Value premium is also able to explain PE sorted and Book to Market sorted portfolios significantly. Value premium is significantly positively related to both high liquidity as well as low liquidity stocks. The same relationship is also observed in momentum sorted portfolios. Therefore, it can be concluded that book to market anomaly is present in Pakistani equity market.

5.2.4 Momentum and Equity Returns

Risk and return of momentum sorted portfolios is reported in Table 5.13. Results indicate that winner's portfolio marginally earned lower rate of returns in comparison to returns of loser's portfolio. Average risk of loser portfolio is higher than winner portfolio. So it can be said that loser portfolios are high risk and high return portfolios and this feature is consistent with economic rationale. It is worth mentioning that winner and loser both portfolios report losses in 2000-2001 and 2004-2005 which may be a result of overall market behavior during these years.

Table 5.13

Average Risk and Return

Momentum Sorted Portfolios

	Returns Winner Stocks	Std Dev Winner Stocks	Returns Loser Stocks	Std Dev Loser Stocks
2000-2001	-0.0032	0.0761	-0.0021	0.0295
2001-2002	0.0154	0.0406	0.0156	0.1010
2002-2003	0.0507	0.0606	0.0429	0.0660
2003-2004	0.0323	0.0746	0.0329	0.0848
2004-2005	-0.0136	0.0767	-0.0025	0.0666
2005-2006	0.0031	0.0448	0.0086	0.0839
2006-2007	0.0105	0.0525	0.0074	0.0536
2000-2007	0.0136	0.0635	0.0147	0.0718

Statistical significance of the difference of returns among momentum sorted portfolios and market returns has been tested by using t-statistics and results are reported in Table 5.14. Panel 1 exhibits the difference between average returns of winner's portfolio and loser's portfolios and its statistical significance. Panel 2 compares the return of portfolio of winner stocks with the market return and reports its statistical significances. Panel 3 examines the performance of the portfolio of the loser stocks in relation to the market and reports its statistical significances

Table 5.14

Comparison among Return of Momentum Sorted Portfolios and Market Return

Time Period	Return Winner Stocks	Return Loser Stocks	Difference	t statistics
2000-2007	0.0136	0.0147	-0.0011	-0.2191
Time Period	**Return Winner Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0136	0.0262	-0.0126	-2.5062*
Time Period	**Return**	**Return**	**Difference**	**t statistics**

	Loser Stocks	Market		
2000-2007	0.0147	0.0262	-0.0115	-1.6929

Above table clearly indicates that returns of portfolio of loser stocks is higher than portfolio comprising of winner stocks for last 12 months but this difference is statistically insignificant. Winner's portfolio and loser's portfolio, both failed to out perform the market and there exist significant difference between returns of portfolio of winner stocks and market returns.

In order to see, whether market prices UMD or not following regression equation is tested

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 UMD_t$$

Where

R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$UMD_t = R_{winner,\,t} - R_{loser,t}$

ε_t = error term

Results of regression analysis are reported in Table 5.15.

Table 5.15

Regression Analysis Two Factor Model

(Momentum and Market Premium)

Dependent variable	Intercept	MKT	Mom	Adj R^2	F Stat	F sig	VIF
P	-0.0036	0.5798		0.5458	100.74	0.00	
t-statistics	-0.7493	10.0373					
p-value	0.4558	0.0000					

P	-0.0036	0.5717	-0.1735	0.5556	52.89	0.00	2.3059
t-statistics	-0.7614	9.9701	-1.6753				
p-value	0.4487	0.0000	0.0977				
S	-0.0026	0.4818	-0.2764	0.37	25.54	0.00	
t-statistics	-0.4306	6.6282	-2.1053				
p-value	0.6679	0.0000	0.0384				
B	-0.0046	0.6617	-0.0706	0.70	98.92	0.00	
t-statistics	-1.1787	13.9219	-0.8228				
p-value	0.2420	0.0000	0.4130				
LPE	-0.0014	0.6030	-0.3738	0.48	39.82	0.00	
t-statistics	-0.2272	8.2011	-2.8150				
p-value	0.8208	0.0000	0.0061				
HPE	-0.0085	0.5760	-0.0243	0.60	63.05	0.00	
t-statistics	-1.9762	11.1647	-0.2607				
p-value	0.0515	0.0000	0.7950				
HBMR	-0.0022	0.5600	-0.3378	0.42	31.06	0.00	
t-statistics	-0.3437	7.2668	-2.4272				
p-value	0.7320	0.0000	0.0174				
LBMR	-0.0052	0.5454	-0.0874	0.56	54.56	0.00	
t-statistics	-1.1854	10.2922	-0.9134				
p-value	0.2393	0.0000	0.3637				
Winner	-0.0034	0.5716	0.3087	0.53	47.42	0.00	
t-statistics	-0.6768	9.5198	2.8475				
p-value	0.5005	0.0000	0.0056				
Loser	-0.0034	0.5716	-0.6913	0.63	71.25	0.00	
t-statistics	-0.6768	9.5198	-6.3752				
p-value	0.5005	0.0000	0.0000				
LLIQ	0.0034	0.3679	-0.0996	0.40	29.23	0.00	
t-statistics	0.8393	7.4430	-1.1159				
p-value	0.4038	0.0000	0.2678				
HLIQ	-0.0101	0.8167	-0.1911	0.63	71.23	0.00	
t-statistics	-1.7414	11.6701	-1.5121				
p-value	0.0854	0.0000	0.1344				

Above table shows that UMD is negatively related to portfolio returns but this relationship is not significant at α =0.05.It indicates that losers earn more than winners in subsequent period. Therefore, it can be said that momentum effect is not present in Pakistani equity market and reversal is observed. Explanatory power of the two factor model is marginally higher than capital asset pricing model. However, CAPM appears to be a valid model. When momentum is used to explain stylized portfolios , it is found that momentum is significantly negatively related to small stocks, high book to market and low PE stocks. However, no significant relationship is observed with portfolio comprising of big stocks, low book to market and high PE stocks. It is worth mentioning that momentum is unable to explain the returns of liquidity sorted portfolios.

5.2.5 Illiquidity Premium and Equity Returns

Descriptive statistics of liquidity sorted portfolios is reported in Table 5.16. The results indicate portfolio of low liquidity stocks earns marginally higher rate of returns in comparison to portfolio of high liquidity stocks. Average risk of high liquidity portfolio is higher than low liquidity portfolio. It indicates that high liquidity portfolio is inefficient as it assumes higher risk but earns lower return. It is worth mentioning high liquidity portfolio report losses during 2000-2001 and 2004-2005 whereas low liquidity portfolios report profit during all years.

Table 5.16

Average Risk and Returns

Liquidity Sorted Portfolio

	Returns low liquidity Stocks	**Returns high liquidity Stocks**	**Std Dev low liquidity Stocks**	**Std Dev high liquidity Stocks**
2000-2001	0.0051	-0.0157	0.0373	0.0903
2001-2002	0.0188	0.0146	0.0480	0.0890
2002-2003	0.0254	0.0517	0.0413	0.0899
2003-2004	0.0230	0.0247	0.0402	0.0878
2004-2005	0.0091	-0.0106	0.0577	0.1110
2005-2006	0.0185	0.0136	0.0501	0.1018
2006-2007	-0.0108	0.0172	0.0496	0.0926
2000-2007	0.0127	0.0136	0.0466	0.0929

Therefore, it can be said that high liquidity stocks are high risk and high return stocks. This tendency is not in line with empirical evidence provided by Amihud and Mendels (1986) who argues that low stocks assume high liquidity risk so these stocks should earn high returns. However, it is consistent with Hwang and Lu(2002) that provides about existence of higher returns in high liquidity stocks in UK. It is worth mentioning high liquidity portfolio report losses during 2000-2001 and 2004-2005 whereas low liquidity portfolios report profit during all years except 2006-2007.

Statistical significance of the difference of returns among liquidity sorted portfolios and market has been tested by using t- statistics and results are reported in Table 5.17. Panel 1 exhibits the difference between average returns of portfolio of low liquidity stocks and portfolio of high liquidity stocks and its statistical significance. Panel 2 compares of the returns of portfolio of low liquidity stocks with the market return and

reports its statistical significances. Panel 3 examines the performance of the high liquidity portfolio in comparison to the market and its statistical significances.

Table 5.17

Comparison among Return of Liquidity Sorted Portfolios and Market Return

Time Period	**Return low liquidity Stocks**	**Return high liquidity Stocks**	**Difference**	**t statistics**
2000-2007	0.0127	0.0136	- 0.0009	-1.0017
Time Period	**Return low liquidity Stocks**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0127	0.0262	-0.0135	-1.8850
Time Period	**Return high liquidity Stock**	**Return Market**	**Difference**	**t statistics**
2000-2007	0.0136	0.0262	-0.0126	-2.7303*

Above table clearly indicates that, in the absence of beta ,returns of portfolio of high liquidity stocks is higher than portfolio comprising of low liquidity stocks but this difference is statistically insignificant. Portfolio of low liquidity stocks and portfolio of high liquidity stocks, both failed to out perform the market and there exist significant difference between returns of portfolio of high liquidity stocks and market.

To see, whether market prices ILLIQP or not following regression analysis is performed

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 ILLIQP_t$$

where

R_{it} = Return of portfolio for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$ILLIQP_t = R_{\text{Low liquidity, t}} - R_{\text{high liquidity,t}}$

ε_t = error term

Results of regression analysis are reported in Table 5.18.

Table 5.18 Regression Analysis Two Factor Model

(Liquidity and Market Premium)

Dependent variable	Intercept	MKT	ILLIQP	Adj R^2	F Stat	F sig	VIF
P	-0.0036	0.5798		0.5458	100.74	0.00	
t-statistics	-0.7493	10.0373					
p-value	0.4558	0.0000					
P	0.0007	0.4356	-0.3184	0.5960	62.22	0.00	2.4
t-statistics	0.1500	6.2679	-3.3434				
p-value	0.8811	0.0000	0.0013				
S	0.0016	0.3552	-0.3080	0.38	26.77	0.00	
t-statistics	0.2581	3.8801	-2.4555				
p-value	0.7970	0.0002	0.0162				
B	-0.0002	0.5160	-0.3288	0.76	130.86	0.00	
t-statistics	-0.0508	9.4708	-4.4039				
p-value	0.9596	0.0000	0.0000				
LPE	0.0048	0.4144	-0.4549	0.51	44.76	0.00	
t-statistics	0.7820	4.5682	-3.6603				
p-value	0.4365	0.0000	0.0004				
HPE	-0.0056	0.4821	-0.2098	0.63	70.43	0.00	
t-statistics	-1.3059	7.6093	-2.4169				
p-value	0.1953	0.0000	0.0179				
HBMR	0.0024	0.4244	-0.3341	0.42	31.33	0.00	

t-statistics	0.3562	4.3410	-2.4946				
p-value	0.7226	0.0000	0.0146				
LBMR	-0.0009	0.4065	-0.3155	0.62	69.28	0.00	
t-statistics	-0.2184	6.4861	-3.6745				
p-value	0.8277	0.0000	0.0004				
Winner	0.0009	0.4118	-0.3209	0.54	48.87	0.00	
t-statistics	0.1835	5.4405	-3.0943				
p-value	0.8548	0.0000	0.0027				
Loser	0.0022	0.4199	-0.4060	0.51	44.44	0.00	
t-statistics	0.3703	4.7971	-3.3851				
p-value	0.7122	0.0000	0.0011				
LLIQ	0.0009	0.4569	0.1862	0.43	32.32	0.00	
t-statistics	0.2230	7.4321	2.2105				
p-value	0.8241	0.0000	0.0299				
HLIQ	0.0009	0.4569	-0.8138	0.82	193.36	0.00	
t-statistics	0.2230	7.4321	-9.6603				
p-value	0.8241	0.0000	0.0000				

Above table indicates that liquidity premium is negatively related to portfolio returns and this relationship is significant at α =0.05. It shows that portfolio of high liquidity stocks earn more than portfolio of low liquidity stocks. Explanatory power of the two factor model is marginally higher than capital asset pricing model. However, capital asset pricing model appears to be a valid model as market premium is significantly positively related portfolio returns and intercept is not significantly different from zero. Moreover, illiquidity preium has significant negative relationship with size sorted, PE sorted and book to market sorted portfolios and this relationship is consistent for value stocks and growth stocks. The negative relationship between illiquidity premium and momentum sorted portfolio returns also confirms the above stated patteren.

5.3 Fama and French Three Factor Model

Fama and French three factor model considers SMB and HML along with market premium to explain the portfolio returns. Statistical properties of portfolios sorted on Size- BMR are reported in Table 5.19.

Table 5.19

Descriptive statistics Size-B/M Ratio Sorted Portfolios

	S/H	S/M	S/L	B/H	B/M	B/L
Mean	0.0155	0.0133	0.0115	0.0181	0.0128	0.0108
Median	0.0055	0.0111	0.0051	0.0221	0.0056	0.0086
Std Dev	0.0791	0.0650	0.0641	0.0760	0.0646	0.0585
Kurtosis	-0.0633	-0.4852	0.1481	-0.3314	-0.3386	-0.2658
Skewness	0.5952	0.2877	-0.1213	-0.0822	0.0817	-0.0754
Minimum	-0.1183	-0.1111	-0.1637	-0.1450	-0.1363	-0.1351
Maximum	0.2163	0.1670	0.1503	0.2060	0.1820	0.1566

Above table indicates that B/H and S/H portfolios are high risk and high returns portfolios. However, B/H is found efficient as it offers higher returns at lower level of risk. In small as well as big stocks segments high book to market stocks out performed low book to market stocks. B/L offers the lowest return which is in line with empirical work on the subject that big companies earn lower rate of return and stocks with low book to market ratio under perform in comparison to stocks with high book to market return (Stattman , 1980).

Six Size –BMR portfolios along with Size sorted portfolios and portfolio comprising of all securities has been regressed against MKT, SMB and HML. The algebraic relationship among variables is presented below

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t$$

where

R_{it} = Return of portfolio 'i' for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

$SMB = 1/3 * [(S/H – B/H) + (S/M – B/M) + (S/L – B/L)]$

$HML = 1/2 * [(S/H – S/L) + (B/H – B/L)]$

ε_t = error term

Statistical properties of the variables constructed for Fama and French Three Factor Model are reported below in Table 5.20.

Table 5.20

Descriptive statistics Fama and French Three Factors

	MKT	SMB	HML
Mean	0.0208	-0.0004	0.0056
Median	0.0179	-0.0008	0.0075
Std Dev	0.0811	0.0343	0.0330
Kurtosis	0.1083	-0.1087	0.4932
Skewness	0.1239	-0.0568	-0.0348
Minimum	-0.1630	-0.0959	-0.0917
Maximum	0.2335	0.0754	0.0912

Above table indicates that average market premium and value premium are positive whereas size premium is negative. Market premium is found more volatile in comparison to size premium and value premium. It is worth mentioning that market premium is on higher side in comparison to size and value effect, it may be a result of outstanding performance of Pakistani equity market during 2000-2007. Correlation

among explanatory variables is estimated to explore the possibility of multicolinearity problem and results are reported in Table 5.21.

Table 5.21

Correlation Matrix- Fama and French Three Factors

	MKT	**SMB**	**HML**
MKT	1		
SMB	-0.41	1	
HML	0.17	0.48	1

As significant correlation exists among market premium and size premium, so tolerance limit have been tested by using variance inflationary factor which is 2.97 as it lies within tolerance level of 5, so both variables can be used simultaneously . However, the model should be used with caution as multiconearity may lead to incorrect decision.

Results of multivariate regression analysis performed to capture the relationship among portfolio return and market premium, size premium and value premium are reported in Table 5.22.

Table 5.22

Fama and French Three Factor Model

Dependent variable	**Intercept**	**MKT**	**SMB**	**HML**	**Adj R^2**	**F Statistics**	**F sig**
P	-0.0070	0.6524	0.5725	0.3838	0.73	75.17	0.00
t-statistics	-1.8661	11.7836	3.8915	2.7172			
p-value	0.0657	**0.0000**	**0.0002**	**0.0081**			
S	-0.0076	0.6523	1.0682	0.4013	0.74	80.88	0.00
t-statistics	-1.9551	11.3590	7.0006	2.7390			

p-value	0.0541	**0.0000**	**0.0000**	**0.0076**			
B	-0.0064	0.6525	0.0767	0.3663	0.74	80.64	0.00
t-statistics	-1.7276	11.9461	0.5288	2.6287			
p-value	0.0879	**0.0000**	0.5984	**0.0103**			
S/H	-0.0078	0.6291	1.1327	0.9518	0.81	116.21	0.00
t-statistics	-1.9625	10.6684	7.2297	6.3263			
p-value	0.0532	**0.0000**	**0.0000**	**0.0000**			
S/M	-0.0067	0.6413	1.0688	0.3246	0.72	7.2E+01	1.1E-22
t-statistics	-1.7044	10.9875	6.8917	2.1794			
p-value	0.0922	**0.0000**	**0.0000**	**0.0322**			
S/L	-0.0069	0.7025	1.0907	-0.1935	0.60	41.98	0.00
t-statistics	-1.4761	10.1713	5.9438	-1.0983			
p-value	0.1438	**0.0000**	**0.0000**	0.2754			
B/H	-0.0063	0.7135	0.1567	0.7516	0.73	76.40	0.00
t-statistics	-1.3957	10.7025	0.8847	4.4189			
p-value	0.1667	**0.0000**	0.3789	**0.0000**			
B/M	-0.0079	0.6194	-0.0631	0.4343	0.70	66.42	0.00
t-statistics	-1.9645	10.3732	-0.3977	2.8505			
p-value	0.0529	**0.0000**	0.6919	**0.0056**			
B/L	-0.0072	0.6400	0.1986	-0.1031	0.66	55.68	0.00
t-statistics	-1.8527	11.1024	1.2968	-0.7010			
p-value	0.0676	**0.0000**	0.1984	0.4853			

It is worth mentioning that value premium is positive and significant for all portfolios except S/L and B/L. It means HML does not explain low B/M stocks. Market premium is found significantly positively related to portfolio returns and this is consistent with conventional capital asset pricing model. Similarly, size premium is found significantly positively related to small portfolio returns. Similarly, size premium is observed as insignificant for portfolios B, BL, B/M, and B/H. It means SMB is not significantly effect returns of big stocks. Conventional CAPM is found valid in the KSE in general. It is evident that Fama and French three factor model

substantially explains the portfolio returns and it explanatory power ranges from 63% to 82%. It is significantly higher than explanatory power of conventional capital asset pricing model which explains 24% to 66% of the total variation in various portfolios as discussed above. Therefore, it can be concluded that market prices size and book to market ratio and investors can use these factors in designing there investment strategies.

5.4 Carthart Four Factor Model

Carthart extends the work of Fama and French by adding a new variable momentum that can explain the returns which are not captured through SMB and HML. The payoffs of momentum are captured by constructing a variable UMD which is difference between returns of winner and loser portfolios. It is worth mentioning that winner and loser portfolios are constituted on the basis of performance of last 12 month.

Statistical properties of portfolios sorted on Size- BMR- Mom are reported in Table 5.23.

Table 5.23

Descriptive statistics Size- BMR- Mom sorted Portfolios

	Mean	Median	Std Dev	Kurtosis	Skewness	Minimum	Maximum
S/H/U	0.0117	0.0064	0.0806	-0.0451	0.2826	-0.1602	0.2235
S/H/D	**0.0197**	0.0094	**0.0896**	-0.0196	0.6400	-0.1416	0.2369
S/M/U	0.0132	0.0095	0.0748	-0.3784	0.0599	-0.1625	0.1813
S/M/D	0.0120	0.0021	0.0639	0.7142	0.6894	-0.1091	0.1934

S/L/U	0.0100	0.0074	0.0736	1.1853	-0.4798	-0.2232	0.1821
S/L/D	0.0128	0.0028	0.0661	-0.1295	0.4503	-0.1146	0.1815
B/H/U	0.0173	0.0240	0.0769	-0.4371	-0.3689	-0.1672	0.1535
B/H/D	0.0189	0.0204	0.0806	0.2358	0.2433	-0.1631	0.2637
B/M/U	0.0144	0.0083	0.0657	-0.1849	-0.2731	-0.1658	0.1396
B/M/D	0.0121	0.0079	0.0720	1.6307	0.5197	-0.1590	0.2891
B/L/U	**0.0088**	0.0129	**0.0607**	0.1101	-0.2649	-0.1494	0.1537
B/L/D	0.0135	0.0171	0.0644	0.0842	0.1186	-0.1207	0.2091

Above table indicate that S/H/D is high risk and high return portfolio whereas B/L/U is lowest risk and return portfolio. S/H/D earns a profit of 1.97% per month with a risk level of 8.96%. Similarly, B/L/U stands at lowest position with reference to investment performance as it earns lowest return of 0.88% per month and assumes lowest risk i.e 6.07%. This performance is in line with theory as well as empirical evidence that provides small stocks earn more than large stocks. Similarly, high B/M stocks earn more than low B/M stocks. Another important feature of above table is that in S/H, S/L and B/L, B/H segments loser stock out performed winner stocks whereas in S/M, B/M segment winner stocks outperformed loser stocks. It is worth mentioning that winners and losers are determined on the basis of last 12 month performance. Six Size –BMR portfolios along with Size sorted portfolios and portfolio comprising of all securities has been regressed against MKT, SMB , HML and UMD.

The algebraic relationship among variables is presented below

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t$$

Where

R_{it} = Return of portfolio ‘’for period “t”

R_{ft} = Risk Free Rate

MKT = R_{mt} - R_{ft}

SMB = 1/6 * [(S/H/U – B/H/U) + (S/H/D – B/H/D) + (S/M/U – B/M/U) +

(S/M/D – B/M /D) + (S/L/U – B/L/U) + (S/L/D – B/L/D)]

HML =1/4 * [(S/H/U – S/L/U) + (S/H/D – S/L/D) + (B/H/U – B/L/U) +

(B/H/D – B/L/D)]

UMD= 1/6 * [(S/H/U – S/H/D) + (S/M/U – S/M/D)+ (S/L/U – S/L/D) + (B/H/U –

B/H /D) + (B/M/U – B/M/D) +(B/L/U – B/L/D)]

ε_t = error term

Statistical properties of the Carhart four factors are reported below in Table 5.24.

Table 5.24

Descriptive statistics Carhart Four Factors

	MKT	SMB	HML	UMD
Mean	0.0208	-0.0009	0.0057	-0.0023
Median	0.0179	-0.0016	0.0080	0.0004
Std Dev	0.0811	0.0340	0.0341	0.0278
Kurtosis	0.1083	-0.1517	0.4200	0.7177
Skewness	0.1239	0.0021	-0.0203	-0.3290
Minimum	-0.1630	-0.0908	-0.0919	-0.0861
Maximum	0.2335	0.0771	0.0897	0.0584

Average market premium during study period 2.08% which is higher than size premium , value premium and payoffs of momentum strategies. Similarly, market

premium is observed as most volatile. Value premium is positive whereas size and momentum payoffs are negative. Size premium how ever appears negligible. These results do not support Jegadeesh and Titman (1993) study that provides past winners outperform the past losers over horizons of 3-12 months. This study is consistent with Kothari, Shanken and Sloan (1995) that provide that momentum effect is not reliable as winner stocks failed to out outperform the losers. Study, further, provides that higher average returns have been earned by loser portfolio in comparison to winner portfolio. Before analyzing the role UMD in explaining portfolio returns in presence of MKT, SMB, and HML, it is appropriate to examine correlation among independent variables so that possibility of multicolinearity can explored. Table 5.25 presents the correlation coefficient among variables of interest.

Table 5.25

Correlation Matrix - Carhart Four Factors

	MKT	SMB	HML	UMD
MKT	1			
SMB	-0.41	1		
HML	0.19	0.45	1	
UMD	-0.07	0.01	-0.21	1

UMD is not correlated with any other variables. However, significant negative correlation exist MKT and SMB. Similarly HML and SMB are correlated. This situation may lead to statistical error. Therefore, VIF is calculated which is 1.58 and it is within permissible tolerance limit so portfolio returns can be regressed on Carhart explanatory variables i.e MKT, SMB, HML, UMD. Results of ordinary least square regression analysis are reported in Table 5.26.

Table 5.26 **Carhart Four Factor Model**

Dependent variable	Intercept	MKT	SMB	HML	UMD	Adj R^2	F Stat	F sig
P	-0.0064	0.6461	0.5441	0.3896	0.1265	0.7176	53.75	0.00
t-statistics	-1.6740	11.2571	3.5094	2.6596	0.9221			
p-value	0.0981	**0.0000**	**0.0007**	**0.0095**	0.3593			
S	-0.0068	0.6441	1.0357	0.4119	0.1211	0.7272	56.30	0.00
t-statistics	-1.6905	10.7088	6.3753	2.6838	0.8424			
p-value	0.0949	**0.0000**	**0.0000**	**0.0089**	0.4021			
B	-0.0060	0.6482	0.0525	0.3672	0.1319	0.7366	59.04	0.00
t-statistics	-1.6119	11.5458	0.3460	2.5632	0.9830			
p-value	0.1110	**0.0000**	**0.7302**	**0.0123**	0.3286			
S/H	-0.0069	0.6141	1.0859	0.9257	0.0246	0.7780	73.74	0.00
t-statistics	-1.6150	9.5643	6.2618	5.6498	0.1603			
p-value	0.1103	**0.0000**	**0.0000**	**0.0000**	0.8731			
S/M	-0.0058	0.6391	1.0579	0.3474	0.2275	0.7241	55.47	0.00
t-statistics	-1.4853	10.8423	6.6439	2.3092	1.6148			
p-value	0.1415	**0.0000**	**0.0000**	**0.0235**	0.1103			
S/L	-0.0062	0.6959	1.0502	-0.1369	0.1859	0.5873	30.53	0.00
t-statistics	-1.3023	9.7908	5.4697	-0.7545	1.0940			
p-value	0.1966	**0.0000**	**0.0000**	0.4528	0.2773			
B/H	-0.0058	0.7043	0.1213	0.7611	0.1795	0.7260	55.99	0.00
t-statistics	-1.2679	10.2829	0.6556	4.3546	1.0966			
p-value	0.2086	**0.0000**	0.5140	**0.0000**	0.2762			
B/M	-0.0075	0.6132	-0.1027	0.4441	0.2071	0.6995	49.30	0.00
t-statistics	-1.8465	10.0415	-0.6226	2.8501	1.4186			
p-value	0.0686	**0.0000**	0.5353	**0.0056**	0.1599			
B/L	-0.0070	0.6440	0.2077	-0.1071	0.0578	0.6613	41.52	0.00
t-statistics	-1.7988	10.9408	1.3066	-0.7129	0.4107			
p-value	0.0759	**0.0000**	0.1952	0.4780	0.6824			

Table 5.26 reports that UMD is not a significant factor in explaining portfolio returns. However, market premium is significantly positively related to portfolio returns. However, value premium is significantly positively related to portfolio return except B/L and S/L. It indicates that high B/M stocks earn more than low B/M stocks. Similarly, size has significantly positive relationship with portfolio return in general. It indicates that small stocks earn more than large stocks. Explanatory power of model ranges from 66% to 77%. It is reasonably higher than traditional CAPM, but marginally different from Fama and French three factor model. It is due to the fact that momentum is not priced by the market and it has no significant relationship with equity returns.

5.5 Liquidity Based Four Factor Model

Liquidity based four factor model extends the work of Fama and French by incorporating illiquidity premium in the Fama an French three factor model. Illiquidity factor can explain the returns which are not captured through SMB and HML. The payoffs of illiquidity premium are estimated by creating variable ILLIQP which is difference between returns of portfolio of low liquidity stocks and returns of portfolio of high liquidity stocks. Statistical properties of portfolios sorted on Size-BMR- LIQ are reported in Table 5.27.

Table 5.27

Descriptive statistics Size- BMR- LIQ Sorted Portfolios

	Mean	Median	Std Dev	Kurtosis	Skewness	Minimum	Maximum
B/H/LL	0.0188	0.0246	0.0646	-0.6859	-0.1471	-0.1187	0.1397
B/H/HL	0.0176	0.0128	0.0957	0.0581	0.1179	-0.2001	0.2791
B/M/LL	0.0112	0.0036	0.0516	-0.2335	0.1705	-0.0995	0.1373
B/M/HL	0.0157	0.0084	0.0852	-0.0640	0.0427	-0.1708	0.2728
B/L/LL	0.0151	0.0136	0.0555	-0.0687	0.2753	-0.0964	0.1606
B/L/HL	**0.0056**	0.0098	0.0745	0.1122	-0.5196	-0.2000	0.1538
S/H/LL	**0.0225**	0.0152	**0.0748**	0.1037	0.4910	-0.1219	0.2398
S/H/HL	0.0087	-0.0006	0.0939	0.0507	0.4780	-0.1725	0.2753
S/M/LL	0.0134	0.0068	0.0607	-0.2373	0.4799	-0.1013	0.1943
S/M/HL	0.0121	0.0080	0.0830	-0.3120	-0.0377	-0.1931	0.2088
S/L/LL	0.0112	0.0083	0.0511	-0.1996	0.1678	-0.1206	0.1170
S/L/HL	0.0117	0.0125	0.0870	0.7304	-0.2898	-0.2445	0.2082

Above table indicate that S/H/LL earns the highest return where as B/L/HL earns a lowest return. S/H/LL secures a return of 2.25% % per month with a risk level of 7.48% per month and B/L/HL earns is 0.56% per month with a risk level of 7.45% per month. It indicates small stocks with high book to market ratio and low liquidity are more efficient than big stocks with low book to market ratio and high liquidity.

Another important feature of above table is that in B/L/HL earns a lowest return which is 0.56% per month. This performance is in line with empirical evidence that provides small stocks earn more than large stocks. Similarly, high B/M stocks earn more than low B/M stocks and low liquidity stocks earn more than high book to market stocks. It is worth mentioning that high liquidity and low liquidity stocks are determined on the basis of last 12 month trading. S/H/HL is an inefficient portfolio it assumes higher risk but earns low returns.

Six Size –BMR portfolios along with Size sorted portfolios and portfolio comprising of all securities has been regressed against MKT, SMB, HML, and ILLIQP.

The algebraic relationship among variables is presented below.

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 ILLIQP_t$$

Where

R_{it} = Return of portfolio ‘’for period “t”

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

SMB = 1/6 * [(S/H/HL – B/H/HL) + (S/H/LL – B/H/LL) + (S/M/HL – B/M/HL) + (S/M/LL – B/M /LL) + (S/L/HL – B/L/HL) + (S/L/LL – B/L/LL)]

HML =1/4 * [(S/H/HL – S/L/HL) + (S/H/LL – S/L/LL) + (B/H/HL – B/L/HL) + (B/H/LL – B/L/LL)]

ILLIQP= 1/6 * [(S/H/LL – S/H/HL) + (S/M/LL – S/M/HL)+ (S/L/LL – S/L/HL) + (B/H/LL – B/H /HL) + (B/M/LL – B/M/HL) +(B/L/LL – B/L/HL)]

ε_t = error term

ILLIQP is included in the model is as Karpoff (1987), Lee and Swaminathan (2000), and Connolly and Stivers (2003) provide evidence that past trading volume significantly explain stock returns. Statistical properties of the four variables are reported below in Table 5.28.

Table 5.28

Descriptive statistics Four Factors

	MKT	SMB	HML	ILLIQP
Mean	0.0208	-0.0008	0.0060	0.0035
Median	0.0179	-0.0025	0.0078	0.0001
Std Dev	0.0811	0.0321	0.0395	0.0382
Kurtosis	0.1083	0.3297	0.4976	0.2784
Skewness	0.1239	0.0675	-0.0295	0.1928
Minimum	-0.1630	-0.0914	-0.0922	-0.0973
Maximum	0.2335	0.0799	0.1167	0.1092

Average market premium during study period 2.08% which is higher than size premium , value premium and liquidity premium. Similarly, market premium is observed as most volatile. Value premium is positive whereas size is negative. Size premium how ever appears negligible. Therefore in the absence of beta average low liquidity stocks on average perform better than high liquidity stocks. Before analyzing the role ILLIQP in explaining portfolio returns in presence of MKT, SMB, and HML, it is appropriate to examine correlation among independent variables so that

possibility of multicolinearity can explored. Table 5.29 presents the correlation coefficient among variables of interest.

Table 5.29 **Correlation Matrix**

MKT -SMB- HML- ILLIQP

	MKT	SMB	HML	ILLIQP
MKT	1			
SMB	-0.26	1		
HML	0.37	0.48	1	
ILLIQP	-0.44	0.02	-0.18	1

ILLIQP is not correlated with any SMB and HML. However, significant negative correlation exists with MKT. Similarly HML and SMB are correlated. This situation may lead to statistical error. Therefore, VIF is calculated which is 3.47 and it is within permissible tolerance limit of 5, so portfolio returns can be regressed on above discussed explanatory variables i.e MKT, SMB, HML, and ILLIQP. Results of ordinary least square regression analysis are reported in Table 5.30.

Table 5.30

Liquidity based Four Factor Model

Dependent variable	Intercept	MKT	SMB	HML	ILLIQP	Adj R^2	F Stat	F sig
P	-0.0006	0.4798	0.525	0.230	-0.538	0.77	70.95	0.00
t-statistics	-0.1816	8.3999	3.728	1.944	-5.508			
p-value	0.856	0.0000	0.000	0.055	0.000			
S	0.0002	0.444	1.037	0.182	-0.592	0.76	67.56	0.00
t-statistics	0.0642	7.151	6.775	1.420	-5.572			
p-value	0.9490	0.000	0.000	0.159	0.000			
B	-0.002	0.516	0.013	0.278	-0.485	0.79	80.48	0.00

t-statistics	-0.449	9.374	0.099	2.439	-5.153			
p-value	0.654	0.000	0.922	0.017	0.000			
S/H	0.002	0.368	1.113	0.621	-0.637	0.78	73.06	0.00
t-statistics	0.392	5.168	6.335	4.214	-5.222			
p-value	0.696	0.000	0.000	0.000	0.000			
S/M	0.000	0.466	1.090	0.100	-0.504	0.74	59.50	0.00
t-statistics	0.059	7.334	6.962	0.763	-4.638			
p-value	0.953	0.000	0.000	0.448	0.000			
S/L	-9.9E-05	0.520	0.998	-0.275	-0.621	0.67	43.11	0.00
t-statistics	-0.023	7.398	5.760	-1.892	-5.160			
p-value	0.982	0.000	0.000	0.062	0.000			
B/H	0.001	0.510	0.093	0.579	-0.652	0.78	75.51	0.00
t-statistics	0.219	7.549	0.558	4.144	-5.640			
p-value	0.828	0.000	0.578	0.000	0.000			
B/M	-0.003	0.485	-0.134	0.330	-0.499	0.75	63.92	0.00
t-statistics	-0.811	7.906	-0.886	2.598	-4.753			
p-value	0.420	0.000	0.378	0.011	0.000			
B/L	-0.004	0.558	0.143	-0.114	-0.359	0.70	50.55	0.00
t-statistics	-1.116	9.191	0.957	-0.904	-3.453			
p-value	0.268	0.000	0.341	0.369	0.001			

Table 5.30 reports that ILLIQP is a significant factor in explaining portfolio returns. As illiquidity premium is calculated by subtracting returns of highliquidity stocks from returns of low liquidity stocks so it can be inferred that high liquidity stocks earn more than low liquidity stocks. Therefore, illiquidity premium exists. Similarly, market premium is significantly positively related to portfolio returns. However, value premium is found significantly positively related to portfolio return except B/L and S/L. Size has significantly positive relationship with portfolio return in general.

Explanatory power of model ranges from 66% to 77%. This explanatory power is reasonably higher than traditional capital asset pricing model and marginally higher

than Fama and French three factor model. It may be noted that capital asset pricing model explains 25% - 71% of the total variation in portfolio returns whereas Fama and French three factor model explains 60% - 74% of total variation in portfolio returns.

5.6 Proposed Five Factor Model

In five factor model, role of size premium, value premium, momentum and illiquidity premium are examined simultaneously. Statistical properties of the portfolios sorted on Size- BMR-Momentum-Liquidity are reported in Table 5.31.

Table 5.31

Descriptive Statistics

Size- BMR-Momentum-Liquidity Sorted Portfolios

	Mean	Median	Std Dev	Kurtosis	Skewness	Min	Max
S/H/U/HL	0.0082	0.0084	0.1040	0.5669	0.2631	-0.2535	0.3078
S/H/U/LL	0.0155	0.0098	0.0738	0.0340	-0.0331	-0.1598	0.1830
S/H/D/HL	0.0153	0.0003	0.1113	0.8711	0.6875	-0.2577	0.3551
S/H/D/LL	0.0237	0.0159	0.0928	0.6183	0.5840	-0.1912	0.3084
S/M/U/HL	0.0132	0.0252	0.0911	-0.1797	-0.3715	-0.2408	0.1845
S/M/U/LL	0.0127	0.0030	0.0780	0.1225	0.2093	-0.1819	0.2071
S/M/D/HL	0.0123	0.0129	0.0863	0.6873	0.3682	-0.1752	0.3069
S/M/D/LL	0.0115	0.0047	0.0605	2.1392	0.9998	-0.0881	0.2558
S/L/U/HL	0.0061	-0.0027	0.0970	1.2439	-0.4213	-0.2933	0.2124
S/L/U/LL	0.0134	0.0182	0.0692	0.5013	-0.1805	-0.1881	0.1899
S/L/D/HL	0.0148	0.0017	0.0896	-0.0353	0.3486	-0.1956	0.2269
S/L/D/LL	0.0107	0.0065	0.0633	2.4668	0.8699	-0.1267	0.2670
B/H/U/HL	0.0200	0.0390	0.0983	0.0573	-0.3092	-0.2576	0.2597
B/H/U/LL	0.0146	0.0146	0.0673	-0.1311	0.0322	-0.1484	0.1726
B/H/D/HL	0.0203	0.0134	0.0997	0.3811	0.3010	-0.2071	0.3218
B/H/D/LL	0.0179	0.0121	0.0768	-0.2358	0.3343	-0.1192	0.2233

B/M/U/HL	0.0148	0.0170	0.0918	0.1446	-0.4640	-0.2599	0.1919
B/M/U/LL	0.0139	0.0121	0.0565	0.3932	-0.0788	-0.1471	0.1488
B/M/D/HL	0.0144	0.0127	0.0843	0.5667	0.3746	-0.1880	0.2849
B/M/D/LL	0.0090	0.0053	0.0767	1.6548	0.4358	-0.1603	0.2934
B/L/U/HL	0.0047	0.0081	0.0793	0.5046	-0.3616	-0.2133	0.1932
B/L/U /LL	0.0125	0.0169	0.0604	-0.0772	-0.1583	-0.1288	0.1671
B/L/D/HL	0.0083	0.0138	0.0794	0.0065	-0.3556	-0.2049	0.1881
B/L/D/LL	0.0184	0.0185	0.0645	1.1530	0.1218	-0.1761	0.2277

Descriptive statistics provide that S/H/D/LL portfolio reports the highest return of 2.37% per month which is equal to an annualized return of 35.6%. In market worse performer is B/L/U/HL that reports a profit of 0.47% per month, which is equal to an annualized return of 5.78%. This result is in line with empirical evidence that requires that small stock with high book to market ratio earn higher returns in comparison to big stock with low book to market ratio. Similarly, in Pakistani market reversal within 12 months is observed so a historical loser outperforms the winner. Further, a low liquidity portfolio assumes higher risk so higher returns are expected. Further S/H/D/HL assumes highest risk but does not offer highest return so this portfolio can be termed as inefficient whereas lowest risk is assumed by B/M/U/LL and it is 5.65% per month. S/H/D/HL reports the highest return during one that is more than 35% whereas maximum loss have been reported by S/L/U/HL which is more than 29% in a month.

Six Size –BMR portfolios along with Size sorted portfolios and portfolio comprising of all securities has been regressed against MKT, SMB, HML ,UMD and ILLIQ premium. The algebraic relationship among variables is presented below

$$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 ILLIQP_t$$

Where
R_{it} = Return of portfolio "i"for period "t"

R_{ft} = Risk Free Rate

MKT = $R_{mt} - R_{ft}$

Statistical properties of the explanatory variables constructed for five factor model are reported below in Table 5.32.

Table 5.32

Descriptive Statistics Five Factors

(MKT-SMB-HML-UMD-ILLIQ)

	MKT	**SMB**	**HML**	**UMD**	**ILLIQP**
Mean	0.0208	-0.0010	0.0058	-0.0022	-0.0018
Median	0.0179	-0.0025	0.0083	0.0004	-0.0012
Std Dev	0.0811	0.0342	0.0339	0.0280	0.0405
Kurtosis	0.1083	-0.1298	0.4980	0.6227	0.6063
Skewness	0.1239	-0.0963	-0.0126	-0.3384	-0.0572
Minimum	-0.1630	-0.0967	-0.0925	-0.0861	-0.1198
Maximum	0.2335	0.0745	0.0907	0.0576	0.1029

Average market premium during study period is 2.08%, which is higher than size premium, value premium and payoffs of momentum strategies. Low liquidity stock on average earns higher returns in comparison to high liquidity stocks**.** Big stocks earn on average high return in comparison to small stocks. Similarly, high book to market stocks on average earn higher returns in comparison to stocks with low book to market ratio.

However, market premium is observed as most volatile. Value premium is positive whereas size, liquidity and momentum payoffs are negative. Size premium, however, appears negligible.

Table 5.33

ProposedFive Factor Model

Dependent variable	Intercept	MKT	SMB	HML	UMD	ILLIQP	Adj R^2	F Stat	F sig
P	-0.0027	0.5295	0.5422	0.3016	0.1374	-0.4551	0.77	58.17	0.00
t-statistics	-0.7629	9.2351	3.9280	2.2729	1.1307	-4.5708			
p-value	0.4478	**0.0000**	**0.0002**	**0.0258**	0.2616	**0.0000**			
S	-0.0029	0.5213	1.0277	0.3229	0.1291	-0.4765	0.78	60.46	0.00
t-statistics	-0.7830	8.6652	7.0946	2.3188	1.0120	-4.5601			
p-value	0.4360	**0.0000**	**0.0000**	**0.0230**	0.3147	**0.0000**			
B	-0.0025	0.5376	0.0568	0.2803	0.1458	-0.4338	0.78	62.31	0.00
t-statistics	-0.7149	9.5196	0.4174	2.1445	1.2177	-4.4226			
p-value	0.4768	**0.0000**	0.6775	**0.0351**	0.2270	**0.0000**			
S/H	-0.0033	0.4967	1.0655	0.8470	0.0342	-0.4512	0.80	70.93	0.00
t-statistics	-0.8124	7.4408	6.6291	5.4820	0.2419	-3.8917			
p-value	0.4190	**0.0000**	**0.0000**	**0.0000**	0.8095	**0.0002**			
S/M	-0.0022	0.5382	1.065	0.2612	0.2381	-0.4092	0.77	56.72	0.00
t-statistics	-0.6761	8.9391	7.355	1.8732	1.8682	-3.9201			
p-value	0.5012	**0.0000**	**0.000**	**0.0653**	0.0651	**0.0000**			
S/L	-0.0022	0.5630	1.052	-0.2393	0.2012	-0.5171	0.67	33.24	0.00
t-statistics	-0.4123	7.8091	6.059	-1.4291	1.3121	-4.1292			
p-value	0.6813	**0.0001**	**0.000**	0.1572	0.1941	**0.0002**			
B/H	-0.0015	0.5674	0.1172	0.6618	0.1877	-0.5317	0.78	59.49	0.00
t-statistics	-0.3604	8.2461	0.7073	4.1556	1.2869	-4.4494			
p-value	0.7195	**0.0000**	0.4815	**0.0001**	0.2019	**0.0000**			
B/M	-0.0040	0.5093	-0.070	0.3402	0.2359	-0.4342	0.75	50.21	0.00
t-statistics	-1.0304	8.1401	-0.465	2.3493	1.7784	-3.9957			
p-value	0.3060	**0.0000**	0.6431	**0.0213**	0.0792	**0.0001**			
B/L	-0.0039	0.5420	0.1900	-0.1719	0.0616	-0.3768	0.70	40.24	0.00
t-statistics	-1.0240	8.7880	1.2794	-1.2044	0.4713	-3.5181			
p-value	0.3090	**0.0000**	0.2046	0.2321	0.6387	**0.0007**			

Above table shows that that there exists a significant positive relationship between market premium and portfolio returns. Similarly, there exists a significant positive relationship between size premium and portfolio of small stocks. However, above multivariate regression analysis also confirms that size premium has insignificant relationship with portfolio of big stocks. HML has significant positive relationship with portfolio returns. However this relationship is found insignificant for portfolio comprising of low B/M ratio stocks. Illiquidity premium is priced by market and there exist significant negative relationship between illiquidity and portfolio returns. UMD has no significant relationship with portfolio returns and this result is consistent with Carhart four factor model that shows that momentum effect does not exist in Pakistani equity market.

5.7 Proposed Six Factor Model

In six factor model, role of size premium, value premium, momentum, illiquidity premium, and P/E premium is examined simultaneously. Statistical properties of the portfolios sorted on Size- BMR-Momentum-Liquidity –PE Ratio are reported in Table 5.34.

Table 5.34

Descriptive Statistics

Size- BMR-Momentum-Liquidity-PE Sorted Portfolios

	Mean	Median	Std Dev	Kurtosi	Skew	Min	Max
S/H/U/LL/LPE	0.0215	0.0179	0.0914	1.2017	-0.3500	-0.2950	0.2533
S/H/U/LL/HPE	0.0082	0.0093	0.0881	1.5572	0.2985	-0.2190	0.3288
S/H/U/HL/LPE	0.0132	0.0021	0.1151	-0.2435	0.2204	-0.2245	0.2876
S/H/U/HL/HPE	0.0043	0.0115	0.1217	1.8356	0.4799	-0.3246	0.3665
S/H/D/LL/LPE	0.0205	0.0063	0.1155	2.1832	0.2058	-0.3586	0.4169
S/Hs/D/LL/HPE	0.0254	0.0135	0.1050	0.2640	0.6474	-0.1972	0.3219
S/H/D/HL/LPE	0.0184	0.0048	0.1202	1.8880	0.7545	-0.2846	0.4644
S/H/D/HL/HPE	0.0201	0.0099	0.1187	1.0503	0.5119	-0.2523	0.4153
S/M/U/LL/LPE	0.0109	0.0088	0.0844	-0.2649	0.2390	-0.1578	0.2142
S/M/U/LL/HPE	0.0150	-0.0045	0.1000	0.4555	0.4156	-0.2466	0.3148
S/M/U/HL/LPE	0.0110	0.0143	0.1076	0.3254	0.0467	-0.2842	0.2942
S/M/U/HL/HPE	0.0153	0.0148	0.1102	1.9048	-0.3045	-0.4019	0.3257
S/M/D/LL/LPE	0.0169	0.0078	0.0903	2.9684	0.5753	-0.2260	0.3802
S/M/D/LL/HPE	0.0092	0.0052	0.0731	0.1819	0.0293	-0.1578	0.2097
S/M/D/HL/LPE	0.0058	0.0123	0.1127	1.7221	0.0923	-0.3011	0.3670
S/MD/HL/HPE	0.0214	0.0221	0.0959	-0.4913	0.1864	-0.1781	0.2468
S/L/U/LL/LPE	0.0139	0.0185	0.0793	1.3774	0.0707	-0.2116	0.2376
S/L/U/LL/HPE	0.0129	0.0091	0.0891	1.8086	0.3413	-0.2583	0.2956
S/L/U/HL/LPE	0.0088	0.0072	0.1131	1.6918	-0.4400	-0.4125	0.2908
S/L/U/HL/HPE	0.0039	-0.0014	0.0974	1.0180	-0.1592	-0.3057	0.2370
S/L/D/LL/LPE	0.0143	0.0043	0.0854	5.8569	1.4636	-0.1506	0.4337
S/L/D/LL/HPE	0.0085	0.0034	0.0662	0.2959	0.1804	-0.1661	0.2014
S/L/D/HL/LPE	0.0160	0.0006	0.1164	1.1521	0.7979	-0.2360	0.3981
S/L/D/HL/HPE	0.0112	0.0103	0.0871	2.4316	0.6074	-0.1797	0.3696
B/H/U/LL/LPE	0.0187	0.0197	0.0743	0.1757	-0.1820	-0.1907	0.1983
B/H/U/LL/HPE	0.0154	0.0089	0.0861	0.5333	0.1084	-0.2367	0.2315
B/H/U/HL/LPE	0.0187	0.0171	0.1144	0.9181	0.5328	-0.2032	0.3891
B/H/U/HL/HPE	0.0146	0.0116	0.1045	0.4469	-0.2095	-0.3034	0.2740
B/H/D/LL/LPE	0.0199	0.0105	0.0806	0.3078	0.5025	-0.1264	0.2744
B/H/D/LL/HPE	0.0140	0.0072	0.0875	0.3186	0.3978	-0.1977	0.2406
B/H/D/HL/LPE	0.0242	0.0091	0.1132	1.7382	0.1437	-0.3860	0.3192
B/H/D/HL/HPE	0.0205	0.0040	0.1229	0.9531	0.5991	-0.2375	0.4004
B/M/U/LL/LPE	0.0231	0.0143	0.0774	0.3878	0.1572	-0.1861	0.2373
B/M/U/LL/HPE	0.0023	0.0078	0.0686	1.6405	-0.2344	-0.2360	0.1828
B/M/U/HL/LPE	0.0182	0.0131	0.0977	0.0274	-0.3860	-0.2410	0.2337
B/M/U/HL/HPE	0.0124	0.0179	0.0996	0.4664	-0.3654	-0.3001	0.2222
B/M/D/LL/LPE	0.0080	0.0024	0.0802	1.6032	-0.0887	-0.2438	0.2389
B/M/D/LL/HPE	0.0113	0.0047	0.0888	7.4612	0.9036	-0.3023	0.4475

B/M/D/HL/LPE	0.0225	0.0201	0.0898	0.9914	0.1691	-0.2530	0.2704
B/M/D/HL/HPE	0.0066	0.0029	0.0939	0.3296	0.5962	-0.1755	0.2994
B/L/U/LL/LPE	0.0139	0.0118	0.0751	-0.5165	-0.2172	-0.1685	0.1644
B/L/U/LL/HPE	0.0108	0.0145	0.0769	1.2377	-0.0703	-0.2157	0.2436
B/L/U/HL/LPE	0.0093	0.0036	0.0898	0.1424	-0.2219	-0.2506	0.1898
B/L/U/HL/HPE	-0.002	0.0011	0.0910	1.1064	-0.3818	-0.2642	0.2590
B/L/D/LL/LPE	0.0208	0.0379	0.1016	1.8046	-0.5988	-0.3241	0.2923
B/L/D/LL/HPE	0.0901	0.0109	0.2046	3.4239	2.0876	-0.0996	0.7364
B/L/D/HL/LPE	-0.044	-0.0023	0.1574	1.2976	-1.3603	-0.5141	0.1725
B/L/D/HL/HPE	0.0030	0.0146	0.0988	-0.1577	-0.3519	-0.2310	0.2136

Descriptive statistics provide that S/H/W/LL/HPE portfolio reports the highest return of 2.54% per month which is equal to an annualized return of 35.12%. B/H/L/HL/LPE ranks second with an equity return of 2.42% per month with an annualized return of 33.23%.

S/H/L/LL/LPE ranks third with an annual return of 29%. In market worse performer is B/L/L/HL/LPE that reports a loss of 0.44% per month. Further B/L/L/LL/HPE assumes highest risk but does not offer highest return so this portfolio can be termed as an inefficient portfolio whereas lowest risk is assumed by S/L/L/LL/HPE and it is 6.62% per month. B/L/L/LL/HPE reports the highest return during one month that is more than 73% whereas maximum loss have been reported by S B/L/L/HL/LPE which is more than 51% in a month.

Six Size –BMR portfolios along with Size sorted portfolios and portfolio comprising of all securities has been regressed against MKT, SMB, HML, UMD, ILLIQ premium, and PE premium. The algebraic relationship among variables is presented below.

$R_{it} - R_{ft} = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 ILLIQP_t + \beta_6 PE\ Premium_t$

where

R_{it} = Return of portfolio "i"for period "t"

R_{ft} = Risk Free Rate

$MKT = R_{mt} - R_{ft}$

Statistical properties of the explanatory variables constructed for six factor model are reported below in Table 5.35.

Table 5.35

Descriptive statistics Six Factors

	MKT	SMB	HML	UMD	ILLIQP	PEPremium
Mean	0.0208	-0.0011	0.0053	-0.0038	0.0071	-0.0012
Median	0.0179	-0.0048	0.0066	0.0013	0.0100	0.0014
Std Dev	0.0811	0.0349	0.0372	0.0294	0.0428	0.0236
Kurtosis	0.1083	-0.3109	0.4748	0.1648	0.3286	0.3873
Skewness	0.1239	0.0048	-0.1191	-0.2220	-0.0143	0.0045
Minimum	-0.1630	-0.0848	-0.1089	-0.0810	-0.1033	-0.0578
Maximum	0.2335	0.0746	0.0875	0.0653	0.1202	0.0713

Above table indicates that average market premium, value premium and illiquidity premium are positive whereas size premium, momentum and PE premium are negative. Market premium is 2.08% per month and its volatility is also highest with a standard deviation of 8.11% per month.

Table 5.36 reports the result of multivariate regression analysis for various portfolios regressed against MKT, SMB, HML, UMD, ILLIQ premium and PE premium.

Table 5.36

Proposed Six Factor Model

Dependent variable	Inter	MKT	SMB	HML	UMD	ILLIQP	PEP	Adj R^2	F Stat	F sig
P	-0.001	0.546	0.560	0.199	-0.017	-0.414	-0.275	0.75	42.50	-0.001
t-statistics	-0.207	9.252	3.992	1.605	-0.136	-4.056	-1.734			
p-value	0.836	**0.000**	**0.000**	0.113	0.892	**0.000**	0.087			
S	-0.001	0.539	1.039	0.176	-0.062	-0.416	-0.292	0.73	38.64	0.00
t-statistics	-0.214	8.265	6.704	1.288	-0.460	-3.686	-1.670			
p-value	0.831	**0.000**	**0.000**	0.202	0.647	**0.000**	0.099			
B	-0.001	0.553	0.081	0.221	0.029	-0.412	-0.257	0.78	50.62	0.00
t-statistics	-0.188	9.909	0.609	1.888	0.249	-4.271	-1.716			
p-value	0.851	**0.000**	0.544	0.063	0.804	**0.000**	0.090			
S/H	-0.002	0.529	1.125	0.627	-0.218	-0.388	-0.425	0.75	42.02	0.00
t-statistics	-0.332	7.065	6.334	3.994	-1.409	-3.002	-2.119			
p-value	0.741	**0.000**	**0.000**	**0.000**	0.163	**0.004**	**0.037**			
S/M	-0.001	0.565	1.117	0.079	0.060	-0.339	-0.250	0.73	37.93	0.00
t-statistics	-0.160	8.822	7.344	0.591	0.451	-3.065	-1.457			
p-value	0.874	**0.000**	**0.000**	0.556	0.654	**0.003**	0.149			
S/L	4E-05	0.563	1.001	-0.260	0.052	-0.464	-0.319	0.63	24.67	0.00
t-statistics	0.009	7.661	5.739	-1.687	0.341	-3.655	-1.621			
p-value	0.993	**0.000**	**0.000**	0.096	0.734	**0.000**	0.109			
B/H	0.001	0.591	0.191	0.510	0.004	-0.527	-0.313	0.77	47.58	0.00
t-statistics	0.279	8.631	1.174	3.552	0.028	-4.454	-1.708			
p-value	0.781	**0.000**	0.244	**0.001**	0.978	**0.000**	0.092			
B/M	-0.002	0.529	-0.05	0.255	0.069	-0.401	-0.257	0.73	38.75	0.00
t-statistics	-0.544	8.383	-0.35	1.927	0.533	-3.677	-1.519			
p-value	0.588	**0.000**	0.723	0.058	0.596	**0.000**	0.133			
B/L	-0.003	0.549	0.170	-0.127	0.037	-0.333	-0.165	0.69	32.38	0.00
t-statistics	-0.713	8.982	1.170	-0.989	0.289	-3.151	-1.006			
p-value	0.478	**0.000**	0.246	0.326	0.773	**0.002**	0.318			

Above table reveals that market premium and size premium are significantly positively related to returns of portfolio comprising of all securities whereas illiquidity premium is significantly negative related to portfolio returns at 95% confidence interval. It indicates that in the Pakistani equity markets, high liquidity stocks in general earns higher returns in comparison to low liquidity stocks. Similarly, small stocks earn higher returns in comparison to large stocks. These attributes of the

market should be kept in mind by investors. It is worth mentioning that PE premium is insignificantly negatively related to portfolio returns at 95% confidence interval. Size sorted portfolios, i.e. portfolios comprising of small stocks and portfolios comprising of large stocks, also shows the same pattern. It can be seen from above table that market premium, size premium and illiquidity premium are priced by the market. However, value premium is found significantly positively related to returns of S/H and B/H portfolios at $\alpha = 0.05$. Above findings does not provide evidence about existence of momentum effect as no significant relationship exist between UMD and portfolio returns. Finally, addition of PE ratio premium does not increase the explanatory power of model so it can be said that other factors like HML can explain the returns of portfolio. It is worth stated that HML is significant in the absence of PE premium so both can not be used simultaneously.

5.8 Comparison among explanatory power of models

Comparative position of explanatory power of various models is reported in Table 5.37 below.

Table 5.37

Comparative Statement of Adj R^2

Dependent Variable	CAPM	3FM-FF	4FM-M	4FM-L	5FM	6FM
P	0.55	0.73	0.72	0.77	0.77	0.75
S	0.35	0.74	0.73	0.76	0.78	0.73
B	0.71	0.74	0.74	0.79	0.78	0.78
S/H	0.25	0.81	0.78	0.78	0.80	0.75
S/M	0.34	0.72	0.73	0.74	0.77	0.73

S/L	0.38	0.60	0.59	0.67	0.67	0.63
B/H	0.61	0.73	0.73	0.78	0.78	0.77
B/M	0.67	0.70	0.70	0.75	0.75	0.73
B/L	0.66	0.66	0.66	0.70	0.70	0.69

Above table provides that explanatory power of five factor models is highest for most of the portfolios except portfolio comprising of large stocks. But it is just marginally high from four factor model comprising of MKT, SIZE, HML and ILLIQP. Therefore, it can be concluded that size premium, value premium, and illiquidity premium exist in the KSE and these anomalies can be used to earn above normal returns. Similarly, an extended four factor model comprising of Fama and French three factors and illiquidity premium should be employed for asset pricing.

5.9 Macroeconomic Variables and Equity Market Returns

5.10 Co integration Analysis- JJ Approach

Table 5.38 displays the descriptive statistics regarding changes in macroeconomic variables and equity market returns. The average monthly returns earned at Karachi stock exchange during last ten years is 2.2 % which is equivalent to an annualized return of 29.28%. This is one of the highest returns offered by emerging equity markets. The highest returns achieved during one month are 24.11% and maximum loss incurred in one month is 27.8%.

Table 5.38

Descriptive Statistics Macroeconomic Variables

	ΔKse100	**Δ IPI**	**Δ Oil**	**ΔX Rate**	**ΔT Bill**	**ΔCPI**	**ΔFPI**	**ΔM1**
Mean	0.0220	0.0022	0.0209	-0.0035	-0.0025	0.0056	0.0055	0.0167
Median	0.0219	0.0016	0.0310	-0.0006	0.0000	0.0047	0.0018	0.0091
Std Dev	0.0912	0.1121	0.0788	0.0121	0.0985	0.0070	0.0238	0.0422
Skewness	-0.3055	-0.4653	-0.6324	-2.4291	-0.6279	0.9219	3.5235	4.2966
Min	-0.2780	-0.4857	-0.2161	-0.0762	-0.4242	-0.0088	-0.0605	-0.0646
Max	0.2411	0.3533	0.2241	0.0307	0.3200	0.0303	0.1651	0.3481

Average monthly industrial growth rate is 0.22% which is not appreciating at all. Oil prices increased at an average monthly rate of 2.09%. Narrow money growth rate is 1.67% per month which is significantly high. Average change in consumer price

index is 0.56% per month whereas T bill rates appear to change at a rate of 0.25% per month. Average decrease in value of Pakistani currency is 0.35%. Percentage changes in exchange rates ranges from a minimum of -7.62% to a maximum value of 3.07% percent. Foreign portfolio investment is on average increased by 0.55% per month. Average change in Treasury bill is 1.81%. However, significantly high volatility is observed in equity returns, industrial production, oil prices and t bill rates. Unstable macroeconomic variables lead to high risk and affect over all quality of decisions.

Table 5.39 shows the correlation among equity returns and macroeconomic variables. Weak correlation is generally observed between the equity return and macroeconomic variables.

Table 5.39

Correlation Matrix

(Equity returns and change in macroeconomic variables)

	ΔKse100	**Δ IPI**	**Δ Oil**	**ΔX Rate**	**ΔT Bill**	**ΔCPI**	**ΔFPI**	**ΔM1**
ΔKse100	1							
Δ IPI	-0.0257	1						
Δ Oil	-0.0391	-0.1321	1					
ΔX Rate	0.1219	0.0579	-0.0943	1				
ΔT Bill	-0.1429	-0.1637	0.0325	-0.1974	1			
ΔCPI	-0.1698	-0.0169	0.1892	-0.2029	0.2557	1		
ΔFPI	0.1490	-0.0146	-0.0655	0.0956	0.0221	-0.0172	1	
ΔM1	0.0241	0.1560	-0.0183	0.1455	-0.0198	-0.0145	0.0498	1

Interest rates are negatively correlated with equity returns which are logical as increase in interest rates leads to increase in discount rate and it ultimately results in decrease in present value of future cash flows which represent fair intrinsic value of shares. However this relationship is found insignificant. The relationship between inflation and equity returns can also be viewed on the basis of above analogy. This relationship is also found insignificant. Foreign portfolio investment increases liquidity in market and higher demand leads to increase in market prices of shares so relationship should be positive. But this relationship is found insignificant. Increase in oil prices increase the cost of production and decrease the earning of the corporate sector due to decrease in profit margins or decrease in demand of product. So negative relationship is in line with economic ration but it is again insignificant. Money growth rate is positively correlated with returns that are in line with results drawn by Maysami and Koh (2000). The possible reason is that increase in money supply leads to increase in liquidity that ultimately results in upward movement of nominal equity prices. However relationship is insignificant and weak. Similarly interest rate parity theory is also confirmed from results as interest rate is negatively correlated with exchange rates. Correlation analysis is relatively weaker technique. Therefore causal nexus among the monetary variables has been investigated by employing multivariate cointegration analysis. Cointegration analysis tells us about the long term relationship among equity returns and set of monetary variables. Cointegration tests involve two steps. In first step, each time series is scrutinized to determine its order of integration. For this purpose ADF test and Phillips-Perron test

for unit has been used at level and first difference. Results of unit root test under assumption of constant and trend have been summarized in Tables 5.40.

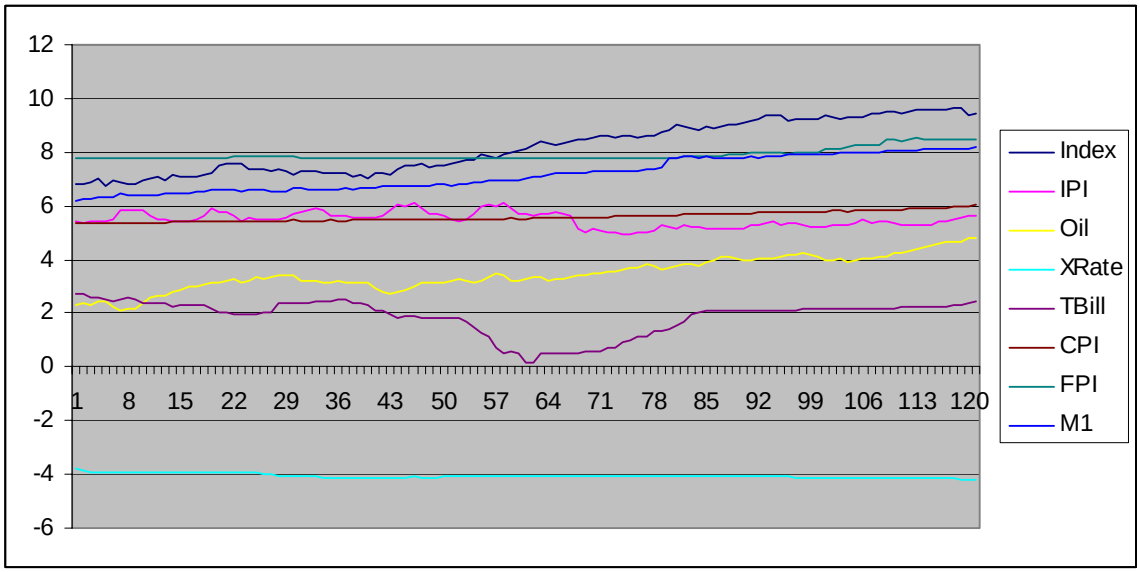
Table 5.40

Unit Root Analysis

	ADF- Level	**ADF- Ist Diff**	**PP- Level**	**PP- Ist Diff**
Ln Kse100	-2.1686	-12.015	-2.0872	-12.2821
Ln IPI	-3.1322	-8.9420	-2.8182	-8.7609
Ln Oil	-2.3550	-8.3208	-2.0543	-8.2033
Ln X Rate	-2.3659	-6.6074	-3.1003	-6.4168
Ln T Bill	-1.6981	-3.6063	-1.3595	-7.8162
Ln CPI	2.9023	-8.6160	2.6215	-8.6190
Ln FPI	0.4762	-3.6651	-0.4640	-10.8700
Ln M1	-1.8832	-10.245	-1.9545	-10.2284
1% Critic. Value	-4.0363	-4.0370	-4.0363	-4.0370
5% Critic. Value	-3.4477	-3.4480	-3.4477	-3.4480
10%Critic Value	-3.1489	-3.1491	-3.1489	-3.1491

Results clearly indicate that the index series are not stationary at level but the first differences of the logarithmic transformations of the series are stationary. Therefore, it can safely said that series are integrated of order one I (1). It is worth mentioning that results are robust under assumption of constant trend as well as no trend.

Fig 4 **Trend of Logarithmic Series**



In second step, time series is analyzed for Cointegration by using likelihood ratio test which include (i) trace statistics and (ii) maximum Eigen value statistics.

Table 5.41 exhibits the results of trace statistics at a lag length of three months. On the basis of above results null hypothesis of no cointegration between the equity indices and macroeconomic variables for the period 6/1998 to 3/2008 cannot be rejected in Pakistani equity market. Trace test indicates the presence of 4 cointegrating vectors among variables at the $\alpha = 0.05$. In order to confirm the results Maximum Eigen value test has also been employed and Max Eigen value test also confirms the presence of cointegration at the $\alpha = 0.05$. Therefore, study provides evidence about existence of long term relationship among macroeconomic variables and equity returns.

Table 5.41

Multivariate Cointegration Analysis

Trace Statistic

Hypothesized No. of CE(s)	**Eigen value**	**Trace Statistic**	**Critical Value**	**Prob.**
None *	0.3923	193.3427	159.5297	0.0002
At most 1 *	0.2630	135.0690	125.6154	0.0117
At most 2 *	0.2087	99.3636	95.7537	0.0276
At most 3 *	0.1958	71.9817	69.8189	0.0333
At most 4	0.1507	46.4931	47.8561	0.0668
At most 5	0.1259	27.3791	29.7971	0.0927
At most 6	0.0667	11.6342	15.4947	0.1753
At most 7	0.0300	3.5632	3.8415	0.0591

It is worth mentioning that Johansen and Jusilius cointegration tests do not account for structural breaks in the data.

As variables are cointegrated so granger causality must exist among the variables. This requirement of granger representation theorem is helps us to identify the direction of causality flow. Table 5.42 reports the results granger causality test.

Table 5.42

Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Probability
Δ IPI does not Granger Cause ΔKSE INDEX	117	0.5518	0.648
Δ KSE INDEX does not Granger Cause ΔIPI		0.6710	0.5716
ΔOIL does not Granger Cause ΔKSE	117	0.6649	0.5753
ΔKSE does not Granger Cause ΔOIL		3.3713	0.0211
ΔXRATE does not Granger Cause ΔKSE	117	6.1909	0.0006
ΔKSE does not Granger Cause ΔXRATE		0.0989	0.9604
ΔTBILL does not Granger Cause ΔKSE	117	3.5113	0.0177
ΔKSE INDEX does not Granger Cause ΔTBILL		0.9056	0.4409
ΔCPI does not Granger Cause ΔKSE	117	2.9798	0.0345
Δ KSE does not Granger Cause ΔCPI		0.3946	0.7571
ΔFPI does not Granger Cause ΔKSE	117	0.3015	0.8242
ΔKSE does not Granger Cause Δ FPI		0.3832	0.7653
ΔM1 does not Granger Cause ΔKSE	117	2.8654	0.0399
ΔKSE does not Granger Cause ΔM1		0.5660	0.6385

Above table provides evidence about existence of unidirectional causality from X Rate , treasury bill, money supply and CPI to equity market returns at α= 0.05. However no granger causality is observed in industrial production and equity market

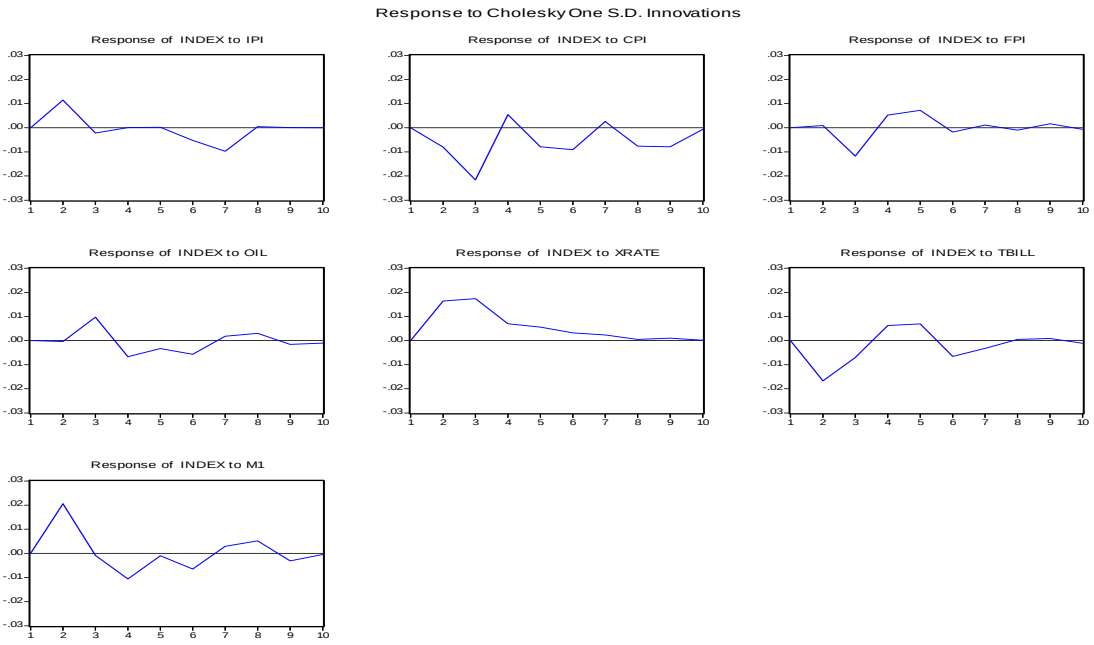
returns. Results can be summarized as that unidirectional causality flowing from monetary variables to equity market and this lead- lag relationship makes it imperative for financial and economic mangers of country to be more careful and vigilant in decision making as these decisions are priced in equity market and sets the trends in capital market which is considered as barometer of economy. However insignificant relationship with industrial production, oil indicates that market movement is not based on fundamentals and real economic activity.

Impulse response analysis provides information about the response of equity market returns to one standard deviation change in industrial production, oil, money growth rate, foreign portfolio investment, inflation, T bill and exchange rate. Fig 5 is graphical presentation of relationship between innovations in macroeconomic variables and equity market returns in the VAR system. Statistical significance of the impulse response functions has been examined at 95% confidence bounds.

Results confirm that one standard deviation change in money supply leads to increase in equity prices due to increase in liquidity and this result is consistent with results of Maysami and Koh (2000). Similarly one standard deviation change in Treasury bill rate leads to reduction in prices of equity due to increased discount rates. No statistically significant impact has been observed with reference to variation in exchange rates. It is acceptable because in Pakistan a managed floating rate system has been observed and during last five years exchange rates has been managed within

a small range by state bank of Pakistan through open market operation. These results are in conformity with earlier work.

Fig. 5 **Impulse Response Analysis**



Impulse response function captures the response of an endogenous variable over time to a given innovation whereas variance decomposition analysis expresses the contributions of each source of innovation to the forecast error variance for each variable. Moreover, it helps to identify the pattern of responses transmission over time. Therefore variance decomposition analysis is natural choice to examine the reaction of equity markets to system vide shocks arising from changes in industrial production, inflation, oil, money supply, Treasury bill rates, foreign portfolio investment and exchange rates. Table 5.43 exhibits the results of VDC Analysis..

Table 5.43

Variance Decomposition Analysis

Period	S.E.	INDEX	IPI	CPI	FPI	OIL	XRATE	TBILL	M1
1	0.08	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.09	86.18	1.56	0.77	0.01	0.00	3.17	3.29	5.02
3	0.10	76.68	1.44	5.58	1.45	0.98	5.97	3.43	4.46
4	0.10	74.47	1.39	5.68	1.67	1.40	6.25	3.70	5.44
5	0.10	72.98	1.36	6.18	2.16	1.47	6.42	4.09	5.33
6	0.10	71.32	1.59	6.82	2.14	1.75	6.36	4.41	5.60
7	0.10	70.50	2.48	6.78	2.12	1.76	6.31	4.44	5.60
8	0.10	69.88	2.46	7.27	2.11	1.83	6.26	4.41	5.80
9	0.10	69.37	2.44	7.80	2.12	1.84	6.22	4.38	5.84
10	0.10	69.36	2.44	7.80	2.12	1.84	6.21	4.39	5.84

Results confirm that monetary variables are a significant source of the volatility of equity market The contribution of an inflation shock to the equity returns ranges from 0.77 % to 7.8%. Similarly the contribution of T bill rates ranges from 3.29% to 4.39% and contribution of X rate ranges from 3.17% to 6.42% which is also significant. Money supply is also one of major contributor of volatility. Role of IPI and oil in equity market volatility also increase gradually. The pattern of transmission of shocks is also apparent and indicates an increasing trend. This may be helpful to stake holders in their decision making process.

5.11 Macroeconomic Variables and Equity Market Returns – ARDL Approach

As above results of unit root test clearly indicate that the index series are not stationary at level but the first differences of the logarithmic transformations of the series are stationary. Therefore, it can be safely said that series are integrated of order one I (1). It is worth mentioning that results are robust under assumption of constant trend as well as no trend. This testing is necessary to avoid the possibility of spurious regression as Ouattara (2004) reports that bounds test is based on the assumption that the variables are I(0) or I(1) so in the presence of I(2) variables the computed F-statistics provided by Pesaran et al. (2001) becomes invalid.

Now causal nexus among the macroeconomic variables has been studied by employing Autoregressive Distribution Lag (ARDL) approach proposed by Peseran and Shin (2001) . Akaike Information Criterion, Schwarz Bayesian Criterion and Hannan-Quinn, Log Likelihood equation are most commonly used measures to determine the number of lags. Duration of the lag which provides the smallest critical value is identified as the model's duration of lag if no autocorrelation is observed. In this study maximum duration of lag has been taken as 3. The number of lags which minimize the Schwarz Bayesian Criterion is 2 as evident from Table 5.44.

Table 5.44

Selection of the Lag Order

	AIC	SBC	LL
Lag 1	127.2179	114.6742	136.2179
Lag 2	125.6181	113.1121*	134.6181
Lag 3	128.7087	113.4699	139.7087

Table 5.45 indicates that econometric problems like autocorrelation, conflict to normal distribution does not exist. LM test confirms that no autocorrelation problem exists at Lag 2. Similarly, Ramsey's RESET Test shows no model specification error exists with reference to Functional form. Shrestha (2005) states that presence of hetero-scedisticity does not effect the estimates and as time series in the equation are of mixed order of integration so it is natural to detect heteroscedisticity.

Table 5.45

Diagnostic Tests

Item	Test Applied	CHSQ (χ^2)	Prob
Serial Correlation	Lagrange Multiplier Test	18.74	0.095
Normality	Test of Skewness and Kurtosis	2.88	0.236
Functional Form	Ramsey's RESET Test	0.59	0.443
Heteroscedisticity.	White Test	4.68	0.03

Table 5.46(a & b) and table below exhibits results of ARDL Model based on Schwarz Bayesian Criterion.

Table 5.46 (a)

ARDL(1,0,0,0,0,0,1,0) selected based on SBC

Regressor	Coefficient	S. Error	T Ratio	Prob.
Ln INDEX(-1)	0.6068	0.0742	8.1819	0.000
Ln IPI	-0.0225	0.0388	0.5783	0.564
Ln OIL	0.0481	0.0360	1.3345	0.185
Ln XRATE	0.4675	0.2239	2.0879	0.039
Ln TBILL	- 0.0797	0.0176	4.5251	0.000
Ln CPI	0.2757	0.3315	0.8316	0.407
Ln FPI	0.7712	0.3376	2.2841	0.024
Ln FPI(-1)	-0.7401	0.3428	-2.1589	0.033
Ln M1	0.4790	0.1037	4.6178	0.000

Table 5.46 (b)

R^2	0.9929	Adj R^2	0.9925
AIC	125.61	SBC	113.11
F Statistics	1949		
F Significance	0.000		
DW Statistics	2.1000		

Results reveal that industrial production, oil prices, inflation are not statistically significantly while interest rates, exchange rates, foreign portfolio investment and money supply have significant impact on equity prices.

The results of the bounds testing approach for Co-integration show that the calculated

F-statistics is 1949 which is significant at 1 percent level of significance implying that the null hypothesis of no cointegration cannot be accepted and there exists cointegration relationship among the variables in this model. Table 5.46 indicates that macroeconomic variables significantly explain equity prices. The value of R-Bar-Squared is 0.99 which indicates a high degree of correlation among variables. F statistics is also significant at 1% which indicates overall goodness of fit.

Table 5.47 displays the results long term coefficients under ARDL approach. Results reveal that industrial production, oil prices, inflation and foreign portfolio investment are not statistically significantly, while interest rates, exchange rates and money supply have significant long run effect on equity prices.

Table 5.47

Estimated Long Run Coefficients for selected ARDL Model

Regressor	Coefficient	S. Error	T Ratio	Prob.
LNIPI	-0.0572	0.0964	-0.5934	0.554
LNOIL	0.1222	0.0829	1.4743	0.143
LNXRATE	1.1891	0.5260	2.2604	0.026
LNTBILL	-0.2027	0.0369	-5.4946	0.000
LNCPI	0.7012	0.8286	0.8463	0.399
LNFPI	0.0794	0.2713	0.2927	0.770
LNM1	1.2185	0.1704	7.1487	0.000

Interest rates are significantly negatively related with equity returns which are logical as increase in interest rates leads to increase in discount rate and it ultimately results in decrease in present value of future cash flows which represent fair intrinsic value of shares. Xrate is significantly related to equity prices and as exchange rate is taken

as $/ Rs so Ln XRate will always be negative so depreciation of home currency is negatively related to equity market prices. Money growth rate is positively related with equity prices that are in line with results drawn by Maysami and Koh (2000). The possible reason is that increase in money supply leads to increase in liquidity that ultimately results in upward movement of nominal equity prices.

Error correction representation of above long run relationship is reported in Table 5.48 which captures the short-run dynamics of relationship among macroeconomic variables and equity prices. The error correction model based upon ARDL approach establishes that changes in industrial production, oil prices, and inflation are not statistically significantly, while changes in interest rates, exchange rates, foreign portfolio investment and money supply have significant short term effect.

Table 5.48

Error Correction Representation for the Selected ARDL Model

Regressor	Coefficient	S. Error	T Ratio	Prob.
ΔLnIPI	-0.2248	0.0389	-0.5783	0.564
ΔLnOIL	0.0481	0.0360	1.3345	0.185
ΔLnXRATE	0.4675	0.2239	2.0879	0.039
ΔLnTBILL	-0.0797	0.0176	-4.5251	0.000
ΔLnCPI	0.2757	0.3315	0.8316	0.407
ΔLnFPI	0.7713	0.3377	2.2841	0.024
ΔLnM1	0.4790	0.1037	4.6178	0.000
ECM(-1)	-0.3932	0.0742	-5.3007	O.000

R^2	0.2670	Adj R2	0.2137
AIC	125.61	BIC	113.11
F Statistics	1949		
F Significance	0.000		
DW Statistics	2.1000		

ECM = Ln Index + 0.057190*Ln IPI - 0.12224*LnOiL - 1.1891*Ln XRate + 0.20266*LnTBill - 0.70118*LnCPI - 0.079440*Ln FPI - 1.2185*LnM1

According to results short term elasticities of interest rates, exchange rates and money supply are -0.08, 0.47, and 0.48 respectively. It is worth mentioning that these elasticities are much lower than long run elasticities. It is also observed that foreign portfolio investment is not significant in long term, but it is statistically significant in short term. ECM (-1) is one period lag value of error terms that are obtained from the long-run relationship. The coefficient of ECM (-1) indicates how much of the disequilibrium in the short-run will be fixed (eliminated) in the long-run. As expected, the error correction variable ECM (-1) has been found negative and also statistically significant. The Coefficient of the ECM term suggests that adjustment process is quite fast and 39% of the previous year's disequilibrium in equity prices from its equilibrium path will be corrected in the current year.

Finally, CUSUM and CUSUMSQ plots are drawn to check the stability of short run and long run coefficients in the ARDL error correction model. Fig. 6 shows the

cumulative sum of recursive residuals whereas Fig. 7 displays the cumulative sum of squares of recursive residuals

Fig 6

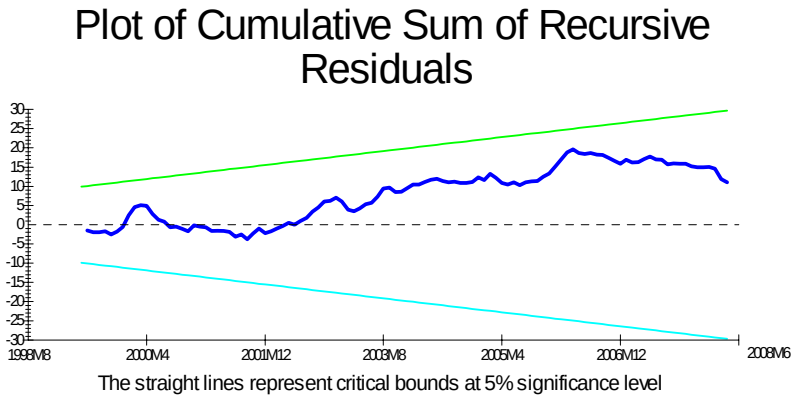


Fig. 7

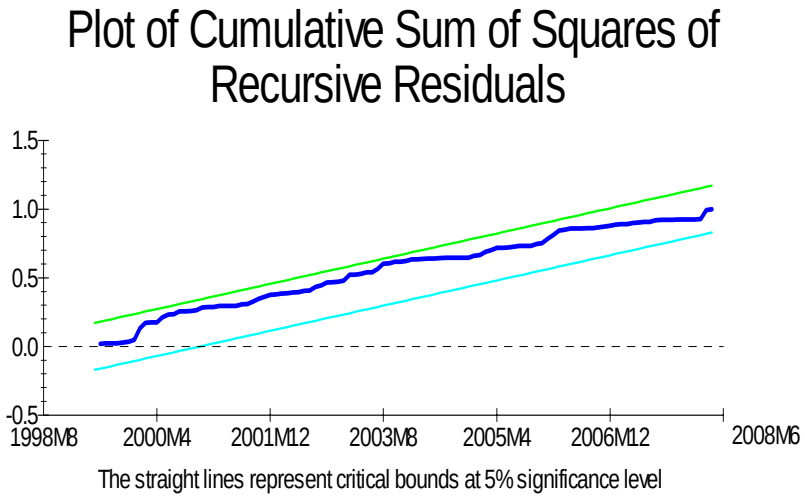


Fig. 6 & 7 shows that both CUSUM and CUSUMSQ are with in the critical bounds of 5% so it indicates that the model is structurally stable.

Chapter 6

CONCLUSION AND RECOMMENDATION

6.1. **Conclusion**

This study investigates the asset pricing mechanism in Pakistani equity market for the period 6/1998 to 6/2008 by using monthly equity prices and macroeconomic data. This study also tests the validity of conventional capital asset pricing model(CAPM) by employing Fama and Macbeth (1973) methodology and finds that historical beta has no significant relationship with expected return as market premium is not found significantly positively related to expected portfolio returns at 95% confidence level. Results indicates that market premium is not significantly different from zero and explanatory power of the model is too weak (0.07%) so results of the study are inconsistent with the CAPM hypothesis. Relationship between beta and expected return is further investigated in up market and down market separately by employing methodology proposed by Pettengill (1995). Results provide evidence about existence of significant positive relationship between beta and expected return in up-market whereas a significant negative relationship is observed between beta and expected returns in down-market. These results are consistent with Pettengill, Sundaram and Mathur (1995), Fletcher (1997) and Hodoshima, Garza and Kunimura (2000). This relationship has economic rationale that if up-market premiums and down-market premiums are simultaneously drawn on scatter diagram. The slope of regression line will be approximately zero indicating that no significant relationship exists between risk premium and beta. This situation weakens the ex-post relationship between betas

and risk premiums. However, when regression lines up-market and down-market are drawn separately the results reveal a different scenario. Here regression lines with up markets and down markets offer estimates which are consistent with SML estimates.

Review of literature reveals the presence of number of fundamental anomalies, i.e size premium, value premium, P/E premium, liquidity premium, momentum effect, debt to equity premium, dividend yield premium, financial distress premium, etc. This study explores the factors that significantly effect stock return in Pakistani equity market. This feature has been explored by investigation the significance of differences in the returns of portfolios formed on the basis of specific attribute i.e size, book to market ratio, price earning ratio, liquidity and momentum. Moreover returns of these portfolios have also been compared with market returns to see whether these portfolios have outperformed the market or not. Secondly, specific factor premium is added with market premium in CAPM to construct two factor models and explanatory power of model is examined. Study reveals the following characteristics of factor sorted portfolios.

For size sorted portfolios, results reveal that average risk and return of large size portfolio is on higher side, but difference between average return of large stocks and small stocks is not significant and both have failed to outperform the market. However, size based two factor models reveals that size premium is priced by market and there exist a significant relationship between size premium and portfolio returns. The explanatory power of model is 15% higher than CAPM.

Average return of small P/E stocks is found significantly higher than returns of high P/E stocks. It may be due to the fact that risk of low P/E stocks is higher than high P/E stocks. However both failed to outperform the market. However, P/E based two factor models reveals that P/E premium is priced by market, and there exist a significant relationship between size premium and portfolio returns. The explanatory power of two factor model is 11% higher than CAPM.

For B/M sorted portfolios, that returns of portfolio comprising of high B/M stocks is higher than portfolio comprising of small B/M stocks, but this difference is statistically insignificant. However both failed to outperform the market. Further, B/M based two factor models reveals that value premium is priced by market and there exist a significant relationship between value premium and portfolio returns. The explanatory power of two factor model is 13% higher than CAPM.

Returns of portfolio comprising of high average return during last 12 months is lower than returns of portfolio comprising of low average returns during last 12 month, but this difference is not statistically significant. However both failed to outperform the market. However, momentum based two factor models reveals that momentum effect is priced by market, and there exist an insignificant relationship between momentum and portfolio returns at a confidence level of 95%. The explanatory power of two factor model is marginally higher than CAPM i.e 1%.

Returns of portfolio comprising of low turnover stocks during last 12 months is higher than returns of portfolio comprising of high turnover stocks during last 12 month but this difference is not statistically significant. However both have failed to outperform the market. Further, liquidity based two factor models reveals that illiquidity effect is priced by market and there exist significant negative relationship between illiquidity and portfolio returns at a confidence level of 95%. The explanatory power of two factor model is 5% more than CAPM.

The findings suggest that 5 out of the 6 factors significantly affect stock returns. These 5 factors are (i) market premium, (ii) size (market capitalization), (iii) book / market ratio, (iv) price /earnings / ratio, and (v) liquidity .The factor that do not affect stock returns is momentum. This study suggests that value stocks in general outperform growth stocks in Pakistani equity market but this relationship is not significant except for low P/E stocks. It may be noted that value portfolios refer to ones with small size, high B/M, and low P/E ratios and growth portfolios refer to large size, low B/M and high P/E ratios.

To propose the asset pricing model that best explains the returns in Pakistani equity market, following models have been tested (i) Capital Asset Pricing Model , (ii) Fama and French's (1993) Three Factor model, (iii) Carhart's (1997) Four-Factor model, (iv) Liquidity based Four Factor model, (v) the Five-Factor model, and (vi) the Six Factor model.

To explore the joint effect of above stated factors, Fama and French three factor model has been tested. Results reveal that Fama and French three factor model substantially explains the portfolio returns, and its explanatory power ranges from 63% to 82% for various portfolios. It is significantly higher than explanatory power of conventional capital asset pricing model that explains 24% to 66% of the total variation in various portfolios. Size premium is found significantly positively related to small portfolio returns, but it is found insignificant for portfolios of big stocks. Value premium is found positive and significant for all portfolios, except low book to market stocks. Then one more factor momentum is added to model to test the Carhart Four Factor Model. Results reveal that momentum is not a significant factor in explaining portfolio returns. However, market premium is significantly positively related to portfolio returns. However, value premium is significantly positively related to portfolio return, except B/L and S/L. Similarly, size has significantly positive relationship with portfolio return in general. Explanatory power of model ranges from 66% to 77%. It is reasonably higher than traditional CAPM, but marginally different from Fama and French three factor model. It is due to the fact that momentum is not priced by the market, and it has no significant relationship with equity returns.

In order to capture the role of liquidity in explaining returns, a factor ILLIQP is added to the model to create liquidity based four factors model. Results reveal that ILLIQP is a significant factor in explaining portfolio returns. Iliquidity premium is calculated by subtracting returns of high liquidity stocks from returns of low liquidity stocks so

it can be inferred that high liquidity stocks earn more than low liquidity stocks. Explanatory power of liquidity based four factor model ranges from 66% to 77%. This explanatory power is reasonably higher than traditional capital asset pricing model and marginally higher than Fama and French three factor model. It may be noted that capital asset pricing model explains 25% to 71% of the total variation in portfolio returns, whereas Fama and French three factor model explains 60% to 74% of total variation in portfolio returns

In five factor model, role of size premium, value premium, momentum and illiquidity premium are examined simultaneously. Results indicate that value premium has significant positive relationship with portfolio returns. However this relationship is found insignificant for portfolio comprising of low B/M ratio stocks. Illiquidity premium is priced by market, and there exist significant positive relationship between illiquidity and portfolio returns. UMD has no significant relationship with portfolio returns and this result is consistent with Carhart's four factor model. It confirms that momentum effect does not exist in Pakistani equity market. It is worth mentioning that explanatory power of the five factor model lies between 67% to 80% which is marginally higher than liquidity based four factor model.

In six factor model, market premium and size premium are found significantly positively related to returns of portfolio comprising of all securities whereas illiquidity premium is significantly negative related to portfolio returns at 95% confidence interval. It indicates that in Pakistani equity markets low liquidity stocks

in general earns higher returns in comparison to high liquidity stocks. Similarly small stocks earn higher returns in comparison to large stocks. It is worth mentioning that PE premium is insignificantly negatively related to portfolio returns at 95% confidence interval. It can be seen from above table that market premium, size premium and illiquidity premium are priced by the market. Results does not provide evidence about existence of momentum effect. Finally, addition of PE ratio premium does not increase the explanatory power of model, so it can be said that other factors can explain the returns of portfolio. It is worth stated that HML is significant in the absence of PE premium, so both can not be used simultaneously.

A comparison between six asset pricing models indicate that five factor model best explains the equity returns in Pakistani equity market during study period. Other models can be ranked in following order (i) Liquidity based Four Factor model,(ii) Six Factor model(iii) Fama &French's Three Factor model and (iv) Carhart's Four Factor model, (v) the CAPM. It is worth mentioning that momentum has insignificant relationship with equity returns as evident from Carhart's Four Factor model, Five Factor model and Six Factor model.

Dynamic and causal relationship between macroeconomic variables is also investigated by using multivariate cointegration analysis and results reveals that null hypothesis of no cointegration between the equity indices and macroeconomic variables for the period 6/1998 to 3/2008 can not be rejected in Pakistani equity market. Trace test indicates the presence of 4 cointegrating vectors among variables

at the $\alpha = 0.05$. In order to confirm the results, Maximum Eigen value test has also been employed and Max Eigen value test also confirms the presence of cointegration at the $\alpha = 0.05$. Therefore, study provides evidence about existence of long term relationship among macroeconomic variables and equity returns. This study also provides evidence about existence of unidirectional causality from X Rate , T Bill , Money Supply and CPI to equity market returns at $\alpha = 0.05$. However no granger causality is observed in industrial production and equity market returns. Results can be summarized as that unidirectional causality flowing from monetary variables to equity market and this lead- lag relationship makes it imperative for financial and economic mangers of country to be more careful and vigilant in decision making as these decisions are priced in equity market and sets the trends in capital market which is considered as barometer of economy. However insignificant relationship with industrial production, oil indicates that market movement is not based on fundamentals and real economic activity and these results are in line with Fazal (2001).

Impulse response analysis provides that one standard deviation change in money supply leads to increase in equity prices and it has economic rationale as increase in liquidity may lead to increase in prices and this result is consistent with results of Maysami and Koh (2000). Similarly, Impulse response analysis provides that one standard deviation change in Treasury bill rate leads to reduction in prices of equity due to increased discount rates. No statistically significant impact has been observed with reference to variation in exchange rates. It is acceptable because in Pakistan a

managed floating rate system has been observed, and during last five years exchange rates has been managed within a small range by state bank of Pakistan through open market operation. These results are in conformity with earlier work. Variance decomposition analysis confirms that monetary variables are a significant source of the volatility of equity market. The contribution of an inflation shock to the equity returns ranges from 0.77 % to 7.8%. Similarly the contribution of T bill rates ranges from 3.29% to 4.39% and contribution of X rate ranges from 3.17% to 6.42% which is also significant. Money supply is also one of major contributor of volatility. Role of IPI and Oil in equity market volatility also increase gradually.

Results have also been confirmed by using ARDL approach, study reveals that industrial production, oil prices, inflation and foreign portfolio investment are not found statistically significant while interest rates, exchange rates and money supply have significant long run effect on equity prices. Interest rates are significantly negatively related with equity returns which are logical as increase in interest rates leads to increase in discount rate and it ultimately results in decrease in present value of future cash flows which represent fair intrinsic value of shares. Xrate is significantly related to equity prices and as exchange rate is taken as $/ Rs so Ln XRate will always be negative, so depreciation of home currency is negatively related to equity market prices. Money growth rate is positively related with equity prices that are in line with results drawn by Maysami and Koh (2000). Error correction representation of long run relationship is employed to capture the short-run dynamics of relationship among macroeconomic variables and equity prices. The

error correction model based upon ARDL approach establishs that changes in industrial production, oil prices, and inflation are not statistically significant while changes in interest rates, exchange rates, foreign portfolio investment, and money supply have significant short term effect. It is also important to note that foreign portfolio investment is not significant in long term, but it is statistically significant in short term. The error correction variable ECM (-1) is found negative, and also statistically significant. It indicates that adjustment process is quite fast and 39% of the previous period's disequilibrium in equity prices from its equilibrium path is corrected in the current period. Finally, CUSUM and CUSUMSQ indicate the stability of short run and long run coefficients in the ARDL error correction model.

6.2 Recommendations

CAPM is not an appropriate model for asset pricing in Pakistani equity market so decision maker should be careful in using this model. It may lead to incorrect determination of cost of capital and it will ultimately lead to incorrect capital budgeting decisions.Therefore, weak estimation of cost of equity may lead to sub optimal allocation of resources.

Pakistani equity market prices , size premium, book to market premium, momentum, and illiquidity premium so these should be considerd during asset pricing. In this connection, five factors model may facilitate the investment decisions as it adequately explains the equity returns. Moreover, investors may also use above stylized facts for designing optimal investment strategies.

In Pakistani equity market, value portfolios earn higher returns than growth portfolios so investors can use this information in designing investment strategies. Similarly, Low liquidity stocks earn more than high liquidity stocks so said fact may also help investors in investment decisions.

Finally, long term relationship between monetary factors and equity returns requires that that monetory policy may have serious implications on equity markets. Therefore, investors should carefully observe the actions of State Bank of Pakistan. Specially, decisions regarding money supply and management of discount rate can create shocks in market. A well conceived decision by State Bank of Pakistan may help to avoid an adverse shock in stock markets.

6.3 Further Research

This study provides empirical evidence about weak the explanatory power of the traditional asset pricing models and recommends that future studies of asset pricing model should not only on focus on identification of factors that influence returns but also on understanding the time and conditions that affect the performance of models. There are following recommended directions of further research.

1. Robustness of the proposed model can be tested in developed markets that have a long trading history.

2. A comparative study can also be done in other emerging markets to compare the result.
3. A detail study may be conducted to explore the determinants of size premium , Value premium, liquidity premium etc.
4. Other combinations of price and non price factors can also be explored to design a more robust asset pricing model.
5. Role of behavioral factors like investor sentiment may also be explored in explaining equity returns.
6. Role of other macroeconomic variables such as the interest rate spread and the level of consumption relative to income and wealth may also be explored.

In academic world, there is a broad agreement on the saying that the worth of a specific model is based on its capability to explain the actual phenomenon. The five factor model proposed in this study is build with the same spirit. It is based on sound theoretical foundation laid down by Rosss (1976) under APT framework. The proposed model has various vital implications, especially, Value stocks outperform growth stocks and size, book to market ratio, liquidity, and momentum are priced by market. It is worth mentioning that this model does not out rightly reject traditional CAPM, and consider beta as most important factor in explaining returns. In nutshell, the proposed model explains the dynamics of the Pakistani equity market effecintly and supports the validity of CAPM in KSE. Thus, it offers the, first ever, explaination from Pakistani equity market about contradictory theories regarding asset prices.

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