Downside Risk Analysis of Financial Institutions in Pakistan

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Dedication

Today is the day: writing this note of thanks is the finishing touch on my thesis. It has been a period of intense learning for me, not only in the academic arena, but also on a personal level. Writing this thesis has had a big impact on me. I would like to reflect on the people who have supported and helped me so much throughout this period.

First of all, I would love to dedicate this thesis to my **DAD,** who was actually my inspiration all the time, especially of this thesis.

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Abstract

This paper adds to the finance literature on the standard CAPM and the DR-CAPM in context of Pakistani equity market. The study analyzed and empirically tested the validity of the standard CAPM and the DR-CAPM for pre-financial crisis period (2002 - 2005), during-financial crisis period (2006 –2009) and post-financial crisis period (2010-2016). A total of 50 financial institutions' monthly stock returns were observed for period 15 years. For this purpose, the paper utilized four already developed downside betas that are Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989) and Estrada (2002) to teset and compare in order to get a more appropriate risk measure for the financial institutions.

The study concluded that the standard CAPM is not suitable for the Pakistani financial institutions due to statistically significant intercept term. For the downside risk based CAPM, The results for Fishburn (1977) appeared to be more appropriate risk measure for the financial institutions listed on Pakistan Stock Exchange, as there is positive and statistically significant premium for holding risky securities. The risk-return relationship is linear. The DR-CAPM of Harlow and Row (1989) also disclose positive and statistically significant risk-return relationship in most of the examined sub-periods. The downside and upside beta of Fishburn (1977) appeared with theoretically appropriate sign which is a positive and also statistically significant and upside beta appeared with theoretically inappropriate sign and also statistically insignificant. The combine model results for Harlow and Row (1989) are satisfactory.

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Chapter 1

Introduction

1.1 Background

Most of the empirical studies have attempted to investigate the ability of different risk measures in combination, in order to clarify the risk-return relationship. While reviewing the history of risk measures, we find that the two primary available risk measures are variance (capital asset pricing model (CAPM)) and semi-variance (downside capital asset pricing model (DR-CAPM)). The mean-variance approach and quadratic utility function of portfolio selection model was first developed by Markowitz (1952). The model was constructed on the hypothesis that investors have focused more on the means and fluctuations of the returns that is the reason the model is known as means-variance based model. According to Markowitz (1952), investors are required to be risk opposed and the risk of any portfolio is measure by the change of portfolio returns. A productive portfolio is assigned on the basis of diminishing fluctuation of profits for the given level of expected rate of return or by expanding the expected rate of return for the given level of change. The portfolio choice model was further drawn-out by Sharpe (1964) and Linter (1965) by considering the two fund separation theorem of Tobin (1958) to define a risk-return relationship.

The CAPM is usually used to estimate the appropriate required rate of return of an asset that is included in well-diversified portfolio, given the asset's non-diversifiable risk i.e systematic risk or market risk. This model considers an asset's sensitivity to systematic risk or market risk while calculating the excess of expected rate of return of risky asset over the rate of return of the risk free asset and this risk is represented by the beta (β) in finance. Both the Sharpe (1964) and the Black (1972) suggested that beta is adequate in explaining the dissimilarities in expected rate of asset's return or portfolio return. They also proposed that these is positive relationship between beta and expected returns. The CAPM comes from an equilibrium in which investors attempt to profit by utility function that relies on the mean and variance of profits of their investment portfolio (Estrada, 2002).

The CAPM is extensively acknowledged model but its empirical findings are very poor and reflecting failure of its theoretical basis. The mean-variance risk measure has some inconsistencies, mainly due to two reasons. Firstly, it is efficient measure of risk when there is symmetric return distribution. Secondly, it is appropriate in case of normal distribution of returns. However, both the symmetry and the normality of returns are enormously questioned by the empirical evidence on this matter. Asymmetric distribution of returns make CAPM a deficient model (Grootveld and Hellerbac (1999), Estrada (2002) and Tahir et al. (2013)).

The investors' preferences cannot be described by the mean-variance approach and the quadratic utility function of Portfolio Selection. Hench and Levy (1970) stated that the mean–variance based analysis fails to describe investor's behavior. Mao (1970) did not consider risk in terms of variance. The assumption that the distribution of returns has normal pattern, is constantly denied by Simkowitz and Beedles (1978), Singleton and Wingender (1986), Chunhachinda et al. (1997) and Parakash et al. (2013). The CAPM's poor performance was also found by Miller (1990). The developing markets are generally considered with non-normal leptokurtic and skewed distribution of returns distribution (Harvey (1995)). Michailidis et al. (2006) rejected the CAPM due to failure of main assumption of positive relationship between risk and return for the Greek Stock Market.

Similarly, Jiri (2011) also found CAPM inefficient for Stockholm Stock Market. Kruger (2011) stated that beta as a risk measure is not able to measure the risk for Jorden's equity market. Ward and Muller (2013) found CAPM unsatisfactory for Johannesburg Stock Market. They suggested that there is need of more factors that can explain the relationship between risk and return.

In context of Pakistan the results for CAPM are also unsatisfactory. Hussain and Uppal (1995) found non-normal distribution of return with high peaks and flat tails for Pakistani stock market. The negative and statistically insignificant risk-return relationship found by Iqbal and Brooks (2007) and Javaid and Ahmed (2009). Hameed and Ashraf (2009) also rejected CAPM because no evidence found for positive premium. For the same reasons Al Refai (2009) and Bhatti and Hanif (2010) also disapproves the CAPM for Pakistan Stock Market.

To solve the shortcomings of semi-variance risk measure, called DR-CAPM, was introduced. Markowitz (1959) introduced the concept of semi-variance risk measure. According to this, investors should focus more on downside risk and for portfolio investment. He suggested that portfolios should be based on semi-variances because it weights upside and downside risk differently. The DR-CAPM is said to be a fast replacement and efficient improvement to CAPM (Abbas, et al. 2006). The downside risk is when an asset's returns co-vary with declining market. The stocks that have higher downside risk have also higher stock returns.

The semi-variance risk measure is a more efficient and suitable risk measure for numerous reasons. First, the semi-variance based analysis makes portfolio selection decision easier by separating upside and downside fluctuations. Second, it is useful when return distribution is asymmetric. And third, the semi-variance based risk measure combines the information provided by two statistics, variance and skewness, into one measure, and estimates the required rate of returns by using a single-factor model. Moreover, the semi-variance analysis is capable of making an alternative behavioral hypothesis that is called the mean-semi-variance behavior (Estrada, 2002).

Mao (1970) considered risk in terms of failure in target rate of return. The loss aversion theory by Kahneman (1979) and the first-order risk aversion theory by Gull (1991) proposed that in an investor's utility function losses should be weighted more greatly than gains. Jegadeesh and Titman (1993) relate high returns to the variations in the downside risk. Grootveld and Hellerbac (1999) focused on the differences and the likeness between application of variance based risk measure and the semi-variance based risk measure and found that the downside risk approach (the semi-variance based risk measure) likely to generate marginally more returns than the mean-variance approach.

With proof collected from prior literature particularly from developing markets, that DR-CAPM and the various improved forms of DR-CAPM overtakes CAPM (Ang, et al. 2006). The acceptance of downside risk is growing among investors and it appears to dominate the standard CAPM. The DR-CAPM is favored as an appropriate and efficient measure of risk by Ang et al. (2006) for New York Stock Exchange, Grootveld and Hellerbac (1999) for US Stock Exchange, Post and Vliet (2005) for US Stock Exchange, Galagedera and Jaapar (2009) for Malaysia Stock Exchange and Artavanas et al. (2010) for London and Paris Stock Exchange. However, Galagedera and Brooks (2005) and Charemushkin (2011) found the DR-CAPM ineffective.

In context of Pakistan, many researches (Ahmed and Zaman (1999), Iqbal and Brooks (2007), Javaid and Ahmed (2009), Abbas et al. (2011), Tahir et al. (2013), and Rashid and Hamid (2015)) have documented that the DR-CAPM is more appropriate measure of risk as compared to the CAPM.

Ahmed and Zaman (1999) empirically tested the higher momentum CAPM in conditional and unconditional framework. They concluded that high return are conditional upon high risk and in case of high volatility of returns, the rates of return are adjusted upward. Iqbal and Brooks (2007) analyzed 89 stocks for the period of 7 years and found that investors demand positive reward for negative skewness. Co-skewness is configured as an important factor of asset pricing by Javaid and Ahmed (2009) co-skewness. Abbas et al. (2011) found DR-CAPM as a best solution for non-normal return distribution. The DR-CAPM helps in selecting the investment portfolio (Tahir et al., (2013). They also concluded that DR-CAPM explains market behavior in a better way. Rashid and Hamid (2015) scrutinized the downside risk based betas proposed by Bawa and Lindenberg (1977), Harlow and Row (1989), and Estrada (2002) and give proof of a positive reward for bearing risk. However, Akbar et al. (2012) analyzed the DR-CAPM of Estrada (2002) and found no significant evidence in support of downside risk in the Pakistan Stock Exchange.

This study adds to the finance literature on the standard CAPM and the DR-CAPM in context of Pakistani equity market. This study inspects the empirical validity of the standard CAPM and the DR-CAPM and found their effectiveness in explaining the cross-section of stock returns. This study examined the standard CAPM and the DR-CAPM for 50 financial institutions listed on Pakistan Stock Exchange (PSE). For this purpose, the study utilized four already developed downside betas that are Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989) and Estrada (2002). All these four downside betas are empirically tesed and compared in order to get a more appropriate risk measure for the financial institutions. The study analyzed and empirically tested the validity of the standard CAPM and the DR-CAPM for pre-financial crisis period (2002 - 2005), during-financial crisis period (2006 –2009) and post-financial crisis period (2010-2016).

1.2 Research Objectives

The study focused on four prime objectives related to the downside risk analysis of returns of the financial institutions listed on Pakistan Stock Exchange (PSE). These objectives are given below:

1. To analyze the mean-variance CAPM and the downside risk based CAPM for the financial institutions, not only in full sample period but also in pre-financial crisis period, during-financial crisis period, and post-financial crisis period.
2. To examine the standard upside, and downside beta (risk premium) in a single equation framework for the financial institutions.
3. To identify the better downside beta (risk measure) among Bawa and Lindenberg (1977) Fishburn (1977), Harlow and Row (1989), and Estrada (2002) that explains expected stocks return for the financial institutions.
4. To explore the investor's preferences towards the assets that are extremely interrelated to the downturn market and the assets that are associated with the increasing market.

1.3 Research Questions

There are four research questions that are framed by the study in order to analyze its objectives. These research questions are as follows:

1. Whether the mean-variance CAPM or DR-CAPM is suitable for the financial institutions?
2. From the standard, upside and downside beta which beta is more valid to quantify the risk premium?
3. Among the four downside betas which beta more appropriately explains the expected stock's return?

4. What is the risk premium of stocks that co-vary with declining market and how investors respond to these stocks?

1.4 Significance of the Study

This study is significant in many respects. This study applies the CAPM and DR-CAPM for the financial institutions that include Islamic and conventional banks, Mudarabah Companies, and Mutual Funds Companies listed at PSE and investigate which risk measure better assess the asset pricing behavior. Once an appropriate risk measure is identified to explain the asset pricing behavior, it will help the investors to evaluate their expected returns and also helpful for investment managers to direct their clients to diversify their portfolio in order to gain higher expected returns.

Finding the risk-return relationship and explanatory variables that explains the cross-section of expected stock's return of financial institutions in the Pakistani stock market, is important for both the local investors as well as international investors. When an efficient pricing mechanism is acknowledged, this will expose profitable investment opportunities which will attract the foreign investors and also the local investors to invest more in efficient portfolio. This will also lead to channelization of savings to the investment. This study enables the bank and firm managers, investors, and researchers to choose the better risk measure and the downside beta that efficiently describes the expected stock's return of financial institutions. The analysis of this study help out individuals and institutional investors in selection of feasible and worthwhile investment opportunities.

One of the main problem is that investors face a problem in investment decision and in portfolio selection when he has lots of accessible prospects in which he can invest and create the portfolios. In the same way, investors in Pakistan are also unaware of stock's return of financial sector that is adjusted to the risk. This study will provide a comprehensive understanding to the investors, lenders and other such groups to make better and secure investment decisions. The findings of this study will also provide considerable support to fund managers, investors and financial analysts in making investment decisions.

1.5 Organization of the Study

The organization of this study is done such a way that Chapter 2 presents the literature review. The literature review consists of theories related to CAPM and DR-CAPM. The empirical evidence on CAPM and DR-CAPM are also presented in this chapter. Chapter 3 consists of the empirical methodology of this study, data and sample used in the estimation process. Detailed discussion on the empirical results is provided in Chapter 4. Chapter 5 concludes the overall study.

Chapter 2

Literature Review

2.1 Introduction

This chapter comprises the traditional theories of CAPM, its empirical evidence, and introduction to DR-CAPM as an improvement over CAPM, the traditional theories regarding DR-CAPM and the empirical evidence on DR-CAPM.

2.2 Traditional CAPM Theories

The CAPM is one of the most famous matter that is numerously discussed and tested in the field of finance. The CAPM describes the risk-return relationship for stock and is used to determine the expected stock prices. The CAPM model specifies that the expected stock's return or portfolio's return equates both, the rate of return on a stock that is risk free and a reward for bearing the risk. The investment in such stocks or portfolios should not be commenced in that do not equal the expected rate of return and the required rate of return. The CAPM was first developed in early 1960s. Firstly, Treynor (1962) developed a model then Sharpe (1964), Lintner (1965) and Mossin (1966) developed the models based on CAPM, separately.

The main comprehensible model to report the problem of risk-return relationship was "mean-variance portfolio model" developed by Markowitz (1952). Before this approach, investors have a lack of solid risk measure, regardless the point that investors knew that "don't put all your investments tied up on one place". This drives to the acknowledgment of Markowitz that he grew scientifically the idea of enhancement. A portfolio involves a blend of compensations (both genuine and money related) to put resources into and held by an investor. Enhancement is the demonstration of having number of assets to lessen the risk. Markowitz showed that it is possible to decrease the risk if investors balance their investments among a couple of securities. This plausibility of risk decrease develops if securities don't move in lock-step style. The risk of a portfolio is enhanced if stocks added to portfolio do not co-vary (i.e. move together) enormously in concordance. The Markowitz's hypothesis depends on the assumption that investors think just about the mean and variance of return. That is the reason his hypothesis is otherwise called mean variance analysis. The investors are mean-variance enhancer, and hence, they look for and lean toward portfolio with most reduced conceivable return change for a given level of mean (expected return). Basically, it infers that investors incline toward portfolios that produce most prominent measure of return with least measure of risk. This additionally recommends change scattering in possible return results is a suitable measure of risk. The theory of Markowitz provided a quantifiable structure for measuring risk of portfolio by the variance of portfolio returns. For this, he used two parameters that are expected rate of return on portfolio and a given level of variance of portfolio to the model choices of investors known as the EV rule[1]. The first parameter that is expected rate of return is calculated as follows:

$$E(r_p) = \sum_{i=1}^{n} w_i r_i$$

$$\sum_{i=1}^{n} w_i = 1$$

[1]When investors maximize expected return for a given level of variance of a portfolio's return, or minimize a variance of portfolio for a given level of expected return and choose well-organized portfolio, is called EV rule (Markowitz 1952).

The second parameter that is the given level of variance of portfolio is calculated as follows:

$$V(r_p) = \sum_{i=1}^{n}\sum_{j=1}^{n}\sigma_{ij}w_i w_j$$

where r_p represents the rate of return on portfolio, r_i represents rate of return on each asset, w_i and w_j are the weights of i^{th} and j^{th} securities in a portfolio calculated by the percentage of capital endowed in such security. σ_{ij} represents given level of variance of a security if $i = j$, and covariance between two assets for $i \neq j$.

The EV rule describes that an investor can choose a suitable portfolio among a number of available portfolios of $E(r_p)$ and $V(r_p)$, which either decrease $V(r_p)$ for a certain level of $E(r_p)$ or increase $E(r_p)$for a certain level of $V(r_p)$. Markowitz (1959) emphasized that "the utility function of an investor can be estimated by the quadratic utility function of mean and variance, over large variety of returns". The formula for estimation of utility function is as follows:

$$E(U) = f[E(r_p), V(r_p)]$$

According to Two Fund Separation Theorem presented by Tobin (1958), the investor should plan an investment strategy such that investing certain amount of capital in assets having less default risk and a certain amount of capital in assets having greater risk. This portfolio selection model was further prolonged by Treynor (1962), and Sharpe (1964).

Sharpe and Lintner added 2 important rules to the Markowitz model to recognize a portfolio that should be mean-variance efficient. The first rule is complete understanding that is the given market clearing costs at time t-1, investors concede to the joint circulation of advantage comes back from time t-1 to t. Furthermore, it is the genuine appropriation, that is, the appropriation from which the profits we use to test the model are drawn. The second rule is that there is borrowing and lending at a risk free rate, R_f, which is same for all investors and does not rely on the amount borrowed or lent, such unrestricted risk free borrowing and lending suggests a solid form of Tobin's (1958) separation hypothesis. The standard CAPM created by Sharpe and Lintner depends on a strict assumption of unlimited borrowing. The risk-return relationship model of Sharpe (1965) and Lintner (1966) is defined as follows:

$$E(r_{it}) - r_f = \beta\,[\,E(r_{mt} - r_f)]$$

or $$E(r_{it}) - r_f = \beta\, E(r_{mt})$$

$$\beta = \frac{Cov(r_i, r_{mt})}{Var(r_{mt})}$$

Where $E(r_{it})$ is the expected rate of return on ith security is, $E(r_m)$ is the expected rate of market return, r_f is the risk free rate and β is the risk measure.

Black (1972) demonstrated that within the sight of borrowing restriction, low beta stocks may perform generally superior to the CAPM predicts. Black proposed his theory by considering doable investment planning to be tracked by various sorts of investors. Assume an investor need to attempt a high beta investment methodology. In the standard CAPM sphere, investor could accomplish his target either by purchasing high beta stocks or purchasing low beta stocks and utilizing this position (getting at the risk free rate). Investors should have to purchase the stocks that have greater risk, in order to overcome the problem of borrowing limitation. Therefore, through this strategy the cost of stocks with greater beta will boost up and expected return ought to be lower than low beta stocks, in the standard CAPM sphere. These renders stocks with low beta attractive and stocks with high beta unattractive to investors who have generally safe portfolios or who are slanted to borrow. This result is called the zero-β form of CAPM which describes that pay for beta risk is lower than in standard CAPM sphere. The zero-β CAPM forecasts that the slop of the line connecting expected rate of return and beta is positive but flatter than what the standard CAPM proposes.

The most compelling work of Fama-French three factor model in which they include two more variables, the return on small shocks minus big shocks (SMB) and the rate of return on high book-to-market value minus low book-to-market value stocks (HML), other than the market rate of return. Fama and French (1992) demonstrated that there is almost no measureable relationship between risk and return. They showed that beta can describe the difference on average rate of return of portfolio arranged on the basis of variables such as book-to-market ratio and size of the firm. Fama and French (1993) empirically discovered that high book-to-market ratios lead to high expected stock returns. Fama and French (1995) explained that the rate of return on HML and SMB portfolios provide the actual macro-economic aggregate non-diversifiable risks. Fama and French (1996) further prolonged their study and found that HML and SMB based portfolios also describe policies regarding other ratios that are book-to-market ratio, price-to-earnings ratio and etc. All these policies are not explained by traditional beta of CAPM. They also concluded that many of the CAPM average rate of return irregularities are correlated and explained by their three factor model.

2.3 Empirical Evidence on CAPM

Many researches have been conducted to empirically test the validity of CAPM. The CAPM defines that there is a positive and linear risk-return relationship and there is no premium for facing a risk other than market risk. The CAPM derived by Sharpe (1964), and Lintner (1965) supports a positive risk-return relationship and suggests that dissimilarities in expected rate of return can be appropriately describe through the formula given below:

$$\beta = \frac{Cov(r_i, r_{mt})}{Var(r_{mt})}$$

While studying the history regarding the empirical evidence on CAPM, the study found that most of the studies rejected the CAPM. The CAPM appeared to be an inappropriate model for explaining the risk-return relationship of risky securities. This model was rejected due to failure of its main assumptions. Some of the studies like Banz (1981), Basu (1983) Bhanduri (1988) and Miller (1999) found no positive relationship between risk and return. They concluded that high risk portfolios do not have positive compensations. Beta as an only informative component and risk measure is useless. The study found the poor performance of CAPM for emerging as well as developed countries that are, Athens, Bangladesh, Belgium, Brazil, Canada, France, Germany, India, Japan, Johannesburg, Pakistan, Spain, UK, and USA.

Pratt (1967) analyzed the risk return relationship in common stocks in 1926-1960 and found that high risk portfolios seem to have no extra rewards, as the theory states the risky portfolios should have positive premium. Friend and Blume (1970) used a cross-sectional regression and found poor performance for risky securities. Black et al. (1972) tested the basic CAPM for the period 1926-1966 and investigated that the behavior of well-diversified portfolio can be more appropriately defined by "two-factor model" than by "single-factor model". Empirical findings regarding the test of CAPM showed beta has a positive premium but intercept term for high value beta is positive and negative for low value beta. Fama and Macbeth (1973) further established the risk-return relationship and extended the work of Black et al. (1972) and approved the linear and positive risk-return relationship. The studies of Rose (1976) and Roll (1977) originated that using portfolio returns as market proxy are deficient because change in efficiency depicts insignificant results for the risk return relationship. Stattman (1980) approved positively related stock returns to the book-to-market ratio.

The CAPM claimed that deviation in portfolio returns can be explained by Single-Factor beta. Many studies like Banz (1981), Basu (1983) Bhanduri (1988) and Miller (1999) came to the conclusion that a single-factor model proposed by Sharpe (1964) is unable to offer the appropriate clarification of cross-sectional expected returns. Reinganum (1981) described many other factors like market-Size, market-beta and book-to-market that effect returns. Levy and Samuelsson (1992) analyzed four different cases on different time periods and found the changing return distribution with time. Fama and French (1992, 1993, and 1996) described that β as an only informative component of the expected return is useless. Their researches contended that portfolios constructed on the basis of book-to-market ratio and size (business sector capitalization) gain greater profits as compare to gains anticipated by the CAPM. In this manner, size and book-to-market proportion can catch the cross-sectional contrasts consequently superior to ß.

Greene (1990) analyzed the CAPM for UK stock market and found CAPM as a deficient model for the UK. Sauer and Murphy (1992) proved that CAPM is an efficient model in clarifying the risk-return relationship of risky securities for German equity market. The cross-section of risky securities was deeply studied by Hawawini (1993) and found the invalidity of CAPM for the stock markets of Belgium, Canada, France, Japan, Spain, the UK, and the USA. Gupta and Sehgal (1993) tested CAPM employed 30 stocks forming BSE sensitive index for the period (1979-1989) and applied portfolio method by creating three equally weighted and value weighted portfolios. The study established that the CAPM did not appear to be an appropriate descriptor of asset pricing for Indian equity market during their study period and there is a weak but positive risk-return relationship. Khilji (1993) examined monthly stock prices in Pakistan, in a time series manner for the period 1981 to 1992. The study found non-normal distribution of returns. They were also generally positively skewed, leptokurtic and have a positive mean. Hussain and Uppal (1995) also checked the normal distribution of expected returns. The data for this examination consist of daily closing share price of 36 companies and the examined period of research comprise 5 years (1989-1993). The study concluded that there is non-normal distribution of expected stock returns.

Chunhachinda et al. (1997) scrutinized the normality of expected return circulations of 14 international stock markets by applying the Wilk-Shapiro W-test. The scrutiny specified that using weekly closing stock prices, the return distributions exhibit weak support for the efficiency of mean variance based portfolios. However, using monthly stock prices, they approved that the return distributions exhibit significant support for the efficiency of mean variance based portfolios. Distributional features of Pakistani stock market were characterized by Hussain and Uppal (1998) for the period (1989-1993) using daily data on 36 companies. The study revealed significant and positive returns and concluded that irregular trading is one factor that depart the observed distribution from returns distribution. The volatility and performance of stock return analyzed by Ahmed and Zaman (1999) for the period (1992-1997) using monthly data. The study evidenced a positive and statistically significant relationship between expected return and market risk and also clarified that excess return in any sector of the economy is not solely dependent upon the risk in that sector but also depends on the market risk. The study also revealed some characteristics of trading at Karachi Stock Exchange. Firstly, the average rate of return is perceived to contain positive reward in case of high unpredictability. Secondly, the high unpredictability of stock returns is considered as a risk due to which stock returns are also adjusted high. Finally, information about increasing or decreasing trend of market is swiftly spread all over the stock market.

Post and Vliet (2004) investigated that CAPM is unable to explain the US stock returns in cross-sectional framework for the period 1926 to 2002. The study found that the CAPM is not efficient in explaining the risk-return relationship for the US Stock Market. Beta is established as a complex measure of risk for the Greek stock market by Michailidis et al. (2006). The study examined the CAPM for the period 1998 to 2002 and used the weekly closing price of 100 stocks traded at Athens Stock Market. The results have shown that there is a linear risk return relationship but refute the CAPM's main assumption 'higher the risk, higher the rate of return'.

Iqbal and Brook (2007) analyzed the CAPM for Pakistan Stock Market for the period 1992 to 2006 and concluded that unconditional version of CAPM is incompetent for Pakistani equity market. They found non-linear risk-return relationship and the skewness appears to have a significant part in clarifying the risk-return relationship. The investors in Pakistan Stock Market appear particularly sensitive to higher moments measured by skewness. Javaid and Ahmed (2008) analyzed the CAPM using both daily and monthly stock prices of 12 year (from 1993 to 2004) of 49 companies. The study stated that there is a negative risk-return relationship and fails to explain the pricing of risky securities. The single factor CAPM appeared inefficient in explaining the risk-return relationship. The additional risks; residual risk and quadratic term is added to model and these risks play a significant role. These results allow the return distribution to fluctuate after some time.

Yoshino and Santos (2009) using Fully Modified Ordinary Least Square Model (FMOLS) found that the CAPM is not able to explain the risk return relation on Brazilian equity market for the period (1998-2006). For this analysis, monthly data was used for the period (1998-2010). Javaid and Ahmed (2009) analyzed 50 stocks traded in Pakistan Stock Exchange for the period (1993-2004) using daily and monthly share prices. The empirical findings established that CAPM is unsupportive for Pakistani equity market because model do not explain assets pricing behavior. The empirical test of CAPM by Hameed and Ashraf (2009) reported that mean variance based risk measure is inappropriate for Pakistan Stock Market because no proof is found that investors are remunerated for bearing risk. This study attempted to model the unpredictability of returns on stock and to empirically test the weak-form efficiency. The weak-form efficiency assumption is repudiated by Hameed and Ashraf (2009) because future prices are based on past information.

Jiri (2011) analyzed the standard CAPM beta to explain the risk-return relationship for the Stockholm Stock Exchange. For this analysis, monthly data of 609 stocks used for the period 1979-2005. The results showed that beta, already developed as risk factor, is not significantly related to the excess stock returns and CAPM is not related to stock returns in cross-sectional framework. These results signal that either there is no risk-return relationship, or beta as a risk measure is unable to efficiently measure the risk.

Unsuccessful CAPM found for Jordon Stock Exchange over the period 1994 to 2007 by Kruger (2011). The study advocated that there must be another multi risk factor based asset pricing model that efficiently explain the cross-section of expected returns on stock and measure the risk. There are some studies, like AlRefai (2009), Hanif (2010), and Bhatti and Hanif (2010) that also approved failure of CAPM as theory which describe positive and linear relationship between risk and expected rate of return.

Both Al-Mwalla and Karasneh (2011) and AlMwalla (2012) also empirically tested the efficiency of CAPM for Amman Stock Market for the period 1999 to 2010. The study reported that the CAPM cannot better explains the differences in portfolio returns. Muhammad et al. (2012) covered 5 years period from (2006-2010) for 10 companies listed in PSE and concluded that CAPM is incapable for Pakistan as very few supported the capability of CAPM. Ward and Muller (2013) observed the single factor CAPM for the Johannesburg equity market for the period of 26 years (1986 to 2011). The study found the CAPM unsatisfactory to satisfy CAPM main assumption. Their study established that there is need of more factors to measure the risk and calculate the stock returns.

Bhatti and Mirza (2014) used daily closing prices of 138 stocks traded at Pakistani stock market for the period 2013-2014 to empirically test the validity of CAPM in defining the cross-section of stock returns. The authors came to the conclusion that the CAPM is unsupportive and there no relationship between risk and expected stock returns. Hossain (2014) examined the empirical validity of CAPM for the Dhaka Stock Exchange for 26 companies for the period ranging from 2012 to 2013. The findings established that the CAPM fails to approve a significant relationship between risk and return. The CAPM was analyzed by Rashid and Hamid (2015) for Pakistani stock Market. For this analysis monthly closing price of 63 companies listed on KSE was used, for the period (2000-2012). They found the CAPM to be unsuccessful in explaining the risk-return relationship. The results reported that CAPM is unfit to forecast the expected rate of return when stock market suffers decreasing market excess return.

2.4 Traditional DR-CAPM Theories

The history of empirical work on CAPM originate that there were some anomalies and shortcomings while using standard mean variance CAPM for investigating the expected return on stock. The mean variance based risk measure is uncertain measure of risk as it is efficient in two cases. Firstly, when there is symmetric distribution of returns. Secondly, when distribution of returns is normal. To overcome these problems, downside risk based CAPM was introduced as an improvement over CAPM and also a solution for the irregularities. Downside risk exists when actual rate of return on securities is less than the expected rate of return. The downside risk based CAPM is also known as semi-variance measure of risk and this model was introduced by Markowitz (1959).

The Safety First benchmark expressed by Roy (1952) in the most renowned downside risk measure in the history of investment and finance literature. Roy's Safety First Criterion advised to measure investment risk by some deficit which measures the decreasing probabilities of investment value that is getting below some predefined tragedy level. Such a tragedy level could be connected to bankruptcy, liquidation or something less intense.

Markowitz (1959) explained the prospect that investors should focus more on downside risk rather than the upside risk or the risk in general. He instructs investors to create portfolios on semi-variances (DR-CAPM) basis because semi-variance based risk measure (DR-CAPM) weights upside risk and downside risk differently. Markowitz (1959) explained that semi-variance picks that investment portfolio whose distribution of return is tilted to the right, or slightly tilted to the left. This is also possible that the distribution of stock return might not be normal and so for such asymmetric distribution of returns the use of semi-variance measure of risk is an appropriate cure. However, for symmetric distribution of returns, the mean-variance (CAPM) and semi-variance (DR-CAPM) both find the similar risk level. Markowitz recommended the measures of downside risk which are below-mean semi-variance (SV_{BM}) and below-targeted-level mean-semi-variance (SV_{BT}). These measures are mathematically represented as follows:

$$SV_{BM} = \frac{\sum_{i=1}^{n} \min[0,(r_i - \mu_i)]^2}{n}$$ (Below-Mean Semi-Variance)

$$SV_{BT} = \frac{\sum_{i=1}^{n} \min[0,(r_i - t)]^2}{n}$$ (Below-Target Semi-Variance)

where r_i is i^{th} asset's return, μ is mean return, t is the targeted level of asset's return that an investor targets to attain. Both SV_{BM} and SV_{BT} pursue to remove only losses whereas variance reduce extreme gains and losses. Markowitz found that DR-CAPM (semi-variance) based constructed portfolios generates better products but he himself remained with mean-variance analysis because in that era mean-variance risk measure was very familiar and also due to computational difficulties in semi-variance analysis. Cyert and March (1963) developed the behavioral model of firm's risk return relationship. According to this model, an investor conceptualizes downside risk as a failure to attain the target rate of return rather than a risk in terms of variance. The model focused on the investor's criteria of selecting portfolio and performance of a firm and concluded that downside risk is positively related to the firm's performance whereas performance is negatively related to the negative risk.

The specific utility functions of expected mean-variance risk measure (EV) and expected semi-variance risk measure (ES) was examined by Mao (1970) to compare advantages and facts of the expected mean-variance risk measure (EV) and expected semi-variance risk measure (ES) criteria. He described the elementary difference between EV and ES measures in such a way that if an investor has to select investment between two investments, the ES measure is biased to a certain fixed point which has the greater scatter of points to the left of zero. Zero is designated as a fixed point against which risk is measured. However, the EV measure is not biased to any specific fixed reference point, rather it uses the means of the distributions to make the decisions regarding portfolio selection. It is biased to the dispersion of points around the mean, whether to the right or to the left of the mean. By this comparison Mao (1970) proved that ES measure based investment selection is more profitable and efficient. It is also worthwhile in making capital budgeting decisions.

Both Kahneman (1979) in his loss aversion utility theory and Gull (1991) in his first-order risk aversion utility theory agreed at a same point that losses should be considered more deeply than gains in an investor's utility function. They also enlightened that if a risk averse investor is not in a favor to bear the downside risk then such a security or an investment portfolio, having higher expected return, with a downside risk is not desirable or an appropriate choice.

Hogan and Warren (1974) established the Co-Semi-Variance (CSV) by scrutinizing Sharpe's (1964) definition of the market systematic risk. This model defines downside risk as, when expected rate of return on market portfolio is less than rate of return on risk free asset or portfolio. Hogan and Warren (1974) defined the market security line equation as:

$$r_i - r_f = r_f + \frac{CSV(r_f;\, r_m, r_i)}{SV(r_f;\, r_m)}\,[\,E(r_m) - r_f)]$$

$$CSV(r_f;\, r_m, r_i) = E[\min(0, r_m - r_f)\,(r_i - r_f)]$$

where r_i represents each asset's rate of return, r_f represents targeted rate of return which is risk-free rate, r_m is the market rate of return. $CSV(r_f, r_m, r_i)$ is the co-semi-variance of the risk free rate of return, the security return, and the market portfolio return. $SV(r_f; r_m)$ is the risk free rate of return and the semi-variance of market portfolio return.

Bawa and Lindenberg (1977) proposed an equilibrium model using CAPM that is called mean lower partial moment model (MLPM). This is the model of equilibrium in capital markets which helps investors to select investment portfolios on the basis of each portfolio's mean and lower partial moment. The effectiveness of the MLPM framework is that this model consists both, the mean-variance framework and the mean scale parameter frameworks as special cases under traditional assumptions of distribution of returns. This model made a practical theory of balance formulation which can be verified by means of accessible market data deprived of restrictions of return distribution assumptions, and limited the traditional models when the market data fulfil or favors the assumptions of return distribution of those traditional models. Bawa and Lindenberg (1977) stated that the downside risk is the risk when the actual return are below than the targeted rate of return. The MLPM model is defined as follows:

$$MLPM = \sum_{i=1}^{n} \min[0, (r_i - t)]^2$$

where r_i represents rate of return on each asset , t represents risk-free rate as the target rate of return, and n denotes the number of assets. Bawa and Lindenberg (1977) also stated that the MLPM model consider the asymmetric distribution of returns.

Fishburn (1977) developed the lower partial moment (LPM) model in which view of MLPM model was prolonged from investor's risk averse behavior to the risk pursuing behavior. According to the Fishburn's definition of downside risk, it is a risk when the expected rate of return is lower than targeted rate of return. This model was basically developed under the analysis that investors while making investment decisions normally associate risk when there is a chance of not getting a targeted rate of return. The LPM model is defined as follows:

$$LPM = \sum_{i=1}^{n} \min[0, (r_i - t)]^a$$

where α is the coefficient of risk aversion , r_i represents rate of return on each asset, and t represents target rate of return. Any combination of α and t defines the risk acceptance manner of an investor, of which $\alpha = 2$ and t = mean semi-variance. $0 < \alpha < 1$ indicates that investor has a risk pursuing behavior, $\alpha = 1$ shows investor's unbiasedness to risk and $\alpha > 1$ indicates investor has a risk averse personality.

When the market expected rate of return is lower than target rate of return, is known as the downside risk (Harlow and Row, (1989)). Harlow and Row (1989) developed an equilibrium model called generalized mean lower partial moment (MLPM) and established means of market return as target rate of return. Harlow and Row (1989) also explained that the socks that are correlated with the downturn market tends to produce high average returns. Investors when invest in such risky portfolios demand for positive premium as a reward for bearing risk. The downside beta as proposed in Harlow and Row (1989) is:

$$Downside - \beta = \frac{E[(r_i - r_f, 0) min\left(r_m - r_f, 0\right)]}{E[min(r_m - r_f, 0)]\text{^}2}$$

where r_i is rate of return on each stock, r_m represents market rate of return, and r_t is target rate of return which is mean of market rate of return.

According to Estrada (2002), downside risk exists when both asset return and market returns are lower than the target rate of return. He defined this version of downside beta by developing the Co-Semi-Variance (CSV) model. In this model, he combined the downside volatility of both asset's return and market's return. Estrada (2002) proposed the target rate of return as the average rate of asset's return and market return. Particularly, the beta proposed by Estrada (2002) is as follows:

$$Downside - \beta = \frac{E[\min(r_i - \mu_i, 0)\min(r_m - \mu_m, 0)]}{E[\min(r_m - \mu_m, 0)]\text{^}2}$$

where r_i represents the rate of return on each asset , μ_i is the average rate of return in each asset , r_m represents the market rate of return, and μ_m is the average market rate of return.

Many studies like Rubinstein (1973), Kraus and Lichtenberger (1976), Friend and Westerfield (1980), and Harvey and Siddique (2000) have been confirmed that investors dislike downside co-skewness, if it means that stocks that are slightly downward skewed expand the returns with greater average. The downside risk should not be mixed with the co-skewness risk. The difference between downside risk and co-skewness risk is that downside beta measures market movements in a non-linear way, whereas co-skewness ignores the irregularities in downturn markets. However, co-skewness asses few characteristics of downside co-variation, so while measuring the premium for downside beta, the co-skewness risk should be controlled Ang et al. (2001, 2006) have documented that an investor treats downside losses and upside gains differently. An investor who focuses more on the downside risk and also demand for the additional positive reward for bearing the downside risk. They also proved that risky stocks usually appeared to have positive compensation. The stocks with higher downside risk have higher expected return, than the return that can be explain by the other effects like the market beta, the size effect, and the book-to-market effect (Ang et al. (2006)).

2.5 Empirical Evidence on DR-CAPM

Jahankani (1976) analyzed semi-variance risk measure for the period (1951-1969) and found no support for the mean-semi-variance model. As compare to above illustrated findings, Harlow and Rao (1989) reported solid proof in favor of the general mean-lower partial moment (MLPM) CAPM, which substitutes the standard CAPM beta with a general MLPM beta. Miller (1996) empirically tested the behavioral model of Cyert. And March (1963). The results favors the downside risk based CAPM and explains that downside risk has a positive effect on performance whereas performance has a negative effect on downside risk.

The empirical results of Ahmed and Zaman (1999) contributed in the research regarding downside risk analysis in perspective of Pakistan. The study utilized daily as well as the monthly closing stock prices at firm level for the period 1992 to 1997. This data was used to empirically test the higher moment CAPM in conditional and unconditional framework and found number of conclusions. First, the risk premium is conditional upon downside risk and investors are agreed to face the downside risk to gain high expected returns. Second, high unpredictability of portfolio return is considered as a risk so in case of high volatility of returns, the rates of returns are adjusted upward. Finally, that market information is rapidly spread throughout the market which indicate viable trading activities at KSE. The study of Grootveld and Hellerbac (1999) analyzed some portfolios traded at US Stock Market on semi-variance basis and found DR-CAPM as better approach that produce higher bond allocations than the CAPM. The study recognized that the DR-CAPM is successful because of the reason that it separates the return fluctuations into the downside losses and upside gains. This model is more applicable when the return distributions are asymmetric.

Ang et al. (2001) stated that more the stock is risky, greater will be the expected rate of return. The results concluded that controlling the other explanatory variables that are market beta, size effect, book-to-market ratio effect, and leads to greater average rates of return on stocks that are positively correlated with the downside risk. Particularly, the results also showed that gains from investing in momentum strategies are also considered as premium for facing downside risk. For partially integrated emerging markets, Estrada (2000) suggested DR-CAPM as a more appropriate in calculating cost of equity. Estrada (2001) further proved that the semi-deviation is appropriate as compared to standard deviation when the expected rate of return tracks the skewed distributions and also suitable exactly as when the distributions of stock returns are symmetric.

Ang et al. (2002) studied downside risk on New York Stock Exchange (NYS) and concluded that the downside beta is appropriate and efficient forecaster of future deviation with downturn market movements. Estrada (2002) analyzed both the developed markets and the emerging markets and examined the volatility of returns in cross-sectional framework, using the monthly closing price of stock's return from 27 capital indices of both, emerging and developed markets for different sample periods. The study stated that in case of joint sample, in which both developed and emerging market's stock data is combined and empirically tested, downside risk based CAPM explain more than 40% volatility in expected rates of return. However in a single sample, which includes only emerging market's stock prices, volatility of expected rates of return is 55%. Furthermore, positive premium is associated with downside risk.

While comparing the standard CAPM and DR-CAPM, in order to discover the most efficient and appropriate risk measure, Post and Vliet (2004) found results similar to conclusion that DR-CAPM overtakes CAPM. He proved that by replacing CAPM by DR-CAPM, the risk-return relationship can be reestablished. It was also established that the downside betas with less beta stocks are significantly higher than the regular betas. However, the downside betas with high beta stocks comprise significantly less systematic downside risk than explained by the regular betas (Post and Vliet, (2004)). Ahmad and Qasim (2004) observed the pricing behavior and effects of shocks on expected rates of return in context of Pakistan. He described that returns' distribution has asymmetric nature. Positive shocks are when there is a positive premium on facing risk, similarly, having no consideration on facing risk is known as a negative shock. Positive shocks have more noticeable strong effect, than negative shocks, on expected stocks' returns. Conditional variance based DR-CAPM (CVAR-beta) was developed by Kaplanski (2004). The study found CVAR-beta more powerful and clarifying impact in explaining stock returns.

Among different risk measures downside risk model is considered as an adequate and appropriate risk measure by Estrada and Serra (2005). It is also stated that downside risk measure has a major influence on investment portfolio decision. Post and Vliet (2005) used semi-variance measure of risk for the period (1926-2002) and established the conclusion for the US stocks returns that the DR-CAPM is the better risk estimator as compared to CAPM. It also explains the risk-return relationship in a better way than the standard CAPM. Moreover, it is also able to partially describe momentum effect. They suggested that the conditional downside risk based CAPM can also be used to investigate the return distribution asymmetry to bonds and other derivatives with embedded options. During the course of the research, researcher have found that investors not only behave differently in downside and upside market risk but they also treat such stocks differently. Ang et al. (2006) found that simultaneous high average returns gained by stocks with the greater downside risk cannot be explained by other factors like size, book-to-market ratio, co-skewness risk, liquidity risk, and the momentum effect. By controlling these factors and some other cross-sectional effects Ang et al. (2006) estimated approximately 6% per annum downside risk premium and established the result that the risky stocks that are highly correlated with downside risk, have high average returns.

Olmo (2007) presented the mean-variance DR-CAPM (MV-DR-CAPM). Through this model he showed that the intercept term was significantly different from zero in the standard CAPM and the DR-CAPM. The MV-DR-CAPM also describes that the stocks that are positively correlated with declining market obliged for positive reward and negative premium for the stocks negatively associated with downturn market. Iqbal and Brooks (2007) analyzed the daily closing stock prices of 89 companies for the period 1999 to 2005. They proved that investors claim positive reward for negative skewness and this is also priced in Pakistan Stock Exchange. The downside risk based CAPM is also advocated for the Pakistani equity market by Javaid and Ahmad (2008). The study analyzed both daily and monthly closing price of 49 stocks for the period 1993-2004 and the results also figured that co-skewness is an important factor of asset pricing. It was also elaborated that downside risk must not be combined with co-skewness risk. The downside beta captures the downturn movements of stock market, in non-linear manner. The co-skewness may vary over time but it does not stress asymmetries for downside and upside market. The time varying approach was applied by Galagedera and Jaapar (2009) in DR-CAPM framework using daily closing prices of stocks traded at Malaysian Stock Exchange. They came to the conclusion that the restricted covariance exists between excess downside returns of portfolio and market.

Artavanis et al. (2010) examined the relationship between risk and return in DR-CAPM framework for the period 1997 to December 2002 by using stock returns of equity markets of London and Paris. The outcomes disclosed that DR-CAPM is better in explaining mean returns than the CAPM. This study also presented the new risk-return relationship that exists when the returns' distribution is normal and the market index lies within the semi-deviation expected return frontier. Abbas et al. (2011) found downside risk based CAPM as a best solution for the anomalies in CAPM. The DR-CAPM consists all characteristics of CAPM except the condition of normality and it is improvement over CAPM in a sense that it separates the upside and downturn fluctuation in stock's return.

The empirical validity of DR-CAPM in the Pakistani context was investigates by Akbar et al. (2012) using sample of 313 stocks for the period 2000 to 2011. The results revealed that the downside risk based CAPM fails to provide statistically significant evidence for the hypothesis of positive risk-return relationship. They also explained the insensitivity of results that these occurred due to the inappropriate selected estimation techniques that are GLS and white-heteroskedasticity consistent standard errors and covariance matrix. Tahir et al. (2013) considered monthly closing price of 84 listed-companies as a sample with estimation period from 2000 to 2010. The study proved that DR-CAPM found to be useful in pricing of risky securities more appropriately and also beneficial in expecting portfolio risk for investors. The downside risk framework helps in selecting the nature of investment (Tahir et al. 2013).

The DR-CAPM explains market behavior in a better way in Pakistan stock market. Rashid and Hamid (2015) compared the downside betas as proposed in Bawa and Lindenberg (1977), Harlow and Row (1989) and Estrada (2002) for 63 companies listed in KSE for the period 2002-2012. They inferred that the DR-CAPM as proposed in Bawa and Lindenberg (1977) are satisfactory in terms of both, the theoretically appropriate sign and statistical significance as compare to other two versions of downside betas used in the study. It means that downside beta of Bawa and Lindenberg (1977) comparatively better risk estimator.

The present research empirically tested the validity of the standard CAPM and DR-CAPM. The study also checked whether standard CAPM and DR-CAPM explain the stocks' return in a cross-sectional framework. The analysis is done for the 50 financial institutions that are Islamic and conventional banks, Mudarabah companies, and Closed-End mutual fund companies listed on Pakistan Stock Exchange. For the DR-CAPM analysis, the study used already developed downside betas that are Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002). These four downside betas are empirically tested and compared to find out the more suitable risk measure for the financial institutions in Pakistan. This analysis is carried out for full-sample period (2002-2016), and for sub-periods that are pre-financial crisis period (2002-2005), during-financial crisis period (2006-2009) and post-financial crisis period (2010-2016).

Chapter 3

Empirical Methodology

3.1 Introduction

This chapter contains the details about empirical methodology, data, and sample used for this research. The study follows the Sharpe's (1964) standard mean-variance based CAPM and analyzed Sharpe's (1964) assumptions related to CAPM. The assumptions are that there is positive risk-return relationship, this relationship is linear and single factor CAPM is adequate in explaining the expected stock return in a cross-sectional framework. The standard CAPM is further extended by incorporating downside risk to the model. The downside risk based CAPM is semi-variance risk measure which considers the investor's downside risk preferences. The study utilized four downside betas, developed by Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002), to identify which downside beta better explains the expected stocks return for financial institutions. All these four betas mainly differ in their benchmark rate of return. The study investigated the empirical soundness of downside risk based CAPM for the following assumptions

1) There is linear risk-return relationship.

2) The positive reward must be associate with the risky stock. An increase in risk must increase the expected rate of return.

3) The co-variation of asset's return with the market rate of return is the only risk hat is priced in market.

Only the DR-CAPM explains the differences in expected stock returns.

3.2 The Standard Capital Asset Pricing Model

The risk-return relationship in the standard CAPM developed by Sharpe (1964) is given as follows:

$$E(r_i) - r_f = \beta_i[\,E\,(r_m - r_f)] \qquad (3.1)$$

$$\beta_i = \frac{\text{Covariance}(r_i, r_m)}{\text{Variance}(r_m)}$$

Where r_i represents each asset's expected rate of return, r_f represents the risk free rate of return, r_m represents the expected rate of return of market, and β is the systematic risk.

For empirical analysis, following formula is used to calculate the returns on stocks and market portfolio:

$$R_{it} = ln\left(\frac{P_{it}}{P_{it-1}}\right) \times 100 \qquad \text{and} \qquad R_{mt} = ln\left(\frac{P_{mt}}{P_{mt-1}}\right) \times 100$$

where P_{it} is the each closing stock price and P_{it-1} is the previous stock's closing price. P_{mt} is the monthly KSE-100 index used as a market portfolio, and $P_{mt-1}$is the previous month KSE-100 index.

The Fama and MacBeth (1973) proposed regression analysis is being used to empirically test the standard CAPM. This regression analysis comprised of two steps that are risk estimation step and testing step. Firstly, beta is estimated in estimation step. In estimation step, asset's returns are regressed on the market portfolio returns, using time series regression. In testing step, excess asset's returns over risk free rate are regressed on betas that are acquired from the estimation step. The regression of returns are expected to undergo the problem of autocorrelation and heteroskedasticity (Javaid and Ahmed (2009, and Javaid and Ahmed (2011)). So to avoid the problem of autocorrelation and heteroskedasticity, generalized least square (GLS) technique is used.

As proposed in Fama and MacBeth (1973), following equation is used to estimate beta for each asset in first step:

$$r_i = \alpha_0 + r_m\beta_i + \varepsilon_i \tag{3.2}$$

Where β is the slope coefficient and is defined as follows:

$$\beta_i = \frac{E[(R_i - \mu_i)(R_m - \mu_m)]}{E[(R_m - \mu_m)]\text{^}2}.$$

The empirical analysis of standard CAPM identifies that following relationship should hold in cross sectional framework:

$$E(r_i) = E(r_m)\beta_i \tag{3.3}$$

where r_i is the excess rate of return over risk free rate of return each asset and r_m is the market risk premium. The above model can be estimated by regressing excess asset's returns on asset's systematic risk measure beta.

This is the simple risk-return relationship model. The study started the empirical analysis by testing the risk-return relationship in a mean-variance frame-work, using the standard CAPM. In this risk-return relationship, beta is an explanatory variable.

$$r_i = \lambda_0 + \lambda_1\beta_i + e_i \tag{3.4}$$

Where λ_0 represents intercept term and λ_1 is reward or premium associated with beta. The intercept must not be statistically different from zero in order to hold the relationship in (3.3) true. The slope coefficients (β) for each asset estimated using (3.2), are used as explanatory variables in (3.4) in testing step.

The squared term of systematic risk that is beta is added to simple risk-return relationship using the standard CAPM in order to check whether the risk-return relationship is linear. The model takes the following form:

$$r_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + e_i \quad (3.5)$$

The coefficient of variable $\beta_i^2 \beta_i^2$ must not be statistically different from zero to hold the standard CAPM true.

Further, to check for the competence of the conventional beta, as the sole measure of risk, the standard deviation is included to the simple risk-return relationship. The addition of standard deviation helps the study to check whether systematic risk that is β, is priced in equilibrium. If the coefficient of standard deviation appeared to be significant, then it means that residual risk plays an important role in explaining the pricing behavior of risky securities. The model can be expressed as follows:

$$r_i = \lambda_0 + \lambda_1\beta_i + \lambda_2 SD_{(\varepsilon i)} + e_i \quad (3.6)$$

The coefficient of variable $SD_{(\varepsilon i)}$ must not be statistically different from zero to hold the standard CAPM true.

Finally, to check the combine effect of all the three explanatory variables, the study estimated the following cross-sectional model.

$$r_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + \lambda_3 SD_{(\varepsilon i)} + e_i \quad (3.7)$$

The estimated coefficients of all the variables are tested using their P-value for the statistical significance. In order to hold the CAPM true, the coefficients must not be different from zero. However, $\lambda_1>0$ to hold the CAPM true.

3.3 The Downside Risk Based CAPM

The estimation of downside beta is different form the estimation of standard CAPM, because it considers only negative assets' returns and market returns. This study compared four downside risk measures (betas) on performance basis, to identify the better downside beta (risk measure) among Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002) that explains expected stocks return for the financial institutions listed in PSE.

The downside beta of Estrada (2002) considers risk when both the asset return and market return are lower than the benchmark rate (the risk-free rate). Thus, according to this version of beta, an asset adds to the portfolio risk when both asset returns and market returns are lower than benchmark rate that this the risk-free rate. The downside beta proposed by Estrada (2002) considers only the negative returns of asset and market.

$$\beta_i^D = \frac{E[min(r_i-\mu_i,0)\ min\,(r_m-\mu_m,0)]}{E[min(r_m-\mu_m,0)]\wedge 2} \quad \text{or} \quad \beta_i^D = \frac{\text{Covar}\,(r_i^-, r_m^-)}{\text{Var}\,(r_m^-)}$$

where $r_m^- = \min\,(r_m - \mu_m, 0)$ and $r_i^- = \min\,(r_i - \mu_m, 0)$

By regressing negative asset's returns on market returns that is $r_i^- = \alpha + \beta_i^D . r_m^- + \varepsilon i$), then downside beta of Estrada (2002) takes a following form:

$$\beta_i^D = \frac{E[(r_{it}^- - \pi_i)(r_{mt}^- - \pi_m)}{E[(r_{mt}^- - \mu_m)]\wedge 2}$$

where π_i is the average of negative asset's returns and π_m is the average of market negative returns. This above illustrated beta is principally different from following beta:

$$\beta_i^D = \frac{E[min(R_i - \mu_i, 0) min(R_m - \mu_m, 0)]}{E[min(R_m - \mu_m, 0)]^2}.$$

Estrada (2002) suggests to regress the model without intercept to calculate the exact downside risk-based beta. In this case, model takes the following form:

$$r_i^- = \beta_i^D (r_m^-) + \varepsilon_i \quad (3.8)$$

where $\beta_i^D = \frac{E[r_i^- r_m^-]}{E[(r_m^-)]^2}$

The present study follows the Estrada (2002) suggestions for beta estimation.

The downside beta of Bawa and Lindenberg (1977) considers the co-variation of asset returns with a declining market as a downside risk. According to this portfolio risk increases when market returns are lower than the benchmark rate, irrespective of whether asset returns are lower than the benchmark rate. The downside beta of Bawa and Lindenberg (1977) is estimated by applying the suggestions of Estrada (2002) regarding regression. The model is given as:

$$r_i = \beta_i^D r_m^- + \beta_i^{UP} r_m^+ + \varepsilon_i \quad (3.9)$$

where

$$\beta_i^D = \frac{E[(R_i - R_f)\ min(R_m - R_f, 0)]}{E[min(R_m - R_f, 0)]^2} \quad \text{and} \quad \beta_i^{Up} = \frac{E[(R_i - R_f)\ max(R_m - R_f, 0)]}{E[max(R_m - R_f, 0)]^2}$$

$$r_m^- = \min(r_m - r_f, 0) \quad r_m^+ = \max(r_m - r_f, 0) \quad \text{and} \quad r_i = (r_i - r_f)$$

Fishburn (1977) considers a risk when the return on asset is below specific target return. For this Fishburn (1977) uses the mean-risk dominance model for choice of mutually exclusive investment opportunities or portfolios having uncertain returns. The mean-risk dominance model in which risk is measured by probability-weighted function of deviation below a specific target return t.

$$LPM = \sum_{i=1}^{n} \min[0, (r_i - t)]^a \tag{3.10}$$

$$r_i^- = \beta_i^D . r_m^- + \varepsilon_i \quad \text{and} \quad r_i^+ = \beta_i^{UP} . r_m^+ + \varepsilon_i$$

$$\beta_i^D = \frac{E[(r_i - 0.20)\ min\ (r_m - 0.20, 0)]}{E[min(r_m - 0.20, 0)]\text{^}2.5} \quad \text{and} \quad \beta_i^{Up} = \frac{E[(r_i - 0.20)\ max\ (r_m - 0.20, 0)]}{E[max(r_m - 0.20, 0)]\text{^}2.5}$$

where $r_m^- = \min(r_m - 0.20, 0)$, $r_m^+ = \max(r_m - 0.20, 0)$, $r_i^+ = \max(r_i - 0.20, 0)$ and $r_i^- = \min(r_i - 0.20, 0$. The target semi-variance is obtained with $\alpha = 2.5$ and $t = 20\%$.

Harlow and Rao (1989) considers only the downside movement of market returns as a downside risk. For Harlow and Rao (1989) downside risk beta is estimated as follows:

$$r_i = \beta_i^D r_m^- + \beta_i^{UP} r_m^+ + \varepsilon i \tag{3.11}$$

where

$$\beta_i^D = \frac{E[(R_i - \mu_i) min\ (R_m - \mu_m, 0)]}{E[min(R_m - \mu_m, 0)]\text{^}2} \quad \text{and} \quad \beta_i^{Up} = \frac{E[(R_i - \mu_i) max\ (R_m - \mu_m, 0)]}{E[max(R_m - \mu_m, 0)]\text{^}2}$$

Where $r_m^- = \min(r_m - \mu_m, 0)$, $r_m^+ = \max(r_m - \mu_m, 0)$ and $r_i = (r_i - \mu_i)$ and μ_i is the average of asset returns and μ_m is average of market returns.

The validity of DR-CAPM is tested in second step by applying GLS same as in the standard CAPM. This is the simple risk-return relationship model. The study started the empirical analysis by testing the risk-return relationship in a semi-variance frame-work, using the DR-CAPM. In this risk-return relationship, the DR-CAPM includes only the beta as an explanatory variable.

$$r_i = \lambda_0 + \lambda_1 \beta_i^D + e_i \tag{3.12}$$

A squared term of risk measure (beta) is added, as an explanatory regressors, to the simple risk-return relationship model in a semi-variance frame-work, using the DR-CAPM.

$$r_i = \lambda_0 + \lambda_1\beta_i^D + \lambda_2\beta_i^{D2} + e_i \quad (3.13)$$

In this equation, the risk-return relationship model considers standard deviation to empirically test the competence of beta as a sole risk-measure. By adding the standard deviation of residuals from the first pass in model 1, it will also check whether unsystematic risk is priced in equilibrium.

$$r_i = \lambda_0 + \lambda_1\beta_i^D + \lambda_2 SD_{(\varepsilon i)} + e_i \quad (3.14)$$

In this model, all three variables are combined together to check their combine effect, in semi-variance frame-work, using DR-CAPM.

$$r_i = \lambda_0 + \lambda_1\beta_i^D + \lambda_2\beta_i^{D2} + \lambda_3 SD_{(\varepsilon i)} + e_i \quad (3.15)$$

3.4 The Upside and Downside CAPM

Finally this study also tested the hypothesis that investor respond differently to the stocks that are correlated with downturn market and to the stock with rising market. Both the downside and upside betas are estimated and tested using the same procedure that is time series regression in estimation step and GLS in testing step. To separate the reward of downside risk from the upside potential, the DR-CAPM is extended by incorporating the upside beta. In particular, the upside beta is introduced in the model, as an explanatory variable, in addition to the downside beta, and estimates of risk premium for both risk measures are compared. The model takes the following form:

$$r_i = \lambda_0 + \lambda_1\beta_i^D + \lambda_2\beta_i^U + e_i \quad (3.16)$$

Where β_i^D is downside beta and β_i^U is the upside beta, λ_1 is the risk premium associated with the downside risk and λ_2 is the risk premium associated the upside potential. The coefficient λ_1 is expected to have positive sign, whereas λ_2 is likely to appear with a negative sign, which is $\lambda_1 > 0$ and $\lambda_2 < 0$.

3.5 Data and Sample

The empirical analysis is done for 50 financial institutions that comprise of Islamic and conventional Banks, Mudarabah Companies and Mutual Funds Companies listed in Pakistan Stock Exchange. These financial institutions are continuously listed on Pakistan Stock Exchange for the selected period and have high market capitalization. Monthly data of closing prices of shares is used to calculate the rate of return for the period January 2002 to April 2016. The data of closing prices of shares is taken from the official website of Pakistan Stock Exchange. The risk free interest rate is represented by the Treasury bill rate. The reason for using Treasury bill rate as a risk free rate is that it is faith and credit backed and their rate of return is fixed. Therefore, the Treasury bill rate is an appropriate measure of risk free interest rate to be compared with the returns on stock market assets. This study used six-month Treasury bill rate as risk-free rate and data is taken from the International Financial Statistics on monthly basis. KSE-100 index is used as a substitute for market portfolio and data is also taken on monthly basis from Pakistan Stock Exchange. The expected return on portfolio are represented by using monthly percentage change in KSE-1000 index.

Chapter 4

Results and Discussion

4.1 Introduction

In this chapter, empirical results of the standard CAPM and DR-CAPM are presented. The DR-CAPM includes downside risk based betas of Bawa and Lindenberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002). This chapter also discusses the validity of each model. The present study follows Fama and MacBeth (1973) proposed regression analysis to empirically test the validity of the models. The regression analysis consists of two pass, estimation and testing. In order to evaluate the time varying impact of risk estimates on return, the complete sample is divided into three sub-periods. The beta that is the risk estimate, is estimated using three sub-samples, full-sample period (2002-2016) and then for the sub-samples that are pre-financial crisis period (2002-2006), during-financial crisis period (2007-2009), and post-financial crisis period (2010-2016). Then again in same sub-periods, both models are empirically tested for full-sample period (2002-2016), and then for each sub-period, first is pre-financial crisis period (2002-2006), second is during-financial crisis period (2007-2009), and third is post-financial crisis period (2010-2016).

4.2 Empirical Results for the Standard CAPM

In first phase, the study scrutinized the relationship between risk and expected rate of return in the standard CAPM framework. Table 4.1 presents the results of full-sample period (2002-2016) and for three sub-periods that are pre-financial crisis period (2002-2006), during-financial crisis period

Table 4.1: Average Risk Premium for the Standard CAPM

Panel A:	Model 1: $r_i = \lambda_0 + \lambda_1\beta_i + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.114***	0.05			0.179	1.162
	(0.00)	(0.02)				
Pre-Financial crisis period	-0.065***	0.021			0.031	0.000
	(0.01)	(0.02)				
During-Financial crisis period	-0.123***	0.009			0.010	0.014
	(0.00)	(0.01)				
Post-Financial crisis period	-0.112***	0.011			0.034	0.012
	(0.00)	(0.01)				
Panel B:	**Model 2:** $r_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.119***	0.113***	-0.200***		0.304	0.274
	(0.00)	(0.03)	(0.07)			
Pre-Financial crisis period	-0.067***	0.070	-0.129		0.070	0.008
	(0.01)	(0.005)	(0.02)			
During-Financial crisis period	-0.118***	-0.051*	0.062**		0.147	0.015
	(0.00)	(0.03)	(0.02)			
Post-Financial crisis period	-0.115***	0.040**	-0.039**		0.139	0.098
	(0.00)	(0.02)	(0.02)			
Panel C:	Model 3: $r_i = \lambda_0 + \lambda_1\beta_i + \lambda_3 SD_{(\varepsilon_i)} + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.117	0.050***		0.034	0.206	0.172
	(0.00)	(0.02)		(0.03)		
Pre-Financial crisis period	-0.057	0.023		-0.105**	0.173	0.118
	(0.01)	(0.02)		(0.05)		
During-Financial crisis period	-0.125***	-0.007		0.053	0.067	0.021
	(0.00)	(0.02)		(0.03)		
Post-Financial crisis period	-0.105***	0.024***		-0.149***	-0.375	0.345
	(0.00)	(0.01)		(0.03)		
Panel D:	**Model 4:** $r_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + \lambda_3 SD_{(\varepsilon_i)} + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.124***	0.145***	0.233***	0.054**	0.368	0.327
	(0.00)	(0.03)	(0.07)	(0.02)		
Pre-Financial crisis period	-0.057***	0.020	0.007	-0.106*	0.173	0.088
	(0.01)	(0.059)	(0.13)	(0.06)		
During-Financial crisis period	-0.115***	-0.059*	0.077*	-0.026	0.153	0.088
	(0.01)	(0.03)	(0.04)	(0.05)		
Post-Financial crisis period	-0.102***	0.010	0.023	-0.184***	0.393	0.348
	(0.00)	(0.02)	(0.02)	(0.04)		

Note: The value of each coefficient is tracked by its standard deviation. In parenthesis. *, **, and *** show the significance at the 1%, 5%, and 10% level of significance, respectively.

(2007-2009), and post-financial crisis period (2010-2016), for the four different models of the CAPM.

The results for first model presented in Panel A of Table 4.1 show there is positive reward for bearing risk in all examined sub-periods. The positive risk premium is consistent with the proposed hypothesis. The intercept term is negative and significantly different from zero for all sub-periods at the 10% level of significance. The results of Model 1 shows that CAPM does not hold true. Although market risk premium is positive but intercept term is significantly different from zero which is inconsistent with the proposed hypothesis of Sharpe (1964).

In Panel B, where β^2 is treated as another explanatory variable, to check the linearity of the model, shows that it has a significant impact on risk-return relationship model. The coefficient of beta λ_2 is statistically significant for during-financial crisis period (2007-2009) with positive sign and post-financial crisis period (2010-2016) with negative sign at the 5% level of significance. It is significant for full-sample period (2002-2016) at the 10% level of significance with negative sign. The significance of coefficient of squared beta shows that the risk-return relationship is non-linear. The coefficient of beta λ_1 is positive in all sub-periods except in during-financial crisis period (2007-2009), where it is negative. It is statistically significant in full-sample period (2002-2016), during-financial crisis period (2007-2009), and post-financial crisis period (2010-2016). However, it is insignificant in pre-financial crisis period (2002-2006). This shows that the risk-return relationship is positive and statistically significant which is consistent with Sharpe's (1964) CAPM. The intercept term (λ_0) appeared to be significantly different from zero. The significance of λ_0 and λ_2 turns the CAPM inefficient.

In Model 3, the standard deviation is negative and statistically significant for pre-financial crisis period (2002-2006) and during-financial crisis period (2007-2009) and shows that residual risk has an impact on the risk return relationship in these sub-periods. The coefficient of beta λ_1 is positive for all sub-periods except during-financial crisis period (2007-2009) where it is negative. It is statistically significant for the sub-periods of full-sample period (2002-2016) and post-financial crisis period (2010-2016), at the 10% level of significance and showing a positive risk return relationship.

In Model 4, where all explanatory variables are combined , the results show that standard deviation is negative in all sub-periods except full-sample period (2002-2016) and statistically significant for all sub-periods except during-financial crisis period (2010-2016). The significance of λ_3 shows that the residual risk plays a role in pricing of risk securities. The coefficient of non-linear beta λ_2 is positive for all sub-periods but statically significant for full-sample period (2002-2016) and during-financial crisis period (2007-2009), which means that in these sub-periods risk-return relationship is not linear. However, in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) the risk-return relationship appears to be linear. The coefficient of beta λ_1 is positive for all sub-periods and but statistically significant for full-sample period (2002-2016) at the 10% level of significance and for during-financial crisis period (2007-2009) at the 1% level of significance. The negative and statistically significant intercept term turns the CAPM untrue.

Over all the results of this table describe that the main assumption of the standard CAPM are not factual for the selected time-period. The premium for bearing the market risk is positive and also statistically significant in many of the examined periods. The other two variables that are squared beta and standard deviation, appear with both positive and negative sign but are statistically significant in most of the examined periods. Addition of non-linear beta in a risk return model has a significant effect and varieties the model non-linear. Iqbal and Brooks (2008) and Javaid and Ahmed (2009) also found non-linearity in risk return relationship. The results for the residual risk provide a significant evidence on the role of residual risk in explaining the cross-section of risky securities and assets. The intercept term is statistically significant in all examined period which turns the CAPM inefficient for Pakistani equity market. The significant insufficiencies in CAPM to explain the risk-return relationship found by Ward and Muller (2013). Our empirical findings disprove this and advocate that CAPM is not an efficient model for Pakistan Stock Exchange for the examined period. Iqbal and Brooks (2007), Javaid and Ahmed (2008), Hanif (2009), Bhatti and Mirza (2014) and Rashid and Hamid (2015 also found failure of CAPM in context of Pakistan. Grunewald and Fraser (1997) for Australia, Quo and Peron (2005) for United States, Michailidis (2006) for Greek, Hui and Christopher (2008) for Japan and USA, Jhiri (2011) for Jordan, and Kruger (2011) for Johannesburg provide evidence of CAPM's rejection for other equity markets.

4.3 Empirical Results for Downside Risk CAPM

The study starts the empirical analysis of downside betas namely, Bawa and Lindenberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002) by testing the risk-return relationship in a semi-variance frame-work, using the DR-CAPM. The results of each downside beta are discussed in detail.

4.3.1 Empirical Results for Downside Beta of Bawa and Lindenberg (1977)

Table 4.2 represents the results of DR-CAPM of Bawa & Lindenberg (1977). The Model 1 in Panel A, the results for the simple risk return model of DR-CAPM describe the negative and statistically significant risk return relationship in all the sub-periods, at the 10 % level of significance, which is not consistent with the assumption of DR-CAPM. The negative and statistically significant intercept term is found over the examined period except for post-financial crisis period (2010-2016) where it is not significant.

The results of second model, when the square beta term is added to the simple model of risk return relationship in downside risk framework, show that the downside beta premium is negative in full-sample period (2002-2016), pre-financial crisis period (2002-2005) and positive in during-financial crisis period (2006-2009) and post-financial crisis period (2010-2016). But statistically insignificant in all sub-periods. However, the coefficient of β^2 appeared to be negative in all sub-periods except in pre-financial crisis period (2002-2005), where it is positive. And statistically significant only in during-financial crisis period (2006-2009). The coefficient of squared beta describes that the risk-return relationship is linear in almost all sub-periods because λ_2 is statistically insignificant. However, in during-financial crisis period (2006-2009) it is not linear because λ_2 is statistically significant. The results describe that DR-CAPM hold in Pakistani equity market in all the sub-periods except in during-financial crisis period (2006-2009).

In third model, reported in Panel C of Table 4.2, where the residual risk is added to simple risk return relationship model. The results for intercept term and downside beta risk premium are almost similar to the Panel A, except for during-financial crisis period (2006-2009) where intercept term is significant at the 10 % level of significance and for full-sample period (2002-2016) where downside beta is significant at the 5 % level of significance. The estimates of standard deviation are negative for full-sample period (2002-2016) and pre-financial crisis period (2002-2005), and positive for during-financial crisis period (2006-2009) and post-financial crisis period (2010-2016). But statistically insignificant for all sub-periods. The insignificant estimates of the residual risk shows no effect on the risk-return relationship model.

Table 4.2: Average Risk Premium for the DR-CAPM of Bawa and Lindenberg (1977)

Panel A:	Model 1: $r_i = \lambda_0 + \lambda_1 \beta_i + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.031**	-0.086***			0.594	0.585
	(0.01)	(0.01)				
Pre-Financial crisis period	-0.019**	-0.065***			0.400	0.380
	(0.01)	(0.01)				
During-Financial crisis period	-0.066**	-0.082***			0.523	0.511
	(0.01)	(0.01)				
Post-Financial crisis period	-0.015	-0.096***			0.364	0.634
	(0.01)	(0.01)				
Panel B:	**Model 2:** $r_i = \lambda_0 + \lambda_1 \beta_i + \lambda_2 \beta_i^2 + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.040	-0.062	-0.015		0.595	0.578
	(0.02)	(0.06)	(0.03)			
Pre-Financial crisis period	-0.005	-0106	0.028		0.406	0.366
	(0.03)	(0.08)	(0.05)			
During-Financial crisis period	-0.108***	0.034	-0.074**		0.567	0.546
	(0.02)	(0.06)	(0.04)			
Post-Financial crisis period	-0.108	0.083	-0.085		0.649	0.633
	(0.10)	(0.20)	(0.09)			
Panel C:	**Model 3:** $r_i = \lambda_0 + \lambda_1 \beta_i + \lambda_3 SD(\varepsilon_i) + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.032***	-0.085**		-0.012	0.597	0.580
	(0.01)	(0.01)		(0.02)		
Pre-Financial crisis period	-0.020**	-0.057***		-0.052	0.425	0.386
	(0.01)	(0.02)		(0.05)		
During-Financial crisis period	-0.071***	-0.080***		0.025	0.539	0.516
	(0.01)	(0.01)		(0.02)		
Post-Financial crisis period	-0.018	-0.092***		-0.015	0.645	0.628
	(0.01)	(0.01)		(0.03)		
Panel D:	**Model 4:** $r_i = \lambda_0 + \lambda_1 \beta_i + \lambda_2 \beta_i^2 + \lambda_3 SD(\varepsilon_i) + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.056*	-0.030	-0.034	0.023	0.603	0.577
	(0.03)	(0.07)	(0.04)	90.020		
Pre-Financial crisis period	0.021	-0.170**	0.082	-0.091*	0.426	0.406
	(0.03)	(0.08)	(0.06)	(0.05)		
During-Financial crisis period	-0.171***	0.176**	-0.161***	0.081***	0.672	0.647
	(0.03)	(0.07)	(0.04)	(0.02)		
Post-Financial crisis period	-0.100	0.068	-0.077	-0.008	0.650	0.624
	(0.11)	(0.21)	(0.10)	(0.03)		

Note: The value of each coefficient is tracked by its standard deviation and in parenthesis. *, **, and *** show the significance at the 1%, 5%, and 10% level of significance, respectively.

Table 4.3: **Average Risk Premium for the Downside and Upside CAPM of Bawa and Lindenberg (1977)**

$r_i = \lambda_0 + \lambda_1 \beta_i^D + \lambda_2 \beta_i^U + e_i$

	λ_0	λ_1	λ_2	R^2	Adjusted R^2
Full sample period	-0.035***	-0.074***	0.005***	0.753	0.742
	(0.01)	(0.01)	(0.00)		
Pre-Financial crisis period	-0.021**	-0.054***	0.018***	0.525	0.493
	(0.01)	(0.01)	(0.01)		
During-Financial crisis period	-0.074***	-0.067***	0.001**	0.576	0.554
	(0.01)	(0.01)	(0.00)		
Post-Financial crisis period	-0.020*	-0.095***	-0.002*	0.669	0.653
	(0.01)	(0.01)	(0.00)		

Note: The value of each coefficient is tracked by its standard deviation and in parenthesis. *, *, and *** show the significance at 1%, 5%, and 10% level of significance, respectively.

The forth model, in Panel D of Table 4.2, presents the results of the combine effect of all regressors that are beta, squared beta and standard deviation. The Model 4 shows that the downside risk premium, squared beta and residuals risk reveal its estimates same as in Panel C of the table. The downside beta has a positive premium in during-financial crisis period (2006-2009) and post-financial crisis period (2010-2016) but statistically significant only in during-financial crisis period (2006-2009) at the 5% level of significance. It has a negative risk premium in full-sample period (2002-2016) and pre-financial crisis period (2002-2005), but statistically significant for the pre-financial crisis period (2002-2005). The squared term is significant at the 10% level of significance for during-financial crisis period (2006-2009). The residual risk is significantly different from zero for during-financial crisis period (2006-2009) and pre-financial crisis period (2002-2005).

Over all the results of Table 4.2 are inconclusive as most of the estimates of downside beta appears with negative sign and some are with positive sign. Most of the negative signs appeared to be statistically significant. Which means that this stock offers a return lower than that needed to compensate for its level of systematic risk, and accepting it will decrease the wealth of shareholders. Galagedera and Brooks (2005) and Akbar et al. (2012) also reported inconclusive results on the validity of DR-CAPM. The additional risk measures are statistically insignificant in most of the examined periods. There is negative and statistically significant intercept which is against the proposed theory. Most of the non-linear beta estimates are negative and statistically insignificant. The residual risk is positive in some sub-periods and negative in some sub-periods but statistically insignificant in all sub-periods except in pre-financial crisis period (2002-2005) and during-financial crisis period (2006-2009) of Model 4, reported in Panel D, where it is significant at the 10% and 1% level of significance respectively.

The residual risk shows that it has no stronger effect on risk return relationship and fails to explain whether unsystematic risk is priced in equilibrium. The finding of Charemushkin (2011) verdict downside beta as an inconsistent measure of systematic risk. Miller and Brommiley (1990) originate that different risk proxies usually appears in change corporate risk-return relationship. Akbar et al. (2012) found no significant empirical validity for DR-CAPM for Pakistan Stock Market. The findings of this downside beta are also similar to Jahankani (1979) who found no support for DR-CAPM.

The upside beta and downside beta are combined in one model, reported in Table 4.3 . The results for this combined model show that the downside beta is negative and statistically significant for all sub-periods at the 10% level of significance. The upside beta is positive for all sub-periods except for post-financial crisis period (2010-2016) where it is negative. And also significantly different from zero in all examined sub-periods. The results are not in accordance with Grootveld and Hellerbac (1999) and Ang et al. (2006) that stated that the semi-variance (DR-CAPM) approach tends to produce on average slightly higher bond allocation than then standard CAPM. The results are also not in line with Iqbal and Brooks (2007), Tahir et al. (2013) who advocated the effectiveness of DR-CAPM in context of Pakistan.

4.3.2 Empirical Results for the Downside Beta of Fishburn (1977)

Table 4.4 represents the empirical results for the downside beta of Fishburn (1977). Panel A of Table 4 presents the results for the simple risk-return relationship model. The intercept term appeared to be negative and significantly different from zero in all the examined sub-periods. The results for the coefficient of downside beta λ1 disclose that there is a positive and statistically significant risk-return relationship in full-sample period (2002-2016) and pre- financial crisis period (2002-2005) at the 5% level of significance. In during-financial crisis period (2006-2009), risk-return relationship appears to be negative and significant. In post-financial crisis period (2010-2016) the estimates of downside beta are positive but statistically insignificant. Overall the results for model shows that the stocks with the higher downside risk has a positive reward, which is in accordance with the main assumption of DR-CAPM.

Panel B shows the result for Model 2 where the squared beta is added to the simple risk-return relationship model. The downside beta has a positive risk premium in full-sample period (2002-2016), pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) but statistically significant in full-sample period (2002-2016) and in post-financial crisis period (2010-2016). In during-financial crisis period (2006-2009) the downside beta is negative and statistically insignificant. The addition of non-linear beta has no significant impact in full-sample period (2002-2016), pre-financial crisis period (2002-2005) and during-financial crisis period (2006-2009). It shows the risk-return relationship is linear. These results are similar to the findings of Price et al. (1982) who found a positive and linear risk-return relationship.

Panel C presents the result for the Model 3 in which standard deviation is added to the simple risk-return relationship model. The coefficient of downside λ_1 appears to be positive in full-sample period (2002-2016), pre-financial crisis period (2002-2005), and post-financial crisis period (2010-

Table 4.4: Average Risk Premium for the DR-CAPM of Fishburn (1977)

Panel A:	*Model* 1: $\gamma_i = \lambda_0 + \lambda_1\beta_i + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.103***	0.001**			0.126	0.108
	(0.00)	(0.00)				
Pre-Financial crisis period	-0.060***	0.002**			0.129	0.101
	(0.00)	(0.00)				
During-Financial crisis period	-0.118***	-0.001***			0.010	-0.014
	(0.00)	(0.00)				
Post-Financial crisis period	-0.110***	0.000			0.014	0.009
	(0.00)	(0.00)				
Panel B:	*Model* 2: $\gamma_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.102***	0.001**	-0.000		0.304	0.274
	(0.00)	(0.00)	(0.00)			
Pre-Financial crisis period	-0.058***	0.001	-0.000		0.153	0.117
	(0.00)	(0.00)	(0.00)			
During-Financial crisis period	-0.118***	-0.001	-0.000		0.164	0.122
	(0.00)	(0.00)	(0.02)			
Post-Financial crisis period	-0.110***	0.001***	-0.000***		0.249	0.213
	(0.00)	(0.00)	(0.00)			
Panel C:	*Model* 3: $\gamma_i = \lambda_0 + \lambda_1\beta_i + \lambda_2 SD_{(\varepsilon i)} + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.105***	0.001***		0.004	0.142	0.105
	(0.00)	(0.00)		(0.00)		
Pre-Financial crisis period	-0.056***	0.000		-0.020**	0.206	0.153
	(0.00)	(0.00)		(0.00)		
During-Financial crisis period	-0.119***	-0.001***		0.003	0.176	0.135
	(0.00)	(0.00)		(0.00)		
Post-Financial crisis period	-0.109***	0.001***		-0.006***	0.255	0.219
	(0.00)	(0.00)		(0.00)		
Panel D:	*Model* 4: $\gamma_i = \lambda_0 + \lambda_1\beta_i + \lambda_2\beta_i^2 + \lambda_3 SD_{(\varepsilon i)} + e_i$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.105***	0.001***	-0.000***	0.016***	0.274	0.226
	(0.00)	(0.00)	(0.00)	(0.01)		
Pre-Financial crisis period	-0.056***	0.000	0.000	-0.046	0.232	0.153
	(0.00)	(0.00)	(0.00)	(0.03)		
During-Financial crisis period	-0.119***	-0.001	0.000	0.006	0.211	0.150
	(0.00)	(0.00)	(0.00)	(0.00)		
Post-Financial crisis period	-0.109***	0.001**	-0.000	-0.005	0.255	0.201
	(0.00)	(0.00)	(0.02)	(0.00)		

Note: The value of each coefficient is tracked by its standard deviation and in parenthesis. *, **, and *** show significance at the 1%, 5%, and 10% level of significance, respectively.

Table 4.5: **Average Risk Premium for the Downside and Upside CAPM of Fishburn (1977)**

	$r_i = \lambda_0 + \lambda_1 \beta_i^D + \lambda_2 \beta_i^U + e_i$				
	λ_0	λ_1	λ_2	R^2	Adjusted R^2
Full sample period	-0.104***	0.001*	0.006	0.142	0.105
	(0.00)	(0.00)	(0.01)		
Pre-Financial crisis period	-0.060***	0.002**	0.003	0.134	0.076
	(0.00)	(0.00)	(0.01)		
During-Financial crisis period	-0.120***	-0.001***	0.008***	0.376	0.345
	(0.00)	(0.00)	(0.00)		
Post-Financial crisis period	-0.110***	0.000	0.001	0.016	0.031
	(0.00)	(0.00)	(0.00)		

Note: The value of each coefficient is tracked by its standard deviation and in parenthesis. *, **, and *** show significance at the 1%, 5%, and 10% level of significance, respectively.

2016) and statistically significant in full-sample period (2002-2016) and post-financial crisis period (2010-2016) at the 10% level of significance. However in during-financial crisis period (2006-2009) the coefficient of downside λ_1 is negative but statistically significant. The residual risk has a significant impact in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) which means that in these sub-periods residual risk is explaining the cross-section of risky securities. However, in full-sample period (2002-2016) and during-financial crisis period (2006-2009) the residual risk fails in explaining the cross-section of risky securities.

Panel D presents the results for the joint hypothesis. The result for intercept term is same as in previous panels. In full-sample period (2002-2016), the risk-return relationship is positive, non-linear and the systematic risk is priced in equilibrium. These findings are significantly different from zero. In pre-financial crisis period (2002-2005), the risk-return relationship is positive, linear, and the systematic risk (β) explains the pricing of risky securities. The findings are not statistically significant. In during-financial crisis period (2006-2009), the risk-return relationship is negative, linear and the unsystematic risk is not priced in equilibrium. The findings are also not statistically significant. In post-financial crisis period (2010-2016), the risk-return relationship is positive, linear, and the systematic risk is not priced in equilibrium and not statistically significant. Overall, the results for the downside beta of Fishburn (1977) are conclusive and reliable for the Pakistani equity market. The stocks that positively co-vary with downturn market, has a positive recompense and the risk-return relationship is linear. Which means that this stock offers a return greater than that needed to compensate for its level of systematic risk, and accepting it will increase the wealth of shareholders. These results are in accordance with the results of Iqbal and Brooks (2007), Javaid and Ahmed (2008), Tahir et al. (2013), and Rashid and Hamid (2015) in case of Pakistan Stock Market, who supported the main assumption of DR-CAPM that high premium is associated with risky securities. However, in case of other equity markets results are in line with Post and Vliet (2005), Ang et al. (2006) and Artavanas et al. (2010) who reported a positive reward for bearing risk.

Table 4.5 illustrates the results for combine model of upside and downside beta. The intercept term appears negative and statistically significant. The downside beta has positive and statistically significant reward in full-sample period (2002-2016) and pre-financial crisis period (2002-2005). In during-financial crisis period (2006-2009) the downside beta appears negative and statistically significant at the 10% level of significance. However in post-financial crisis period (2010-2016) it is positive but statistically insignificant. The coefficient of upside beta λ_2 is positive in all sub-periods but statistically significant only in during-financial crisis period (2006-2009). The effects of downside beta are consistent with Ang et al. (2006). The upside beta has lacking effects.

4.3.3 Empirical Results for the Downside Beta of Harlow and Row (1989)

The empirical results for the downside beta of Harlow and Row (1989) are reported in Table 4.6. The intercept term appears with negative sign in all sub-periods and statistically significant, for all four models and signifying that securities are mispriced in all examined periods. These results are similar to the Akbar et al. (2012) and Rashid and Hamid (2015). In Panel A, the downside beta has a positive risk premium in all sub-periods except during-financial crisis period (2006-2009) and statistically significant in full-sample period (2002-2016) and post-financial crisis period (2010-2016) at the 10% and 1% level of significance. The results report a positive and statistically significant risk return relationship, which is similar to the proposed hypothesis. The results approve that there is a higher expected rate of return for bearing risk.

In Panel B, the non-linear beta is negative all sub-periods and positive in during-financial crisis period (2006-2009) but statistically significant in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) at the 5% and 1% level of significance. These findings show that the risk return relationship is not linear in these sub-periods. The risk premium associated with downside beta is also positive and statistically significant in most of the examined periods. These findings supports the theory of Markowitz (1959) that proposes the positive risk premium for bearing downside risk. The intercept term is similar to the previous models.

In Panel C, the residual risk is positive in full-sample period (2002-2016) and during-financial crisis period (2006-2009), and negative in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016). But statistically significant in all the sub-periods except full-sample period (2002-2016). The estimates of residual risk show that it has a significant effect on risk return relationship model. The systematic risk is priced in equilibrium. The downside beta has positive signs for all sub-periods and statistically significant in full-sample period (2002-2016) and post-financial crisis period (2010-2016) at the 10% level of significance. The estimated coefficient of downside beta indicates the positive premium for bearing downside risk.

Table 4.6: Average Risk Premium for the DR-CAPM of Harlow and Row (1989)

Panel A:	Model 1: $r_{it}=\lambda_0+\lambda_1\beta_i+e_{it}$					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.103***	0.360***			0.142	0.124
	(0.00)	(0.01)				
Pre-Financial crisis period	-0.061***	0.220			0.051	0.020
	(0.00)	(0.02)				
During-Financial crisis period	-0.121***	-0.006			0.005	0.019
	(0.00)	(0.01)				
Post-Financial crisis period	-0.110***	0.013*			0.084	0.062
	(0.00)	(0.01)				
Panel B:	**Model 2: $r_t=\lambda_0+\lambda_1\beta_i+\lambda_2\beta_i^2+e_i$**					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.102***	0.034**	-0.300		0.154	0.118
	(0.00)	(0.01)	(0.04)			
Pre-Financial crisis period	-0.058***	0.030*	-0.133**		0.201	0.147
	(0.00)	(0.02)	(0.06)			
During-Financial crisis period	-0.123***	-0.015	0.038		0.042	0.006
	(0.00)	(0.01)	(0.03)			
Post-Financial crisis period	-0.109***	0.018**	-0.017*		0.158	0.118
	(0.00)	(0.01)	(0.01)			
Panel C:	**Model 3: $r_i=\lambda_0+\lambda_1\beta_i+\lambda_3 SD(\varepsilon_i)+e_i$**					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.106***	0.036**		0.033	0.169	0.134
	(0.00)	(0.01)		(0.03)		
Pre-Financial crisis period	-0.053***	0.020		-0.109**	0.206	0.153
	(0.00)	(0.02)		(0.05)		
During-Financial crisis period	-0.125***	-0.011		0.051*	0.086	0.040
	(0.00)	(0.01)		(0.03)		
Post-Financial crisis period	-0.103***	0.018***		-0.129***	0.383	0.353
	(0.00)	(0.01)		(0.03)		
Panel D:	**Model 4: $r_i=\lambda_0+\lambda_1\beta_i+\lambda_2\beta_i^2+\lambda_3 SD(\varepsilon_i)+e_i$**					
	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.105***	0.033**	-0.041	0.040	0.191	0.139
	(0.00)	(0.01)	(0.04)	(0.03)		
Pre-Financial crisis period	-0.054***	0.026	-0.082	-0.071	0.243	0.165
	(0.00)	(0.02	(0.07)	(0.06)		
During-Financial crisis period	-0.026***	-0.010	-0.008	0.057	0.086	0.016
	(0.00)	(0.01)	(0.04)	(0.04)		
Post-Financial crisis period	-0.100***	-0.013**	0.025**	-0.203***	0.445	0.405
	(0.00)	(0.01)	(0.01)	(0.04)		

Note: The value of each coefficient is tracked by its standard deviation in parenthesis. *, **, and *** show the significance at the 1%, 5%, and 10% level of significance, respectively.

Table 4.7: Average Risk Premium for the Downside and Upside CAPM of Harlow and Row (1989)

$r_i = \lambda_0 + \lambda_1 \beta_i^D + \lambda_2 \beta_i^U + e_i$

	λ_0	λ_1	λ_2	R^2	Adjusted R^2
Full sample period	-0.104***	0.033**	0.009	0.153	0.117
	(0.00)	(0.01)	(0.01)		
Pre-Financial crisis period	-0.061***	0.024	-0.009	0.063	0.001
	(0.00)	(0.02)	(0.01)		
During-Financial crisis period	-0.124***	-0.013	0.015***	0.194	0.154
	(0.00)	(0.01)	(0.00)		
Post-Financial crisis period	-0.109***	0.021**	-0.013	0.123	0.081
	(0.00)	(0.01)	(0.01)		

Note: The value of each coefficient is tracked by its standard deviation and in parenthesis. *, **, and *** show the significance at the 1%, 5%, and 10% level of significance, respectively.

In Panel D, where all the three regressors are combined in single model. In this model, the downside beta is as same as in Panel B. The non-linear beta estimates are negative and insignificant for all sub-periods except post-financial crisis period (2010-2016) where it appears positive and statistically significant. The residual risk signs are similar to the Panel C and statistically different from zero in post-financial crisis period (2010-2016) at the 10% level of significance. In a combine model, intercept term is negative and statistically significant. The downside beta has positive risk premium in some sub-periods. The additional risks: squared beta and residual risk appears to be statistically significant in most of the sub-periods and have not effect on the simple risk return relationship model.

Overall the results for the downside beta of Harlow and Row (1989) are reliable and consistent with the main assumption of DR-CAPM that on bearing the downside risk, there is positive premium for the investors. This is similar to Grootveld and Hellerbac (1999), Post and Vliet (2005), and Ang et al. (2006). The negative and statistically significant intercept term inconsistent with the Pakistani equity market, also found by Akbar et al. (2012). Tahir e al. (2013) and Rashid and Hamid (2015) also found a positive risk-return relationship based on DR-CAPM for the Pakistani equity market.

Table 4.7 presents the results of the model when the upside and downside beta are combined in a single equation. The downside beta has a positive risk premium in all sub-periods except in during-financial crisis period (2006-2009). It is significant in pull-sample period (2002-2016) and post-financial crisis period (2010-2016) at the 5% level of significance. The upside beta has a negative risk premium in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016), and positive risk premium in full-sample period (2002-2016) and during-financial crisis period (2006-2009).

The results are satisfactory when both the downside and upside betas are combined in single equation and tested for statistical significance. The empirical results of the model show that the downside beta of offering a positive and statically significant incentive for enduring the market risk. The estimates of upside beta for full-sample period (2002-2016) and during-financial crisis period (2006-2009) evidence that the assets/stocks negatively co-vary with declining market have negative risk premium (Ang et al. 2006). The results also support the findings of Rashid and Hamid (2015).

4.3.4 Empirical Results for the Downside Beta of Estrada (2002)

The empirical results for the downside beta of Estrada (2002) are reported in Table 4.8. As in the empirical results for the downside beta of Bawa and Lindenberg (1977) and Harlow and Rao (1989), the intercept term in the empirical results for the downside beta of Estrada (2002) is also negative and statistically significant for all sub-periods in all four models. In first uni-variate model, the downside beta risk premium is negative in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) and significant at the 10% level in post-financial crisis period (2010-2016). It is positive and statistically insignificant in full-sample period (2002-2016) and pre-financial crisis period (2002-2005). Which means that in case of holding risky securities there is positive premium for the investors.

In Model 2 where squared beta is added as an explanatory variable, the coefficient of squared beta is positive in three out of four sub-periods and statistically significant in two out of four sub-periods of Panel B. The results illustrate that the risk return relationship is non-linear in full-sample period (2002-2016) and during-financial crisis period (2006-2009). The downside beta has a positive and insignificant risk premium only in pre-financial crisis period (2002-2005) and a negative and statistically significant risk premium in remaining sub-periods, which is against the proposed hypothesis.

The third model, in Panel C of the table, shows the result when standard deviation is added to simple risk return model. The residual risk is positive for all sub-periods except in pre-financial crisis period (2002-2005) and statistically significant in pre-financial crisis period (2002-2005) and Post-financial crisis period (2010-2016) at the 5% and 10% level of significance. The downside beta has a positive risk premium in all sub-periods except in during-financial crisis period (2006-2009) but statistically significant in post-financial crisis period (2010-2016). The residual risk has a statistical significant effect and shows that in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) systematic risk is priced in equilibrium. This also explains that the single factor beta competent in explaining the risk-return relationship. The results also state the addition of residual risk turns the simple risk return relationship model appropriate and fit to the theory suggested by Markowitz (1952) according to which there is a positive reward for those investors who face the downside risk.

Table 4.8: Average Risk Premium for the DR-CAPM of Estrada (2002)

Panel A: Model 1: $r_i = \lambda_0 + \lambda_1 \beta_i + e_i$

	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.105***	0.012			0.028	0.007
	(0.00)	(0.01)				
Pre-Financial crisis period	-0.056***	-0.020			0.060	0.030
	(0.00)	(0.01)				
During-Financial crisis period	-0.123***	0.005			0.006	-0.019
	(0.00)	(0.01)				
Post-Financial crisis period	-0.106***	-0.009*			0.068	0.047
	(0.00)	(0.01)				

Panel B: Model 2: $r_t = \lambda_0 + \lambda_1 \beta_i + \lambda_2 \beta_i^2 + e_i$

	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.090***	-0.082***	0.089***		0.219	0.185
	(0.01)	(0.03)	(0.03)			
Pre-Financial crisis period	-0.060***	0.009	-0.031		0.074	0.012
	(0.01)	(0.05)	(0.05)			
During-Financial crisis period	-0.113***	-0.065**	0.048***		-.178	0.137
	(0.00)	(0.03)	(0.02)			
Post-Financial crisis period	-0.101***	-0.034**	0.012		0.122	0.081
	(0.00)	(0.02)	(0.01)			

Panel C: Model 3: $r_i = \lambda_0 + \lambda_1 \beta_i + \lambda_3 SD(\varepsilon_i) + e_i$

	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.105***	0.023		-0.059	0.037	0.004
	(0.00)	(0.02)		(0.09)		
Pre-Financial crisis period	-0.054***	0.022		-0.271**	0.219	0.167
	(0.00)	(0.02)		(0.11)		
During-Financial crisis period	-0.124***	-0.011		0.086	0.030	0.018
	(0.00)	(0.02)		(0.09)		
Post-Financial crisis period	-0.102***	0.011*		-0.282***	0.367	0.337
	(0.00)	(0.01)		(0.06)		

Panel D: Model 4: $r_i = \lambda_0 + \lambda_1 \beta_i + \lambda_2 \beta_i^2 + \lambda_3 SD(\varepsilon_t) + e_i$

	λ_0	λ_1	λ_2	λ_3	R^2	Adjusted R^2
Full sample period	-0.090***	-0.076**	0.088***	-0.022	0.220	0.169
	(0.01)	(0.03)	(0.03)	(0.08)		
Pre-Financial crisis period	-0.056***	0.038	-0.018	-0.265**	0.223	0.143
	(0.01)	(0.04)	(0.04)	(0.11)		
During-Financial crisis period	-0.114***	-0.070**	0.046**	0.039	0.183	0.120
	(0.01)	(0.03)	(0.02)	(0.08)		
Post-Financial crisis period	-0.102***	0.009	0.001	-0.279***	0.367	0.321
	(0.00)	(0.02)	(0.01)	(0.07)		

Note: The value of each coefficient is followed by its standard deviation and in parenthesis. *, **, and *** at the 1%, 5%, and 10% level of significance.

Table 4.9: Average Risk Premium for the Downside and Upside CAPM of Estrada (2002)

	$r_i = \lambda_0 + \lambda_1 \beta_i^D + \lambda_2 \beta_i^U + e_i$				
	λ_0	λ_1	λ_2	R^2	Adjusted R^2
Full sample period	-0.103***	0.039**	-0.021*	0.094	0.055
	(0.00)	(0.02)	(0.01)		
Pre-Financial crisis period	-0.052***	-0.001	-0.027	0.178	0.123
	(0.00)	(0.02)	(0.01)		
During-Financial crisis period	-0.123***	-0.031*	0.015***	0.177	0.136
	(0.00)	(0.02)	(0.01)		
Post-Financial crisis period	-0.103***	-0.001	-0.103***	0.155	0.115
	(0.00)	(0.01)	(0.00)		

Note: The value of each coefficient is followed by its standard deviation and in parenthesis. *, **, and *** show significance at the 1%, 5% and 10% level of significance, respectively.

In multivariate model, where all regressors are combined, shows that the residual risk estimates are same as in Panel C. The non-linear beta is positive in full-sample period (2002-2016), during-financial crisis period (2006-2009) and post-financial crisis period (2010-2016). But statistically significant in full-sample period (2002-2016), during-financial crisis period (2006-2009). The downside beta has a positive and statistically insignificant risk premium in full-sample period (2002-2016), and during-financial crisis period (2006-2009) at the 5% level of significance. In combine model where joint hypothesis is tested, shows that the risk return relationship is positive and linear in pre-financial crisis period (2002-2005) and post-financial crisis period (2010-2016) but are statistically insignificant. There is a positive reward for the investors who hold risky securities. The residual risk explains the cross-section of risky assets only in pre-financial crisis period (2002-2005). However, in remaining sub-periods the residual risk is not able to explain the cross-section of risky securities.

Over all the results for the downside beta of Estrada are also unsatisfying. These results are similar to observation of Galagedera and Brooks (2005) and Charemushkin (2011) who also witnessed unsatisfying results for DR-CAPM. The downside beta has positive but statistically insignificant relationship. The estimates also show that there are some risky securities that have negative and statistically significant relationship with falling market. These finding are not consistent with the proposed hypothesis. The other risks: residual risk and squared beta have different effects with respect to statistical significance. The squared beta is positive and statistically significant in most of the examined periods, which means model is non-linear. However the residual risk is negative and statistically significant in most of the examined periods, which means unsystematic risk is priced in equilibrium. Abbas et al. (2012) found the DR-CAPM untrue for Pakistani equity market.

Table 4.9 presents the results of a model in which upside and downside beta are combined in a single equation. The results show that the downside beta has negative risk premium in all sub-periods and statistically significant at the 1% level of significance in during-financial crisis period (2006-2009). In full-sample period (2002-2016), it is positive and statistically significant at the 5% level of significance. The upside beta is negative all sub-periods except in during-financial crisis period (2006-2009) and statistically significant in all sub-periods.

According to Ang et al. (2006), by holding risk stocks investors claim for positive compensation for bearing risk. The assets that are correlated to rising market, have a tendency to pay greater payoffs. Thus, the less risky assets, the lower the required rate of return. This theory holds true in full-sample period (2002-2016) in which risk premium associated with downside beta is positive and risk premium for upside beta is negative, with $R^2 = 9\%$ and adjusted-$R^2 = 55\%$. Where as in remaining sub-periods, the DR-CAPM does not hold true. The estimates do not support the theory.

Chapter 5

Conclusion

5.1 Summary and Conclusion

The standard CAPM is the well-known and far and wide understood one risk factor model, which explains a positive and linear risk-return relationship. The standard CAPM has productively served to change the state of mind of academicians and investors (Harrington, 1993). Moreover, this model has been widely tested. Some scholars approved the standard CAPM (Lau and Quay, 1974). However, others ((Javaid and Ahmed, 2008), and (Hanif, 2009)) criticized the applicability of this model. Conversely, most of the empirical evidences regarding the validity of CAPM are against the assumption of CAPM. The CAPM claimed that deviation in portfolio returns can be explained by Single-Factor beta. Many studies such as Banz (1981), Basu (1983) Bhanduri (1988) and Miller (1999) came to the conclusion that a single-factor beta as used by Sharpe (1964) is unable to offer the appropriate clarification of cross-sectional expected returns. Foremost studies in this regard are Fama and French (1992, 1993, and 1996) and Jegadeesh and Titman (1993) who suggested size and value effect, momentum effect, and Book-to-market ratio as explanatory variables. So this standard model was rejected due to failure of its main assumptions. When the mean-variance approach is used as a risk measure it equally weights the upside and downside fluctuations of returns and do not separate them. For asymmetric return distribution, variance classifies an asset with either positively or negatively skewed distribution as a risky asset.

In order to overcome these shortcomings, Markowitz (1959) suggested the semi-variance risk measure called DR-CAPM as more appropriate risk measure. Investors should focus more on the downside risk than the risk in general. The DR-CAPM is appropriate when underlying distribution is non-normal, asymmetric and it gives different weights to upside and downside risk by separating the return fluctuations. Kahneman (1979) and Gul (1991) also emphasized that in an investor's utility function losses should be focused more by giving more weights to the losses than gains. The downside risk is popular among investors because it separates the return fluctuations (Abbas, et al. 2006).

Several models were developed in order to conceptualize the downside risk that is the failure to achieve the target rate of return. Bawa and Lindenberg (1977) consider the co-variation of asset returns with a declining market as a downside risk. Fishburn (1977) ruminates risk as the return on asset is below specific target return. The downside movement of market returns are identified as a downside risk by Harlow and Rao (1989). According to Estrada (2002), downside risk is when both the asset return and market return are lower than the benchmark rate. The DR-CAPM explains market behavior in a better way in Pakistan Stock Market (Ahmed and Zaman (1999), Abbas et al. (2006), Tahir et al. (2013), and Rashid and Hamid (2015)). In context of other markets, the DR-CAPM found to be the appropriate and efficient measure of risk e.g. Ang et al. (2006) for New York Stock Exchange, Grootveld and Hellerbac (1999) for US Stock Exchange, Post and Vliet for (2005) US Stock Exchange, Galagedera and Jaapar (2009) for Malaysia Stock Exchange and Artavanas et al.(2010) for London and Paris Stock Exchange, separately.

This study empirically tested the standard CAPM and DR- CAPM to examine the cross-section of risky stocks traded at PSE. A total of 50 financial institutions comprising of Islamic and conventional banks, Mudarabah Companies, and Mutual Funds Companies listed on PSE were observed for period from January 2002 to April 2016. The full sample was further divided into three categories namely pre-financial crisis period (2002-2005), during-financial crisis period

(2006-2009), and post-financial crisis period (2010-2016). These institutions have high market capitalization and continues listing throughout the selected period. For this analysis, the study used monthly closing stock prices of the selected financial institutions. The study carried out the examination following Fama & MacBeth (1973) two pass regression analysis using GMM in the first pass and GLS in the second pass. The procedure used for this analysis to expected rate of return using the standard CAPM by calculating beta (β) through slope. The findings and results of this present study favored the main assumption of the standard CAPM. The risk-return relationship appeared to be linear in 3 out of 4 examined sub-periods. The study concluded that the standard CAPM is not suitable for the Pakistani financial institutions due to statistically significant intercept term. The results of the present study for the standard CAPM were found to be similar to the findings of Iqbal and Brooks (2007), Javaid and Ahmed (2008), Hanif (2009), Bhatti and Mirza (2014) and Rashid and Hamid (2015) in Pakistani context. However, with reference to other equity markets the findings are similar to the Grunewald and Fraser (1997) for Australia, Quo and Peron (2005) for US, Michailidis (2006) for Greek, Hui and Christopher (2008) for Japan and USA, Jhiri (2011) for Jordan, and Kruger (2011) for Johannesburg.

For the downside risk based CAPM, the study focused on downside betas developed by Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002). The study also compared four downside risk measures (betas) on performance basis, to identify the better downside beta (risk measure) among Bawa and Linderberg (1977), Fishburn (1977), Harlow and Row (1989), and Estrada (2002) that explains expected stocks return for the financial institutions and to explore that investors treats differently the stock that are highly correlated to the downside market and the stocks that are highly correlated with the upside market. The results for Bawa and Lindenberg (1977) downside risk based CAPM are very poor, as they shown negative and also statistically significant risk-return relationship. Fishburn (1977) downside risk base CAPM appeared to be more appropriate risk measure for the Islamic and conventional financial institutions listed on Pakistan Stock Exchange, as there is positive and statistically significant premium for holding risky securities. The risk-return relationship is linear in some sub-periods and in some sub-periods it is significantly non-linear. The DR-CAPM of Harlow and Row (1989) also disclose positive and statistically significant risk-return relationship in most of the examined sub-periods. However, the results for Estrada (2002) present inconclusive result, which shows downside beta of Estrada (2002) a deficient measure of risk for the financial institutions of Pakistan.

When both the standard upside, and the downside beta (risk premium) are examined in a single equation framework for Islamic and conventional financial institutions, the downside and upside beta of Bawa and Lindenberg (1977) appeared with theoretically inappropriate sign. The downside beta of Fishburn (1977) appeared with theoretically appropriate sign which is a positive and also statistically significant and upside beta appeared with theoretically inappropriate sign and also statistically insignificant. The downside beta of Harlow and Row (1989) theoretically appropriate sign and upside beta appeared with theoretically appropriate sign in 2 out of 4 sub-periods but statistically insignificant. The downside of Estrada (2002) appeared with a negative sign which is theoretically inappropriate and upside beta appeared with positive sign which is theoretically appropriate.

5.2 Limitations and Recommendations for Further Research:

- The present study analyzed the monthly closing price of the stocks, however daily and weekly closing prices of the stocks can also be used in order to obtain the appropriate results.
- This study evaluated the stocks' returns of the financial institutions that comprise of Islamic and conventional banks, Mudarabah Companies and Close-end mutual fund Companies. However, other financial institutions like Insurance Companies, Investment Banks, Investments Companies, Leasing Companies, and Future Contracts can be used for downside risk analysis.
- The downside beta comparison can also be extended by add the downside beta as proposed by Hogan and Warren (19740 to find beta that better explains the expected returns for investors. Besides this, some new downside risk based betas can also b searched and utilized for this purpose.

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Appendix

This empirical analysis will be carried out for 58 financial institutions that include Islamic and conventional banks, Mudarabah companies and Closed-end mutual fund companies listed at PSE. List of these financial institutions is following:

List of Islamic and conventional banks

Symbol	Bank
ABL	Allied Bank Limited
AKBL	Askari Bank Limited
BAFL	Bank Al-Falah Limited
BAHL	Bank AL-Habib Limited
BIPL	Bank Islami Pakistan Limited
BOK	Bank of Khyber
BOP	Bank of Punjab
FABL	Faysal Bank Limited
HBL	Habib Bank Limited
HMB	Habib Metropolitan
JSBL	JS Bank Limited
MCB	MCB Bank Limited
MEBL	Meezan Bank Limited
NBP	National Bank Pakistan
NIB	NIB Bank Limited
SBL	Samba Bank Limited
SCBPL	Standard Chartered Bank Limited

SILK	Silk Bank
SMBL	Summit Bank
SNBL	Soneri Bank Ltd
UBL	United Bank

List of Close-End Mutual Funds

Symbol	**Company**
DOMF	Dominion Stock Mutual Fund
FDMF	First Dawood Mutual Fund
GASF	Golden Arrow Fund
INMF	Inv. Mutual Fund
PGF	PICIC Growth Fund
PIF	PICIC Inv. Fund
POAF	Pak Oman Advance Fund
PUDF	P.S. Fund
TSMF	Tri-Star Mutual Fund

List of Mudarabah Companies

Symbol	**Company**
ARM	Allied Rent Mudarabah
BFMOD	B.F. Mudarabah
BRR	B.R.R.Guardian
CSM	Crescent Standard Mudarabah
FANM	First AL-Noor Mudarabah
FCONM	First Constellation Mudarabah

FECM	First Elite Capital Mudarabah
FEM	First Equity Mudarabah
FFLM	First Fid. Leasing
FHAM	Habib Mudarabah
FIBLM	F. I.B.L. Mudarabah
FIM	First Investment Mudarabah
FIMM	First Imrooz Mudarabah
FISM	First Islamic Mudarabah
FNBM	First National Bank Mudarabah
FPJM	First Punjab Mudarabah
FPRM	First Paramount Mudarabah
FTMM	First Treet Manufacturing Mudarabah
FTSM	Tri-Star 1st. Mod.
FUDLM	U.D.L. Mudarabah
KASBM	KASB Mudarabah
MODAM	Mudarabah Al-Mali
PAKMI	Pak Mudarabah
PMI	Prud Mudarabah 1st
SCM	Standard Chartered Mudarabah
SINDM	Sindh Mudarabah
TRSM	Trust Mudarabah
UCAPM	Unicap Mudarabah