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Testing the empirical validity of the CAPM, Higher order moment CAPM and the downside risk based CAPM for Pakistan Stock exchange

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Abstract

There is plethora of asset pricing models proposed to explain the asset returns; however, the popularity gained by Capital Asset Pricing Model (CAPM) is unique when we compare it to the other rival asset pricing models. The present study aims to investigate the empirical validity and comparative performance of the three versions of the CAPM unconditional settings for Pakistan's emerging stock market. For empirical analysis study uses the Fama-MacBeth methodology (Fama & MacBeth, 1973). Accordingly, a sample of 550 stocks is chosen. Selected sample represents all sectors listed at the concerned stock exchanges. Monthly data on all the variables was obtained over sample period January 2018 to December 2023. Market indices were used as a proxy for market returns and the Treasury bills (T-Bill) rate is used as a substitute for risk free rate. Lagged macroeconomic variables, mostly containing business cycle information, are used for conditioning information. The information set includes the first lag of the following business cycle variables: market return, call money rate, term structure, inflation rate and growth in oil prices. Time series and cross section regressions were used in line with the Fama-MacBeth methodology. To overcome the problem of heteroskedasticity Generalized Least Squares (GLS) method is used. Based on the main findings of this study, it is concluded that the content is missing evidence to validate traditional CAPM, the higher moment CAPM and the D-CAPM.

Introduction

Financial economics plays a far more protuberant role in the training of economists these days than it used to be few years ago. This change is mostly associated with the parallel revolution in

capital markets that has occurred in recent times. It is true that assets of the worth of trillions of dollars are traded on daily basis in financial markets which used to be hardly existed couple of decades ago. Financial economics draws together analysis from different field of economics, therefore is a challenging subject, as macroeconomic analysis uses general equilibrium models with money and financial securities in multi-periods settings along with the uncertainty, microeconomics takes on the challenge of individual preferences and decisions, monetary economics has its own domain of inspiring tasks so on and so forth. Underlying all of financial economics are concepts of present value and uncertainty, which are said to be the two main pillars of modern finance e.g. time value of money and risk management. So finance has its own complex dimensions in current time, a generation ago finance theory was little more than institutional description combined with practitioner-generated rules of thumb that had little analytical basis and, for that matter, little validity. Financial economists agreed that in principle security prices should be responsive to the analysis done by using basic economic theories, but in practice most did not devote much effort to specializing economics in this direction. Today, in contrast, financial economics is increasingly occupying center stage in the economic analysis of problems that involve time and uncertainty. Many of the problems formerly analyzed using methods having little finance content now are finance topics.

Theoreticians and researchers have put serious efforts in the past to develop models for fair valuation of asset pricing but the most valuable efforts came from the William F. Sharpe (1964) and John Lintner (1965), which resulted in the development of Capital Asset Pricing Model (CAPM). The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic or market risk), which is generally represented by beta (β). The model is based on the assumptions of perfect markets but given the imperfect conditions of the markets and lack of empirical support, different editions of the model have been tested and proposed (e.g. Black, 1972; Merton 1973; Breeden 1979; Banz, 1980; Fama and French, 1993, 1995, 1997, 1998, 2004, 2005, 2006, 2007, 2012, 2015, 2017). To tackle some of the theoretical and empirical limitations of the traditional model, an alternative model i.e. the higher-order moment model was proposed (Kraus and Litzenberger, 1976; Harvey and Siddique, 1999; Athayde and Flores Jr.,2000; Christine-Davis and Chaudhry, 2001; Jurczenkoy, 2001, Ajibola et.al., 2015; Vendrame, 2016; J Jang, 2017). Co- skewness and co-kurtosis used to be included in these

models as extra measures of risk which are supposed to be priced significantly and appropriately. Co-kurtosis risk is theoretically hypothesized to be positive whereas co-skewness is imagined as negative. The empirical validity of the traditional CAPM has been a debate for financial economists from several decades. Some of the extensions we already have discussed and one important extension which is also be the part of the present study is the Downside risk based CAPM (D-CAPM) which gained appreciation in recent past due to its sound theoretical framework and empirical validation (Harlow and Rao, 1989; Estrada, 2002; Post and Valiet, 2006; Akbar et.al., 2012). D-CAPM carries characteristics which are quite suitable to determine the required rate of returns in emerging equity markets (Estrada, 2002), so this is one reason of using this specific extension in the present study as we are dealing with four emerging equity markets.

The information regarding the market gets more accurate and somehow said to be more asymmetric so the investors grew up in confidence as well. Currently, the developing economies have increased their market capitalization to around $12 trillion (Business insider, 2018). A widespread analysis of literature concludes that the response of emerging markets to political, economic, fiscal changes vary as compare to the developed economies. This variability in response has several root causes mainly because of the institutional, liquidity, size, developmental and cultural differences (Claessens et al, 1995; Diamonte et al, 1996; Martin and Rey 2006). In developing economies the general behavior is that the economic and political changes are quite unexpected and sudden but that do not sustain long in general, this situation turned around in rather quick time. The market participants lack in expertise with which they can analyze and predict these unpleasant changes.

The role and share of these developing economies in the world share is increasing and playing a significant role in the world economy. Table II is presenting an overview about this argument about the Asian emerging economies and we can see that the market capitalization and trading volume has amounting significantly. Most of these economies like China, Japan, India, and Korea are the ones which contribute heavily in current economic world.

Pakistan

The Pakistan capital market is of significant size with 556 listed companies, a total market value of $64.8 billion at the end of November 2015, and a turnover of $27 billion at the end of November 2021. Turnover is currently much depressed because of political uncertainty, but it is recovering.

There were three stock exchanges—the Karachi Stock Exchange (KSE), Lahore Stock Exchange, and Islamabad Stock Exchange. Now the country has only one official market which is Pakistan Stock Exchange (PSE), formerly KSE. A demutualization law was passed in March 2012, more than 12 years after the matter was first discussed.

CAPM is still the most debatable and at the same time most acceptable model due to its simple intuitive. One of the reason is its strong theoretical background which makes it hard to reject and consider as out dated. Many explanations have been given for its empirical failure (Naqvi, 2000) but at the same time many contradicting argumentsand justifications have been provided for its empirical support like Reingnum andRoll (1980); Lo and Mackinaly (1990); Roll andRoss (1994) andKothari et al (1995) andRedy and Durga (2015).

Higher-Order Moment Model: Extension of the Conventional Framework

Conventional model based on the quadratic utilityfunction. One of the assumptions of underlying utility function is that investor choose their investments on the basis of expected returns and variance. However, these assumptions also require that:

a) The distribution of the probability of return on investment is normally divided.

b) The utility functions of investors are quadratic.

Following tests of the model suppose normal returns that are an implausible assumption from an empirical point of view (Arditti, 1967, Harvey, 1995). The higher value moment valuation model recognizes the distribution of non-normal returns and extends the basic model for risk management (co-asymmetry and co-kurtosis) to market risk measures (Rubinstein, 1973; Harvey andSiddique, 1999).

The proposals in the higher-level CAPM are that the highermoments are valued significantly in the rate of return required by investors, study that the study examines empirically in the context of the stock markets of four Asian countries from South. The literature indicates that positive co-skewness ought to be valued at a negative price and that negativeco-skewness should be

positively assessed (Wolfleand Fuss, 2010). On the other hand, positive co-kurtosis must be valued at a positive price and the rate of return required from investors must include a negative price for negative co-kurtosis.

extension to a higher instant. Among the most recent and notable studies are Iqbal and Brooks (2007),Javid (2008, 2009) and Akbar et al (2012) conducted a survey on the empirical validity of CAPM at greater moment.

Down Side Risk Based CAPM (D-CAPM): An AlternativeFramework

Contemporary portfolio theory of Harry Markowitz (1952) gives explanation that risks and benefits of an investment are efficiently measured by the mean, variance and the expected return on investment. The risk metric, i.e. the variance, is considered to be lower than and above the mean of the deviation, which also contributes to the perceived risk of the investor. However, it is been observed that investorsare more anxious about the deviationsbelow mean than deviationsabove the mean (Libbyand Fishburn, 1977). It is said that the behavior of downside risk aversion is theoretically consistent with the S-shaped utility function of the prospect theory of Kahneman and Tversky (1979) and Gul (1991). This utility function series believes that the investor's credence loss is greater than the benefit of its utility function. Therefore, investors oppose losses, not risk aversion. Estrada (2002) also disparaged the use of income differences as indicators of risk measurement for couple of reasons, namely the irregularity and the normality of returns. Variance is a good quality indicator of jeopardy when the distribution of returns is symmetrical and normal (Estrada, 2002).

Problem Statement

Asset valuation models (such as CAPM) are based on assumptions that are well-suited to developed market characteristics therefore; applicability of CAPM requires ideal markets whereas features of emerging markets have different characteristics. Model assumes that only systemic risk measures can explain the stock returns. The higher-order moment model broadens the definition of market risk, including not only the risk of covariance, also the risks of co-skewness and co-kurtosis.

Earlier Studies in the field of empirical capital asset pricing shows that the model could not found some favorable results even in the case of developed markets (e.g. Fama andFrench 1992, 1996). Several assumptions of the standard model found inconsistence and the weak theoretical basis were some of the reasons of those failures. Also ignorance of higher moments and behavior of investors about the downside risk measures contributed to the empirical collapse of the standard model (Naqvi, 2000; Estrada, 2002; Olmo, 2007).

On the basis of theory and according to the contextual point of view the ontological assumption of this study is:

> *"To examine the performance that how traditional, higher-moment and D-CAPM explains the stocks returns in developing equity markets of SAARC region and the most suited model for these markets also to analyze a premature feasibility about the integration of SAARC countries financial markets."*

Above mentioned ontological hypotheses are establish to empirically test different versions of the CAPM in conditional and unconditional settings to test which measure of the systematic risk is statistical significant for the sample equity markets.

Research Objectives

The purpose of this study is to examine and establish empirical validity of the traditional CAPM, higher-moment and downside risk model in emerging equity markets of SAARC countries and to examine the performance of these models so as the behavior of the four stock markets. The study is planned to accomplish the subsequent objectives in particular:

1. To test the validity of the traditional risk-based CAPM mechanism, upwards or downwards, in the equity market performance section of the emerging equity market of Pakistan.

2. Determine whether the downside risk model is better suited to explain the stock returns than the traditional and higher moment model in the selected equity markets.

Research Questions

In particular, the study responds to the followingresearch questions to get the stated objectives:

a) Does the traditional, higher-order moment and D-CAPM explain and predict cross-sectional changes in equity market returns in the emerging equity market of Pakistan?

b) Does the D-CAPM better explainthe stock returns thanthe traditional and the higher-moment model in the emerging stock market?

Literature review

Iqbal and Brooks (2007a) examined validity of the CAPM for the stocks listed on PSE (formerly KSE) for a period September 1992 to April 2006. In this study they have used individual stocks and portfolios based on size. Their study was a comprehensive one as they have used the daily, weekly and monthly data. To summarize it is concluded that there study favored the validity of the model. Though, they found a non-linear risk and return relationship. Furthermore, they reported a mature behavior of the PSE and positive risk premiums for investors were recorded.

Javid and Ahmad (2008) conducted a research to test the validity of the CAPM for the Pakistani stock market over the sampling period 1993 to 2004. They used daily and monthly returns data of 49 listed stocks. Their results were not in favor of unconditional version of the model but results were favoring the conditional model with variable market risk and risk premium. Variables of the business cycle were taken in the information set.

Hanif andUzair (2010) explored empirical validity of the model by using the time series regression. Results of the study were based on the sample of 60 stocks for a period from the 2003 to 2008. Outcomes of the study were significantly different from the expected return and the actual returns. They concluded that CAPM does not hold for Pakistani market, i.e. PSE. Akbar *et al* (2012) concluded that the downside risk based CAPM is the best among standard and higher order moment CAPM given there unconditional and conditional settings. They have used data of 313 stocks registered at KSE.

Qamar *et al* (2013) conducted a study for Pakistan Stock Exchange (PSE) by using a small data of 10 companies for five years and results were partially refuted as some of the sample periods showed some positive results but overall results are not in favor of the CAPM. One of the earliest empirical studies was conducted by Kraus and Litzenberger (1976) subsequently Rubinstein (1973). In the mentioned study authors have estimated a three-moment model by including another moment i.e. co-skewness. The estimated parameters of the model e.g. beta premium and

co-skewness premium appeared to be significant and signs were also in the line with the theory supporting the higher-moment CAPM. As according to the theory the sign of the co-skewness risk premium should be negative same was the case in this study.

Lim (1989) extended the earlier study of Kraus andLitzenberger (1976) by increasing the sample size from 1933 to 1982. In this study he divided sample into tensub-samples where each sub-sample consists of five years. Findings of the study recommended investors behavior which is in favor of co-skewness given that positive skewnessof market returns. Converse is not true.

Harvey and Siddique (1999) included time-dependent conditional skewness in their model to accommodate time varying means and variances. Their study was comprehensive in the sense that they have used high frequency data from the U.S., German, Japanese, Mexican, Chilean, Taiwanese and Thailand stock markets. Results of the study confirmed importance of autoregressive conditional skewness.

Harvey (2000) presented empirical evidence for inclusion of co-skewness as it was appreciably valued in investors' returns. Though, these factors have no role to play in developed stock markets. Study further suggested no positive and significant relationship in the model after inclusion of new higher moment as explanatory variables. One of the reasons in the study for failure of empirical validity of the model was presented as low level of integration in the developing markets. However, Harveyand Siddique (2000) in their study) for the developed market of U.S.A accounted support for undertaking investments with positive co-skewness.

Research Design

This research purposes the comparative analysis of empiricalperformance of the CAPM to explain the stock returns of Pakistan. Assumptions discussed in the previous sections have been empirically tested to achieve the objectives. We have used secondary timeseries monthly data of stock returns and market returns also macroeconomic variables data is obtained from several official sources hence study is quantitative in nature. Sample has been chosen by size means firms having the larger market capitalization is mainly be the part of the sample hence representative samples been chosen. Assuming models normative than descriptive to implement several statistical tests. This is in line with the previous work of Fama and MacBeth (1973), Fama andFrench (1992), Kothari et al (1995), Javed et al (2008, 2009), Iqbaland Brooks (2007b)

, Raza et al (2011) and Akbar et al (2012). In detail research methodology has been the subject matter of this chapter.

Population

Pakistan Stock Exchange (PSE) is merely the stock exchange of the country hence it is taken as the demonstrative one which has 573 registered companies divided into 35 different sectors. Lastly, the Colombo Stock Exchange (CSE) which is the only stock exchange of the country and is having 294 registered companies comprises of twenty (*20*) business sectors. The details of selected stock exchanges with listed companies are given below in table 4.1.

Table 4.1: Summary about Selected countries equity markets

Country	listed companies	Market value ($ Million)	Brokers	Stock exchanges	Equity Turnover ($ Million)
Pakistan	573	43,676	261	1	13,675.0

Source: Asian development Bank (ADB), 2016 & SAARC Finance 2017.

Sample

Out of the above population sample selection has been made by using three criteria:

(1) Continuous listing of companies for the whole analysis period.

(2) All the important sectors are covered in the sample.

(3) Companies with higher turnovers have been considered.

Data

The stock prices data is obtained from using several different sources but mainly by using the official websites of the concerned stock exchange and for conditional information set macroeconomic variables also have been used and Table 3 displays a detailed picture of the variables used and there source from where they have been taken. Market weighted indices for each stock have been used as a proxy for market portfolio Table 4 below have detailed description. All of these indices are having higher (80% or above) market capitalization.

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Table 4.2: Data and Sources

Variables	Definition	Source
Market returns	These are the market index based on the most consistent/active stock; there are different criteria for the selection of market index. These indices are the proxy for market returns.	Websites of respective stock exchange, *PSE*.
Manufacturing Output Index	This index is composition of real production output of industries, utilities etc normally Fisher indexes are used for estimations.	Official monthly reports available and published by Central Banks, Ministry of Finance or Economic Affairs. *WDI* and *IFS*.
Call Money Rate	Interest on short-term loans.	Official monthly reports available and published by Central Banks, Ministry of Finance or Economic Affairs. *WDI* and *IFS*.
T-Bill rate	A short-term debt obligation backed by the Government	Official monthly reports available and published by Central Banks, Ministry of Finance or Economic Affairs. *WDI* and *IFS*.
Oil Price Index	Composition of crude oil prices as price shown in terms of USD as it plays the most influential role in economic development.	OPEC Website
Foreign Exchange Rate	Price of domestic currency expressed in terms of other currency, normally USD is the other currency as in case of the present study.	Official monthly reports available and published by Central Banks, Ministry of Finance or Economic Affairs. *WDI* and *IFS*.
Stock returns	Stock returns are returns that the investors gained from the stock market. These returns could be in the form of profit through trading or in the form of dividends.	Official websites of respective stocks and the data of Pakistan and Sri Lanka are provided by *Prof. Dr. Lieven DE MOOR (VUB, Belgium).*

Table 4.3: Information of market indices

Name of the stock	Name of the market Index
Pakistan Stock Exchange (PSE), Pakistan.	KSE 100 index

Monthly stockreturns are calculated frommonthly stock prices data as:

$$\boldsymbol{R_{it} = ln\left(\frac{S_{it}}{S_{it-1}}\right)}$$

Where $R_{it}$the month end is returnson stock 'i'S_{it} is the month-end cost of stock 'i', S_{it-1} is the last month-end price of stock 'i' and *ln* is the natural log. Correspondingly the month to month

return available portfolio i.e. the KSE100 index/ BSE 500/ASPI/DSEX are determined as pursues:

$$\boldsymbol{R_{mt} = ln\left(\frac{Market\ Index_t}{Market\ Index_{t-1}}\right)}$$

In the above equation $Market\ Index_t$ is the value of the concerned market index at the end of month and $Market\ Index_{t-1}$ is the month end price of the index in the previous month. *ln* is the natural log. 91-days (or 3-month) Treasury-bill rate (T-bill rate) is used to proxy the risk free rate.

Portfolio Formation Procedure

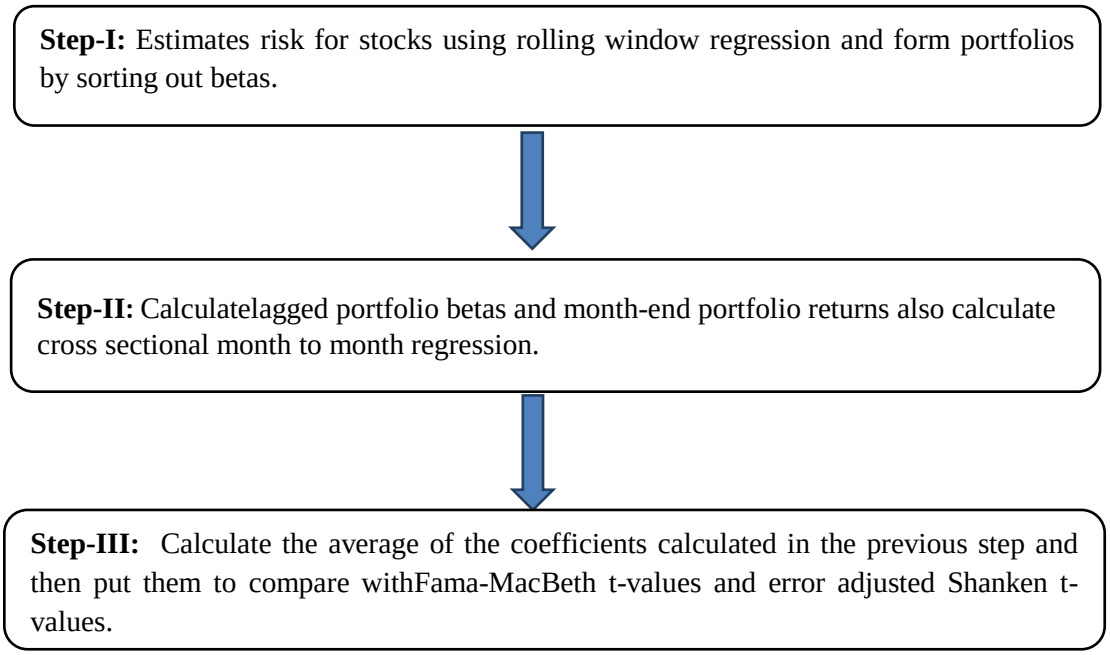
Present study used the standard Fama-MacBeth (1973) methodology for empirical estimations. Same methodology used by Javid (2008, 2009), Iqbaland Brooks (2007b) and Akbar et al (2012).

Use of portfolios instead of individual stock was proposed by Blume (1970), Friends and Blume (1970), Black et al (1972) and Fama andMacBeth (1973) to avoiderror-in-variable issue for testing. Fama and French (2003) suggested the use of month to month regression coefficients in the testing of the model while using Fama-MacBeth procedure to tackle with the standard errors in mean and to consider allestimation errors. Recent literature supports our proposition of using portfolios e.g. Fama and French (1992, 1993), Davis (1994), Kothari et al (1995), Iqbal andBrooks (2007), Attaullah et al (2011) and Akbar et al (2012). However, as mentioned previously that we have assumed model normative which is contrary to the Iqbal and Brooks (2007b),Javid (2008, 2009) and Attaullah et al (2011).

Econometric Methods

Since there are five diverse versions of model, indicated in the hypothetical system, the econometric particular of every evaluating model is different. In this way, the econometric demonstrating for every model is given independently underneath.

The renowned Fama-MacBeth (Fama and MacBeth, 1973) methodology has been used and is depicted the summary of it in the figure 4.1 below as:



Econometric Specifications of Unconditional Higher-Moment Model

Unconditional higher moment model add additional explanatory variables in the form of covariance, co-skewnessand the risks of co-kurtosis (beta, lamda and gamma) are approximated for each stock. 36month rolling window regression is used to estimate the highest moments with GMM asestimation method. Theeconometric specification of the model used to estimate theUnconditional highermoment CAPM is the cubicmodel of Fangand Lai (1997) as:

$$\boldsymbol{R_{it} = \alpha + \hat{\beta}_{imt}(R_{mt}) + \hat{\gamma}_{imt}(R_{mt})^2 + \hat{\delta}_{imt}(R_{mt})^3 + \mu_t}$$

The unconditional models' specification of equation 4.8 measures the risk of co-skewness as$\hat{\gamma}_{imt}$ and risk of co-kurtosis as$\hat{\delta}_{imt}$. To estimate GMM parameters, instrumental variable were added in the form of surplus market return and lagged surplus market returns. 4.8 can be extended to include the terms ARMA to solve the problem of autocorrelation.

The detail of cross-sectional regressions as follows:

$$\boldsymbol{R_{pt} = \hat{\eta}_0 + \hat{\eta}_1\beta_{pmt-1} + \hat{\eta}_2\gamma_{pmt-1} + \hat{\eta}_3\delta_{pmt-1} + \varepsilon_{pt}}$$

$\hat{\eta}_0$, is the intercept term$\hat{\eta}_1$, $\hat{\eta}_2$ and $\hat{\eta}_3$ are the risk premiums. The hypotheses set in to test the unconditional higher-moment CAPM formulated by averaging the coefficients and then put them to test, following are the tested hypotheses:

$\hat{\eta}_0 = 0$, intercept term is insignificant.

$\hat{\eta}_1 > 0$, risk premium for systematic risk is positive and significant.

$\hat{\eta}_2 < 0$, risk premium for co-skewness risk is negative and significant.

$\hat{\eta}_3 > 0$, risk premium for co-kurtosis risk is positive and significant.

Econometric Specifications of Downside Risk Based Model

Specifications for the downside risk based model are reliable with that of genuine CAPM. To get the estimates of this model 36 month rolling window regression is used for the following equation using GMM. Same instrumental factors were used discussed in the previous sections. The estimation of D-CAPM is given as:

$$\mathbf{min}[\mathbf{0}, \boldsymbol{R_{it}}] = \boldsymbol{\alpha} + \boldsymbol{\beta_{imt}^{D}}\,(\mathbf{min}(\mathbf{0}, \boldsymbol{R_{mt}})) + \boldsymbol{\mu_t}$$

β_{imt}^{D} is for downside risk that is in consistent with Estrada (2002). In order to overcome the problem of autocorrelation the appropriateARMA terms were included to expand the model accordingly.

After this we have formed portfolios as did in earlier cases So for each portfolio there is a lagged portfolio beta which would be the average beta of individual securities as this is the mentioned standard methodology of Fama and MacBeth (1973), Then a monthly cross sectional regression on diversified betas in the portfolio is estimated as follows:

$$\boldsymbol{R_{pt}} = \boldsymbol{\hat{\omega}_0} + \boldsymbol{\hat{\omega}_1 \beta_{pmt}^{D}} + \boldsymbol{\varepsilon_{pt}}$$

$\hat{\omega}_0$ shows intercept term, $\hat{\omega}_1$ is the market risk premium for the downside risk. To over whelmed the difficulty of heteroscedasticity, white heteroscedasticity are used the estimate equation 4.16. same equation is also estimated with GLS in cross-sectional regression. Square betas serve as an instrument variable because the GLS methodrequires that the weighting variable is not negative. More specific are the following assumptions were tested to determine the empirical validity of the model:

$\hat{\omega}_0 = 0$, intercept term is statistically zero.

$\hat{\omega}_1 > 0$, Market risk premium for downside risk is positive and significant.

DATA ANLAYSIS & EMPIRICAL RESULTS

This section introduces the most important findings and conclusions in the assessment of asset pricing models specified in previous section. Section discusses different descriptive statistics the variables in each asset pricing model for empirical evaluation. Then empirical results of statistical tests of embedded hypotheses in each model provided in the tables. Models are

evaluated in sub-sample periods and alternatives evaluation method (heteroscedastic-consistent white standard error and covariance and GLS).

Empirical Findings of Pakistan Stock Exchange (PSE)

Table 5.4 shows the results of unconditional CAPM for Pakistan equity market i.e. Pakistan Stock Exchange (PSE), which is the only official stock market of the country now. The hypothesis embedded from equation 4.4 about the intercept term that *the intercept term is zero and insignificant* appeared to be significant but non-zero for the whole sample period 2018-2023. Sub-sample period 2018-2020 and 2021-2023 also showed significant but non-zero results whereas these results have to be insignificant.

The unimportant intercept term centrals to the deduction that the market risk is solely explained by systematic risk of the end of month returns on the portfolios and hence there are no omitted variables in the analysis. Also demonstrates that there is no mispricing of the securities in the respective stock exchanges if the intercept term in the equation 4.4 is zero.

The second hypothesis driven from equation 4.4 is that *the market risk premium is positive and significant.* This hypothesis holds for the whole sample period as the value is positive and significant as per the hypothesis anticipated.

Hypotheses embedded from equation 4.5 were *zero and insignificant intercept term and positive and significant market risk premium*. If we analyse the table 5.2 for the second hypothesis we come to know that the positive risk premium found significant and for the entire sample period and the important thing is that for the whole sample period shows some significant risk premium for the systematic risk beta.So, a better performance of the CAPM appeared in case of Pakistan as well. One of the reason is that after 2008political stability has been seen in the country that added by the suitable environment for the financial institutions like banks, insurance companies etc. Another reason could be the merger of stock exchanges into one prime stock market, PSE previously known as Karachi Stock Exchange (KSE). The other important thing is that the data we have used by far the largest data set compare to other studies for Pakistan except the study of Akbar et.al (2012) which used 313 stocks whereas in present study we have used 340 so that could be one reason as well.

The inclusion of non-linear term though, suggests a weak empirical validity which is in line with the earlier studies of (Javed, 2008, 2009; Akbar et.al 2012; Yasmeen et. al, 2012).The value of $R^2$is 0.329 i.e. 39% in case of the inclusion of non-linear term in the model for the whole sample period that can be interpreted as the total variation in the model is being determined 32% by the explanatory variables, which in case of financial data is not too low. Whereas this value is 32% in case of non-inclusion of the non-linear term that is in line with the other notable studies for the developing equity markets (Javed, 2008, 2009; Akbar et al, 2012).

To sum up, we achieved that this study reports empirical support in favor of unconditional CAPM for the Pakistan Stock Exchange (PSE) during the study period i.e. Jan 2018 to Dec 2023 with the given conditions and assumptions of the standard model. It may be suggested for the future research that the daily returns can be used for the empirical validity of the model.

Table 5.4: Average Risk Premium for Unconditional CAPM, Pakistan Stock Exchange, (Pakistan)

Sample Period	$R_{pt} = \hat{\lambda}_0 + \hat{\lambda}_1 \beta_{pmt-1} + \varepsilon_p$			$R_{pt} = \hat{\lambda}_0 + \hat{\lambda}_1 \beta_{pmt} + \hat{\lambda}_2 \beta_{pmt}^{\ 2} + \hat{\lambda}_3 \sigma_{\epsilon_{pt-1}} + \epsilon_p$				
	$\hat{\lambda}_0$	$\hat{\lambda}_1$	R^2	$\hat{\lambda}_0$	$\hat{\lambda}_1$	$\hat{\lambda}_2$	$\hat{\lambda}_3$	R^2
2018-2023	0.01*** (1.54) [1.50]	0.02** (2.22) [2.20]	0.26	0.02** (1.96) [1.80]	0.40** (1.94) [1.04]	-0.01* (-1.83) [-1.72]	0.00 (1.30) [1.31]	0.27
2018-2020	0.03* (3.43) [3.40]	0.01 (0.51) [0.50]	0.30	0.01 (0.32) [0.68]	-0.02** (-1.50) [-1.10]	0.01 (0.40) [0.60]	0.00 (0.20) [0.31]	0.24
2021-2023	0.02** (2.19) [2.54]	0.04* (3.49) [1.40]	0.29	-0.01* (-1.90) [-1.01]	0.08*** (1.49) [1.18]	0.17* (2.63) [1.58]	0.00*** (1.45) [1.38]	0.37

*Note: Average coefficient values are followed by Fama-MacBeth t-values and Shanken error adjusted t-values. * Shows significance at 1 percent level ** shows 5 percent and*** shows 10 percent level.*

5.3 Empirical results of Unconditional Higher-Order Moment CAPM

The following sub-sections discuss the descriptive statistics of the unconditional CAPM also the Estimated results and findings have been discussed.

5.3.1 Description of the Data

Descriptive returns statistics, unconditional systematic risk, unconditional co-asymmetry the unconditional risk and co-kurtosis risk of portfolios in the beta of the high moment unconditional model . Statistics of unconditional portfolio betas are estimated on the basis of a higher moment the statistics are shown in Table 6, Appendix A. These portfolio bonds are obtained with equal weighting individual shares in each portfolio.It should be noted that most portfolios, with the exception of portfolios 22 to 29 have an unconditional negative co-kurtosis. Jarque-Bera's statistics show that normally distributed risk premiums.

5.3.5 Empirical results of Unconditional Higher-Order Moment CAPM for Pakistan Stock Exchange, Pakistan

Table 5.12 shows the results of unconditional higher-moment CAPM for Pakistan Stock Exchange (PSE). In this study as mentioned we tried to empirical estimate and check the validity of the CAPM and its variants. In the same effort we found results for PSE which shows that intercept terms appeared to be significant but zero for the whole as well in all sub-sample periods it has to be zero as per the set hypothesis but it is in case of PSE. The entire sample period shows a non-zero intercept but significant.

The covariance risk premium is found positive and significant in sub-sample period 2018-2023 and 2018-2020 and in case of sub-sample periods 2021-2023 it is positive but not significant. It has to be negative theoretically (Javed, 2008,2009; Akbar et al 2012) also it is significant at 10% level of significance.

Wolfleand Fuss (2010) revealed similar results about the unconditional higher-moment model for the Korean stock market. The results of higher moment model analyzed in this study is consistent with Hung et al. (2004).

Remittances Review
April, 2024
Volume: 9, No: 2, pp.3810-3836
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Table 5.12: Average Risk Premium for Unconditional CAPM, Pakistan Stock Exchange (Pakistan)

Sample Period	$R_{pt} = \hat{\eta}_0 + \hat{\eta}_1\beta_{pmt-1} + \hat{\eta}_2\gamma_{pmt-1} + \hat{\eta}_3\delta_{pmt-1} + \varepsilon_{pt}$				
	$\hat{\eta}_0$	$\hat{\eta}_1$	$\hat{\eta}_2$	$\hat{\eta}_3$	R^2
2018-2023	-0.02** (1.67) [1.64]	0.02* (2.55) [2.44]	0.01 (1.05) [1.04]	0.01* (1.98) [1.98]	0.24
2018-2020	0.04* (4.25) [1.58]	0.002** (1.85) [1.80]	0.01* (2.08) [1.94]	0.001 (-0.30) [-0.30]	0.29
2021-2013	-0.01*** (-1.39) [-1.37]	0.01 (0.88) [0.88]	0.00 (-1.13) [-1.09]	0.02** (1.78) [1.78]	0.31

*Note: Average coefficient values are followed by Fama-MacBeth t-values and Shanken error adjusted t-values. * Shows significance at 1 percent level ** shows 5 percent and*** shows 10 percent.*

5.5 Empirical results of Downside Risk Based CAPM (D-CAPM)

The following sub-sections discuss the descriptive statistics of the downside risk based CAPM also the estimated results and findings have been discussed. In the present study we have used Estrada (2002) version of D-CAPM

Description of the Data

The average of downside betas are the average of the individual stocks. Anyway, the average return of the sample portfolios are negative and therefore suggest the negative distribution of the portfolio returns. Jarque-Bera statistics suggest that most returns are not normally distributed.

Empirical results of Downside CAPM for Pakistan Stock Exchange, Pakistan

Table 5.19 shows the same behaviour of the results of intercept term even in case of D-CAPM, we have used Estrada (2002) version for empirical validity, the intercept terms appeared to be significant but non-zero but if we see in case of the whole sample period for PSE the intercept is almost zero up to two decimal points. Sub-sample periods 2018-2020 have shown significant but negative results. Value of R^2 has shown 47% results for the entire analysis period which is quite elaborating as mentioned in the previous sections as well that the financial time series supposed to be showing around 40 to 50% coefficient of determination results (Akbar et al, 2012).

To sum up, in case of PSE we have found empirical validity of the downside risk based CAPM given the sample set and analysis period.

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Table 5.20: Average Risk Premium for Downside Risk Based CAPM, Pakistan Stock Exchange (Pakistan)

Sample Period	$R_{pt} = \hat{\omega}_0 + \hat{\omega}_1 \beta^D_{pmt} + \varepsilon_{pt}$		
	$\hat{\omega}_0$	$\hat{\omega}_1$	R^2
2018-2023	0.03*** (1.40) [0.75]	0.002 (-0.65) [-0.35]	0.33
2018-2020	-0.01** (-1.88) [-1.78]	-0.01*** (-1.45) [-1.20]	0.36
2021-2023	0.01* (2.39) [2.27]	0.01* (2.44) [2.14]	0.35

*Note: Average coefficient values are followed by Fama-MacBeth t-values and Shanken error adjusted t-values. * Shows significance at 1 percent level ** shows 5 percent and*** shows 10 percent.*

5.6 Discussion

This study is conducted to determine the empirical validity of traditional CAPM, higher-order moment model and the downside risk based CAPM (D-CAPM) in emerging equity market of Pakistan. The stocks data is collected from companies listed on respective exchanges and their respective market indices (market portfolio) were used during the reporting period from Jan 2018 to Dec 2023. The results showed mostly unclear evidence of the empirical validity of property prices consider. The results of the traditional CAPM are failed to satisfy the statistical tests provided unconditional settings in conditional settings we have found a better performance of the model in case of all markets. The outcomes of this study are in line with the previous studies. Like Harvey (1995), Lettau andLudvigson (2001), Iqbal et al (2007) and Javid et al (2008, 2009) and Akbar et al (2012). Emerging markets such as KSE, CSE and DSE are characterized by unpaid returns, transaction costs and higher taxes, asymmetries of information, etc. In addition, the results of this study suggestthat non-linear systemic risk and the residual risk is not statistically significant for the full price and the part sampling. It does not matter; Using GLS as anestimation technique in cross-sectional regression, results were discovered Non-linear systemic risk is negative and statistically significant according to the sub-sample the period. The systemic risk of covariates is positive and substantial next the results suggest that the R^2 value issignificantly improved if GLS is used as an estimate technique in transversal regression. It has been found that the results of the traditional model in conditional settings are better fit compare to that applied to traditional in unconditional environments. It is also located the results of the unconditional standard model are robust thanks to the choice of the estimate methodology. The results of the study are similar to those of Harvey (1995), Lettau andLudwigson (2001), Iqbaland Brooks (2007) and Javid (2008, 2009). Pursuing markets, as mentioned above, characterized by poorly distributed returns, transaction costs and higher taxes,asymmetries of information, etc.

Adhikari (2015). Determinants of Systemic Risk for Companies Listed on Nepal Stock Exchange. Global *Journal of Management and Business Research*: Finance 15 (5).

Agren, M. (2006). Prospect Theory and Higher Moments. Working paper 2006:24, Department of Economics, Uppsala University, Uppsala, Sweden.

Ahmad, E. and Badar-uz-Zaman (1999).Volatility and Stock Return at Karachi Stock Exchange. Pakistan Economic and Social Review, 37(1), pp. 25–37.

Akber et al (2012), The Myth of Downside Risk Based CAPM: Evidence from Pakistan. Interdisciplinary journal of contemporary research in business,4(6), pp. 860-869.

Ang, A., Chen, J. and Xing, Y. (2001). Downside Risk and the Momentum Effect. Working Paper 8643, National Bureau of Economic Research, Massachusetts.

Ang, A., Chen, J. and Xing, Y. (2006). Downside Risk. Review of Financial Studies, 19, pp. 1191-1239.

Ansari, V. (2000). Capital Asset Pricing Model: Should We Stock Using It?. Vikalpa, 25(1), pp.55-64.

Artavanis, N., Diacogiannis, G. and Mylonakis, J. (2010). The D-CAPM: The Case of Great Britain and France. International Journal of Economics and Finance, 2(3), pp. 25-38.

Asian Development Bank. https://www.adb.org/

Ajibola, Kunle and Prince C (2015). Empirical Proof Of The CAPM With Higher Order Co-Moments In Nigerian Stock Market: The Conditional And Unconditional Based Tests. Journal of Applied Finance & Banking. 5(1).pp. 151-162 ISSN: 1792-6580 (print version), 1792-6599 (online).

Basu, D. and Chawla, D. (2010). An Empirical Test of CAPM-the Case of Indian Stock Market. Global Business Review, 11(2), pp. 209-220.

Bawa, V. and Lindenberg, E. (1977). Capital Market Equilibrium in a Mean-Lower Partial Moment Framework. Journal of Financial Economics, 5(2), pp.189-200.

Bajpai and Sharma (2015). An Empirical Testing of Capital Asset Pricing Model in India. Procedia - Social and Behavioral Sciences 189. pp.259 – 265.

Bekaert, G. and Harvey, C. (2002). Research in Emerging Markets Finance: Looking to the Future. Emerging Markets Review, 3, pp. 429-448.

Black, F. (1972). Capital Market Equilibrium with Restricted Borrowing. Journal of Business, 45(3), pp. 444-454.

Bollerslev, T., Engle, R. and Wooldridge, J. (1988). A Capital Asset Pricing Model with Time Varying Covariances. Journal of Political Economy, 96, pp. 116-131.

Campbell, J. and Vuolteenaho, T. (2004). Bad Beta, Good Beta. American Economic Review, 94, pp. 1249-1275.

Chang, B., Christoffersen, P. and Jacobs, K. (2010). Market Volatility, Skewness, and Kurtosis Risks and the Cross section of Stock Returns. Working Paper, McGill University.

Cheremushkin, S. (2011). Internal Inconsistencies of Downside CAPM Models. Electronic Journal of Corporate Finance, 4(20), pp. 90-111.

Copeland, T., Weston, J. and Shastri, K. (2009). Financial Theory and Corporate Policy. 4th Edition, Pearson Education Inc., Delhi, India.

Markets. Financial Analysts Journal, 52 (3), pp. 71-76.

Dittmar, R. (2002). Nonlinear Pricing Kernels, Kurtosis Preference, and Evidence from the Cross section of Equity Returns. Journal of Finance. 57(1), pp. 369-403.

Econometrica, 50, pp.987-1007.

Estrada J. (2000). The Cost of Equity in Emerging Markets: A Downside Risk Approach. Emerging Markets Quarterly, 4, pp. 19-30.

Fama, E. and French, K. (1992). The Cross section of Expected Return. Journal of Finance, 47(2), pp. 427-465.

Fama, E. and French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, 33, pp. 3-56.

Fama, E. and French, K. (1996). Multifactor Explanations of Asset Pricing Anomalies. Journal

of Finance, 51, pp. 55-84.

Galagedera, D. and Brooks, R. (2005). Is Systematic Downside Beta Risk Really Priced? Evidence in Emerging Market Data. Working Paper 11/05, Department of Econometrics and Business Statistics, Monash University, Australia.

Hanif, M. and Uzair, B. (2010). Validity of Capital Asset Pricing Model: Evidence from KSE Pakistan. European Journal of Economics, Finance and Administrative Sciences, 20, pp. 140-

Hassan, M. Z. et al. (2012). Relationship between risk and expected returns: Evidence from the Dhaka stock exchange. Proc. Econ. Finance. 2: 1-8.

Haroon, M. (2005). Trend Analysis of Karachi Stock Exchange: A Case Study of Ten Years (1992-2002). Unpublished Manuscript, Hamdard Institute of Management Sciences, Hamdard University, Karachi.

Harvey, C. and Siddique, A. (2000).Conditional Skewness in Asset Pricing Tests. Journal of Finance, 55, pp. 1263-1295.

Hui, G. and Christopher, N. (2008). Investigating the Intertemporal Risk-Return Relation in International Stock Markets with the Component GARCH Model. Economics Letters, 99(2), pp. 371-374.

Hung, D., Shackleton, M. and Xu, X. (2004). CAPM, Higher Co-moment and Factor Models of UK Stock Returns. Journal of Business Finance and Accounting, 31, pp. 87-112.

Iqbal, J. and Brooks, R. (2007a). A Test of CAPM on the Karachi Stock Exchange. International Journal of Business, 12(4), pp. 429-444.

Iqbal, J. and Brooks. R. (2007b). Alternative Beta Risk Estimators and Asset Pricing Tests in Emerging Markets: the Case of Pakistan. Journal of Multinational Financial Management, 17, pp. 75-93.

Jagannathan, R. and Wang, Z. (1996). The Conditional CAPM and the Cross section of Expected

Return. Journal of Finance, 51(1), pp, 3-53.

Javid, A. (2008). Time Varying Risk Return Relationship: Evidence from Listed Pakistani Firms. Journal of Scientific Research, 22(1), pp. 16-39.

Javid, A. (2009). Test of Higher Moment Capital Asset Pricing Model in Case of Pakistani Equity Market. European Journal of Economics, Finance and Administrative Sciences, 15, pp. 144-162.

Khwaja, A. and Mian, A. (2005). Unchecked Intermediaries: Price Manipulation in an Emerging Stock Market. Journal of Financial Economics, 78, pp. 203-241.

Kongtoranin, T. (2007). Comparison of CAPM Models in Stock Exchange Thailand: Evidence in 2000 to 2006. School of Management, Assumption University. Available at: http://academicpapers org/ocs2/session/Papers/C8/939-1465-1-RV.pdf

Kothari, S., Shanken, J. and Sloan, R. (1995). Another Look at the Cross section of Expected Stock Returns. Journal of Finance 50(1), pp. 185-224.

Lee, W. and Rao, R. (1989). Asset Pricing in a Generalized Mean-Lower Partial Moment Framework: Theory and Evidence. The Journal of Financial and Quantitative Analysis, 24(3), pp. 285-311.

Lintner, J. (1965). The Valuation of Risk Assets and Selection of Risky Investments in Stock

Markowitz, H. (1952). Portfolio Selection. The Journal of Finance, 7, pp. 77-91.

Merton, R. (1973). An Intertemporal Capital Asset Pricing Model. Econometrica 41(5), pp. 867–87.

Miller, M. and Scholes, M. (1972). Rates of Return in Relation to Risk: A Reexamination of Some Recent Findings. In M. C. Jensen (ed.) Studies in the Theory of Capital Markets. New York: Praeger.

Post, T. and van Vliet, P. (2006). Downside Risk and Asset Pricing. Journal of Banking And Finance, 30(3), pp. 823-849.

Rahman and Baten (2006), An Empirical Testing of Capital Asset Pricing Model In Bangladesh. Journal of Research (Science), 17(4) pp. 225-234.

Rahman, Baten and Alam (2006). An empirical testing of Capital Asset Pricing Model in Bangladesh. Journal of Applied Sciences 6(3). pp: 662-667.

Raheja (2014). CAPM – Empirical Study of NSE stocks. INDIAN JOURNAL OF APPLIED RESEARCH. 4(4).| ISSN - 2249-555X 129-130.

Raza, S., Jawaid, S., Arif, I. and Qazi, F. (2011). Validity of Capital Asset Pricing Model in Pakistan: Evidence from Karachi Stock Exchange. African Journal of Business Managment,5(32), pp. 12598-12605.

Qamar, Rehman, Shah (2013). Applicability of Capital Assets Pricing Model (CAPM) on Pakistan Stock Markets. International Journal Management Review, 4(1), 1-9.

Roll, R. (1977). A Critique of the Asset Pricing Theory's Tests; Part I: on Past and Potential Testability of the Theory. Journal of Financial Economics, 4, pp. 129-176.

Ross, S. (1977). Return, Risk and Arbitrage. In Friend I. and Bicksler, J. (Eds.), Risk and Return in Finance, Vol (1), Massachusetts: Ballinger, pp. 189-218.

Shanken, J. (1990). Intertemporal Asset Pricing. Journal of Econometrics, 45, pp. 99-120

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. Journal of Finance, 19, pp. 425-442.

Sonal (2016). Higher Order Moments Based Models to Evaluate the Performance of Mutual Funds: Indian Evidence. IUP Journal of Applied Finance. 22(3).

Tang, G. (1998). Monthly Pattern and Portfolio Effect on Higher Moments of Stock Returns: Empirical Evidence from Hong Kong. Asia-Pacific Financial Markets, 5(3), pp. 275–307.

Tobin, J. (1958). Liquidity Preferences as Behaviour Towards Risk. Review of Economic Studies, 25, pp. 65–86.

Wolfle, M. and Fuss, R. (2010). A Higher-Moment CAPM of Korean Stock Returns. International Journal of Trade and Global Markets, 3(1), pp. 24-51.

Yartey, C. (2008). The Determinants of Stock Market Development in Emerging Economies: Is

South Africa Different, Working Paper No. 08/38, International Monetary Fund, Washington D.C.

Xue, H. and Zhou, H. (2001). Empirical Test of CAPM in Shanghai Stock Exchange. Research on the Financial and Economics Issues, 11, pp. 33-37