TWO-PASS MODEL OF CAPM: EVIDENCE FROM PAKISTAN STOCK EXCHANGE

Ruqia Shaikh, Dr. Sarfaraz Ahmed Shaikh, and Muhammad Usman

ABSTRACT

This research study analyzes the variation in monthly returns of securities for companies listed in Pakistan Stock Exchange-PSX (Formerly known as KSE). The Capital Asset Pricing Model (CAPM) of SLB has provided a method for researchers and experts to forecast the risks and returns. The main purpose of CAPM is to estimate beta of security to explain how much security is aligned or sensitive with the movement or changes in the market return. The research is conducted by means of monthly market capitalization of companies; portfolios are formed and the role of idiosyncratic risk in explaining the variations in the stock returns have been studied. With the same portfolios, the relationship of risk and return relationship has also been analyzed. This empirical analysis is conducted for the period of May 2010 - April 2014. Data analysis reveal that the idiosyncratic risk is a significant factor in explaining the stock returns. Capital Asset Pricing model is rejected in this study context because of positive and significant intercept in all portfolios. The research findings strongly support Chan and Chui (1996) and Strong and Xu (1997), assertions that the relationship between beta and security returns is weak. Therefore, CAPM is an empirically anemic model to be used in the Pakistani market.

Keywords: *Capital Asset Price Modelling; CAPM; Stock Returns; Pakistan Stock Exchange (PSX), Idiosyncratic Risk.*

INTRODUCTION

The Capital Asset Pricing Model (CAPM) of SLB (Sharpe, 1964; Lintner, 1975; Black, 1972), has formed a method for researchers and experts to have a look at risks and returns. The main purpose of CAPM is to estimate the beta of security to explain how much security is aligned or sensitive with the movement or changes in the market return. This SLB model can estimate the equity cost and evaluate the size of hedging contracts to be sold for the hedging of an equity portfolio. The model can measure the abnormal returns on assets and the performance of a diversified portfolio.

The standard form of CAPM provides a clear description of capital market behavior provided its basic assumptions are reliable (De Luca, 2018). The popularity of Capital Asset Pricing Model lies in the element that the risk of any asset is measured through the covariance between market return on portfolio and the return of an asset itself. There is an assumption in the SLB model that the only efficient portfolio is the market portfolio which holds all the risky assets. Investors have lots of opportunities to form a well-diversified portfolio which is in fact not a rational assumption and is difficult to implement in the practical world. Many researchers have supported the Capital Asset Pricing Model through their research studies. Black (1972), found that the beta can work as a single factor to explain the variation in the cross-section of stock returns. Similarly, Fama and MacBeth (1973), followed the findings of Black (1972), and asserted that the beta explains the cross-section of returns of securities. However, Blume and Friend (1973), have not supported the Capital Asset Pricing Model in their research design. Similarly other studies have also rejected Capital Asset Pricing Model in their research context e.g. (Elshqirat, 2018; Basu, 1983; Lakonishok & Shapiro, 1986; Ritter & Chopra, 1989; Fama & French, 1992; Fama & French, 1993; Fama & French, 1996; Miles & Timmermann, 1996; Morelli, 2003; Simlai, 2009). Comparably, in the context of Pakistan, Shaikh, Shaikh, and Shaique, (2017); Syed, Imtiaz, and Fahim (2011), conducted a test on validity of CAPM in PSX (Pakistan Stock Exchange) and found CAPM as a valid model to accurately predict the security returns in the short term investment as compared to the long term investment. However, Mirza and Reddy (2017), observed the validity of CAPM on PSX (Pakistan Stock Exchange) in their study and found it an invalid model to determine the returns of securities. Similarly, in another study conducted by Iqbal and Brooks (2007), to test the validity of CAPM on PSX and found a nonlinear relationship of risk and return, intensively in recent period because of the market performance supported by intensive trading activity and elevated level of liquidity.

The above empirical discussion and evidence conclude that the estimated results provided by CAPM with a single factor of market risk cannot explain the cross-sectional variation in the returns of securities. There is an ample discussion on the linearity of risk and return relationship in the earlier studies and many researchers have questioned this relationship. Up till now the literature of finance and accounting could not find a reasonable and logical conclusion about risk and return relationship that either it is linear or nonlinear in nature. Thus, the first objective of this study is to check the linearity of the risk-return relationship. To check this relationship, we have used a two-pass regression method. It is observed that the investors are compensated for bearing risk, that is systematic or non-diversifiable because another risk named idiosyncratic risk can be eliminated through diversification of portfolios. But in practice, it is not possible for investors to always hold a fully diversified portfolio; rational investors always claim a price of risk or premium which is an idiosyncratic risk. Pukthuanthong-Le and Visaltanachoti (2009), conducted a cross country analysis on idiosyncratic volatility and stock returns and found that the idiosyncratic volatility has a positive relationship with stock returns. These findings are found statistically significant in thirty-six countries from 1973 to 2007. However, in Pakistan, there is a minimal investigation carried on the importance of idiosyncratic risk in determining the security's return.

In this context, the second objective of this study is to investigate whether systematic risk explains the security's return in the context of Pakistan. To investigate the influence of unsystematic risk on the returns of securities, we have segregated the total risk into two parts systematic and nonsystematic risks and check the significance of both factors independently.

LITERATURE REVIEW

Research study investigated by Black (1972), used monthly return on securities listed in the New York Stock Exchange (NYSE) for the period of 1931 to 1965 and formed ten portfolios on the basis of beta. In each portfolio, the investors decide on the basis of their risk preferences, if the investors are risk averse, they will select low beta portfolios and if the investors are risk seekers, they will select high beta portfolios. Black found that the portfolios with lower risk have positive alpha and high-risk portfolios have lower or negative alphas. In this way, three out of ten portfolios statistically significantly violated the zero intercept hypotheses in the time-series tests.

Additionally, Fletcher (1997), found that there is no effect of the size of the firm on UK security returns and concluded that the only market risk (beta) is valid to explain cross-sectional variation in the security returns. Blume and Friend (1973), conducted a study on the linearity of risk and return relationship and concluded that this relationship between risk and return is questionable. In contrast, Basu (1983), found that the firms having higher earning to price ratio (E/P) earn higher returns, which are risk-adjusted than firms with lower earnings to price ratio. Furthermore, the size effect evaporates when risk and earning price ratio difference is adjusted and controlled for the return of security. Lakonishok and Shapiro (1986), proclaimed that neither the market risk (beta) nor deviation of market returns can explain the cross-sectional variation in security's returns, whereas the size is the only factor that plays an important role in explaining the returns. Similarly, Ritter and Chopra (1989), conducted a research study on the same subject and concluded that there is no cross-sectional relation between market risk and return. Chan and Chui (1996); and Strong and Xu (1997), followed the Fama and French (1992), approach and found that the relationship between market risk and returns is weak. Relatedly, Fama and French opposed the CAPM model in their 1992, 1993 and 1996 studies. In their studies, they found that the security returns cannot be explained only by beta and emphasized that the CAPM is an incorrect estimator of securities' return. They argued that securities with lower market risk are exceptionally underpredicted and securities with higher market risk are immensely overpredicted. In this regard, Jegadeesh and Titman (1993), observed the relationship of price and average return and discovered that the relationship is flat, even after the inclusion of beta as an independent variable. The study further concluded that the firm characteristics like BE/ME (Book to Market equity) and the size of the firm can better explain the cross-sectional variation in the returns of assets. Further, Morelli (2003), found that the CAPM model is valid only for a specific time period and risk premium provided by SLB model is insignificant in the regression model based on cross-sectional data.

CAPM model assumes that the market risk is the only systematic risk which should be priced in the market and investors should be compensated for bearing this risk (Rossi, 2016). Nonetheless, the theory says that total risk consists of two parts, the systematic risk and unsystematic (diversifiable or idiosyncratic) risk. Previously, studies conducted on the CAPM model have rejected this assumption as it does not hold any practicality in the real trading world. Empirical work done by researchers have investigated whether unsystematic risk plays any role in explaining the cross-sectional returns of securities and whether investors should be compensated for bearing the unsystematic risk. Thus, the possibility that the unsystematic risk can be eliminated while forming a portfolio has been researched and conflicting results are found. Some studies have observed on the number of securities an investor should hold to form a fully diversified portfolio of assets (Choi, Fedenia, Skiba, & Sokolyk, 2017).

Evans and Archer (1968), demonstrate that at least thirty securities make a portfolio a fully diversified one, similarly, Statman (1987) followed their results. Bradfield and Munro (2017) suggested that in the African context, a set of thirty-three securities can make a portfolio risk aversive and reduce 90% of the risk. Relatedly, Domian, Louton, and Racine (2007), contend that the enclosure of hundred securities is even not sufficient for diversification of a portfolio. The study proposed that there might be a pronounced amount of unsystematic or idiosyncratic risk in the portfolio of an investor. In another comprehensive study conducted by Goetzmann and Kumar (2008), a sample of sixty-two thousand (62000) household investors during the period of 1991 to 1996 was observed. It was found that more than 25% of the investor portfolios have only one stock, over 50% of the investor portfolios do not have more than three stocks, and only 5-10% of them have more than 10 stocks. This shows that it is exceedingly difficult for every investor to hold many numbers of securities in their portfolio.

There is a high probability that the unsystematic risk can play a significant role in explaining the cross-sectional variation in the stock returns. Moreover, Campbell, Lettau, Malkiel, and Xu (2001), discussed that household investors confront a variety of severe mistakes due to their misunderstanding about the characteristics of securities. As a result, portfolios become undiversified and the investors also bear the unsystematic risk. Campbell et al. (2001), studied the statistical properties of idiosyncratic volatility and revived the role of unsystematic risk in explaining the returns of stock and pricing of assets. The possibility of the role of unsystematic risk in explaining the returns has been investigated in two recent studies. Campbell et al. (2001), formed a model on the hypothesis that probably the investors cannot hold the market portfolio. This model included the unsystematic risk as a determining factor of returns of the stocks. They studied the relationship between the returns of security and unsystematic risk and found positive results. Another study by Ang et al. (2006), opposed this relationship and proposed that the securities with higher systematic risk provide terribly lower returns.

Other studies have also discussed the importance of idiosyncratic or unsystematic risk in explaining the cross-sectional variation of stock returns (Bali, Cakici, Yan, & Zhang, 2005; Goyal & Santa-Clara, 2003; Campbell et al., 2001). As the variations in stock returns of value weighted portfolios are predicted by the volatility of equally weighted portfolio, Guo (2003), quantified the volatility by using quarterly data and expounded that the unsystematic risk of value weighted portfolio returns of the stock are negatively related with the future stock returns. Studies by Campbell et al. in 2018; and Campbell in 2006, suggested that if the investor does not hold a fully diversified portfolio or a market portfolio, which is a common practice in the real world, then the idiosyncratic or non-systematic risk becomes positively related to the stock returns.

DATA AND RESEARCH METHODOLOGY

In this research, we have taken data sample of well reputed and highly trading companies listed in the Pakistan Stock Exchange. Data has been taken for the period of May-2010 to April-2014. We have taken prices and the market capitalization of 65 companies in total. Prices have been used to calculate the returns of company stocks at every month end, while capitalization has been taken to rank the companies in order to form size-based portfolios (market cap is used as a proxy for size). Five portfolios have been formed based on market capitalization, Portfolio 1 is formed on smallest sized companies and portfolio 5 has been formed on largest sized companies. Based on prices, we found both equal weighted and value weighted portfolio returns. Prices and market cap data have been taken from "Bloomberg" market data portal. In order to find excess returns, we use 3-month Treasury bill rate which has been taken from State bank of Pakistan website.

Betas for each individual security are estimated by regressing monthly excess returns with market excess returns. The regression equation for beta calculation is given as under:

$$\tilde{R}_{it} = \alpha_i + \tilde{\beta}_{rm} + e_{it} \qquad (1)$$

Here $\tilde{R}_{it}$ represents excess returns on portfolios at "i "time t; is α_i intercept of portfolio i; r_M is the excess return on market, $\tilde{\beta}$ is coefficient of excess market return, and it is found by regressing excess returns of the portfolio with excess market returns. And e_{it} is the random error of regression for "i" portfolio at time t. To check the applicability of CAPM we test the following hypothesis;

Ho represents the null hypothesis and *H1* is the alternative hypothesis.

$$H_0 : \alpha_i = 0, \quad H_1 : \alpha_i \neq 0$$

If α_i is significantly different from zero, that means there is some part of return which CAPM is unable to explain, hence the rejection of Ho is tantamount to the rejection of CAPM. To prove the significance of idiosyncratic risk in explaining portfolio returns we need to find the idiosyncratic risk of every portfolio. To find idiosyncratic and systematic risk we use market risk model;

$$\sigma^2_{it} = \tilde{\beta}^2 \sigma^2_{Mt} + \sigma^2_{eit} \qquad (2)$$

σ^2_{it} is total risk of the portfolio "i" at time t, σ^2_{Mt} is total market risk which is calculated by finding the variance of excess market returns. $\tilde{\beta}^2$ is square of the beta of portfolio "i" found through regression of excess portfolio returns against excess market returns. The first term of equation (2) is the total market risk of the portfolio "i" and $\sigma^2_{\varepsilon it}$ is the idiosyncratic risk of the portfolio "i". Idiosyncratic risk is found by subtracting market risk of the portfolio from total risk.

To examine the relationship between security returns and betas, we use two pass regressions. By using equation (3) we first find the average beta of each security by regressing excess return of securities against excess returns of all 65 securities. Returns of securities are taken for the whole period specified above.

$$\tilde{R}_{jt} = \alpha_j + \tilde{\beta}_j \tilde{R}_{Mt} + v_{it} \qquad (3)$$

J=1,2,3…….65, and t=1,2,3………48 (months); whereas *vit* is the random error term of regression.

We call above regression as pass-one of our model, in which we find betas for each security. In the second pass, we regress average excess returns of all 65 securities against betas to see the relationship between beta and security returns. Average returns are taken as dependent variable and betas are taken as the independent variables in the second pass. The equation used in the second pass is given as under;

$$\bar{R}_j = \gamma^0 + \gamma^1\tilde{\beta}_j + \gamma^2\tilde{\beta}^2 + \gamma^3\sigma^2_{(\varepsilon j)} \qquad (4)$$

$\bar{R}_j$ is the average excess return of each security, γ^0 is intercept. $\tilde{\beta}_j$ represents betas of securities found in the first pass and γ^1 is coefficient of $\tilde{\beta}_j$, which represents the sensitivity of beta to security excess returns. $\tilde{\beta}^2$ in Equation (4) has been put to test nonlinear relationship between beta and returns. It is found by taking the square of the beta of each security and γ^2 is coefficient of $\tilde{\beta}_j^2$ which measures how sensitive $\tilde{\beta}_j^2$ is to excess returns of securities. $\sigma^2_{(\varepsilon j)}$ has been put to test whether idiosyncratic risk explains the excess returns of securities. For CAPM to hold, γ^0 must be equal to zero, while γ^2 and γ^3 must be insignificant and γ^1 must prove to be significant.

EMPIRICAL ANALYSIS

Regression Results and Descriptive Statistics

Table 1 shows the descriptive statistics in which beta and the average size of each portfolio taken from PSX (Pakistan Stock Exchange) is reported. Panel A of table 1 depicts the size of portfolios which are extensively dispersed, though the mean of smallest (Portfolio 1) and largest (Portfolio 5) is 2933.18 million rupees and 124653.9 million rupees respectively. Additionally, the coefficient of variation of smallest and largest sized portfolios is higher than other three portfolios depicting that the standard deviation of smallest and largest portfolios is higher compared to the mean of these portfolios. Other three portfolios have a moderately small coefficient of variation in comparison to the smallest and largest portfolio.

Panel B of table 1 depicts the beta portfolios in which betas of securities ranges from a minimum of -0.3205 in Portfolio 1 and 1.753 in portfolio 2, but the mean betas of the portfolios have a narrow spread of 0.5164 in portfolio 4 to 0.6808 in portfolio 3. These finding of size and beta portfolios are analogous with the results of Fama and French (1992), They formed 100 portfolios based on double sorted size and beta and found a range of portfolios based on size from 0.92 to 1.44. Strong and Xu (1997), pre-ranked the ten size portfolios and showed the narrow range of betas from 0.94 to 1.26. Similarly, Fletcher (1997) showed a range of 0.59 to 1.47 in betas of 100 size portfolios.

Table 1. Descriptive Statistics of Capitalization and Betas for Portfolios

	1	2	3	4	5
Panel A: size in 5 portfolios (RS million)					
Mean	2933.186	7211.071	12846.050	26141.210	124653.900
Maximum	5582.497	8858.855	18739.770	42738.310	306572.200
Minimum	304.885	5616.809	9254.203	18811.720	44913.830
Std. Dev.	1532.809	1083.647	3487.445	8040.956	93829.940
Skewness	0.230	0.132	0.455	0.823	0.926
Kurtosis	2.687	1.699	1.852	2.356	2.401
CV	0.5226	0.1503	0.2715	0.3076	0.7527
Panel B: Beta in 5 portfolios					
Mean	0.6793	0.5997	0.6808	0.5164	0.6015
Maximum	1.4171	1.7533	1.1665	1.2316	1.6631
Minimum	-0.3205	-0.1289	0.2622	0.0977	0.0304
Std. Dev.	0.5623	0.5321	0.2923	0.3589	0.4398
Skewness	-0.2261	0.6666	0.1442	0.5826	0.7251
Kurtosis	1.8480	2.8737	1.9517	2.3029	3.7772
CV	0.8277	0.8873	0.4294	0.6951	0.7313

Notes: *Mean size represents an average of capitalization of all securities in every portfolio at every month end.*
Amounts in capitalization are represented in million rupees.
Mean beta is average of betas of securities in i portfolio.
Max, min, and std. dev are maximum, minimum, and standard deviation values in capitalization and in betas of portfolios.
CV is Coefficient of variation calculated by dividing standard deviation with mean.
Skewness and kurtosis are given to check the distribution of capitalization and betas of all portfolios.

In Table 2. descriptive statistics of average returns are reported for Value Weighted Portfolio (VWP) and Equally Weighted Portfolio (EWP). Panel A depicts the descriptive statistics of monthly average returns of equally weighted portfolios. The average monthly return spread ranges from 1.21% for portfolio 4 to 3.48% for portfolio 1. Panel B depicts the descriptive statistics of monthly average returns of equally weighted portfolios. The average monthly return spread ranges from 0.54% for portfolio 5 to 4.82% for portfolio 1. The table clearly rejects the CAPM model which says higher beta portfolio must earn higher returns and vice versa. In table 2 it is clearly observed that portfolio 3 has the highest mean beta but still, it earns lower returns, while portfolio1 is the highest earner but it has relatively lower beta. These empirical results are contradicting the CAPM assumption of a positive relationship between risk and return. The results support the findings of French (1992), that the smaller sized firms are earning higher returns than larger sized firms.

Table 2. Descriptive Statistics Monthly Average Returns for Portfolios

	1	2	3	4	5	KSE-100
Panel A: EWP						
Mean	0.0348	0.0261	0.0165	0.0121	0.0125	0.0155
Max	0.2077	0.2776	0.1583	0.1344	0.1538	0.1423
Min	-0.1309	-0.1501	-0.1301	-0.1484	-0.1160	-0.1157
Std. Dev.	0.0771	0.0824	0.0644	0.0555	0.0574	0.0465
Skewness	0.4656	0.5125	0.0726	-0.3375	0.1836	-0.3694
Kurtosis	2.7236	4.2768	2.4834	3.3104	2.8904	3.8859
Panel B: VWP						
Mean	0.0482	0.0260	0.0181	0.0154	0.0054	
Max	0.3398	0.2566	0.1481	0.1343	0.1678	
Min	-0.1463	-0.1239	-0.1227	-0.1398	-0.2399	
Std. Dev.	0.0912	0.0790	0.0611	0.0556	0.0722	
Skewness	0.8239	0.5536	0.0207	-0.4167	-0.4600	
Kurtosis	3.8929	3.8200	2.5262	3.4183	4.6048	

Notes*: EWP and VWP are abbreviated for equal weighted and value weighted portfolios.*
Above descriptive are calculated on all 48 months' time series return data.
EWP and VWP mean has been calculated by taking arithmetic mean of excess returns and value-weighted excess returns of portfolios respectively.
To check the distribution, we test skewness and kurtosis of all portfolios.
Min, Max and Std.dev. represent minimum, maximum values and standard deviation in returns.
KSE-100 represents monthly index returns.

In the illustrated statistics, the histogram of portfolio return shows the rightward skewness, mean returns are more skewed toward right than to the left. It means that portfolio returns have features of asymmetric or unequal distribution. The histograms of portfolio returns are presented in figure 1. The distribution of portfolio return is prospective either to require a higher price of risk or to be discouraged from taking higher risk. Moreover, distribution of returns has higher kurtosis values greater than zero.

Figure 2 shows the bar graphs of portfolio returns showing time wise occurrence of returns. The pattern of graphs in all portfolios and KSE-100 index return do not show any trend, which means that returns are unpredictable.

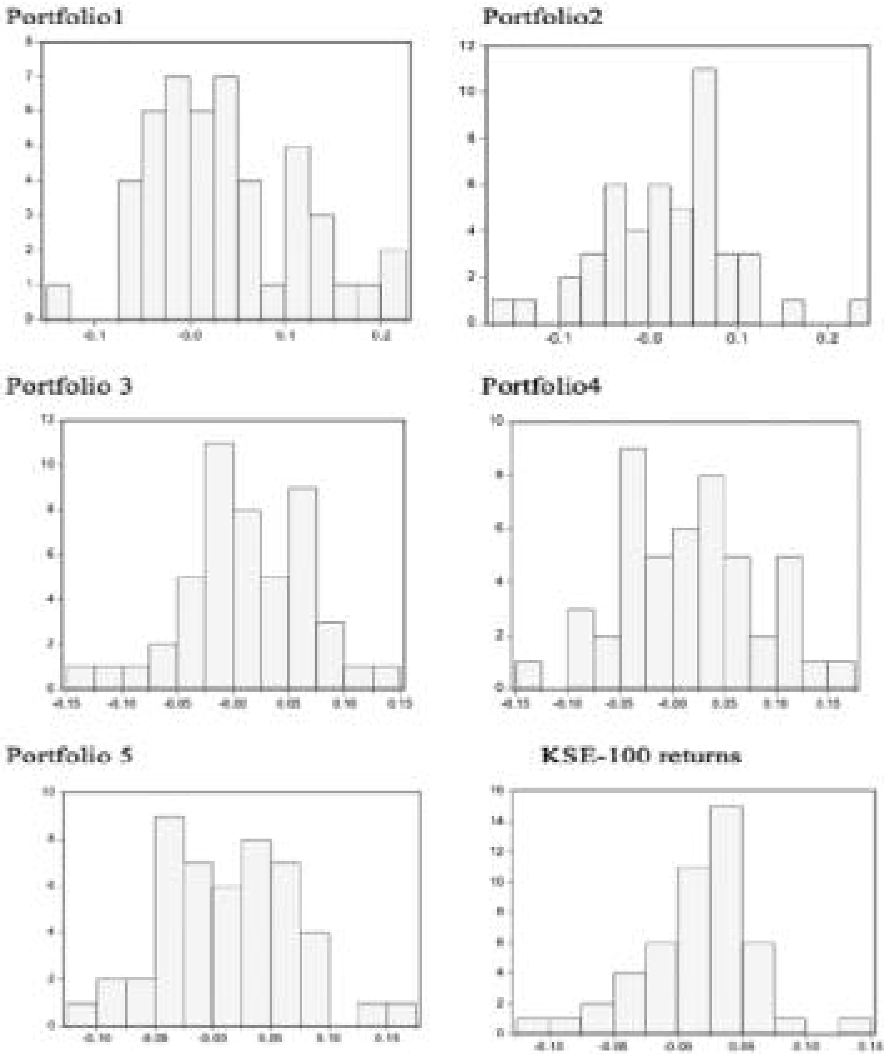

Figure 1. Distribution of Portfolio Returns

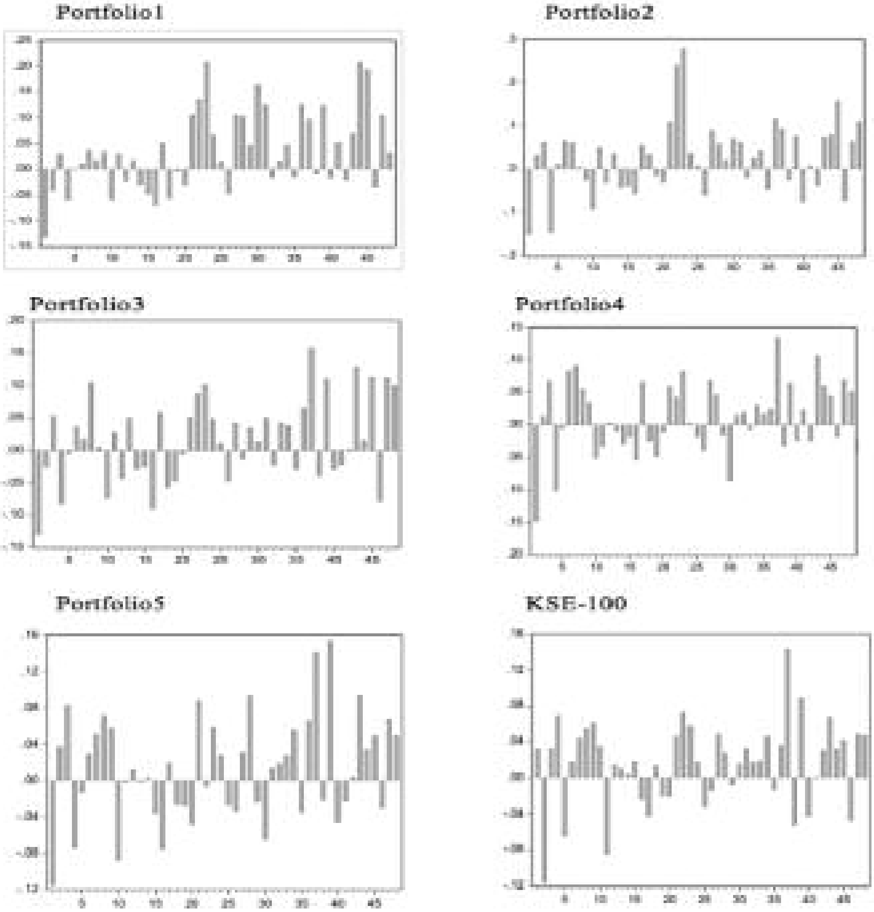

Figure 2. Graphical Representation of Time Wise Occurrence of Portfolio Returns

Table 3. Systematic Risk and Idiosyncratic Risk Equal Weighted Portfolios

Portfolio	Total risk	systematic risk	Idiosyncratic risk	IRTR (%)	Sharpe ratio
EWP: Panel A KSE-100 as market risk (σ^2m) in equation (3)					
1	0.0059	0.0004	0.0055	0.9293	0.4512
2	0.0068	0.0007	0.0061	0.8942	0.3173
3	0.0042	0.0003	0.0039	0.9294	0.2563
4	0.0031	0.0004	0.0027	0.8716	0.2179
5	0.0033	0.0003	0.0030	0.9138	0.2167
Average	0.0047	0.0004	0.0042	0.9077	0.2919
KSE-100	0.0022	0.0022			0.3335

Panel B. 65 Stocks as Market Risk (σ^2m) in Equation (3)

1	0.0059	0.0046	0.0014	0.2302	0.4512
2	0.0068	0.0056	0.0011	0.1693	0.3173
3	0.0042	0.0035	0.0006	0.1552	0.2563
4	0.0031	0.0023	0.0008	0.2587	0.2179
5	0.0033	0.0023	0.0010	0.2921	0.2167
Average	0.0047	0.0037	0.0010	0.2116	0.2919
65 stocks	0.0037	0.0037			0.3401

Portfolio	Total risk	systematic risk	Idiosyncratic risk	IRTR (%)	Sharpe ratio
VWP: Panel A. KSE-100 as Market Eisk (σ^2m) in Equation (3)					
1	0.0083	0.0012	0.0071	0.8508	0.5289
2	0.0062	0.0025	0.0037	0.5950	0.3285
3	0.0037	0.0004	0.0033	0.8926	0.2971
4	0.0031	0.0004	0.0027	0.8618	0.2774
5	0.0052	0.0003	0.0049	0.9349	0.0752
Average	0.0053	0.0010	0.0043	0.8270	0.3014
KSE-100	0.0022	0.0022			0.3335
Panel B. 65 Stocks as Market Risk (σ^2m) in Equation (3)					
1	0.0083	0.0060	0.0023	0.2804	0.5289
2	0.0062	0.0032	0.0030	0.4848	0.3285
3	0.0037	0.0030	0.0007	0.1857	0.2971
4	0.0031	0.0020	0.0011	0.3665	0.2774
5	0.0052	0.0024	0.0029	0.5494	0.0752
Average	0.0053	0.0033	0.0020	0.3734	0.3014
65 stocks	0.0037	0.0037			0.3401

***Notes**: In the table (3) EWP and VWP are abbreviated for equal-weighted and value-weighted portfolios. We calculate total risk, systematic risk, and idiosyncratic risk by using equation (2).*
Each portfolio has been divided into two parts. In one-part variance of KSE-100 index is used as total market risk, in the second part variance of all 65 stocks is taken as total market risk. These two variances are used in the calculation of systematic and idiosyncratic risks in both portfolios (EWP and VWP).
IRTR is the proportion of idiosyncratic risk in total risk.
Sharpe ratio is calculated by taking the ratio of the average excess returns of the portfolio to the standard deviation of portfolio return.
KSE-100 represents monthly excess returns on hundred index and 65 stock shows returns of all 65 companies included in our portfolios.

In Panel A of table 3, we have shown both systematic and idiosyncratic risks for all five portfolios in equal weighted and value weighted categories. Smaller companies tend to be riskier than larger firms (Fama & French, 1993), hence the idiosyncratic risk of smaller companies must be higher than that of larger firms, and this relationship is proved in our analysis. In panel A. the idiosyncratic risk of small firm portfolios (portfolio1) is largest in both cases; when KSE-100 variance, and 65 stock variances are taken as total market risk. Idiosyncratic risk in porfolio1 (smallest) is 0.0055, while it is 0.0033 in portfolio 5 (largest). IRTR again proves this relationship true here. IRTR for portfolio1 is 92.93% which is higher in comparison to IRTR of 91.31% in the largest portfolios. Idiosyncratic risk is narrowly distributed EWP in panel A. range is 5% maximum. If we compare results of the value weighted portfolios with equal weighted portfolios, we do not find any different results as Idiosyncratic risk is higher for portfolio 1 (0.0071) in comparison to the largest portfolio which has an idiosyncratic risk of 0.0049.

Sharpe ratio confirms the results of Merton (1987), who propositioned that idiosyncratic risk contributes to explaining the returns of securities and their prices. Smaller securities must have higher Sharpe ratio because they are riskier than larger securities, hence they need more risk premium to compensate for any additional risk. Table 3, panel A and B again prove this relationship true. For smaller portfolios, we have higher Sharpe ratios. In EWP side portfolio 1 has Sharpe ratio 0.4512 which is the highest among all given portfolios. Panel B of the table also supports this argument. In this part of the table, we have the highest Sharpe ratio (0.5289) for portfolio 1 (smallest). This is again highest among all given portfolios. Sharpe ratio also proves the risk factor given by Fama and French (1993), in which they stated smaller firms are riskier, hence, they require more premium than larger ones. Highest Sharpe ratio securities are considered riskier, hence portfolio 1 is riskiest of all because it has the highest Sharpe ratio. Sharpe ratio in panel A and Panel B decreases across five portfolios as we move down from smaller to larger portfolios. This supports Fama and French (1993), findings that size is one of the factors in determining the price of an asset.

When we compare the Sharpe ratio of the KSE-100 index with that of all five portfolios we get some astonishing results. The market is considered as diversified portfolio hence it is considered to have zero idiosyncratic risks; thus, its total risk must be lesser than that of any of five portfolios and its Sharpe ratio must be highest among all five portfolios. What we observe in the table is that the Sharpe ratio of KSE-100 index is lesser than Sharpe ratio of portfolio1 in both EWP and VWP panels. This difference in results is attributed to survivorship bias. There might be some companies in the KSE-100 which have been replaced by other companies or delisted on the stock exchange in our period of analysis. Because of this return on individual stocks tend to be higher than returns on KSE-100, which leads to a higher Sharpe ratio for individual securities. If there were no survivorship bias, average excess returns of all 100 individual securities must have equal to average excess returns of KSE-100 index. Therefore, because of equal returns and lesser risk, the KSE-100 index would have had a higher Sharpe ratio. Panel B of table 3 also prove the same relationship that the Sharpe ratio of 65 stocks is higher than that of portfolio 2-5 but it is lower than portfolio 1.

In table 4 we report the results of the market regression model (equation 1). Based on portfolio returns for the period 2010-2014, we tried to explore the relationship between portfolio returns and market returns. We run regression between portfolio returns and KSE-100 index returns. In results, our focus will be on the alpha coefficient. If alpha is significantly different from zero, this will help us rejecting the CAPM model. Our results for equal weighted and value weighted portfolios except portfolio 1 seem to support CAPM. The alpha coefficient of all portfolio is significantly different from zero at 1% significance level, this means that CAPM does not explain all the variation in the returns of these portfolios. In EWP, it under-predicts portfolio 1 and portfolio 2 and over-predicts portfolio 3-5. In VWP it over-predicts all portfolios except 3 and 5. The main reason behind this diversion in results is a higher Sharpe ratio and higher idiosyncratic risk. CAPM under predicts or over predicts securities with higher idiosyncratic risk (Bali et al., 2005), hence portfolio 1-5 has a higher idiosyncratic risk, thus, this supports the view that CAPM does not hold in every condition, rather we need a modified model for those securities which have a higher idiosyncratic risk. In other words, if we violate the CAPM assumption of diversification of securities, CAPM does not apply. Based on this argument we have great room for rejecting CAPM as a prime model in the asset pricing.

Table 4. Summary Results of Market Index Model for Value Weighted Portfolios and Equal Weighted Portfolios.

	1	2	3	4	5
Panel A: EWP					
β	1.1105	1.2329	0.9727	0.7851	0.7939
α	0.0118	0.0006	-0.0036	-0.0042	-0.0040
T-statistics (α)	2.0641	0.1153	-0.9269	-0.9557	-0.8329
P-value (α)	0.0447	0.9087	0.3588	0.3442	0.4092
Adjusted	0.7649	0.8307	0.8414	0.7357	0.7015
Panel B: VWP					
β	1.2707	0.9315	0.9052	0.7262	0.7965
α	0.0219	0.0067	-0.0006	0.0004	-0.0111
T-statistics (α)	2.9421	0.7854	-0.1479	0.0716	-1.3393
P-value (α)	0.0051	0.4363	0.8830	0.9433	0.1871
Adjusted	0.7135	0.5046	0.8103	0.6254	0.4388

Notes: *EWP and VWP are abbreviated for equal weighted and value weighted portfolios. P-values and t-statics have been estimated by OLS regression.*

The results of simple and multiple regression models are reported in table 5. This table presents the second pass of our research model. To test the relationship between security returns with betas and idiosyncratic risk, we have taken average excess returns as dependent variable and betas of securities along with squired betas and idiosyncratic risk as independent variables. In model 1 intercept term is positive (0.0203) but it is significantly different from zero, which means that returns are mispriced. Coefficient of beta (γ^1) is near to zero (0.0007) and insignificant with P-value 0.9054. Hence, we reject the applicability of CAPM in Pakistan.

In model 2 we test the explaining power of idiosyncratic risk alone. Our results support the findings of (Bali et al., 2005). We find intercept value 0.0121 which is significantly different from zero, but its value is approximately zero and idiosyncratic risk is found to be a significant factor in explaining security returns. Idiosyncratic risk coefficient (γ^3) has a value of 0.5089 with the p-value of 0.0.0191, hence we must consider idiosyncratic risk when pricing the securities.

Model 3 tests nonlinearity of relationship between return and beta. The beta coefficient in model 3 is -0.0238 which is not consistent with existing theories of risk return relationship. Higher risk must earn a higher return, but in this case, it is the opposite of it. Secondly, the coefficient of beta and beta square are found to be insignificant which means that findings of Blume and Friend (1973), about questionable linearity of beta and returns, are found valid here.

Model 4 tests the effect of systematic and idiosyncratic risk at the same time. The coefficient of beta is insignificant with a p-value of 0.1072 but the coefficient of idiosyncratic risk is significant at the 1% significance level. The p-value for idiosyncratic risk is 0.0047.

Model 5 tests impact of all three factors together. Intercept is again approximately zero and significant with p-value 0.0050. No difference is found in estimates of beta and beta square. The coefficient of beta is -0.0216 with a p-value of 0.1705; this estimate again goes against the theory with a negative sign. Coefficient of "$ß^2$" is 0.0078 with p-value "0.4825." On the basis of these results, we reject both CAPM and its linearity of relationship, but we consider idiosyncratic risk as a prime factor in explaining asset returns.

Table 5. Single and Multiple Regression Model Summary

		γO	γ^1	γ^2	γ^3
Model1	coefficient	0.0203	0.0007		
	t-statistic	4.3385	0.1193		
	P-value	0.0001	0.9054		
Model2	coefficient	0.0121			0.5098
	t-statistic	2.7312			2.4048
	P-value	0.0082			0.0191
Model3	coefficient	0.0253	-0.0238	0.0177	
	t-statistic	4.5666	-1.4757	1.6433	
	P-value	0.0000	0.1451	0.1054	
Model4	coefficient	0.0151	-0.0119		0.7613
	t-statistic	3.1870	-1.6348		2.9314
	P-value	0.0023	0.1072		0.0047
Model5	coefficient	0.0178	-0.0216	0.0078	0.6903
	t-statistic	2.9107	-1.3869	0.7065	2.4699
	P-value	0.0050	0.1705	0.4825	0.0163

***Note**: Coefficients, t-statistic and p-values are estimated by using OLS regression. P-values are tested at 5% significance level.*

CONCLUSION

In this study, the CAPM model has been tested as a tool for measuring security returns. Findings of Black (1972); Lintner (1975); Sharpe (1964), have been found invalid in the context of Pakistan. We have found the intercept of index model positive in nearly all instances. This shows that CAPM significantly underpredicts the returns of securities (Shaikh, Shaikh, & Shaique, 2017). CAPM also assumes that investors hold fully diversified portfolios, but when we violate this assumption and put idiosyncratic risk and systematic risk separately, we find idiosyncratic risk a significant factor in explaining the returns of securities. From this, we infer that for undiversified portfolios CAPM is not a proper pricing method and in that condition considering idiosyncratic risk is indispensable. Our two-pass model has also tested non-linearity of the relationship of beta and excess returns of portfolios. We have found robust evidence that the relationship between beta and security returns is weak. The empirical results of the model are consistent with Chan and Chui (1996), and Strong and Xu (1997). However, future studies may opt for further analysis in order to improve the generalized ability. Furthermore, the daily data may be used for the analysis purpose as it may give more accurate results.

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