

APPLICABILITY OF CAPM: EVIDENCE FROM PAKISTAN STOCK EXCHANGE (PSX)

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ABSTRACT

The Capital Asset Pricing Model (CAPM) has been extensively used in the world of finance, for computing the expected return of securities. This study examines whether Capital Asset Pricing Model (CAPM) is a useful technique for evaluating the return on the securities of cement sector companies listed on Pakistan Stock Exchange (PSX). Further, this research also tests the applicability and validity of model on cement sector companies. The inferences taken from this study through data analysis, reveal a weak correlation of expected return and realized excess returns on securities; hence, CAPM is an empirically weak model to be used in the market for accurate forecasting of returns.

Keywords: *Asset Pricing Theory, Capital Asset Pricing Model (CAPM), Pakistan Stock Exchange (PSX), Return on Securities*

INTRODUCTION

The zeal of financial experts has always been focused on expediting the intellectual capacity of determining the valuation of uncertain inflows and outflows of cash outlay made by the investor. In fact, there is a rule of thumb that financier always undertakes a higher return for funds invested in more uncertain projects or securities, than funds invested in less uncertain securities and projects. However, the exact valuation of risky projects and accurate determination of the price of risk is blurred in the finance literature.

In many cases, the returns of stock-markets, in all over the world, are bewildering. Therefore, the financial experts advocate investors to prioritize the formation of effective portfolio so that the diversifiable risk or systematic risk of securities can be adequately evaluated. The financial investors are always counseled to take their financial decisions assuming that prices of securities are reflecting all publicly available information.

Markowitz (1952), was working on his doctoral thesis, and fashioned an amazing mechanism of inclusion or exclusion of stocks in the portfolio, on the grounds of having high returns on bearing a certain risk. His new conceptualization was acknowledged by a lot of researchers, professionals, and experts around the world.

One of the most significant advancement available finance literature, finance under the Modern Capital Theory, is CAPM (Capital Asset Pricing Model). The CAPM of Schlumberger Ltd. (SLB), have formulated a method for researchers and experts to have a look at risk and return (Black, 1972; Lintner, 1965; Sharpe, 1964). The primary purpose of CAPM is to estimate beta of security to explain that how much security is aligned or sensitive to the movement or changes in the market returns. This SLB model can estimate the equity cost and the level of hedging contracts to sell hedging equity portfolios. It can measure abnormal returns on assets and the performance of the diversified portfolio.

However, the CAP Model is persisted as a principal model in empirical researches over the last many decades, it is still generally accepted and extensively used in practice. Either it is an estimation of the cost of the capital of the firms or evaluation of the performance of the managed portfolio, CAPM remained a centerpiece of the analysis. The magnetism of this model is that it proposes influential and instinctively agreeable forecasts about risk measurement and the risk-return relationship. Unluckily, the empirical record of CAPM is too weak to undermine the way it is used in practice.

Numerous studies have shown the reservations and distrust on the capability to forecast the actual return behavior. A lot of practitioners and scholars has put serious concerns and criticisms on the CAPM application. Contrary, many researchers have relied expansively on CAPM to foreknow the expected returns. CAP Model has accomplished the satisfactory outcomes which pertain to actual returns.

Accordingly, there is an essential requirement to inspect the validity and rationality of CAPM in overall world. Many researchers studied the same research question in different parts of the world for different periods of time. Different studies have been conducted in markets like Pakistan, India, Malaysia, China, Belgium, United States of America, United Kingdom, Egypt, and Greek, etc. As this study is conducted in Pakistan,

the validity of CAPM is also studied a lot in different stock exchanges of Pakistan. The study sample is segregated to one of the major sectors of Pakistan Stock Exchange (PSX), and investigation on the validity of one of the prime and widely debated models is attempted, which has remained as a bone of contention for researchers.

LITERATURE REVIEW

It is extensively acknowledged phenomena that the financiers always demand a higher premium for funds invested in risky projects or securities. Several other models are used by the financial experts and financiers to foreknow the riskiness of any fundamental security. Capital Asset Pricing Model (CAPM) has been used extensively by all the experts, analysts, and financiers. It is also been observed that capital asset pricing model is advantageous for the investments done for a more extended period of time (Jagannathan & Wang, 1993).

This Model is used over and over again by the financial managers, financial analysts and financial investors, for risk evaluation of uncertain cash flows and for knowing the appropriate discounting factors for proper valuation of any investment, project or security. As per properties of this CAP Model, the risk-return relationship is linear, and the factor of risk is measured by the beta of uncertain cash flows coming through the return of the market portfolio.

In CAPM model, beta is a measure of systematic risk only, which can be avoided by adequate management and diversification of the portfolio. However, diversification of any portfolio cannot be fortified by the systematic risk. The impact of an increase in systematic risk will be an increase in the foreknown return on the investment by the investor (Lau, Quay, & Ramsey, 1974).

Many research studies have been done to assess the worth of CAPM model that either it can explain the returns of securities, or if the relationship of risk and return of stocks is positive and linear. Breeden (1979), studied that “the intercepts were larger than existing risk-free rates and the coefficients of systematic risk were not significant.” (Sharpe & Guy, 1972), discovered and concluded that risk and return relationship is positive between New York Stock Exchange common stocks through 1931-1967, but linearity was not there.

A study of the relationship of risk and return of portfolios steered by Black, Jensen and Scholes (1972), concluded that there is a positive and linear relationship between the portfolio of beta, and excess return of stocks, though the expected value of intercept was below the level. Research study investigated by Black (1972), used the monthly return on securities, listed on NYSE (New York Stock Exchange), for the period from 1931 to 1965 and formed ten portfolios on the basis of beta. In each portfolio, the investor decides on the basis of their risk preferences. If the investor is risk averse he will select low beta portfolios and if the investor is risk seeker he will select high beta portfolios. Black found that portfolios with low 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 time-series tests.

Another study (Basu, 1983), found that earning to price ratio also explain the variation in the expected return of security, and returns will be higher than predicted by finding another factor which is the size of the firm measured by Market capitalization (Share price times share outstanding). It is said that the stocks having low market capitalization show higher expected returns as compared to those with high market capitalization.

Fletcher (1997), conducted a study and found that there is no effect of firm-size on UK security returns and concludes that only market risk (beta) is valid to explain cross-sectional variation in security returns. In contrast, Basu (1983), found that firms having higher earning to price ratio with high E/P earn higher returns which are risk-adjusted than firms with lower earnings to price ratio, and size effect evaporates when risk and earning price ratio difference is adjusted and controlled for the return of security.

Lakonishok and Shapiro, (1986), asserted that neither market risk (beta) nor deviation of market returns could explain the cross-sectional variation in security's returns, size is the only factor that plays an important role in explaining the returns. Ritter and Chopra (1989), conducted a research study and concluded that there are no cross-sectional relations between market risk and return.

Chan and Chui (1996), and Strong and Xu (1997), following the Fama and French (1992), approach found a weaker relationship between market

risk and returns. Fama and French opposed the CAPM model in their studies of 1992, 1993 and 1996. They found in their studies that security returns cannot be explained only by beta. 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.

Several other studies also contradicted the CAPM theory and criticized its wide application. Roll (1983), concluded that it is empirically impossible to diversify the portfolio of securities perfectly. Therefore it is impossible for CAPM to model the proper evaluation of a portfolio of securities. Fletcher (1997), conducted a study and found that there is no effect of firm-size on UK security returns and concludes that the only market risk (beta) is valid to illuminate cross-sectional variation in the returns on securities.

Fama and French (2004), exposed the work done on Capital Asset Pricing Model since 1970s. Evidence suggests that cross-sectional variation in stock returns is not associated with its risk measure (beta). Yang, Xu, and Hellström (2006), studied the validity of CAPM on Chinese stock market. They studied one hundred companies listed on Shanghai stock exchange from the period of 2000 to 2005. They found that linearity of risk-return relationship persists in the sample period, but the intercepts were not equal to zero. Hence the statistical results showed that the hypothesis of CAPM that intercepts should equal to zero was not supported and another hypothesis of CAPM that slopes should equal to risk premium was also not supported by the statistical results.

Another study was conducted on 100 listed companies of Athens Stock exchange for the period of 1998 to 2002 by Michailidis, Tsopoglou, and Papanastasiou (2006). They disproved the CAPM's prediction of stock returns. This test rejected the hypothesis of CAPM that intercepts must equal zero and slopes must equal to an average risk premium. They rejected the CAPM in their context. Jegadeesh and Titman (1993), studied the relationship between price and average return and discovered that the relationship is flat even after the inclusion of beta as the independent variable. They further concluded that firm characteristics like BE/ME (Book to Market equity) and firm-size could better clarify cross-sectional variation in the returns of assets.

Further Morelli (2003), found that Capital asset pricing model is valid only for the specific period of time and risk premium provided by SLB model is insignificant in regression model based on cross-sectional data. CAPM model assumes that there is only a systematic risk which is a market risk which should be priced in the market and investors should be compensated for bearing that risk.

In Pakistani Context Raza, Jawaid, Arif and Qazi (2011), have conducted a test on the validity of CAPM in PSX (Pakistan Stock Exchange), and they found that the CAPM is valid and is accurately predicting the returns of securities and stocks of short-term investment comparing with long-term investment. Another study on “A test of CAPM on PSX (Pakistan Stock Exchange)” conducted by Iqbal and Brooks (2007), found that there is a nonlinear relationship of risk and return intensively in recent period because of the performance of market supported by intensive trading activity and high level of liquidity.

Furthermore, another study conducted in Pakistan by Javid and Ahmed (2008), explored the risk-return relationship of 49 companies listed on PSX from July of 1993 to December of 2004. They found that CAPM does not explain the return variation in equity market of Pakistan. They also found that the residual risk also helps in explaining the cross-sectional variation of returns.

Above discussion of studies, conducted empirically, on Capital Asset Pricing Model have brought forth the varied results and findings, mainly indicative of inappropriateness of CAPM in its novel form. Conversely, the studies support the primary ingredient of risk and return fundamental to CAPM theory. As a result, this study will test the validity of Capital Asset Pricing model on companies of cement sector listed on the Pakistan Stock Exchange.

RESEARCH METHODOLOGY

This study apprehends the stocks or securities of companies listed on Pakistan Stock Exchange and categorized in one of the vital sectors that is Cement sector of Pakistan. It is one of the largest sectors listed on Pakistan Stock Exchange. This analysis is conducted on the time period of June 2004 to December 2012 on the monthly returns of selected companies of cement sector listed on Pakistan Stock Exchange.

This study has extended the previous studies conducted in Pakistan and used the two formal procedures to check the validity of Capital asset pricing model. One way is the Robust Least Square Regression Analysis

to check the validity and applicability of CAPM using Eviews software for analysis. Another method used for this analysis is (Fama & MacBeth, 1973) Regression Analysis.

The historical data was collected for constructs under study, which are monthly returns on stocks (R_j), monthly return on the market (R_m) and risk-free monthly rate (R_f). The closing prices of stocks were collected from the website of the Business recorder and Pakistan Stock Exchange. These closing prices were used to calculate the monthly returns of the stocks or securities of companies under study. The KSE-100 index was used as a proxy for the market, and the monthly index of Karachi Stock Exchange (KSE-100) was collected from the website of Pakistan Stock Exchange, and index points were used to calculate the monthly return on the market (R_m). The data of three months T-bills was taken from the website of State Bank of Pakistan and converted in the risk-free monthly rate. The below-mentioned equation of Capital Asset Pricing Model was well-thought-out through Robust Least Square Estimation Procedure to evaluate the required returns on the stocks or securities:

$$(R_j - R_f) = b(R_m - R_f)$$

Where

R_j = Required return of stock or security

R_f = Risk-free rate prevailing in market

b = Systematic or non-diversifiable uncertainty or risk associated with the stock, and

R_m = Return on market

Return on Stock (R_j)

The expected return of a stock is the rate required by financier or investor on the investment which he/she made in any risky security or stock. It is calculated from closing prices of the stocks, through the following formula:

$$R_j = (\text{endingprice} / \text{beginningprice}) - 1$$

The effect of dividend and bonus announcements was taken into account while analyzing the stock returns.

Return on Stock (R_m)

It is the return on stock market denoted by R_m . As mentioned above KSE-100 index was considered a proxy for the market. Monthly index points were used to calculate the return on the market to use in the

analysis. The market return is measured by the following formula:

$$R_m = (\text{Index}_{\text{ending}} / \text{Index}_{\text{beginning}}) - 1$$

This market return is calculated in the same way as returns on stocks are calculated.

Beta (b)

Beta is a degree of the undiversifiable or systematic risk of any security or stock. It is defined as the degree by which the return of security (R_j) is correlated with the market return (R_m). Beta is calculated through Robust Least Square regression by the following formula:

$$b = \text{Cov}(R_m, R_j) / \text{Var}(R_m)$$

Risk-Free Rate (R_f)

Risk-free rate (R_f) is the payment expected by the financier or investor for investing in any asset which gives virtually assured nominal return. It can be inferred that the standard deviation or risk is zero in that investment. The securities of government have a particular return, that return is considered as a proxy for these types of investments. In this study, the three months t bill rate is used as expected or requires a return on zero risk investment.

The principal purpose of this research study is to determine the applicability and validity or expounding power of the Capital Asset Pricing Model in forecasting the returns of stocks or securities of companies of Cement sector listed in the Pakistan Stock Exchange. To attain the mentioned purpose, the realized returns of stocks were calculated by the following formula of CAPM.

$$(R_j - R_f) = a + b(R_m - R_f)$$

Where the intercept term should be zero in the CAPM world. The rationality of the CAPM is confirmed by evaluating whether the intercept term (alpha) of security or stock is significantly different from zero. The Regression equation was run in Eviews software through Robust Least Square Estimation procedure to analyze the results.

Another Method for testing the applicability of CAPM is through Fama and Macbeth Regression. For Application of (Fama & MacBeth, 1973), Regression the excess returns of stocks of companies were sorted on a

monthly basis from June of 2004 to December of 2012. The Fama and MacBeth Regression procedure is applied in two steps. In the first step we run the time series regression to find beta through following regression equation:

$$E(R_{jt} - R_{ft}) = \alpha_j + \beta_j(R_{mt} - R_{ft}) + e_{it}$$

We get series of betas for each company under analysis. So, we have one beta for each company. In second and final step we run a cross-sectional regression to regress returns on estimated betas to find the risk premium. The formula presented is below:

$$E(R_j - R_f) = \beta_{j1}(R_{mt} - R_{ft}) + e_{it}$$

Here we assume that the intercept is zero in excess of the risk-free rate. In this method, we will not compute the variances of estimated parameters at each period. Instead, we calculate the variance of the average of estimated coefficients using time series of the estimates. This method is used to take the benefit of easy accommodation of unbalanced panels. The premium of returns is not dependent upon the number of stocks under consideration, which can vary over time. This procedure also flexible for betas varies with time. As Fama & French (1992) reported that the moving average betas does not provide the different results. It also leads to the autocorrelation in returns which are accounted by Newey West Errors for accurate estimation of results.

The following hypothesis was tested:

Ho: $\alpha=0$ (alpha is equal to zero) against the alternative that Ha: $\alpha \neq 0$ (Alpha is not equal to zero).

The T-test is applied to the regression equation of the CAPM. If the T-statistic is more than 2 or intercept is more than two, standard error from zero then we reject the null hypothesis of intercept is equal to zero. Hence, we can reject the theory of CAPM that the intercept or alpha is not equal to zero and significantly different from zero. So, the Capital asset pricing model validity is tested or evaluated on the cement sector of Pakistan Stock Exchange.

This research study is restricted to check the rationality of SLB model that is Capital Asset Pricing Model in predicting or forecasting the results of cement sector companies listed on Pakistan Stock Exchange for a time

period of June 2004 to December 2012. This study can be extended for overall sectors of Pakistan Stock Exchange, and the CAPM validity can be tested for pre and the post financial crisis period analysis that either CAPM is valid for pre-financial crisis period or for post-financial crisis period.

RESULTS

In this study, a probable justification and description on behalf of the financial theory of Capital Asset Pricing is reviewed and presented, to elucidate and explain the findings proven empirically.

Table 1. Regression Results (Capital Asset Pricing Model)

Dependent Variable: AVERAGE				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.116338	0.03199	-3.636693	0.000400
RM	0.863834	0.036536	23.64339	0.000000
R-squared	0.846972	Mean dependent var		-0.837165
Adjusted R-squared	0.845457	S.D. dependent var		0.250139
S.E. of regression	0.098335	Akaike info criterion		-1.781652
Sum squared residual	0.976643	Schwarz criterion		-1.730492
Log-likelihood	93.75506	Hannan-Quinn criteria.		-1.76093
F-statistic	559.0097	Durbin-Watson stat		1.786085
Prob. (F-statistic)	0.000000			

The calculated t- statistics show the level of significance of 1% at which the value of intercept is very high, meaning that the intercept value computed from the regression analysis of CAPM is significantly different from zero. The R-Squared value is 0.8469, interpreted as the 84.68% of the variation in excess returns of stocks or securities of companies is explicated by the Capital Asset Pricing Model Theory. The F-Statistics value (F=559.007, p=0.0000) is significant at 1% level of significance. The Durbin Watson (DW) statistics depicts that there is no autocorrelation problem in this model. The applicability of the model is also tested through the Fama and Macbeth (1973), regression procedure.

Level of standard deviation shows that there is a high standard deviation in the excess returns of stocks meaning that the prices of stocks are not consistent and the performance of companies underneath the cement sector listed on Pakistan Stock Exchange is not consistent enough. It depicts that the Capital Asset Pricing Model is not holding on the cement sector companies listed on PSX. This model does not explain the

variations in the excess returns. Maybe the inefficiency and instability in the emerging market of Pakistan is the cause of this behavior.

CONCLUSION

The study above interrogates the abundance of evidence to bury beta. There is always an inconclusive debate on the Capital Asset Pricing Model. According to Chan and Lakonishok (1993), we cannot take any conclusive stance on this issue. We have studied the validity of this widely debated topic of Capital Asset Pricing Model. The analysis of data depicts that there is virtually no correlation between realized excess returns with the returns provided and foreknown by CAPM. The domino effect of analysis is in line with the other studies already conducted on Pakistan Stock Exchange like (Bhatti & Hanif, 2010). Apart from Pakistan, the study results are also in line with the studies conducted in other countries like (Choudhary & Choudhary, 2010; Diwani & Asgharian, 2010, in India; Fraser, Hamelink, Hoesli, & Macgregor, 2004, in the UK; Sharifzadeh, 2010, in the USA). On the basis of these results and supporting studies, we concluded that the CAPM is not a reliable tool to foresee the expected returns of stocks of cement sector of Pakistan and may result in the inaccurate risk and return association. The opposing justifications and uncertainties surrounding the evidence of CAPM proposed that game is not over for CAPM. It is even one of the reasons behind the long-lasting survival of this model, and despite having a lot of unrealistic axioms, it is still most preferred model in the world of finance. Conversely, one must be familiar with the limitations while using it.

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