

## Validity of Capital Asset Pricing Model (CAPM) in Predicting Stock Return for Dhaka Stock Exchange

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### Abstract

As CAPM is the most basic method to find a relationship in speculated return and risk associated with a particular security. For pricing different securities and ascertaining the portfolio returns on different stocks CAPM is the most extensively used model. This model tries to identify the value of the risk. The purpose of this study is to test the validity of Capital Asset Pricing Model (CAPM) in Dhaka Stock Exchange. We used monthly returns of 10 stocks & 5 different sectorial indices listed on the DSE, for a period of 5 years (January 2012 to December 2016) for the analysis. The paired sample t-test is applied to find the difference between actual and expected returns. We run the regression analysis on monthly data from 2012 to 2016 on a yearly basis to find out beta in each sector. Results show that capital asset pricing model (CAPM) predict more accurately the expected return on the investment. It is recommended that the investors should more focus on CAPM results for their investment of Dhaka Stock Exchange.

**Keywords:** CAPM, Beta, Dhaka Stock Exchange (DSE), Portfolio returns.

### 1. INTRODUCTION

The Capital Asset Pricing Model (CAPM) describe the relationship between risk and expected return, and it serves as a model for the pricing of risky securities. CAPM says that the expected return of a security or a portfolio equals the rate on a risk free security plus a risk premium. Expected rate of return on any asset is related with systematic risk in a positive linear relationship, which means stocks with high returns have high risks (Biligin and basti, 2011).The model that represents this relation was first proposed independently by John Linter, William F. Sharpe and Mossin, J as follows:

$$R_{cin} = R_f + \beta_i(R_m - R_f)$$

Where:  $R_{cin}$  is the expected rate of return on company stock I,  $R_f$  is the risk free which represent return on treasury bills issued by central bank,  $\beta_i$  is beta coefficient of company i,  $R_m$  is the expected return on market portfolio.

The CAPM model is built on the concept that for a given exposure to uncertain outcomes, shareholder prefers higher expected returns. This theory seems rational due to its predictive nature. Following the foundation of the CAPM in the late 1960s, a good agreement of performed experimental work supported the forecasting ability of the CAPM that an asset's additional return over the risk-free rate should be proportional to its exposure to the whole market risk measured by beta (Dempsey, 2013).

The findings and results of CAPM model are very mix. The results of studies from late sixties, seventies and eighties supported the validity of CAPM Model. In these decades it is concluded that the CAPM model is able to predict the Expected return on investments. But in the mid of eighties it is able to find out that the single risk factor model does not accurately predict the expected return on stocks because there are so many other factors affecting the returns on investments such as firm size market value, financial ratios, price earnings ratio, economic condition, seasonality effect and inflation.

Dhaka stock Exchange is not sustainable market and investors find very fluctuations in prices of stock's for that reason Dhaka Stock Exchange have very different risk –return relationship. The investors discover that the market can up or down dramatically in a few sessions in April 2017 the Bangladesh DSE General Index increased 48 points or 0.84% to 5739 on Monday April 3 from 5599 in the previous trading session. Historically the Bangladesh Stock Market (DSE General) reached an all-time high of 8918.51 in December of 2010 and a record low of 282.43 in October of 1991. The main problem of DSE for investor and portfolio managers is to quantify the risk associated with securities and expected return on bearing this risk.

In general all previous regarding CAPM were aimed to achieve two objectives. Therefore the main objectives of this study is to determine that how accurately the Capital Asset Pricing model predicts the expected return and risk associated with securities listed on DSE. Secondly: How to provide information about financial assets or projects in order to help investors take financial decisions, through using the model to construct portfolios and chose its assets. The study outline will be as follows: (1) Introduction; (2) Review of previous studies on empirical evidences on CAPM; (3) Objectives of the study; (4) Data and methodology; (5) Testing CAPM; (6) Empirical results and discussion; (7) Recommendation and Conclusions;

## 2. LITERATURE REVIEW

In respect to the literatures regarding to the empirical test of the CAPM, many researchers have already engaged the relevant study in financial markets of different countries. In this section after summarizing the CAPM theoretical background, empirical studies are reviewed.

### 2.1 *theoretical background*

The risk is divided into two parts unsystematic risk and systematic risk. The unsystematic risk is risk to a particular company or industry. It is independent of economic, political and other factors that affect all securities in systematic manner. A wildcat strike may affect only one company. A new competitor may begin to produce essentially the same product, or a technological breakthrough may make an existing product obsolete. However by diversification this kind of risk can be reduced and even eliminated if diversification is efficient. Systematic risk is due to risk factors that affect the overall market such as changes in the nation's economy, tax reform, or a change in the world energy situation. These are risk that affect securities overall and, consequently, cannot be diversified away. In other words, even an investor who holds a well-diversified portfolio will be exposed to this type of risk.

The CAPM unsystematic risk is eliminated through efficient diversification. The capital asset pricing model is mainly discussing about the systematic risk, the risk related to entire market. The measure of a systematic risk in CAPM is the beta. The CAPM argues that the expected return on investment or on security will be positively related to its market beta that's mean higher or lower the security's beta the higher or lower the expected return on investment.

As an idealized theory of financial markets, the model's assumptions are clearly unrealistic. But the true test of CAPM naturally is how well it works. There have been numerous empirical test of CAPM. Most of these have examined the past to determine the extent to which stock returns and have corresponded in the manner predicted by the security market line. With few exceptions the major empirical studies in this field have conducted that:

As a measure of risk, beta appears to be related to past returns, because of the close relation between total and systematic risk, it is difficult to distinguish their effects empirically. Nonetheless, inclusion of a factor representing unsystematic risk appears to add little explanatory power to the risk/return relationship.

The relationship between past returns and beta is linear that is reality conforms to what the model predicts. The relationship is also positively sloped that is there is a positive trade-off between the two (high risk equals high return, low risk is the low return).

The capital assets pricing model was developed in hypothetical world with certain assumptions.

(i) All investors are efficient investors, who want to target points on the efficient frontier. (ii) All investments are for the same period of time. (iii) There are no taxes on trading (iv) There is no transaction cost on trading (v) All investors can lend and borrow unlimited amounts at the risk free rate. (vi) The investors have same expectations about expected returns (vii) Investors have all and equal information (viii) the investors have same expectations about expected returns (ix) the investors deal with securities that are all highly divisible into small parts.

## **2.2 empirical studies**

The Capital Asset Pricing Model (CAPM) is the most famous asset pricing model in finance literature. Since CAPM was developed half a century ago, many researchers in finance field tries to test its validity in order to evaluate its ability in explaining risk-return relationship in stock markets. Some of these studies results supported the model while others contradicted the supportive results.

Black, Jensen and Scholes (1972) analysed the impact of CAP model on New York Stock Exchange over the period 1931-1965, instead of individual stock return, to eliminate or reduce the company unsystematic risk in order to deal with effect of systematic risk on returns which can measure by beta coefficient. This method will reduce the statistical errors that may appear when estimating beta coefficient. Their findings showed a linear relationship between average excess portfolio return and the beta, and portfolios with high beta have higher returns, while portfolios with lower beta have lower returns. Fama and MacBeth (1973) extended the work of Black et.al (1972) and reached the same results.

Lau and Quay (1974) analysed the validity of CAPM on Tokyo Stock Exchange. They used the data of period of 100 companies listed on Tokyo Stock Exchange for the period of five years (1964-1969). They found that the CAPM is accurately predicts the expected return of stocks and they concluded that CAPM is perfectly applicable on Tokyo Stock Exchange.

Jagannath and Wang (1993) argued that the CAPM is widely used model to predict the risk of investment and expected return of the stocks among the investors and portfolio managers. Groenewold and Fraser (1997) used data of eight sectors of Australian stock exchange for the period from 1983 to 1993 to make comparison between CAPM, GARCH model and APT model. They found that the GARCH model and APT model provides almost same results and both models accurately predict the expected return of securities. They also concluded that the results of CAPM do not match with actual situations and provide misleading results to investors.

Khan et al. (2012) tested the CAPM in Pakistan stock exchange during the period 2006-2010 by using ten companies stock, they calculated beta of each company and its expected return then they compared the expected return with the actual return, their results indicated that CAPM is not applicable to Pakistani an stock exchange.

Depending on the previous studies mentioned above, we can concluded that some of these studies supported the CAPM while others don't. As we noticed all studies used different methods in testing the validity of the model, some used unconditional CAPM while others used conditional CAPM and thus the results are inconclusive.

### 3. OBJECTIVES OF THE STUDY

1. To evaluate the level of systematic risks for firms listed on the DSE
2. To evaluate the levels of rates of returns for firms listed on the DSE
3. To evaluate the levels of market returns for the DSE
4. To analyse how expected returns fluctuate in response to shifts in the systematic risk for firms listed on the DSE

### 4. DATA SELECTION AND METHODOLOGY

This study will cover the period 1<sup>st</sup> January 2012 to 31<sup>st</sup> December 2016. To test the validity of CAPM we use secondary type of data. All the secondary data is gathered from following sources: website of Dhaka Stock Exchange, record room of brokerage house, website of Bangladesh bank. This research is conducted on 10 companies on 5 different sectors of DSE are randomly selected. The study used the monthly closing stock prices to calculate rate of return of each stock and the monthly closing values of DSE index as proxy for the market return. Furthermore the rate of Treasury bill issued by government is used in this analysis as a risk free rate.

### 5. TESTING CAPM

The test of CAPM with portfolios can be conducted in few steps. First step starts with estimating actual returns of stock and return of market using the monthly closing stock prices and monthly closing stock values of DSE index according to the following equation

$$R_{it} = (P_t - P_{t-1}) / P_{t-1} \quad (1)$$

Where,  $R_{it}$  is the return on asset  $i$  at time  $t$ ,  $P_t$  is the closing price of stock  $i$  for month  $t$ ,  $P_{t-1}$  is the closing price of stock  $i$  for month  $t-1$ .

$$R_{mt} = (I_t - I_{t-1}) / I_{t-1} \quad (2)$$

Where,  $R_{mt}$  is the return on the market portfolio at time  $t$ ,  $I_t$  is the index value in the end of month  $t$ ,  $I_{t-1}$  is the index value in the end of month  $t-1$ .

Next step starts with estimating beta coefficient for individual stock using monthly return through regressing each stock's monthly return against the market return according to the following equation:

$$R_{it} = R_{ft} + \alpha_i + \beta_i(R_{mt} - R_{ft}) + e_{it} \quad (3)$$

Where,  $R_{it}$  is the return on asset  $i$  at time  $t$ ,  $R_{ft}$  is the risk free rate,  $\alpha_i$  is the intercept,  $\beta_i$  is the beta of stock  $i$ ,  $R_{mt}$  is the return on the market portfolio at time  $t$ ,  $e_{it}$  is the random disturbance term in the regression equation at time  $t$ .

The equation can be also express as follows

$$r_{it} = \alpha_i + \beta_i r_{mt} + e_{it} \quad (4)$$

Where  $r_{it}$  is the excess return of stock  $i$ ,  $= (R_{it} - R_{ft})$ .  $r_{mt}$  is the risk premium,  $= (R_{mt} - R_{ft})$ .  $\alpha_i$  is the intercept,  $e_{it}$  is the random disturbance term in the regression equation at time  $t$  and the  $\beta_i$  is the beta of stock  $i$ .

The study will use the additional to the risk free return. Then we will regress the company stock return as dependent variable against the market return as the independent variable.

In the second steps we will construct the portfolios by using the calculated beta through arranging the individual beta for each stock in the sample on ascending order, and then stocks will be grouped into portfolios with 5 years each according to their beta. The first portfolio will included monthly data of company for the year 2012. Similarly portfolios are created for the consecutive 5 years from 2012 to 2016.

Table 1: Portfolio formation and estimation period

| Beta estimation period | Portfolio formation period. | No of stock | No of sectors |
|------------------------|-----------------------------|-------------|---------------|
| 2012-2016              | 2012-2016                   | 10          | 5             |

In the third step we will use statistical tool Paired Sample t- test to analyse the significance of difference between actual and expected return.

## 6. ESTIMATION AND RESULT

The beta co efficient is states the relation between movement in particular security and movement in the market. Beta co efficient is a good toll to predict the relationship between risk and return.

Table 2: Selected beta co efficient and their interpretation.

| Beta | Comment                               | Interpretation                                   |
|------|---------------------------------------|--|
| 2.0  | Moves in same direction as market     | Twice as responsive as the market (more riskier) |
| 1.0  |                                       | Same responsive as the market (normal)           |
| 0.5  |                                       | Half responsive as the market (normal)           |
| 0    |                                       | Independent                                      |
| -0.5 | Moves in opposite direction as market | Half responsive as the market (defensive)        |
| -1.0 |                                       | Same responsive as the market                    |
| -2.0 |                                       | Twice as responsive as the market (more riskier) |

From the monthly data the actual and CAPM return are calculated by formula and statistical tools for the analysis and findings of this study. According to the past studies the CAPM gives mixed results when applied on the stock markets of different countries. The CAPM provide accurate results or return on a certain securities for some years on the other side it does not give accurate results in some years. We also find some mixed but mostly favourable results when applied the CAPM on Dhaka Stock Exchange and make comparison different sectors.

Table 3: Calculation of portfolio beta and interpretation

| Portfolio | P1    | P2    | P3    | P4    | P5    | P6     | P7     | P8     | P9     | P10    |
|-----------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|
| Beta      | 1.15  | 1.285 | 1.267 | 0.833 | 1.153 | 0.127  | 1.139  | 0.474  | 0.954  | 0.637  |
| Mean      | .0198 | .0109 | .0124 | .0231 | .0544 | -.0450 | -.0179 | -.0632 | -.0206 | -.0573 |

From the table we get the value of beta. When we run the regression analysis on data from 2012 to 2016 on a monthly basis we find that there is no sectors have aggressive beta. There is only one sector having normal beta; P9 and P10, but P4 also having normal beta although it is included in another sector. There are two companies having defensive beta which are P6 and P8. In view of point there are total five companies having responsive data where the particular security and market security both have same sensitivity in the market.

Table 4: Results of Pair t- test on significance difference between actual and CAPM return for yearly basis

| Portfolio | Mean   | t-value | P- value | Correlation | Standard Error |
|-----------|--------|---------|----------|-------------|----------------|
| P1        | .0198  | .572    | .598*    | -.424       | .0346          |
| P2        | .0109  | .940    | .400*    | .029        | .0115          |
| P3        | .0124  | .373    | .728*    | -.523       | .0335          |
| P4        | .0231  | .337    | .753*    | -.679       | .0685          |
| P5        | .0544  | .569    | .600*    | .596        | .0957          |
| P6        | -.0450 | -1.654  | .173*    | -.493       | .0272          |
| P7        | -.0179 | -.651   | .550*    | -.055       | .0275          |
| P8        | -.0632 | -1.989  | .118*    | -.149       | .0318          |
| P9        | -.0206 | -.960   | .392*    | -.323       | .0215          |
| P10       | -.0573 | -1.517  | .204*    | .371        | .0378          |

\*, significant at 5%

We apply paired t-test to find the p-value which indicates the significance of difference between actual and expected return. If the p-value is less than 0.05 which means there is a significant difference between actual return and CAPM return. When we analyse the data on monthly basis we find the 10 companies has no significance difference in between actual return and CAPM returns. This confirms the validity of Capital asset pricing model on Dhaka Stock Exchange. The CAPM accurately predicts the expected return of different sectors of Dhaka stock Exchange.

Our results could not consistent with the findings of Quo and Perron (2005) where they found that CAPM is not providing accurate result in most of time. Our findings are consistent with the findings of Md. Zobaer Hasan, Anton Abdul basah Kamil, Adli Mustofa and Md.AzizulBaten (2011) they found that CAPM provides the accurate results when applying on Dhaka Stock exchange.

## 7. RECOMMENDATIONS

It is recommended that the investors should more focus on CAPM results for long-term investments in Dhaka Stock Exchange.

It is necessary when studying CAPM to take in consideration the impact of the following variables; EPS, P/E, MV/BV, Dividend Yield of stock, Company Size and other financial and



marketing indicators, thus many studies proved that these variables have significant impact on stock return.

Expand the study period for at least 10 years to cover more data and companies.

It also recommended that the area of research should be included the comparing of statistically analysed CAPM return with multi factor model like APT and GARCH model.

## 8. CONCLUSION

This research paper examines the testing of the CAPM on the Dhaka Stock Exchange (DSE-30) by using Paired t-test for the time period between January 2012 and December 2016 on 10 individual companies using monthly re-turns. CAPM has been tested widely for several equity markets but there is little empirical evidence of CAPM testing on the emerging stock market of Dhaka.

The CAPM hypothesis regarding the intercept coefficient is that it should be equal to zero meaning the expected return of a stock equals the risk free rate when there is no systematic risk. A two sided t-test is employed on the intercept and the findings of this report indicate that CAPM predicts more accurately the expected return in yearly basis there is no significance difference in the return of five sectors in ten companies. Where the p-value is not less than 0.05, which means there is no significant difference between actual and CAPM. In order to further analyse the applicability of the CAPM, since it predicts a liner risk and return relationship the beta squared co efficient are used in the Pair testing

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