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Forecast Ability of the Blume's and Vasicek's Technique: Evidence from Bangladesh

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Abstract: *Estimation of forecasted beta is one of the most discussed issues both in finance literature and empirical research. This paper deals with the theoretical and empirical issues of forecasted beta estimation. Empirical study is focused on the forecast ability of different methods to estimate systematic risk and finally hypothesis testing is done in order to find out is there any significance differences between these methods to estimate future betas on the context of Bangladesh during a specified time period. This study was carried on single stocks listed in the Dhaka Stock Exchange (DSE) instead of stock portfolio. It is concluded that there exists no significance difference between Blume's Technique and Vasicek's Technique to estimate future betas on the context of Bangladesh. And forecasted beta in Blume's Technique and Vasicek's Technique are significantly different from actual beta. The findings of this paper will be useful for policy makers, all kinds of investors, corporations and other financial market- participants.*

Keywords- *Beta, Portfolio, Blume's Technique, Vasicek's Technique, Dhaka Stock Exchange (DSE).*

I. Introduction

The use of single index model calls for estimates of the beta of each stock that is a potential candidate for inclusion in a portfolio. Estimates of future beta could be arrived at by estimating beta from past data and using this historical beta as an estimate of the future beta. There is evidence that historical betas provide useful information about future betas. Although the majority of the studies were carried out in developed countries, only a limited number of studied were conducted in developing countries. The study attempts to forecast beta using Blume's and Vasicek's Technique as well as their accuracy. And finally hypothesis testing is done in order to find out is there any significance differences between these methods to estimate future betas on the context of Bangladesh during a specified time period.

1.1 Problem Statement

Beta is a valuable instrument in finance for different purposes such as for stock valuation or portfolio optimal composition, where only future values are relevant, the forecast of systematic risk becomes a significant issue. Therefore, stationary characteristics of stock and portfolio betas turn to be a researchable question. The problem statement for this research is to observe any pattern on stock's systematic risk in order to increase its forecast ability.

1.2 Objectives of the Study

The study has been conducted to forecast beta using Blume's Technique and Vasicek's Technique. And the study has been conducted on individual securities listed in Dhaka Stock Exchange (DSE). The objectives of this study are:

a. Risk-return analysis of individual securities listed in DSE.
b. Forecast beta using Blume's Technique and Vasicek's Technique.
c. Comparing the forecasted beta with actual beta.
d. Find out which technique performs well to forecast beta in DSE as well as Bangladesh Stock Market.
e. Assist investors in portfolio selection process to make the right choice.

1.3 Structure of the Paper

The text is divided into six parts: Part One, 'Introduction', introduces the importance of forecasting beta. Hence, background of the problem was given briefly in this part; followed by Problem Statement, Objectives of the Study of this research. Part Two, 'Literature review', has been executed in three phases; it discusses, firstly, overview of Dhaka Stock Exchange; secondly, Systematic Risk; thirdly, Adjusted Beta. Part Three, 'Methodology and Data', explains data source and methodology. Part Four, 'Data Analysis and Findings', discusses the results of the study. As the result of the study determined by Analysis of Variance (ANOVA), the presenting of data in the findings part is considered easier to understand. Part Five, 'Conclusion', concludes the research result as well as the limitation of the research. Part Six, 'References', provide the lists of full bibliographical details and their journal titles.

II. Literature Review

2.1 Overview of Dhaka Stock Exchange (DSE)

235 companies traded on DSE until June 2012. In 2010-2011, the volume of trade of listed securities increased by manifold at the Dhaka Stock Exchange. In 2010-2011, a total of 1969 crore and 52 lakh securities were traded on the Dhaka Stock Exchange, the value of which stands at Tk. 3 lakh 25 thousand 915 crore. On the other hand, 1012 crore and 84 lakh securities were traded in 2009-10, the value of which was Tk. 256,349 crore. The number of trading days was 240 days in 2010-2011, which was 244 days in 2009-2010. The average number of securities traded was 8.20 crore in 2010-2011 and average transaction was Tk. 1357 crore 98 lakh. On the other hand, 4.15 crore securities were traded in 2009-2010 and average transaction was Tk. 1050 crore and 61 lakh. DSE's all-share price index was 5160.05 points at the year ended on June 30, 2010 which lost 66.86 points and stood at 5093.19 points on June 30, 2011. The DSE's all-share price index stood highest 7383.94 points on December 5, 2010. Nine new companies were listed at the DSE during 2010-11 raising the number of listed companies to 232.

In addition, The DSE's market capitalization to GDP ratio was 41.10 percent at the year ended on June 30, 2011. Collecting tax at source on share transaction from its member companies, the Dhaka Stock Exchange deposited Tk. 325.91 crore in fiscal year 2010-2011 and Tk. 128.17 crore in fiscal year 2009-2010, to the government exchequer.

2.2 Systematic Risk

The measurement and determination of risk have received considerable attention in recent years. One measure of risk is systematic risk, defined as the risk inherent to the entire market or entire market segment. It is also known as "un-diversifiable risk" or "market risk." Interest rates, recession and wars all represent sources of systematic risk because they affect the entire market and cannot be avoided through diversification. Whereas this type of risk affects a broad range of securities, unsystematic risk affects a very specific group of securities or an individual security. Systematic risk can be mitigated only by being hedged. Even a portfolio of well-diversified assets cannot escape all risk. Systematic risk is also defined in terms of the covariance of a security's return with the return from the market portfolio. The relationship is often standardized by dividing the covariance by the variance of return from the market portfolio. Hereafter, this measure of standardized systematic risk shall be referred to as *beta.*

2.2 Adjusted Beta

To correct the tendency towards one, two main models were suggested in the literature: Blume's Model and Vasicek's Model. Which model is preferable, if any, in forecasting betas? Murray (1995), Hawawini, Michel and Corhay (1985), Luoma, Martikainen and Perttunen(1996) presented the evidence that adjusted betas tend to outperform unadjusted betas. [3]

Gooding and O'Malley (1977) who developed an empirical test on both adjusted and unadjusted betas rejected beta stationary. They found that well-diversified portfolios of extreme betas are significantly non-stationary. Therefore they concluded that in order to improve performance on beta forecasts; adjustments should be made not only to take into consideration the regression tendencies but the market trends too. [4]

According to Blume (1971 and 1975), the systematic risk of stock portfolio tends to show relatively stable characteristics. However, he observed a tendency of betas to converge towards the mean of all betas (1.0). He corrected past betas by directly measuring this adjustment toward one and assuming that the adjustment in one period is a good estimate of the adjustment in the next. It modifies the average level of level of betas for the population of stocks. [6]

Vasicek (1973) has suggested the following scheme that incorporates these properties: If we let $\bar{\beta}_i$ equal the average beta, across the sample of stocks, in the historical period, then the Vasicek procedure involves taking a weighted average of $\bar{\beta}_i$ and the historic beta for security *i*. The weighting procedure adjusts observations with large standard errors further toward the mean than it adjusts observations with small standard errors. As Vasicek has shown, this is a Bayesian estimation technique. The estimate of the average future beta will tend to be lower than the average beta in the sample of stocks over which betas are estimated. [7]

Klemkosky and Martin (1975) found that the Bayesian technique had a slight tendency to outperform the Blume technique. However, the differences were small and the ordering of the techniques varied across different periods of time. [8]

Elton, Gruber and Urich (1978) found some time periods where, with statistical significance, the blume technique outperformed the vasicek technique on forecasting future betas. But the answer to which is the best, should be a result of the goal for which betas are being computed. [9]

Emanuel (1980) concluded that for small portfolios their beta coefficients of one period were good predictors of the corresponding betas in the subsequent period. [10]

Dimson and Marsh (1983) investigated the stability of the beta of thin trading securities after using a method designed to avoid thin trading bias. The findings of this study indicated that the stability of individual securities betas was moderate; whereas portfolio betas were very stable (the portfolio beta stability was examined by using the transition matrices method, while the present study utilizes the mean square error technique). Also by employing two adjustment techniques (Blume and Vasicek) for the security beta coefficients their results showed improvements in beta forecasts. [11]

Bera and Kannan (1986) tested the data and observed possible deviation from normality and concluded that adjustment techniques proposed by Blume and Vasicek may not always be appropriate. [12]

Lally (1998) concluded that typical applications of Vasicek's method seem to mistakenly equate the prior distribution with the cross-sectional distribution of estimated rather than true betas, that Blume's implicit forecast of any tendency for true betas to regress towards one may not be desirable, that preliminary partitioning of firms into industry type groups (as is typical for Vasicek) is desirable, and that conversion of OLS equity betas to asset betas before applying the correction process is also desirable. [13]

Cloete, Jonah and Wet (2002) Showed that the idea of combining robust estimators with the Vasicek-estimator yields a class of new estimators that performs well when compared to traditional estimators. [14]

Gray, Hall and Klease (2006) showed that *Vasicek* beta estimates are an unbiased estimate of the subsequent period's *OLS* beta estimate, while *OLS* and *Blume* beta estimates are biased predictors. [15]

Sinha and Jayaraman (2012) observed that Bayesian techniques outperform classical methods in most of the cases. Further, they observed that the Blume's technique helps to capture the over and under estimation in the beta measure, this information can be utilized optimally to apply the Bayesian model under bilinear loss function and improve the accuracy of the estimates. [16]

Based on the study's objectives and the literature review the following hypotheses can be formulated:

H1: There is no significance difference between actual beta and forecasted beta using Blume's Technique.

H2: There is no significance difference between actual beta and forecasted beta using Vasicek's Technique.

H3: There is no significance difference between the outcome of Blume's Technique and Vasicek's Technique.

III. Methodology And Data

3.1 Data Source

This paper aims at forecasting beta using Blume's technique and Vasicek's technique as well as their ability to forecast beta. For this purpose monthly closing price of the shares, dividend information and monthly closing index value of the benchmark market index (DSE all share price index) have been used for the period from January 2001 to December 2012. They were collected from Dhaka Stock Exchange. This study takes 101 companies listed in Dhaka Stock Exchange (DSE). The study has used secondary data because it pertains to historical analysis of reported financial data. The collected data were consolidated as per study requirements. Various statistical tools have been used to analyze data through Microsoft Excel software.

3.2 Methodology

This study is based on different techniques for better estimation of betas. Beta is simply a measure of sensitivity of stock to market movement. Forecasting betas with accuracy is important because they affect the inputs for the portfolio analysis. The calculation of beta for each stock is formally shown below:

$$\beta_i = \frac{\sigma_{im}}{\sigma^2_m} \tag{1}$$

Where β_i = Beta for individual security *i;* σ^2_m = Covariance between the return on individual security *i* and the return on market; and σ_{im} = Variance of the market return.

3.2.1 Blume's Technique

Blume's analysis on the behavior of betas over time shows that there is a tendency of actual betas in the forecast period to move closer to one than the estimated betas from historical data. Blume's technique attempts to describe this tendency by correcting historical betas to adjust the betas towards one, assuming that adjustment in one period is a good estimate in the next period. Consider betas for all stocks i in period 1, β_{i1} and betas for the same stocks i in the successive period 2, β_{i2}**.** The betas for period 2 are then regressed against the betas for period 1 to obtain the following equation:

$$\beta_{i2} = b_0 + b_1\beta_{i1} \tag{2}$$

The relationship implies that the beta in period 2 is $b_0 + b_1$ times the beta in the period 1.And use equation (1) to forecast betas for period 3.

3.2.2 Vasicek's Technique

Vasicek's technique adjusts past betas towards the average beta by modifying each beta depending on the sampling error about beta. When the sampling error is large, there is higher chance of larger difference from the average beta. Therefore, lower weight will be given to betas with larger sampling error. The following formula demonstrates this idea:

$$\beta_{i2} = \frac{\sigma^2_{\beta i1}}{\sigma^2_{\bar{\beta}1} + \sigma^2_{\beta i1}} \bar{\beta}_1 + \frac{\sigma^2_{\bar{\beta}1}}{\sigma^2_{\bar{\beta}1} + \sigma^2_{\beta i1}} \beta_{i1} \quad (3)$$

Where βi_2 = forecast of beta for stock i for period 2 (later period); $\bar{\beta}_1$ = average beta across the sample of stocks in period 1 (earlier period); $\sigma^2_{\bar{\beta}1}$ = variance of the distribution of historical estimates of beta across the sample of stocks; βi_1 = estimate of beta for stock i in period 1; and $\sigma^2_{\beta i1}$ = variance of the estimate of beta for stock i in period 1.

IV. Data Analysis And Findings

For estimating beta, a sample size of 101 companies is selected from the securities listed on Dhaka Stock Exchange (DSE). DSE all share price index is taken as the market index. Monthly closing price of these securities is used for the period from January 2001 to December 2012. They are collected from DSE.

Table 1: Sector-wise Percentage of Data Coverage

Name of the Industry	Total Number of Companies	No. of Companies	% of Data Coverage
Bank	30	16	53.33%
Financial Institutions	22	3	13.64%
Engineering	23	16	69.57%
Food & Allied	16	5	31.25%
Fuel & Power	14	3	21.43%
Jute	3	0	0.00%
Textile	26	10	38.46%
Pharmaceuticals & Chemicals	20	13	65.00%
Paper & Printing	1	0	0.00%
Services & Real Estate	4	2	50.00%
Cement	6	4	66.67%
IT - Sector	6	0	0.00%
Tannery Industries	5	4	80.00%
Ceramic Industry	5	2	40.00%
Insurance	45	17	37.78%
Miscellaneous	9	6	66.67%
Total	**235**	**101**	42.98%

From the table 1 it can be seen that among 235 companies 101 companies are selected due to the reason of the availability of data within the time frame (January 2001 to December 2012). It has covered 42.98% data and it can be said that data coverage is moreover satisfactory to make a decision.

Hypothesis Testing 1: There is no significance difference between actual beta and forecasted beta using Blume's Technique.

For this purpose ANOVA or the "Analysis of Variance' procedure or "F-test" is used to test the significance of the differences between actual beta and forecasted beta using Blume's Technique.

Table 2: Output of Hypothesis Testing 1

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.808445	1	0.808445	17.25845	4.83E-05	3.888375
Within Groups	9.368687	200	0.046843			
Total	10.17713	201				

Table 2 clearly explains the results of hypothesis testing. The .05 and .01 significance levels are the most common, but other values, such as .02 and .10 are also used. In theory, we may select any values between 0 and 1 for the significance level. In this case 5% significance level is used. At the 0.05 significance level, the F-critical value is 3.888375. The decision rule is to reject the null hypothesis if the computed value of *F* is greater than 3.888375. From the ANOVA table it is found that the calculated F value is 17.25845**.** And the result is statistically significant as it is significant at 0.000 level which is less than 0.05 or 5% level. That's mean the forecasted beta in Blume's Technique is significantly different from actual beta. In fact, this p-value is less than 1%. There is a small likelihood that null hypothesis is true.

Hypothesis Testing 2: There is no significance difference between actual beta and forecasted beta using Vasicek's Technique.

For this purpose ANOVA or the "Analysis of Variance' procedure or "F-test" is used to test the significance of the differences between actual beta and forecasted beta using Vasicek's Technique.

Table 3: Output of Hypothesis Testing 2

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.808445	1	0.808445	16.40282	7.32E-05	3.888375
Within Groups	9.857395	200	0.049287			
Total	10.66584	201				

From Table 3 it is found that the calculated F value is 16.40282. In this case 5% significance level is used. At the 0.05 significance level, the F-critical value is 3.888375. The decision rule is to reject the null hypothesis if the computed value of *F* is greater than 3.888375. And the result is statistically significant as it is significant at 0.000 level which is less than 0.05 or 5% level. That's mean the forecasted beta in Vasicek's Technique is significantly different from actual beta. In fact, this p-value is less than 1%. There is a small likelihood that null hypothesis is true.

Hypothesis Testing 3: There is no significance difference between the outcome of Blume's Technique and Vasicek's Technique.

ANOVA or the "Analysis of Variance' procedure or "F-test" is used to test the significance of the differences between the outcome of Blume's Technique and Vasicek's Technique.

Table 4: Output of Hypothesis Testing 3

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0	1	0	0	1	3.888375
Within Groups	0.846236	200	0.004231			
Total	0.846236	201				

From Table 4 it is found that the calculated F value is 0. In this case 5% significance level is used. At the 0.05 significance level, the F-critical value is 3.888375. The decision rule is to reject the null hypothesis if the computed value of *F* is greater than 3.888375. From the ANOVA table it is found that the p-value is 1. That's mean there is no reason to reject the null hypothesis. So, there is no significance difference between the outcome of Blume's Technique and Vasicek's Technique.

V. Conclusion

Forecasting betas with accuracy is important because they affect the inputs for the portfolio analysis. The variance covariance matrix is based on the value of beta for each stock. There are basically two reasons for estimating betas: The first is in order to forecast future betas. The second is to generate correlation coefficients as inputs to the portfolio problem. Different techniques have been proposed for better estimation of betas.

This empirical study is focused on the forecast ability of different methods to estimate systematic risk and finally hypothesis testing is done in order to find out is there any significance differences between these methods to estimate future betas as well as their accuracy. For this purpose Blume's Technique and Vasicek's Technique were applied by using the monthly closing prices of 101 companies listed in DSE and DSE all share price index for the period from January 2001 to December 2012. It is concluded that there exists no significance difference between Blume's Technique and Vasicek's Technique to estimate future betas on the context of Bangladesh. Blume's Technique and Vasicek's Technique fails to forecast accurate beta due to the inefficient scenario of Bangladesh stock market during the time frame taken for this study.

5.1 Limitations of the Research

This paper attempts to forecast beta by using Blume's Technique and Vasicek's Technique and thereby helps to make investment decisions. The current study however has some limitations. This study did not take into consideration the companies that are not listed on the DSE and the companies that are listed and traded but stopped operations. This study used monthly data rather than daily data. This study has successfully concluded the forecast ability of these two techniques; future research may concentrate on forecasted beta estimation with accuracy and the development of new adjusted beta techniques as well as their synthesis.

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