**“Beta” with “Size Premium” an Augmented Approach in The Frontier Equity Market: Evidence from Dhaka Stock Exchange.**

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**Abstract**

Traditionally, firm size has adopted in numerous heuristic asset pricing models as a determining factor of expected stock returns. So far as like systematic risk “beta”, there is diminutive consensus over the magnitude and firmness of the “size” premium. Converging on the controversy this article attempts to examine the traditional Capital Asset Pricing Model (CAPM) and “size” augmented CAPM in the Dhaka Stock Exchange (DSE). The goal of this article is to examine the impact of an overall market factor and factor related to the firm size risk on expected stock returns at the portfolio level. Our sample encompasses non-financial stocks listed on DSE, with daily observations starting from January 2014 to December 2018. Depending on Market Capitalization and Book-to-Market Ratios we construct nine different portfolios, Ordinary Least Square (OLS) regression methodology is used to examine the models. Unlike common reckoning, we observe the strong existence of the “size” effect in frontier equity market DSE and has a tangible impact on explaining expected stock returns at the portfolio level. Additionally, the “size” augmented Capital Asset Pricing Model explains DSE better than the standard CAPM, may indeed be a good tool for a realistic assessment of the expected asset returns, and can improve the description of equilibrium in the Frontier equity market DSE.

**Keywords**: Capital Asset Pricing Model (CAPM); Size Premium; Frontier Equity Market

JEL classification: E44, G11, G12, G17

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**1.0 Introduction**

No financial theory is a perfect representation of reality. A rudimentary question in finance that has not yet been fully answered is how the expected return relates to the risk associated with an investment. Around the 1930s, the thought of portfolio formation was well established within the minds of knowledgeable investors. In 1938, John Burr William’s captured the thinking of the portfolio formulation by framing the “dividend discount model” (William, 1938). Meaningful theories of investor’s risk preferences and decision-making under uncertainty came into light between the 1940s and 1950s, especially through the work of Neumann and Morgenstern (1944). In such a scenario, the Capital Asset Pricing Model (CAPM) evolved and considered the first comprehensible mathematical framework for exploring the risk-return relationship of an investment. The model was developed in the early 1960s by William Sharpe (1964) and Linter (1965). Fama once a great advocate of CAPM, later in 1992 questioned the validity of CAPM examining the US market. They did not find anything substantial between average return and beta, however, in the same study, they observe two significant risk factors namely “size” and book-to-market equity in explaining the variation in average returns. Fama and French (1993) proposed a multifactor asset pricing model that coincides with market risk, “size” and “book to market” equity are two additional risk factors needed to explain the variation in average returns.

Around the early eighty’s, the very beginning of the earliest days of empirical work in academic finance, the size effect was the first market anomaly to challenge the standard asset pricing model and prompt arguments about market efficiency. Numerous empirical studies show that companies of smaller size are associated with more risk and, therefore, they have a greater cost of capital. In either way, the idea that smaller firms on average generate higher stock-market returns compares to their large competitors, even if after risk adjustment it was an unwavering fact of financial markets has been in trend for decades. Banz (1981) and Reinganum (1981) study outcome favor this trend to establish that small-caps outperformed on average the market index.

In this study, we followed Fama and French (1993) approach where the size effect is analyzed with reference to standard CAPM. Henceforth, the objective of this study is to examine the excess returns of the size sorted portfolios comparing with commonly used asset-pricing models and by what means the models capture the average returns of stock in DSE. Nevertheless, our research limitation is that we have not attempted to further clarify how precisely the market proxy used approximated the true market portfolio. The rest of this study is structured as follows. Section 2 reviews the literature relating to risk-return relationship and the size anomaly. Section 3 provides the dataset and methodology, Section 4 offers the result discussion and Section 5 concludes the study.

**2.0 Literature Review**

This evidence Fama (1993) was key to the growth of small-cap mutual funds that capitalized on the size premium. In reality, the discovery of the size effect spurred a series of small-cap indices and active funds to a point in which the investment terrain has reshaped and is now classified into large and small stock universes. Despite its grand appearance by Banz and Reinganum (1981) as an asset pricing anomaly in financial literature, within a short period “size effect” has gone under debate. This debate started when Keim (1983) and few other scholars (See Brown et al.,1983; Schultz, 1983; Stoll and Whaley, 1983) noted that the “size effect” may have disappeared. Keim (1983) examine NYSE and AMEX common stocks month-by-month and observed that the relation between abnormal returns and size is always negative. Prior research of Dimson and Marsh (1999), Horowitz et al. (1999) Hirshleifer (2001) Schwert (2003) Cochrane (2005) concluded similarly rather than a proposing different explanation for the disappearance of size effect only.

However, in the last decade, “size effect” seems to reappear as an anomaly in asset pricing. Though in this decade findings of Brailsford et al. (2011), Dou et al. (2012), Fama & French (2012), Cakici and Tan (2014), and Chiah et al. (2016) denies the significant existence of “size effect”, in contrary C. Ang (2018), Atanasov and Nitschka (2017), Schmidt et al. (2017), Ibbotson et al. (2016), Gaunt (2015) Zhong et al. (2014) and De Moor and Sercu (2013) in their study reaffirms the size effect anomaly and most importantly the relationship between abnormal return and size anomaly is observed substantial.

Most of the previous studies regarding asset pricing anomalies heavily focused on developed markets including very few in the emerging markets. Since by virtue frontier markets are characterized as inefficient market, application of asset pricing models regarding those markets is observed rarely. In this paper, we try to explore the systematic risk-return relationship at the portfolio level and additionally added between expected return and firm size for data from the Dhaka Stock Exchange (DSE), a frontier equity market during 2014 to 2018. The essence of this study is to interpret whether an investor with a frontier market approach can take benefit of the reality of such an anomaly to generate statistically significant abnormal returns. Typically, international investor’s portfolios have a habit of being prejudiced in the direction of the largest and most liquid listed companies. Hence, these aftermaths are mostly useful to those international investors as well as for local investors of frontier equity market DSE.

**3.0 Data and Methodology**

3.1 Data Source

Daily data of listed stocks on the DSE is used in this study. The sampling period for this paper extends from January 1, 2014, to December 31, 2018, within five years, since beta calculated over a longer period may lead to biased results as the beta may change over the period (Bartholdy and Peare, 2003). Daily returns are calculated as differences in price at closing. Data used include net asset value (NAV), market capitalization (MC), the number of shares, and the year-end closing price of the studied companies. The number of stocks outstanding and the year-end closing price is used to calculate MC. NAV and the year-end closing price are the inputs used to calculate Book-to-Market (BMR) Ratio. The yield on the 91 days Treasury bill (TB) taken from the Bangladesh Bank Quarterly report, and used as an approximation of the risk-free rate. The present study considered DSE 30 Index (DS 30) is developed by leading index providers S&P Dow Jones as a proxy from which the overall market returns are calculated. The excess return of the market is the return of the market over the risk-free return.

3.2 Sample

In this study, non-financial companies are considered following the criteria set by Fama and French (1992, 1993) and recently followed by Pena et al. (2010), Hasan et al. (2011), Gabriel (2014), Acheampong and Swanzy (2016), Ajlouni and Khasawneh (2017). Financial companies do not indicate the same meaning as non-financial firms. Hence, the study sample comprises all companies in DSE in all cases, excluding banks, insurance, finance company, and mutual funds. In addition, stocks having negative NAV and whose return data are not available for the full year, reasonably excluded from the sample. Partitioning companies into market equity sizes perform by following Basiewicz and Auret (2010) application. Based on the above criteria, the present study covers 138 companies in 2014; 163 companies in 2015; 174 companies in 2016; 177 companies in 2017, and 186 companies in 2018 and considered as a sample.

3.3 Portfolio Construction

Considering the “size” and number of eligible companies, we construct nine portfolios considering the Market Capitalization (MC) and Book-to-Market Ratios (BMR) of the companies. Here stocks are divided into three MC and three BMR set for the bottom 30% (Low, ‘L’), middle 40% (Medium ‘M’,) and the Higher 30% (High, ‘H’) by following Karp and Vuuren, (2017), Eraslan, (2013), Bhatnagar and Ramlogan, (2012), Djajadikerta and Nartea, (2005), and Connor and Sehgal, (2003). When divided MC into three parts, the first part named is MC1 (Low Market Capitalization), the second part is MC2 (Medium Market Capitalization), and the third part is MC3 (High Market Capitalization). In the same way, BMR is divided into three parts. The first part is named BMR1 (Low Book-to-Market Ratios), the second part as BMR2 (Medium Book-to-Market Ratios), and the third part as BMR 3 (High Book-to-Market Ratios). According to these, nine portfolios are constructed by combining the three size portfolios and three Book-to-Market portfolios, thereafter it produces a 3х3 matrix of stock portfolios, which is visualized in Table 1.

Table 1: Portfolio Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Table 1 3х3 Matrix of nine Portfolio formed on MC and BMR | | | | | |
|  | MC (Size) | Low | Medium | High |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | Small | S/L | S/M | S/H |  |  |
|  | Medium | M/L | M/M | M/H |  |  |
|  | Big | B/L | B/M | B/H |  |  |
|  |  |  |  |  | BMR |  |

3.4 Estimation methodology

To estimate different factor models we used the Ordinary Least Squares (OLS) method in regression analysis. Time Series Regression (TSR) test for evaluating the performance of portfolio returns. This study follows the same Fama and French (1993) approach to measure the predictive capability of the stock risk-return relationship and whether there is the existence of a “size” effect at the portfolio level in DSE. There are several indicators to measure firm size, however, following Al-Khazali, Osamah, & Zoubi (2011), the market capitalization indicator is used to measure as size factor and used. In order to estimate SCAPM and standard CAPM, we used the OLS method in regression analysis. In regression analysis, we included Heteroskedasticity and J. Minović and B. Živković Autocorrelation Consistent Covariances (HAC) method for consistent standard error estimates. The HAC method gives consistent estimates of standard errors in the presence of strange form of heteroskedasticity and autocorrelation (Minović and Živković, 2012). We used the R2 determination coefficient, F-test for regression significance, and t-test for parameters significance to check the adequacy of the model, we have chosen a model that best describes the equilibrium of the DSE.

3.4.1 Independent Variable:

3.4.1.1Excess Return on the Market *(RM-RF)*:

It is the daily changes in DSE 30 Index (DS 30) (proxy for Market Return) subtracted from the Risk Free Rate of Return () (Converted 91 days T-bill into daily Risk Free Rate of Return).

3.4.1.2 *SMB*

Size Premium or Small minus Big (*SMB*) represents the premium required by investors as a reward for bearing the size risk, which is the difference between the daily return on a portfolio of small stocks and the portfolio of big stocks at time*t* (Fama and French, 1993; Karp and Vuuren, 2017). *SMB* is measured as:

*SMB*= (S/L+S/M+S/H) - (B/L+B/M+B/H)

3.4.2. Dependent Variables

3.4.2.1 Expected Excess Return of a Portfolio ***(****RP- RF)*:

It is the daily excess rate of return for the portfolios, which is measured as the rate of return on a portfolio at time*t* (daily basis) minus Risk-Free Rate of Return (Converted 91 days *t*-bill into daily Risk-Free Rate of Return). The excess returns on the nine portfolios are used as dependent variables in the case of the Time Series Regressions (TSR).

Mathematically the CAPM model can be presented as follows:

*RPt - RFt* = *a0*+*β1 (RMt- RFt)*+ *εt*----------------------------------------------------------------------- (1)

Where

*RPt* =Total Return of a Portfolio at time*t*

*RFt* = Risk Free Rate of Return at time*t*

*RMt* =Total Market Portfolio return at time*t*

*RPt - RFt* = Expected Excess Return of a Portfolio

*RMt -RFt* = Excess Return on the Market Portfolio

*β1* = Factor Coefficient

*εt* = Error term

In line with the basic CAPM equation (equation 1) one additional factor, *SMBt*, is added in the CAPM model to observe the size effect as well as its impact on the explanatory power of the model in DSE. The regression equation is specified as follows:

*RPt - RFt* = *a0+β1 (RMt-RFt ) + β2SMBt + εt*-------------------------------------------------------(2)

*RPt* =Total Return of a Portfolio at time*t*

*RFt* = Risk Free Rate of Return at time*t*

*RMt* =Total Market Portfolio return at time*t*

*RPt - RFt* = Expected Excess Return of a Portfolio

*RMt -RFt* = Excess Return on the Market Portfolio

*SMBt* = Size Premium (small minus big)

*β1, 2* = Factor Coefficients

*εt* = Error term

**4.0 Result discussion**

Table 2: Descriptive Statistics of the Independent Variables and nine Portfolios for the year 2014 to 2018.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Portfolio | Mean | Std. Dev. | Minimum | Maximum |
| S/L | 0.0006 | 0.0096 | -0.0327 | 0.0973 |
| S/M | -0.0001 | 0.0096 | -0.0387 | 0.0479 |
| S/H | -0.0003 | 0.0107 | -0.054 | 0.0416 |
| M/L | 0.0003 | 0.0091 | -0.0283 | 0.1004 |
| M/M | -0.0004 | 0.0098 | -0.0412 | 0.0539 |
| M/H | -0.0006 | 0.0103 | -0.0735 | 0.0475 |
| B/L | 0.0006 | 0.0078 | -0.0333 | 0.0985 |
| B/M | -0.0002 | 0.0073 | -0.0287 | 0.0361 |
| B/H | -0.0004 | 0.0076 | -0.0465 | 0.0298 |
| *RMt-RFt* | -0.0001 | 0.0072 | -0.0284 | 0.0373 |
| *SMBt* | 0.00007 | 0.0066 | -0.0249 | 0.0289 |

Source: Authors own calculation

Table 2 shows mean, standard deviation, minimum and maximum of nine portfolios (S/L, S/M, S/H, M/L, M/M, M/H, B/L, B/M, and B/H) for the study period. Excess Return on the Market Portfolio *(RMt -RFt)*, have negative mean, however, for *SMBt* portfolio returns have positive mean. It confirms that the return of small firms is higher than those of large firm.

Table 3 : The Capital Asset Pricing Model (CAPM): Excess Return on the Market Portfolio *(RMt -RFt)* is Independent Variables and the Excess Rates of Return of the nine Portfolios are Dependent Variables (Year: 2014 to 2018).

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***RPt - RFt = a0 +β1 (RMt - RFt) + εt*** | | | | | | | | | | | | |
| Portfolio | Book-to-Market Ratio | | | Book-to-Market Ratio | | | Book-to-Market Ratio | | | Book-to-Market Ratio | | |
| LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH |
| ***a0*** | | | ***β1*** | | | **t- statistic** | | | **P Value** | | |
| **MC1** | 0.0007 | -0.00005 | -0.0002 | 0.2898 | 0.4816 | 0.4664 | 6.3457 | 8.4181 | 7.8694 | 0.000 | 0.000 | 0.000 |
| **MC2** | 0.0004 | -0.0003 | -0.0006 | 0.4072 | 0.5829 | 0.571 | 9.4933 | 9.3295 | 9.5902 | 0.000 | 0.000 | 0.000 |
| **MC3** | 0.0006 | -0.0001 | -0.0003 | 0.2939 | 0.4737 | 0.461 | 9.1964 | 10.8953 | 11.451 | 0.000 | 0.000 | 0.000 |
| **Determination** | **Adjusted R2** | | |  |  |  |  |  |  |  |  |  |
| **MC1** | 0.0461 | 0.1306 | 0.0971 |  |  |  |  |  |  |  |  |  |
| **MC2** | 0.1037 | 0.1814 | 0.1589 |  |  |  |  |  |  |  |  |  |
| **MC3** | 0.0738 | 0.2165 | 0.1917 |  |  |  |  |  |  |  |  |  |

Source: Authors own calculation

The present study shows that the market factor beta features a significant positive relationship with stocks’ excess returns altogether nine portfolios. The coefficients of the small firm portfolios are above the large firms’ portfolios and therefore the difference between the average small firm portfolios slope and the average large firm portfolios slope is 0.003067. This finding implies that when the size factor increases by one unit, the stock return for the small portfolios also increases by 0.003067, which is above the large portfolios on average. For medium-firm portfolios, the coefficients are higher also than the large firms’ portfolios are. Consequently, the difference of slope value between the average medium-firm portfolios and the large firm portfolios is 0.110833. In addition, the average slope value for the high BMR portfolios market factor is 0.169167 and this value is higher than those of low BMR portfolios market factor. It designates that when the BMR increases by one unit, the stock return for the high BMR portfolios also increases by 0.169167 and it is higher than the low BMR portfolios on average. The average slope for the medium BMR portfolios market factor is 0.182433 and this value is higher than the low BMR portfolios market factor. These findings reveal that the firm size exists on the DSE and these findings are consistent with the findings of previous studies (Fama and French, 1992; Fama and French, 1993; Drew et al., 2003). The values of adjusted R2 for nine portfolios are ranging from 4.61% to 21.65%. This result indicates that the CAPM performs rather weakly in predicting the variation of the stock’s return at the portfolio level in DSE. The earlier study of Ajlouni and Khasawneh (2017); Karp and Vuuren (2017); Hanif and Bhatti (2010); Bajpai and Sharma (2015); Ansari (2000) Gupta and Sehgal (1993) also demonstrated similar findings.

Table 4 shows the results of CAPM with the size premia (*SMBt*)on DSE. The purpose is to check whether the presence of the size effect is or not and additionally patterned the explanatory power of the size augmented CAPM in DSE. After adding explanatory variable size premia (*SMBt*), the average adjusted R² of nine portfolios increased to 30.78% from 13.31%, which confirms a round about 130% rise in the explanatory power of the model. For small firm portfolio, size premia spotted more dominant and therefore the average adjusted R² value rises to 54.03% from 9.13%.

Table 4: The CAPM with *SMBt*: Excess Return on the Market Portfolio *(RMt-RFt)* and the *SMBt* are Independent Variables and the Excess Rates of Return of the nine Portfolios are the Dependent Variables (Year: 2014 to 2018).

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***RPt - RFt = a0 +β1(RMt - RFt) + β2SMBt + εt*** | | | | | | | | | | | | |
| Portfolio | Book-to-Market Ratio | | | Book-to-Market Ratio | | | Book-to-Market Ratio | | | Book-to-Market Ratio | | |
| LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH | LOW | MEDIUM | HIGH |
| ***a0*** | | | ***β1*** | | | **t- statistic** | | | **P Value** | | |
| **MC1** | 0.0006 | -0.0001 | -0.0003 | 0.2869 | 0.4787 | 0.4628 | 9.133 | 11.037 | 11.803 | 0.000 | 0.000 | 0.000 |
| **MC2** | 0.0003 | -0.0003 | -0.0006 | 0.4063 | 0.5821 | 0.5694 | 10.287 | 9.768 | 10.818 | 0.000 | 0.000 | 0.000 |
| **MC3** | 0.0006 | -0.0001 | -0.0004 | 0.294 | 0.4739 | 0.4605 | 9.202 | 10.846 | 11.783 | 0.000 | 0.000 | 0.000 |
|  | ***a0*** | | | ***β2*** | | | **t- statistic** | | | **P Value** | | |
| **MC1** | 0.0006 | -0.0001 | -0.0003 | 0.9299 | 0.9467 | 1.168 | 9.133 | 24.455 | 26.989 | 0.000 | 0.000 | 0.000 |
| **MC2** | 0.0003 | -0.0003 | -0.0006 | 0.2953 | 0.2899 | 0.5251 | 6.965 | 5.307 | 9.665 | 0.000 | 0.000 | 0.000 |
| **MC3** | 0.0006 | -0.0001 | -0.0004 | -0.053 | -0.0746 | 0.1722 | -1.382 | 10.846 | 3.92 | 0.167 | 0.060 | 0.000 |
| **Determination** | **Adjusted R2** | | |  |  |  |  |  |  |  |  |  |
| **MC1** | 0.452 | 0.556 | 0.613 |  |  |  |  |  |  |  |  |  |
| **MC2** | 0.149 | 0.219 | 0.272 |  |  |  |  |  |  |  |  |  |
| **MC3** | 0.075 | 0.22 | 0.214 |  |  |  |  |  |  |  |  |  |

Source: Authors own calculation

The result shows the significance of the size effectin explaining variations in portfolio return and that its contribution tends to be greater for small portfolios (S/L, S/M, S/H) than for medium portfolios (M/L, M/M, M/H) and big size portfolios (B/L, B/M, B/H). The findings of this study are similar to the small firm effect theory which explains smaller firms perform better than larger firms do. Moreover, it is noticed that the *SMBt* is negative relative to the stock returns and this finding is consistent with the earlier findings of Wang and Xu (2004). One plausible explanation for the present finding is that smaller firms have a greater amount of growth opportunities and have a tendency to be more volatile compared to their peers of larger firms. Earlier, Ajlouni and Khasawneh (2017), Kilsgard and Wittorf (2010), Drew et al. (2003) and Fama and French (1993) conclude with similar notation.

Table 5: Summary of Adjusted R2 for the Year 2014 to 2018.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | CAPM | | | | | | | | |
| Portfolio | S/L | SM | S/H | M/L | M/M | M/H | B/L | B/M | B/H |
| Adjusted R2 | 0.0461 | 0.1306 | 0.0971 | 0.1037 | 0.1814 | 0.1589 | 0.0738 | 0.2165 | 0.1917 |
| Model | The CAPM augmented with *SMB* | | | | | | | | |
| Adjusted R2 | 0.452 | 0.5563 | 0.613 | 0.149 | 0.2186 | 0.272 | 0.075 | 0.2203 | 0.2136 |

Source: Authors own calculation

Table 5 shows the summary result of the adjusted R2 value in time series regression. The average adjusted R² of nine portfolios in the CAPM model is 13.33%, besides this when the size premia factor is added in the CAPM model average adjusted R² value of nine portfolios raises significantly from 13.33 % to 30.78%. For only small size (S/L, S/M, S/H) portfolio average adjusted R² value reaches 54.04%, for medium portfolios (M/L, M/M, M/H) it increases from 14.82% to 21.32%. However, for big-size portfolios (B/L, B/M, B/H) adjusted R² value before and after adding “size” premium is observed 16.06% and 16.96 %, are almost identical.

**5.0 Conclusion**

In this paper, we examined standard CAPM and “size” augmented CAPM in the Dhaka Stock Exchange. We used data from the DSE for the period starting from January 1, 2014, to December 31, 2018. Following Fama and French (1993) methodology, we have construct nine different portfolios and applied the OLS method in regression analysis. In order to estimate the factor models time series regression test is done. Our results show that “size” augmented CAPM performs better in explaining stock returns than the traditional CAPM in frontier market DSE. In addition, our results showed that overall market risk and firm size together have a significant impact on price formation in DSE. Here, the most important result is that the size and the sign of the individual factor loadings could differ across cross-sectional groups. For the sampling period as a whole, the size premium (i.e. the perceived tendency of small-cap stock to outperform their medium- and large-cap counterparts) was found to be largest among stocks with below-average market capitalization. This finding reaffirms the existence of “size” anomaly which coincides with recent finding by C. Ang (2018), Atanasov and Nitschka (2017), Schmidt et al. (2017). To the end, from the empirical evidence, we might opine that the inclusion of size premium can craft traditional capital asset pricing model more effective and may improve the description of the frontier market DSE. Future research should examine the impact of size premium on time-varying parameters on expected asset returns in the Dhaka Stock Exchange.

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