ORIGINAL RESEARCH ARTICLE

J. F. Mkt. Gov. (2024) Vol. 3, Issue. 2
DOI: https://doi.org/10.54728/JFMG.202408.00083

CAPM and Fama-French Three-Factor Model: A Dual Examination of Risk-Return Predictive Capabilities in the Bangladesh Capital Market

Atiar Hossain Fahad
Investment Corporation of Bangladesh
Email: atiarfahad@gmail.com
Faysal Ahmad Khan*
Bangladesh Institute of Capital Market
Email: faysal@bicm.ac.bd
S.M. Shaiqul Alam
Investment Corporation of Bangladesh
Email: swapanicb@gmail.com
Md. Athekur Rahman
Investment Corporation of Bangladesh
Email: nfsicb@gmail.com

Keywords:
Capital Asset Pricing Model (CAPM), Market Efficiency, Fama-French Three-Factor Model, Bangladesh Stock Market, Empirical Testing

JEL Classification:
G15, G12, G11

Manuscript number
JFMG-202408-00083

Received: 27 August, 2024
First Revision:14 October, 2024
Final Revision: 16 October, 2024
Accepted: 24 October, 2024
Published Online: 15 December, 2024
Published in Print: 31 December, 2024

ISSN (Online): 2958-9290
ISSN (Print): 2958-9282

*Corresponding Author

This study investigates the impact of different risk factors on stock returns in the Bangladesh capital market by empirically testing the Capital Asset Pricing Model (CAPM) and the Fama-French Three-Factor Model. The aim is to conduct a comparative analysis to determine which model better explains stock returns in an emerging market like Bangladesh, known for its volatility, inefficiency, and instability. While CAPM and Fama-French models are extensively tested in developed markets, their application in Bangladesh remains underexplored. This research fills that gap by analyzing monthly returns from 170 securities listed on the Dhaka Stock Exchange between 2009 and 2023. The study forms ten portfolios based on a wide spread of estimated betas and examines whether the relationship between expected return and risk is linear. While the CAPM showed significant results across all portfolios, the relationship between mean excess return and beta was linear but negative, attributed to negative average market returns during the study period. The Fama-French Three-Factor Model, tested on 110 companies from 2014 to 2023, utilized a 3x3 sort methodology based on size and book-to-market equity factors. This model demonstrated higher explanatory power, with a 60.58% improvement over CAPM and only 0.7% of excess returns unexplained by the factors. GRS test statistics further indicated that, while both models rejected the null hypothesis over the entire period, the Fama-French model performed better in sub-period analyses, suggesting superior accuracy in capturing stock returns in the Bangladesh market. Overall, the findings highlight the Fama-French Three-Factor Model as more effective than the CAPM in explaining portfolio excess returns in this emerging market context.

1.0 Introduction

Explaining the risk-return relationship is a topic of interest for both financial researchers and investors. Researchers have come up with different models to explain portfolio returns. The excess returns not being explained by traditional economic models have been referred to as the 'equity premium puzzle' (Mehra & Prescott, 1985). According to the efficient market hypothesis (EMH) (Fama, 1970), risk is the basis of explaining returns. Capital asset pricing model (CAPM) uses market factor β to explain systematic risk (Sharpe, 1964). If the market portfolio (index) is the asset, the risk can be measured by the conditional variance of market return. Beta is the only asset/security specific parameter that influences the equilibrium return on a risky stock (Mandelker & Rhee, 1984). Assumptions of asset pricing models are - (1) all investors are single period risk-averse utility of terminal wealth maximizers and can choose among portfolios solely based on mean and variance, (2) there are no taxes or transaction costs, (3) all investors have homogeneous views regarding the parameters of the joint probability distribution of all security returns, and (4) all investors can borrow and lend at a given riskless rate of interest (Jensen et.al. 1972). Research showing that only beta cannot capture all risks (Reinganum, 1981) has inspired researchers to find more risk-based factors that explain stock returns. Fama and French Three-Factor Model was developed to explain the impact of other factors on stock returns. The authors argue that their three-factor model captures anomalies related to the CAPM more efficiently.

Most of the prior research was focused on matured markets like those in the US and Europe. Little research has been done in developing/emerging markets like Bangladesh. Bangladesh's capital market is thought to be extremely volatile, inefficient, and unstable. This indicates that when price-sensitive information becomes accessible, the market does not react quickly; instead, it gradually takes in publicly available information, giving a group of market participants a methodical way to take advantage of trading opportunities and generate extraordinary profits. The DSE is dealing with thin trading, poor liquidity and market capitalization ratios, a dearth of institutional investors, a small number of mutual funds, and investors who are expressing an ecstatic preference for short-term results. According to Bepari and Mollik (2008), the stock market in Bangladesh is still in its early stages of development, with a tiny market size in relation to GDP and characteristics including excessive market concentration and weak liquidity. These seem at odds with the market efficiency and CAPM assumptions that underpin the model. Nonetheless, it is intriguing to look at how risk and return behave in developing markets like DSE because CAPM beta is widely used as a benchmark for company-specific risk around the globe, including emerging markets. Second, given that emerging countries have a greater potential for diversifying equity risk and for producing average returns that are higher than those of developed markets, the DSE might be significant for global diversification (Harvey, 1995). However, the benefit of international diversity is significantly diminished if factors outside the market push returns to emerging economies. This is the case when the market in question is more tightly connected with global markets (Wolf, 1998). One of the stock markets that has been least impacted by the most recent global financial crisis (GFC) is the DSE. During the global financial crisis, the stock prices of the DSE increased while the majority of other world markets declined. This suggests that the DSE had greater potential for international diversification with higher average returns than the developed markets because it was less integrated with the developed markets. However, formal research is needed to determine the risk premium and the level of diversification benefits, which calls for factual data unique to a certain emerging market. This research aims to test the Capital Assets Pricing Model and Fama and French three-factor model by applying them in the context of publicly listed companies in Bangladesh to evaluate the performance of the theories in explaining excess return over risk free return.

The paper is organized as follows: In the next chapter, we discussed the theoretical framework of the Capital Asset Pricing Model (CAPM) and the Fama and French Three-Factor Model. Chapter 3 contains a literature review that provides an overview of different theories put forth to explain stock returns and the objectives of the research. In Chapter 4, the data and methodology are discussed. In chapter 5, we presented the results and discussion and chapter 6 concludes the paper.

1.1 Background of the study

The capital market of Bangladesh has evolved significantly since its inception, playing a pivotal role in the country's economic growth and development. This market encompasses both the stock market and the bond market, providing essential platforms for companies and the government to raise long-term capital. Despite various challenges, the capital market remains a cornerstone of Bangladesh's financial system. The history of the capital market in Bangladesh dates back to the early 1950s. The Dhaka Stock Exchange (DSE) was established in 1954, making it one of the oldest stock exchanges in South Asia. Initially, the market was underdeveloped, characterized by a lack of regulations, limited investor base, and inadequate technological infrastructure. The establishment of the Chittagong Stock Exchange (CSE) in 1995 marked a significant step towards expanding the capital market's reach and capacity. The motivation for this study arises from the need to critically assess the validity and comparative performance of the CAPM and the Fama-French Three-Factor Model in the Bangladesh capital market. While these models have been extensively tested in developed markets, their application in emerging markets like Bangladesh is less explored. This study seeks to fill this gap by providing empirical evidence on how well these models explain the variations in stock returns in the Bangladesh context. Additionally, understanding the factors influencing model performance can offer valuable insights for investors, policymakers, and academics.

1.2 Research objectives

The objectives of this study are as follows-

- **To test the validity of CAPM:** Evaluate the applicability of the CAPM in the Bangladesh capital market by analyzing the relationship between expected returns and beta.
- **To assess the Fama-French Model:** Examine the performance of the Fama-French Three-Factor Model in explaining stock returns in Bangladesh.
- **To compare models:** Conduct a comparative analysis of the CAPM and the Fama-French model to determine which provides a better fit for the Bangladesh capital market.

1.3 Significance of the study

This study holds significant importance for several reasons. Firstly, it enhances the understanding of how well-established financial models apply to an emerging market context, contributing to the global discourse on asset pricing. Secondly, the findings can help investors make more informed decisions, potentially leading to better investment outcomes. Thirdly, the study can aid policymakers in developing regulations that enhance market efficiency and investor confidence, ultimately supporting the growth and development of the Bangladesh capital market.

2.0 Theoretical framework

2.1 The classic theory - CAPM

The Capital Asset Pricing Model denoted CAPM, describes the relationship between risk and expected return and is used in the pricing of risky securities. This relationship was first proposed independently by John Lintner, William F. Sharpe and Mossin which can be represented by the following linear equation:

$$E[R_i]= R_f+\beta_i*(E[R_m]-R_f)\text{..........................}(1)$$

Where:

R_f = Risk-free rate of return

β_i = Beta of the security i

$E[R_m]$ = Expected return on market

(R_m-R_f) = Market premium

The CAPM introduced that the expected return of a security or a portfolio equals the rate of return on a risk-free rate plus a risk premium. This model offers a simple tool for investors to evaluate their investments. If this expected return does not meet or beat the required return, then the investment should not be undertaken. The CAPM is a ceteris paribus model. It is only valid within a special set of assumptions.

2.2 Fama and French Three-Factor Model:

Though CAPM contends that the only driver or factor of equity return is the market factor. After the 1980s, substantial empirical evidence showed that the market factor alone failed to explain the return. In the US and other equity markets, evidence suggests that small cap stocks or value stocks generate higher returns over the long run than the CAPM predicts. In 1993 researchers, Fama and French addressed the perceived weakness of the CAPM in a model with Three Factors, which is known as Fama French Model (FFM) or Three-Factor Model (TFM).

The three factors of return in the FFM are:

- **RMRF** or market factor which is measured as return on market value weighted equity index in excess of risk-free rate.
- **SMB** (Small Minus Big) or size factor which is the return to a portfolio of small capitalization stocks less the return to a portfolio of large capitalization stocks.
- **HML** (High Minus Low) or value factor which is the return to a portfolio of stocks with high ratios of book-to market values less the return to a portfolio of low book-to-market value stocks.

The FFM estimate of the required return on equity can be expressed as:

$$R_i=R_f+\beta_1*\text{RMRF}+\beta_2*SMB+\beta_3*HML \quad \text{.......(2)}$$

The Fama-French-MacBeth (FFM) equation states that the necessary return on equity is not solely determined by the market component, as in the Capital Asset Pricing Model (CAPM). In addition to the market element, two additional variables of return - the size factor and the value factor - also contribute to establishing the required return on equity. The market risk factor premium, as well as the average historical estimates of the size factor premium and value factor premium, are all positive. This implies that investors will demand a larger return for investing in a small-sized company compared to an average-sized company, even if both companies have the same market beta. The rationale for this is that smaller companies are inherently riskier compared to companies of average size, and the market beta of the CAPM model fails to account for this risk associated with the size component. High value companies, which have a high book value to market price ratio, require a greater return compared to average value companies, even if both types of companies have the same market beta. In the Fama-French Model (FFM), the beta for the market factor has a neutral or average value of 1, similar to the Capital Asset Pricing Model (CAPM). However, the beta for the size and value factors has a neutral or average value of zero. A security with a beta value of 0 for the size and value factors indicates that the security is not influenced by either size or value preferences. A positive beta value for the size factor indicates that the security is smaller in size compared to the average firm in the market. Conversely, a negative beta value for the size factor suggests that the security is comparatively larger than the average company in the market. The reason why the needed return found by the Capital Asset Pricing Model (CAPM) is lower than the return determined by the Fama-French Model (FFM) is that CAPM believes that investors do not require further compensation for the size factor premium and value factor premium. CAPM considers these factor premiums to be either incorporated in the market factor premium, or it attributes the presence of these premiums to market inefficiencies. Extensive research and empirical evidence have consistently demonstrated that small-cap companies and high-value companies consistently outperform large-cap companies and low-value companies over lengthy periods in both the US and other developed markets.

3.0 Literature review

Ever since Markowitz proposed the Efficient Market Hypothesis, investors and scholars have been deeply engrossed in the conversation about the ideal portfolio, minimising risk, and the attributes of asset return. This sparked a period of intensive study along the lines of return and risk. The Capital Asset Pricing Model, developed by Sharpe (1964) and Lintner (1965), was enhanced by the inclusion of a risk-free asset. When paired with the premise that buying and selling are limitless at a constant rate (r), CAPM offered a single, efficient portfolio point and made it possible to derive multiple efficient portfolios by combining the single portfolio with the risk-free asset. In keeping with this, the CAPM asserts that market beta, or the covariance between an asset's portfolio and the market, determines asset returns. When compared to historical returns, it provided only a partial explanation for asset return, although it was straightforward and mathematically valid in its implications. Over time, some academics have attempted to enhance the prediction potential of the CAPM by discovering alternative explanations for this anomaly. These explanations may have been added through the addition of variables, additional assumptions, or a combination of these. All of them have produced some astounding revelations about the limitations and predictive ability of beta. Various studies conducted in the past have endeavoured to demonstrate distinct variables as surrogates for varying risks in exchange for asset returns. In his 1973 work, Merton discovered that even in the absence of systematic risk, the expected returns on hazardous assets could deviate from the risk-free rate. Reinganum (1981) supported the size factor's role in explaining an asset's cross-sectional average return in his study. Additionally, Banz (1981) offered proof that the cross-sectional average return is explained by factors other than the CAPM and that the CAPM is misspecified. Banz discovered a significant size effect on US stock cross-sectional average returns spanning at least 40 years. His research indicates that the size impact is real, but the cause of it has not been identified. Gibbons (1982) also discovered that the practical content of the CAPM is rejected for the time with a significance level of less than 1% when the market beta is considered alone to explain cross-sectional average returns on US stocks from 1926-1975.

Research by Banz (1981), Basu (1938), Rosenberg, Reid and Lanstein (1985), and Lakonishok, Shleifer and Vishny (1994) revealed additional firm-specific characteristics that are associated with an organization's average stock return. According to these studies, a company's market capitalization, book to market equity (book value of common equity/market value), earnings to price (E/P), cash flow to price (C/P), and historical sales growth all have an impact on the average stock return (FF, 1996). Fama and French (1993) and Fama and French (1995) show that there is a BE/ME factor in fundamentals (profits and sales) similar to the common factor in returns, which supports this theory. They also establish covariation in returns due to BE/ME beyond the covariation described by the market return. According to Fernandez, statistically substantial explanatory power is provided by the combination of the Fama-French components SMB and HML over nearly all sample return horizons. He contends that the FF components are superior in real application and that SMB and HML serve as proxies for market risk metrics that the CAPM is unable to capture. These claims are in line with Fernandez's (2002) findings. Similarly, Kothari (1995) discovered that while average returns indeed, in the case when betas are recorded annually, indicate compensation for beta risk, beta by itself is unable to fully explain the cross-sectional volatility in expected returns as elucidated by the CAPM. To increase the CAPM's explanatory ability, Fama and French developed a three-factor model. According to empirical research by Fama and French (1992), cross-sectional variations in returns on equities can be largely explained by the covariance of market return and portfolio return, but not by the excess portfolio return changes. Fama and French discovered that the relationship between average return on NYSE-listed stocks and market beta vanished between 1963 and 1990. Their experiments refute the SLB model's prediction that market beta and average stock returns are positively correlated. The study's findings indicate that the cross-section of average returns can be explained by two readily observable variables: size and book to market equity. A strong correlation between BE/ME and the average stock return on NYSE equities from 1963 to 1990 was discovered by FF (1992). The market premium, value premium, and size premium are included in the Fama and French Three-Factor Model (1993) as predictive variables for the excess return of a portfolio. Since they provide a clearer picture of excess portfolio return, the model suggests forming portfolios based on market capitalization, book-to-market, and earning-to-price (Fama and French, 1992; Lakonishok, Shleifer, and Vishny, 1994) (Chan, 1991). Sattar (2017) (cement industry) and Sayeed, Chowdhury and Khatun (2014) found the same result in the Bangladesh market. However, some studies in emerging markets were unable to demonstrate a linear risk-return relationship. For instance, Claessens et al. (1995) used eight years of data from 1986 to 1993 to analyse a group of 19 emerging markets, including Pakistan. They find that while similar factors govern the cross-section of emerging market return, the majority of the coefficients have signs that differ from those of developed markets. It's important to note that Pakistan was the only nation in their study to have a statistically significant negative beta risk premium. According to Estrada (2000), there appears to be no correlation between betas and stock returns in emerging countries. Three Asian markets—South Korea, Taiwan, and Singapore—have negative risk/return relationships, according to Bark (1991) and Huang (1997). Taiwan and South Korea likewise have a weak risk/return relationship, according to Cheung et al. (1993). In the Hong Kong market, Cheung and Wong (1992) discovered a shaky correlation between risk and return. Molla and Mobarek (2009) proposed, based on the Dimson corrected beta and daily returns, that the share returns on the Botswana Stock Exchange over the years 2000–2005 were not impacted by general market movements. For the majority of the time, portfolios built using ranked beta showed a monotonic inverse connection to what the CAPM recommends, according to Ward and Muller's (2012) research. According to them, it is therefore improper to use the single beta CAPM. Studies conducted by Hasan et al. (2010) and Hasan et al. (2011) have presented conflicting findings on the association between risk and return. These studies have employed different models and datasets to analyse this relationship. Rahman and Baten (2006) conducted a study to assess the accuracy of the Capital Asset Pricing Model (CAPM) by utilising the Fama-French (1992) Three-Factor model on a specific dataset. In their cross-sectional models, they discovered a statistically significant relationship between the beta and size (sales) and returns. The beta was found to be inversely related to returns. The researchers employed a statistical approach that involved analysing the average cross-section and pooled time-series and cross-section models. They used logarithmic transformation of daily return frequencies, including both lagged and leading values, to estimate the individual equity beta. Alam et al. (2007) demonstrated a negative correlation between risk and return in the DSE. They used the average market returns from 1994 to 2005 and the Bangladesh T-bill rate as the risk-free rate of return in the well-known single index market model equation. Their approach is rather simplistic to establish the findings, and the average return computation may be influenced negatively by incorporating the period of market crisis in 1996, thus strengthening the inverse association. Ali et al. (2010) conducted a study to assess the accuracy of the Capital Asset Pricing Model (CAPM) in the Dhaka Stock Exchange (DSE). They employed the Fama and Macbeth (1973) methodology and analysed data from 160 companies over the period from July 1998 to June 2008. A positive correlation is observed between 24-month rolling monthly risk (beta) and return, albeit it is non-linear and statistically insignificant. They remarked that beta is not suitable as the primary and exclusive measure of risk. Hasan et al. (2011) examined the correlation between risk and return in the Dhaka Stock Exchange (DSE) using the Capital Asset Pricing Model (CAPM). They analysed monthly stock returns for 80 nonfinancial companies from January 2005 to December 2009. The researchers noted that the intercept term showed a considerable deviation from zero, indicating a positive link between beta and share return that was not statistically significant. During their study period, the researchers also noted the presence of linearity in the security market line, as well as the lack of significant interaction between unique risk factors. Michael Drew (2010) compared the explanatory power of a single index model with the multifactor asset-pricing model of Fama and French (1996) for Hong Kong, Korea, Malaysia and the Philippines. Results of the study entailed that the CAPM beta alone is not enough to describe the cross-section of expected returns & also suggested that firm size and book-to market equity help explain the variation in average stock returns in a meaningful manner. Prince Acheampong and Sydney Kwesi Swanzy (2015) in their paper stated that “It is then conclusive enough that, the multi-factor asset pricing model introduced by Fama and French (1992) was a better asset pricing model to explain excess portfolio returns on the Ghana Stock Exchange than the Capital Assets Pricing Model (CAPM) and that there exist the firm size and BTM effects on the Ghanaian Stock market”. Neharika Sobti (2016) revisited CAPM and Fama French Three-Factor Model in Indian Equity Market. Fama French Three-Factor Model proved to be a better model than one factor CAPM. Challenging the previous studies, a non-linear relationship was found between excess returns and beta (systematic risk) for CAPM. Size effect still prevails in Indian equity market whereas value effect is not apparent for the period. Choi, Soo and Woo (2017) Studied Capital Asset Pricing Model and Fama-French Three-Factor Model empirically. The result specified lower mean squared error and higher correlation between actual and predicted value for Fama-French Three-Factor Model. Thus, suggested that Fama-French Three-Factor Model has a better predictive power than CAPM. Neraj (2020), in his paper “Test of capital market integration using Fama-French three-factor model: empirical evidence from India” found the superiority of Fama-French three-factor model over CAPM. In 2012, Faruque conducted a study on the effectiveness of the Arbitrage Pricing Theory (APT). The study revealed that out of the seven macroeconomic variables evaluated, the exchange rate was the only important component that affected the pricing in the DSE. The individual utilised monthly data sets consisting of the 23 most regularly traded equities and macroeconomic factors. The data covered the time from December 1995 to November 2010. We applied both the Capital Asset Pricing Model and the Fama and French

4.0 Data and methodology

4.1 Data

This study tests the effectiveness of both the CAPM and the Three-factor model. Data have been collected primarily from the Dhaka Stock Exchange (DSE). For CAPM monthly returns of 170 companies for the period from 2009 to 2023 have been used to run the regression model. Both the capital gains and adjustments for cash or stock dividends have been considered for the calculation of total return. The total return formula used in this study for stock i is as follows:

$$R_i = \frac{P_t(1+Div_{Stock})+Div_{Cash}-P_{t-1}}{P_{t-1}} \quad \text{.............. (3)}$$

Where,

R_i=Total Return on Stock i.

P_t = Stock Price of Current Period.

P_{t-1}= Stock Price of Previous Period.

Div_{Stock}= Stock Dividend Percentage.

Div_{Cash} = Cash Dividend Amount Per Share.

For the Fama and French Three-Factor Model, the monthly returns of 110 companies for the period from 2014 to 2023 have been used to run the regression model.

Risk-free rate

One-year T-bill is used as the risk-free rate. Each year from 2009 to 2023 T-bill data has been collected from the Bangladesh Bank Website. The annualized rate is converted to a monthly risk-free rate.

Market return

On January 28, 2013, DSE introduced the DSE Index (DSEX) as a market index. The base date of the index is January 17, 2008. So, for our research, we have used DESX return as the market return. DSEX month end value has been collected from the DSE website.

Size and value premium

Size is expressed as market capitalization (ME). That is stock price times the amount of ordinary stock outstanding. The book value (BE) is defined as the book value of equity: total assets (TA) minus total liabilities (TL). The book-to-market ratio is then defined as $\frac{BE}{ME}$.

4.2 Methodology

Both single-factor (CAPM) and multi-factor (Fama-French) models have been applied via regression to find out the effectiveness of the models in comparison to each other. For CAPM we have used the same method as Black et al in 1972 and also the method Fama and MacBeth used in 1973. Portfolios were formed to obtain the maximum possible dispersion of risk coefficients.

4.2.1 Regression model for CAPM

Black, Jensen and Scholes introduced a time series test of the CAPM. The test is based on the time series regressions of excess portfolio return on excess market return, which can be expressed by the equation below:

$$R_{it}-R_{ft}=\alpha_i+\beta_i*(R_{mt}-R_{ft})+\in_{it} \quad \text{............... (4)}$$

Here, (R_{it}-R_{ft}) Excess Return over the risk-free rate is the dependent variable and (R_{it}-R_{ft}) Market Excess return or market premium is the independent variable, β_i is the coefficient of market premium or systematic risk, intercept is α_i and $\in_i$ is the residual standard error.

Equation (4) can be written as,

$$r_{it}= \alpha_i+\beta_i*r_{mt}+\in_{it} \quad \text{............................ (5)}$$

Here, r_{it} = R_{it}-R_{ft}, Excess Return over the risk-free rate and r_{mt} = R_{mt}-R_{ft}, Market Excess return or market premium.

It is recommended to use the genuine beta of stocks when constructing portfolios. Otherwise, a selection bias would be introduced if portfolios were ranked according to projected betas. Positive measurement error in beta estimation would be more common in stocks with high estimated beta. For high-beta portfolios, this would result in a positive bias in beta and a negative bias in the estimate of the intercept.

To address the measurement bias, Black, Jensen, and Scholes employed a grouping-combination method. To reduce statistical mistakes from the beta estimation, they evaluated the previous year's betas and utilised these to group the portfolios for the following year.

In our study, we have used five years of previous monthly data to obtain estimates. β_{i0}. The ranked values of β_{i0} are used to assign stocks to different groups. We began by estimating the coefficient β_i (call these estimates β_{i0}) in (5) for the five years January, 2009-December, 2013 for 170 securities to form portfolios for the year 2014. These securities were then ranked from high to low based on the estimates β _i0 and were assigned to ten portfolios. The largest 10% were grouped in the first portfolio and so on. The return in each of the next 12 months for each of the ten portfolios was calculated. Then the entire process was repeated for those 170 securities to form portfolios for the year 2015. This process was repeated through the year 2023. In this way, we have obtained 10 years of monthly returns on 10 portfolios from 170 securities.

Table 1: Summary statistics of the 10 portfolios

Particulars	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	RM.RF
Mean Excess Return	0.0071	0.0038	0.0112	0.0091	0.0090	0.0093	0.0118	0.0081	0.0086	0.0171	-0.0005
Average Beta	1.8810	1.4923	1.3293	1.1987	1.0782	0.9617	0.8488	0.7136	0.5744	0.2329	1.0000
Standard Deviation	0.0767	0.0744	0.0661	0.0670	0.0660	0.0618	0.0531	0.0523	0.0507	0.0654	0.0448
Correlation with RM.RF	0.7259	0.8002	0.7539	0.7607	0.7283	0.8301	0.7002	0.8149	0.6999	0.4545	1.0000

Source: Authors' Calculation

The next step is to estimate the ex-post Security Market Line (SML) by regressing the portfolio returns against the portfolio betas. Fama and MacBeth used monthly cross-sectional regression of excess return of the portfolio on the estimated betas to test the Capital Asset Pricing Model.

2nd pass regression:

$$r_p = \gamma_0 + \gamma_1 * \beta_p + \epsilon_p \ldots\ldots\ldots\ldots\ldots (6)$$

Where,

r_p is the average excess return on a portfolio p,

β_p is beta of portfolio p,

$\in_p$ is the random disturbance term in the regression equation.

If the CAPM is true, γ_0 should be equal to zero and the slope of SML, γ_1, is the market portfolio's average risk premium.

4.2.2 Regression model for Fama and French Three-Factor Model

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i} * (R_{mt} - R_{ft}) + \beta_{2i} * SMB + \beta_{3i} * HML + \in_i \ldots\ldots (7)$$

Where,

R_{it} is the return of stock or portfolio at time t,

R_{ft} is the risk-free rate,

R_{mt} is the market return,

SMB (small-minus-big) is a size-related factor,

HML (high-minus-low) is a value related factor,

β_{1i} is the coefficient of market premium,

β_{2i} is the coefficient of size factor,

β_{3i} is the coefficient of value factor,

α_i is the intercept and $\in_i$ is the residual standard error.

To run the regression model, we have collected data for 110 companies during the period 2013 to 2023. Accounting data of year (t-1) was used to form portfolios for year t. The explanatory variables are calculated with the use of 2 x 3 portfolios (S/L, S/M, S/H, B/L, B/M, B/H). This means that the portfolios are based on two company characteristics (e.g., Size x BE/ME), of which the first is divided into 2 categories (e.g., Size: 55 companies with the largest size vs. 55 companies with the smallest size), and the second is divided into 3 categories (e.g., 37 companies with highest BE/ME, 37 companies with lowest BE/ME and 36 companies in between). It has been shown that the model's performance is not sensitive to how the factors are defined (Fama & French, 2015). It is important to understand the interpretation of the factors. The factors show the return difference that a certain attribute causes and, as reasoned by Fama and French (1992; 1993; 2015), therefore mimics the risk related to these attributes. For example, the Size factor is expressed as SMB (small-minus-big) and shows the difference between the returns, and thus risk, of portfolios with small stocks (S/L, S/M and S/H) and portfolios with big stocks (B/L, B/M and B/H). Similarly, the HML factor shows the difference in returns between high BE/ME portfolios (S/H and B/H) and low BE/ME portfolios (S/L and B/L).

For the left-hand side of the regression, 9 portfolios were formed using 3 x 3 sorts. That is both Size and BE/ME factors were divided into three categories and the breakpoints are 33.33% and 66.67%. Descriptive Statistics of the 9 portfolios are given below-

Table 2: Average number of stocks in the portfolios

BE/ME Size	Low	Medium	High
Small	13.4	11.8	11.8
Medium	7.8	12.6	15.6
Big	15.8	11.6	9.6

Source: Authors' Calculation

Table 3: Average excess returns of the portfolios

BE/ME Size	Low	Medium	High
Small	2.24%	1.37%	2.07%
Medium	0.33%	0.39%	0.52%
Big	0.49%	0.66%	0.90%

Source: Authors' Calculation

Table 4: Standard deviations of the portfolios

BE/ME Size	Low	Medium	High
Small	7.91%	7.01%	8.01%
Medium	7.02%	6.03%	6.65%
Big	4.31%	9.73%	6.44%

Source: Authors' Calculation

Table 5: Correlation of the portfolios with three factors

Factors	*P11 (S/L)*	*P12 (S/M)*	*P13 (S/H)*	*P21 (M/L)*	*P22 (M/M)*	*P23 (M/H)*	*P31 (B/L)*	*P32 (B/M)*	*P33 (B/H)*
RM.RF	0.3845	0.4014	0.5429	0.5313	0.6841	0.7727	0.7559	0.4177	0.8507
SMB	0.6309	0.5773	0.4811	0.3220	0.1514	0.2143	-0.1070	-0.5338	-0.0304
HML	-0.1622	0.2382	0.5118	-0.0029	0.3542	0.6029	0.0399	0.3006	0.3981

Source: Authors' Calculation

4.2.3 Model performance

The desire is to know if the three-factor model is an improvement over the CAPM in explaining stock returns. The models are compared based on the adjusted R-Square, average α and joint α (using GRS). If the factors fully capture the returns, intercept α must have a value of 0. Therefore, for each model must be tested whether the intercept significantly differs from 0. To test this hypothesis, a GRS test is run (Gibbons, Ross, & Shanken, 1989) per the methodology of Fama and French (2015).

The null hypothesis (H_0) of the GRS test (Gibbons, Ross, and Shanken, 1989) is that $\alpha_i = 0$ jointly for all i, while the alternative hypothesis (H_1) is that at least one α_i is non-zero. Under the assumption that the error term ($\in_i$) is normally and independently distributed with zero means and non-singular covariance matrix Σ, the GRS test is a finite-sample F-test whose statistic is given by

$$F \equiv \left[\frac{T(T-N-K)}{N(T-K-1)} \times \frac{\hat{\alpha}'\widehat{\Sigma^{-1}}\hat{\alpha}}{1+\bar{\mu}'\widehat{\Omega^{-1}}\hat{\mu}}\right] \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where T is the sample size, N is the number of securities (or portfolios), and K is the number of risk factors. From ordinary least-squares estimation of the models, $\tilde{\alpha}$ is the N × 1 vector of the estimators for the vector of intercepts, $\hat{\Sigma}$ is the (N×N) unbiased estimator of error covariance matrix, while $\hat{\Omega}$ is a (K×K) factor covariance matrix and $\hat{\mu}$ is a K × 1 vector of the sample means of asset-pricing factors. Affleck-Graves and McDonald (1989) find that the GRS test is reasonably robust to the non-normality of the error term in the regression equation. The null hypothesis is rejected when the F-statistic given above is greater than the critical value at a prescribed level of significance or its p-value is less than 0.05 (mostly used value).

5.0 Model estimations and empirical result

5.1 Capital Asset Pricing Model (CAPM)

Given the 10 years of monthly returns on each of the 10 portfolios calculated as explained previously, we then ran the regression model using R-studio and calculated the parameters α_i and β_i in (5) for each of the ten portfolios (i = 1, . . ., 10) using all 10 years of monthly data. The results are summarized in Table 6. Portfolio number 1 contains the highest-risk securities and portfolio number 10 contains the lowest-risk securities. The estimated risk coefficients range from 1.3283 to 0.6631.

Table 6: Regression result for the entire period (2014-2023)

Portfolios	Intercept (α_i)	β_i	P-value (α_i)	P-value (β_i)	Adjusted R^2
P1	0.0077	1.2427	0.1187	0.0000	0.5229
P2	0.0045	1.3283	0.2813	0.0000	0.6372
P3	0.0118	1.1127	0.0041	0.0000	0.5646
P4	0.0097	1.1381	0.0176	0.0000	0.5751

P5	0.0095	1.0723	0.0244	0.0000	0.5264
P6	0.0099	1.1455	0.0024	0.0000	0.6864
P7	0.0122	0.8307	0.0007	0.0000	0.4859
P8	0.0086	0.9513	0.0028	0.0000	0.6611
P9	0.0090	0.7916	0.0080	0.0000	0.4855
P10	0.0174	0.6631	0.0016	0.0000	0.1998
Average	0.0100	1.0276	0.0462	0.0000	0.5345

Source: Authors' Calculation

From Table 6 we can see that the average value of β_i is 1.0276 which means if the market premium moves by 1%, a portfolio's return will move by 1.0276% in the same direction. The average value of the intercept is 0.01. The average Adjusted R-square is 0.5345 which indicates that 53.45% of the excess return can be described by the independent factor (market premium). P-value for β_i is significant in all portfolios which implies the model is significant for all portfolios. Regression results for two sub periods (2014-2018) and (2019-2023) are shown in Tables 7 & 8 respectively.

Table 7: Regression result for sub period (2014-2018)

Portfolios	Intercept (α_i)	β_i	P-value (α_i)	P-value (β_i)	Adjusted R^2
P1	0.0005	1.0404	0.9223	0.0000	0.6375
P2	-0.0007	1.2519	0.8724	0.0000	0.7546
P3	0.0091	1.0835	0.0378	0.0000	0.6887
P4	0.0043	1.0901	0.3159	0.0000	0.6925
P5	0.0005	0.9809	0.9216	0.0000	0.5644
P6	0.0091	1.1293	0.0388	0.0000	0.7002
P7	0.0150	0.6953	0.0038	0.0000	0.3994
P8	0.0098	0.8903	0.0059	0.0000	0.6972
P9	0.0161	0.6237	0.0017	0.0000	0.3541
P10	0.0290	0.4926	0.0018	0.0156	0.0888
Average	0.0093	0.9278	0.3122	0.0016	0.5578

Source: Authors' Calculation

From Table 7 we can see that the average value of β_i is 0.9278 which means if the market premium moves by 1%, a portfolio's return will move by 0.9278% in the same direction. The average value of the intercept is 0.009 which is close to zero. The average Adjusted R-square is 0.5578 which indicates that 55.78% of the excess return can be described by the independent factor (market premium). P-value for β_i is significant in all portfolios which implies the model is significant for all portfolios.

Table 8: Regression result for sub period (2019-2023)

Portfolios	Intercept (α_i)	β_i	P-value (α_i)	P-value (β_i)	Adjusted R^2
P1	0.0153	1.4600	0.0776	0.0000	0.5036
P2	0.0099	1.4114	0.1754	0.0000	0.5725
P3	0.0146	1.1449	0.0405	0.0000	0.4843
P4	0.0153	1.1913	0.0305	0.0000	0.5077
P5	0.0190	1.1731	0.0053	0.0000	0.5270
P6	0.0107	1.1629	0.0292	0.0000	0.6738
P7	0.0095	0.9727	0.0556	0.0000	0.5798
P8	0.0073	1.0154	0.1097	0.0000	0.6397
P9	0.0018	0.9660	0.6614	0.0000	0.6502
P10	0.0056	0.8384	0.3134	0.0000	0.4419
Average	0.0109	1.1336	0.1499	0.0000	0.5580

Source: Authors' Calculation

From Table 8 we can see that the average value of β_i is 1.1336 which means if the market premium moves by 1%, a portfolio's return will move by 1.1336% in the same direction. The average value of the intercept is 0.01. The average Adjusted R-square is 0.5580 which indicates that 55.80% of the excess return can be described by the independent factor (market premium). P-value for β_i is significant in all portfolios which implies the model is significant for all portfolios.

Next, the results were used to run cross section regression using equation (6). Results are shown in the next table.

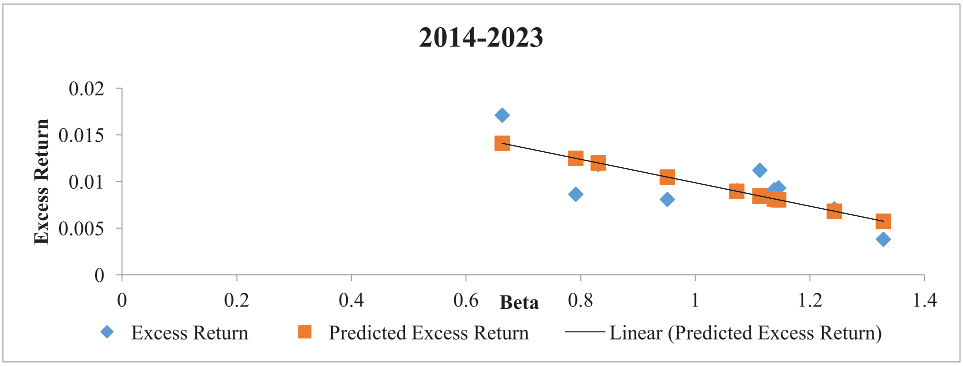
Table 9: Statistics of the estimation of the SML

Particulars	2014-2023	2014-2018	2019-2023
Intercept (γ_0)	0.0224	0.0389	-0.0071
Slope (γ_1)	-0.0126	-0.0321	0.0150
Excess Market Return	-0.0005	-0.0001	-0.0009
P value (γ_0)	0.0004	0.0002	0.4334
P value (γ_1)	0.0090	0.0012	0.0815
Adjusted R^2	0.5438	0.7213	0.2479

Source: Authors' Calculation

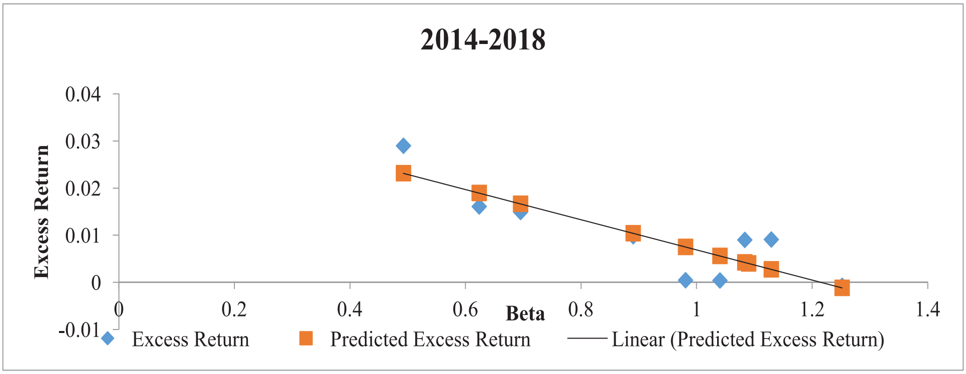
The traditional form of the asset pricing model implies that the intercept (γ_0) in (6) should be equal to zero and the slope (γ_1) should be equal to r_m, the mean excess return on the market portfolio. Over these 10 years, the average monthly excess return on the market portfolio r_m, was -0.00048, and the theoretical values of the intercept and slope are (γ_0)=0 and (γ_1) = -0.0126. For the sub period 2014-2018 the empirical slope is steeper than the theoretical slope and in the sub period 2019-2023 slope (γ_1) even has the wrong sign.

Fig-1: Average excess return versus systematic risk for the whole period (2014-2023)



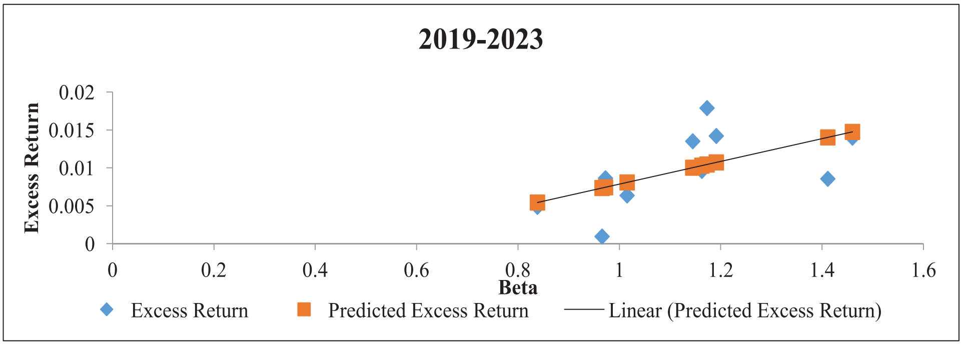
Source: Authors' Calculation

Fig-2: Average excess return versus systematic risk for sub period (2014-2018)



Source: Authors' Calculation

Fig-3: Average excess return versus systematic risk for sub period (2019-2023)



Source: Authors' Calculation

The result is inconsistent with the CAPM hypothesis. However, the regression model is significant for the whole period and first sub period. Further research can be done to investigate the reason behind the inconsistency in the sub period 2019-2023. For example, the introduction of floor price in the year 2020 might have some impact on the model. The deviation implies that there are mispriced stocks (portfolio), some under-valued and some over-valued, in the DSE. The result also indicates that the market factor is one of the factors for the asset pricing model but not the only factor.

5.2 Fama and French Three-Factor Model

Given the 10 years of monthly returns on each of the ten portfolios calculated as explained previously, we then ran the regression model using R-studio and calculated the parameters in equation (7) for each of the nine portfolios. The results are summarized in Table 10.

Table 10: Regression result for the whole period (2014-2023)

Particulars	P11	P12	P13	P21	P22	P23	P31	P32	P33	Average
α_i	0.0129	0.0052	0.0120	-0.0010	0.0018	0.0016	0.0061	0.0166	0.0091	0.0071
β_{1i}	1.0018	0.6079	0.7520	1.0247	0.8830	0.9543	0.8541	0.7279	1.1911	0.8885
β_{2i}	0.9936	0.8527	0.8654	0.4768	0.2473	0.3875	-0.0644	-0.9542	0.0441	0.3165
β_{3i}	-0.5876	0.2169	0.7006	-0.3728	0.1407	0.5448	-0.3199	0.2470	0.0869	0.0730
P-value (α_i)	0.0032	0.2514	0.0052	0.8380	0.6554	0.5998	0.0117	0.0183	0.0051	0.2653
P-value (β_{1i})	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
P-value (β_{2i})	0.0000	0.0000	0.0000	0.0000	0.0018	0.0000	0.1654	0.0000	0.4802	0.0719
P-value (β_{3i})	0.0000	0.0480	0.0000	0.0021	0.1466	0.0000	0.0000	0.1424	0.2630	0.0669
Adjusted R^2	0.6668	0.5342	0.6856	0.4452	0.5047	0.7759	0.6568	0.4257	0.7205	0.6017
F-Stat	79.04	45.72	86.03	32.29	40.73	136.03	75.64	29.91	101.53	69.66
ϵ_i	0.2376	0.2609	0.2299	0.3115	0.2054	0.1131	0.0727	0.6200	0.1322	0.2426

Source: Authors' Calculation

From Table 10 we can see that the Average value of the intercept is 0.0071 which is very much close to zero. P-value for β_{1i} are significant in all portfolios. P-value for β_{2i}, β_{3i} are significant in most of the portfolios. The average Adjusted R-square is 0.6017 which indicates that 60.17% of the excess return can be described by the set of independent factors (Market Factor, SMB & HML). The model produced an average coefficient of 0.8885 for the market premium which means if the market premium moves by 1%, a portfolio's return will move by 0.8885% in the same direction. Since this coefficient is lower than 1.00, the prices of portfolios formed are theoretically less volatile than what they should be in a normal market. The model also produced an average coefficient of 0.3165 for size premium which means if size premium moves by 1%, a portfolio's return will move by 0.3165% in the same direction. The model produced an average coefficient of 0.0730 for the value premium which means if the value premium moves by 1%, a portfolio's return will move by 0.0730% in the same direction. F-statistics indicate the model is significant for all the portfolios.

5.3 Comparative results the CAPM and Fama and French Three-Factor Model

For comparison between the two models, we have used the same data used in Three-Factor Model. The comparison has been done in three segments: the first one is the comparison of the explanatory power, the second one is the statistical validity of the model and the third one is using the GRS Test.

5.3.1 Explanatory power

Adjusted R-Square is the representation of the explanatory power of the model. This key statistic has been presented for each of the 09 portfolios for both the model and the improvement of the explanatory power in Fama and French Three-Factor Model has been shown in percentage form as follows:

Table 11: Comparison of explanatory power between the Capital Asset Pricing Model and Fama and French Three-Factor Model

Portfolios	Adjusted R-Square		Improvement in FF3F Model
	CAPM	FF3F	
P11	0.1405	0.6668	374.57%
P12	0.1539	0.5342	247.22%
P13	0.2886	0.6856	137.54%
P21	0.2761	0.4452	61.27%
P22	0.4634	0.5047	8.92%
P23	0.5936	0.7759	30.71%
P31	0.5676	0.6568	15.71%
P32	0.1674	0.4257	154.36%
P33	0.7213	0.7205	-0.11%
Average	**0.3747**	**0.6017**	**60.58%**

Source: Authors' Calculation

On average Capital Asset Pricing Model can explain 37.47% of the excess return of the 09 portfolios and the Fama and French Three-Factor Model can explain 60.17% of the excess return of the stocks in the same. So, the Fama and French Three-Factor Model is superior in estimating the excess return of portfolios with 60.58% relatively higher explanatory power than the Capital Asset Pricing Model. Furthermore, in 08 of the cases, an improvement in the explanatory power was observed when the Fama and French Three-Factor Model was chosen over the Capital Asset Pricing Model for estimating the excess return of the portfolios. According to Table 11 highest improvement has been observed for portfolio P11 (S/L) and the lowest has been for portfolio P33 (B/H).

5.3.2 Statistical validity

For comparing the statistical validity of the model, intercepts and F-statistics will be compared. Intercepts and F-statistics have been presented for each of the 09 portfolios for both the model as follows:

Table 12: Comparison of statistical validity between Capital Asset Pricing Model and Fama and French Three-Factor Model

Portfolios	Intercept		F-Stat (Model)	
	CAPM	FF3F	CAPM	FF3F
P11	0.0228	0.0129	20.1267	79.0416
P12	0.0140	0.0052	22.2736	45.7289
P13	0.0212	0.0120	48.4693	86.0265
P21	0.0037	-0.0010	45.6139	32.2949
P22	0.0044	0.0018	102.0311	40.7333

P23	0.0058	0.0016	171.9112	136.0167
P31	0.0053	0.0061	154.6040	75.6364
P32	0.0070	0.0166	24.5169	29.9096
P33	0.0096	0.0091	303.8452	101.5342
Average	**0.0104**	**0.0071**	**99.2658**	**69.6580**

Source: Authors' Calculation

According to Table 12 on average Capital Asset Pricing Model has 1.04% of the excess return that is independent of the explanatory variable and the Fama and French Three-Factor Model has 0.7% of the excess return that is independent of the explanatory variables. So, with a lower level of uncaptured excess return, clearly Fama and French Three-Factor Model is statistically a superior model to the Capital Asset Pricing Model. F-stats are significant for all the portfolios in both models.

5.3.3 GRS test

To test whether that $\alpha\_i = 0$ jointly for all the portfolios GRS test was run. The GRS test statistic and corresponding p-value for both the model are given below:

Table 13: Comparison of GRS Test between Capital Asset Pricing Model and Fama and French Three-Factor Model

	2014-2023	
	GRS	P-value
CAPM	3.14266	0.002111
FF3F	2.982981	0.003323

Source: Authors' Calculation

Recall that the GRS test tests whether the α values are jointly zero for a certain model, with H0: the intercepts αi are not significantly different from 0. The p-value is significant for both the CAPM and Fama and French Three-Factor Model, indicating that the null hypothesis can be rejected for both models. But we can see that the GRS statistics value is lower in Three-Factor Model. We have conducted the tests again for two sub periods (2014-2018 & 2019-2023). The results are shown in Table 14.

Table-14: Comparison of GRS Test between Capital Asset Pricing Model and Fama and French Three-Factor Model (for two sub-periods)

	2014-2018		2019-2023	
	GRS	P-value	GRS	P-value
CAPM	2.599881	0.015213	2.171716	0.04094
FF3F	1.716695	0.11102	1.998828	0.061151

Source: Authors' Calculation

From the table, we can see that the p values of the Fama and French Three-Factor Model for both the sub periods are greater than 0.05. The null hypothesis is accepted for the three-factor model, indicating that joint αi is zero and that the factors accurately capture returns. For CAPM null hypothesis is rejected for both sub periods. This shows that Three-Factor Model is an improvement over the CAPM.

6.0 Conclusion

The objective of this study is to test common risk factors in stock returns through the empirical testing of the Capital Asset Pricing Model and Fama and French Three-Factor Model in the Dhaka Stock Exchange (DSE). Furthermore, the study aims to determine whether Fama and French Three-Factor Model is a superior model to the Capital Asset Pricing Model when it comes to estimating the excess return of securities in Dhaka Stock Exchange (DSE).

To test the CAPM, we used monthly returns of 170 securities listed on the Dhaka Stock Exchange for the interval between 2009 and 2023. To gain efficiency, we grouped the securities into ten portfolios in such a way that the portfolios had a large spread in their betas. However, grouping the securities based on their estimated betas would contain measurement error. Such a procedure would introduce a selection bias into the tests. To eliminate this bias, we used an instrumental variable, the previous period's estimated beta, to select a security's portfolio grouping for the next year. Using these procedures, we constructed ten portfolios whose estimated betas were unbiased estimates of the portfolio "Beta." The estimated betas of the portfolios constructed in this manner ranged from 1.3283 to 0.6631. The time series regressions of the portfolio excess returns on the market portfolio excess returns did not show consistency in the risk-return relationship but the model was significant for all the portfolios. The cross-sectional plots of the mean excess returns on the portfolios against the estimated betas indicated that the relation between mean excess return and beta was linear but negative. The slope was negative because the average market return was negative.

To test the Fama and French Three-Factor Model we used monthly returns of 110 companies during the period 2014 to 2023. For the left-hand side of the regression, 9 portfolios were formed using 3 x 3 sorts. That is both Size and BE/ME factors were divided into three categories and the breakpoints are 33.33% and 66.67%. The 10-year data series of the excess return of each portfolio has been regressed against the market premium (RM-RF) for the Capital Asset Pricing Model and against market premium (RM-RF), size premium (SMB) and value premium (HML). The results showed the Average value of the intercept is 0.0071 which is very close to zero which means the model captured portfolio excess returns more accurately.

For comparison between the two models, Adjusted R-Square, intercepts and F-statistics were compared. Besides the models were compared using the GRS test statistics. The result showed the Fama and French Three-Factor Model is superior in estimating the excess return of portfolios with 60.58% relatively higher explanatory power than the Capital Asset Pricing Model. Besides, the Fama and French Three-Factor Model has 0.7% of the excess return that is independent of the explanatory variables. In the GRS test, the null hypothesis was rejected for both models. But in the sub-periods, the null hypothesis was accepted for the three-factor model, indicating that joint α was zero and that the factors accurately capture returns. For CAPM null hypothesis was rejected for both sub periods. This showed that Three-Factor Model is an improvement over the CAPM.

In the context of the Bangladesh market, the SMB factor might reflect a larger premium due to the illiquidity and riskiness of smaller firms. However, the low liquidity could deter investors, making the size premium less attractive in practice. On the other hand, the HML factor's performance may be heavily influenced by the country's corporate governance practices. Investors in Bangladesh may face a significant risk premium when investing in value stocks due to concerns over transparency, management quality, and financial reporting reliability. Both factors suggest that investors need to be cautious, incorporating not only size and value considerations but also liquidity and governance risks specific to Bangladesh when assessing returns.

Based on the findings, the study recommends that the cost of capital estimates would be more accurate using the three-factor model rather than the CAPM model; portfolio managers should increase portfolio returns by investing in small-size and high-value firms that have performed well during the testing period.

Both models have limitations, especially when applied in emerging markets like Bangladesh. Firstly, CAPM relies on the assumption that markets are efficient and that all investors have access to the same information. In Bangladesh, market inefficiencies and information asymmetry are common. Secondly, CAPM only considers systematic risk (beta), ignoring other factors that may influence returns. In a developing market, factors such as liquidity, political risk, and macroeconomic conditions can be significant. For the Fama-French model, it includes size and value factors but it may still overlook other relevant factors specific to the Bangladeshi market, such as growth, momentum, or local economic conditions. Besides, the introduction of floor price has complicated the assumptions regarding market efficiency, risk perception, and investor behavior. These changes may have led to deviations from the expected outcomes predicted by the model.

It can be concluded that market premium (RM-RF), size premium (SMB) and value premium (HML) are significant risk factors in measuring excess returns of stocks listed in the Dhaka Stock Exchange. Further studies can be done to find the impacts of other risk factors in the Bangladesh Capital Market.

7.0 References

Alam, M. M., Alam, K. A. and Uddin, M. G. S., (2007), Market Depth and Risk Return Analysis for Dhaka Stock Exchange: An Empirical Test of Market Efficiency. ASA University Review, 1(1), pp. 93-101.

Ali, M. H., Islam, S. and Chowdhury, M. M., (2010), Test of CAPM in Emerging Stock Markets: A study on Dhaka Stock Exchange, The Cost and Management, November- December, 34 – 37.

Banz, R. (1981) “The relationship between returns and market value of common stock.” Journal of Financial Economics 9: 3-18.

Bark, T., (1991). Anti-dumping Restrictions against Korean Exports: Major Focus on Consumer Electronics Products. Korean Institute for International Economic Policy (May) No. 91-02.

Basu, S. (1977). Investment performance of common stocks in relation to their price_earnings ratios: A test of the efficient market hypothesis. The Journal of Finance, 32(3), 663-682.

Black, F., Jensen, M. C. and Scholes, M. (1972) The Capital asset pricing model: Some empirical tests. Studies in the Theory of Capital Markets. New York: Praeger. p.79-121.

Bodie, Z., Kane, A., Marcus, A.J. (2024) Investment. 13th. Edition-Ch-13.

Chan, & Lakonishok. (2004). Value and Growth Investing: Review and Update. Financial Analysts Journal, 60(1), 71-86, CFA Institute.

Cheung, Y.L., Wong, A. and Ho, K.Y., (1993). The pricing of risky assets in two emerging Asian markets—Korea and Taiwan. Applied Financial Economics, 3(4), pp. 315–24.

Cheung, Y.L. and Wong, K.T., (1992). An Assessment of Risk and Return: Some Empirical Findings from Hong Kong Stock Exchange. Applied Financial Economics, 3, pp. 315-324.

Claessens, S., Dasgupta, S. and Glen, J., (1995). Return Behavior in Emerging Stock Markets. World Bank Economic Review, 9(1), pp. 131-151.

Estrada, J., (2000). The cost of equity in emerging markets: A downside risk approach. Emerging Markets Quarterly, 4, pp. 19-30.

Fama, E. F. and MacBeth, J. (1973) “Risk, return and equilibrium: Empirical tests”. Journal of Political Economy 81: 607-636.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Fama, & French. (1992). The Cross-Section of Expected Stock Returns. The Journal of Finance, XLVII(2).

Fama, & French. (1995). Size and Book-to-Market Factors in Earnings and Returns. The Journal of Finance, 50(1), 131-155, Wiley.

Fama, & French. (1996). Multifactor Explanations of Asset Pricing Anomalies. The Journal of Finance, 51(1), 55 84, Wiley.

Fama, & French. (2004). The Capital Asset Pricing Model Theory and Evidence. Journal of Economic Perspectives, 18(3), 25–46, American Economic Association.

Fama, & French. (2006). The Value Premium and the CAPM. The Journal of Finance, 61(5), 2163–2185, Wiley.

Fama, & French. (2007). Migration. Financial Analysts Journal, 63(3), 48-58, CFA Institute.

Fama, & French. (2012). Size, value, and momentum in international stock returns. Journal of Financial Economics, 105(3), 457-472.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of financial economics, 116(1), 1-22.

Fama, E. F., & French, K. R. (2016). International tests of a five-factor asset pricing model. Journal of Financial Economics, 123(1), 441-463.

Fernandize. (2002). The CAPM and Value at Risk at Different Time Scales. Chile, Center for Applied Economics.

Gibbons. (1982). Multivariate Tests of Financial Models: A New Approach. Journal of Financial Economics, 10(1), 3-27.

Gibbons, M. R., Stephen A Ross, and Jay Shanken, 1989, A test of the efficiency of a given portfolio. Econometrica, 57, 1121–1152.

Harvey, C., (1995). Predictable risk and returns in emerging markets. Review of Financial Studies, 8, pp. 773-816.

Hasan, M. Z., Kamil, A. A., Mustafa, A. and Baten, M. A., (2011). A Validity test of Capital Asset Pricing Model for Dhaka Stock Exchange. Journal of Applied Sciences, 11(20), pp. 3490 – 3496.

Huang, Y. S., (1997). An empirical test of the risk-return relationship on the Taiwan Stock Exchange. Applied Financial Economics, 7, pp. 229-239.

Kothari, et, al. (1995). Another Look at the Cross-Section of Expected Stock Returns. The Journal of Finance, 50(1), 185-224, Wiley.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. The journal of finance, 49(5), 1541-1578.

Lintner, J., (1965). Security prices, risk and maximum gains from diversification. Journal of Finance, 20, pp. 587-616.

Mandelker, G. and S. Rhee, (1984). The Impact of the Degrees of Operating and Financial Leverage on Systematic Risk of Common Stocks. Journal of Financial and Quantitative Analysis, March, pp. 45-57.

Md. Tanvir Hasan & Syfuddin Tamim (2019). Fama and French Three Factor Model: A Superior Model to Capital Asset Pricing Model (CAPM) in Estimating Excess Return of Securities in Bangladesh, Journal of Business Studies, Vol. XL, No. 3.

Mehra, R., & Prescott, E. C. (1985). The equity premium: a puzzle. Journal of Monetary Economics, 15(2), 145-161.

Merton. (1973). An Intertemporal Capital Asset Pricing Model. Econometrica, 41(5), 867-887, The Econometric Society.

Mollah, S. A. and Mobarek, A., (2009). Thin Trading, the Estimation of Beta and the Relationship between Share Return and Beta in the Emerging Market of Botswana, International Journal of Business Research, 9(1), pp. 119-125.

Mollik & Khokan Bepari (2015) Risk-Return Trade-off in Emerging Markets: Evidence from DSE AABFJ | Volume 9, no. 1.

Neeraj Sehrawat, Amit Kumar, Narander Kumar Nigam, Kirtivardhan Singh and Khushi Goyal (2020). Test of capital market integration using Fama-French three factor model: empirical evidence from India. Investment Management and Financial Innovations, 17(2), 113-127.

Prince Acheampong & Sydney Kwesi Swanzy (2015). Empirical Test of Single Factor and Multi-Factor Asset Pricing Models: Evidence from Non Financial Firms on the Ghana Stock Exchange (GSE), International Journal of Economics and Finance; Vol. 8, No. 1; 2016

Rahman, M., Baten, A., Uddin, B., & Zubayer, M. (2006). Fama-Frenchs CAPM: An empirical investigation on DSE. Journal of Applied Sciences, 2297-2301.

Reinganum, M. R. (1981). Misspecification of capital asset pricing: Empirical anomalies based on earnings' yields and market values. Journal of Financial Economics, 9(1), 19-46.

Rosenberg, B., Reid, K., & Lanstein, R. (1985). Persuasive evidence of market inefficiency. The Journal of Portfolio Management, 11(3), 9-16.

Sattar, M. (2017). CAPM Vs Fama-French Three-Factor Model: An Evaluation of Effectiveness in Explaining Excess Return in Dhaka Stock Exchange. International Journal of Business and Management, 12(5), p.119.

Sayeed, M., Khatun, M. and Chowdhury, B. (2014). Does the Fama-French Three Factor Model Outweigh the CAPM Model? Evidence from the Dhaka Stock Exchange. SSRN Electronic Journal.

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance, 19(3), 425-442.

Sobti, N. (2016), Revisting CAPM And FAMA French Three Factor Model In Indian Equity Market, Business Analyst, vol. 37(1), 31-46.

Ward, M. and Muller, C., (2012). Empirical testing of the CAPM on the JSE. Investment Analysts Journal, 76: 1 – 12.

Wolf, H.C., (1998). Determinants of Emerging Market Correlations in Emerging Market Capital Flows, R. M. Levich, Ed, Kluwer Academic Publishers, Boston.

8.0 Appendix

Table A1: Estimated beta of the portfolios from 2014 to 2023

Year	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
2014	1.4224	1.1940	1.1034	1.0242	0.9668	0.8972	0.8274	0.7475	0.6549	0.4087
2015	1.7947	1.5132	1.3616	1.2338	1.1346	1.0581	0.9712	0.8902	0.7907	0.5131
2016	1.7266	1.5226	1.4476	1.3367	1.1992	1.0818	1.0150	0.9050	0.7857	0.4849
2017	1.5272	1.3094	1.2224	1.1218	1.0155	0.9109	0.8182	0.6999	0.5481	0.1621
2018	1.6712	1.4010	1.2675	1.1634	1.0773	0.9321	0.7784	0.6250	0.4756	-0.0594
2019	1.7011	1.3834	1.2659	1.1672	1.0351	0.9100	0.7692	0.6235	0.4755	-0.0532
2020	2.1681	1.7068	1.4869	1.3400	1.1672	0.9889	0.8586	0.7014	0.5292	0.1373
2021	2.3027	1.6417	1.4022	1.2031	1.0512	0.9185	0.7782	0.6149	0.4671	0.1898
2022	2.2147	1.5866	1.3613	1.1866	1.0568	0.9416	0.8382	0.6783	0.5262	0.2870
2023	2.2808	1.6643	1.3746	1.2101	1.0782	0.9776	0.8341	0.6505	0.4911	0.2583
Average Beta	1.8810	1.4923	1.3293	1.1987	1.0782	0.9617	0.8488	0.7136	0.5744	0.2329

Source: Authors' Calculation