UNIVERSITY OF GHANA

ASSESSING THE EXPLANATORY POWER OF BOOK TO MARKET VALUE OF EQUITY RATIO (BTM) ON STOCK RETURNS ON GHANA STOCK EXCHANGE (GSE)

BY

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DECLARATION

Candidate's Declaration

I do hereby declare that this Dissertation is the result of my own original research and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been fully acknowledged.

I bear sole responsibility for any shortcomings.

Candidate's Signature:…………………… Date:……………........

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CERTIFICATION

I hereby certify that this thesis was supervised in accordance with the procedures laid down by the University of Ghana.

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(Prof. A .Q. Q. Aboagye)

DEDICATION

This work is dedicated to my mother.

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ABSTRACT

The objective of this research was to assess the explanatory power of Book-To-Market value of equity ratio (BTM) and firm size on portfolio returns in Ghana. This study also sought to compare the strength of BTM to size in explaining returns. The last objective was to measure the efficiency of Fama and French (1992) Three-Factor Model on the Ghana Stock Exchange (GSE) over the period January 1997 to December 2009 and to compare the Three-Factor Model to the Capital Asset Pricing Model (CAPM).

The sample includes only non-financial firms that traded on the Ghana Stock Exchange over the test period. The sample size increased from eleven (11) non-financial firms in 1997 to twenty-one (21) non- financial firms in 2009. Each year, six Size-BTM sorted portfolios are formed namely; Big-High (BH) portfolio which consist of stocks with big size and high BTM ratio, Big-Medium (BM) portfolio which contains stocks with big size but medium BTM ratio , Big-Low(BL) portfolio which consist of stocks with big size and Low BTM ratio, Small-High (SH) portfolio which contains stocks with small size and high BTM ratio, Small-Medium (SM) portfolio contains small size and medium BTM ration whilst Small-Low (SL) portfolio contains stocks with small size but low BTM ratio.

This research found out that, CAPM alone could not predict portfolio returns and that by adding the two other factors, namely the size effect and the book-to-market ratio effect, to the CAPM to derive the Fama and French (1992) Three- Factor Model improves the efficiency of the explanation. It was therefore concluded that The Fama and French Three - Factor Model consisting of Beta, BTM and firm size could explain risk in portfolio return better than the beta alone as contended by the traditional CAPM. This study also identified that BTM effect was stronger on the Ghanaian market than the size effect as identified by Fama and French (1992) on the US market.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Over the past decades, the Asset Pricing Model of Sharpe (1964), Lintner (1965), and Black (1972) (SLB) has been used both by academics and practitioners to estimate cost of capital and to calculate expected returns on a stock. It has established the relationship between average expected return and risk. Given certain assumptions, the CAPM states that the expected return on a security is directly related to the security's non-diversifiable risk (or beta) measured relative to the market portfolio of all marketable securities. If the model is accurate and security markets happen to be efficient, then security returns are expected on the average to conform to this linear relation.

Early tests like Fama and MacBeth (1973) , Black, Jensen and Scholes (1972) supported the CAPM, however; the explanatory power of beta came into question in the late 1970s when some researchers identified that, firm characteristics such as the earnings-to-price ratio, firm size and Book To Market value of equity ratio (BTM ratio) among others have better explanatory power than beta.

According to Fama and French (2004), the empirical record of the famous Sharpe-Lintner-Black (SLB) model is so poor and poor enough to invalidate the way it is used in application. Those studies which have contradicted the CAPM empirically identified certain variables as explaining the cross-sectional variation in asset returns better than the Capital Asset Pricing

Model (CAPM) Dimson (1988).The most prominent of these contradictions is what has become known as Size Effect by Banz (1981). In his work, Banz finds that firm size measured by market equity, ME (stock price times shares outstanding) adds to the explanation of the cross section of average returns provided by market betas (**β**s). This invariably implies that beta alone cannot explain variation in expected returns as claimed by CAPM but rather there is an aspect of the variation of expected returns which is explained by the firm size. He concluded that, average returns on small (low ME) stocks are too high given their beta estimates and that of large stocks are too low given their beta.

Ball (1978) contends that the ratio of earnings-to-price (E/P ratio) is a blanket proxy for unnamed risk factors in expected returns; hence E/P ratio also can add to the explanation of variation in expected return.

Another of such contradiction of the Sharpe-Lintner-Black (SLB) model is the positive relation between leverage and average return documented by Bhandari (1988).He concludes that, financial leverage is related to risk and expected return, but in the SLB model leverage risk is captured by market beta. Bhandari finds however that leverage helps explain the cross-section of average stock returns in tests that include size as well as beta.

One other variable which has been identified as capable for capturing risk and hence able to explain variation in returns is Book-to- Market value of equity ratio (BTM). This ratio has caught the attention of many researchers lately such that its explanatory power has been tested and it is still being tested on several markets around the world. Early studies on the BTM ratio were by Stattman (1980) and Rosenberg, Reid and Lanstein (1985). They both found out that average returns on U.S stocks were positively related to the ratio of a firm's BTM.

Book-to-market (BTM) ratio is a very instrumental ratio when it comes to investment analysis. Book-to-market ratio (BTM) can be defined as the ratio of a firm's book value of equity to its market value of equity. Book value of equity is determined by the firm's accountants using historic cost information. Market value of equity is determined by buyers and sellers of the stock using current information. It is said to have a significant explanatory power over stock return and could be used as a proxy for risk.

The landmark paper of Fama and French (1992) rekindled the whole argument about the BTM and size effects. In their paper they observed that market beta was not significant in explaining stock returns but rather BTM effect and size effect accounted for all the variation in US stock returns over the study period. The finding of their research was received with skeptism by many researchers and was criticized on several grounds .Much of the criticisms centered on the premium for distress thus the average HML return. Kothari, Shanken and Sloan (1995) contended that this premium is due to survivorship bias and data snooping. Others also argued that the finding was specific to the US and for a particular time period that is 1963 to 1990. Though other research has been conducted to disprove most of the criticisms, Campbell, Lo and Mackinlay (1997) noted that sufficient new data from different economies must be used to provide a true out-of-sample check on the strength of these variables on stock returns and this study is a respond to their call by providing out of sample evidence from Ghana which is indeed the maiden research to be carried on this topic in our country.

Against this background, this study aimed at assessing the explanatory power of beta, BTM ratio and firm size on portfolio returns in Ghana (i.e. Fama and French 3 factor model) and then compared the explanatory power of CAPM to Three Factor model in order to find out which is better in explaining portfolio returns in Ghana.

1.2 Statement of the Problem

Internationally, literature documenting the explanatory power of the BTM ratio and firm size on stock returns is not scarce. Stattman (1980) finds a positive relationship between average return and BTM for U.S. stocks. This linear relationship was confirmed by Rosenberg, Reid, and Lanstein (1985). Chan, Hamao, and Lakonishok (1991) find that BTM is useful in explaining Japanese stock returns whilst Banz (1981) and Fama and French (1992) documented the size effect on returns.

The idea that BTM and firm size may be a proxy for risk has also been documented by several researchers like Fama and French (1992), Daniel and Titman (1997), Strong and Xu (1997), Ho, Strange and Piesse (2000), Drew et al. (2003) and Griffin and Lemmon (2002), to name but a few. Some of the markets tested include those in the U.S., U.K. and Italy with just a few on South African market by van Rensburg and Robertson (2003) and Auret and Sinclaire (2006). Despite the abundance of academic research on these risk factors (BTM and firm size) and average stock returns from the western worlds and developed economies, relatively little attention has been paid to it from the African perspective especially Western Africa. These developed markets have been found to be more efficient and hence different from emerging economics like ours. The case of emerging capital markets such as the Ghana

Stock Market could be entirely different because our market is mostly illiquid and small. It is also important to add that, this study provides an out of sample evidence to advance the debate over the appropriate asset pricing model and therefore response to the call of Campbell, Lo and Mackinlay (1997).

Up to date, no study has tested the combined explanatory power of beta, BTM and firm Size effects (Three factor model) on the Ghanaian stock market. Therefore this study aims to fill this gap in the literature.

It is also further motivated by Griffin's (2002) suggestion that practical applications of the Three Factor model are best performed on a country-specific basis. The Ghana stock market provides an interesting setting for such a study because of its unique characteristics. It is a small and illiquid market. Osei (2002) reported that the Ghanaian stock market is efficient in the weak form and this may impact on our result making it different from the other studies done elsewhere especially those from more efficient markets.

1.3 Objectives of Study

This research principally aims at investigating the explanatory power of BTM ratio and size effect on portfolio return on the Ghana Stock Exchange (GSE) using the Three Factor Model of Fama and French (1992).

Specifically, the study seeks to achieve the following objectives:

- to examine if beta risk is the only risk needed to the explain variation in portfolio returns (CAPM).
- to examine the explanatory power of BTM ratio captured by HML on portfolio returns.
- to assess the explanatory power of firm size captured by SMB on portfolio returns.
- to compare the explanatory power of BTM to size effect on the Ghanaian stock market.
- to test the Fama and French three-factor model on the Ghanaian stock market and compare it to the CAPM.

1.4 Research questions

This study sought to answer the following research questions:

- does beta capture all the risk which determines expected return on a portfolio?
- does BTM capture risk and hence able to explain some of variation in portfolio returns?
- does firm size capture risk and hence able to explain some of variation in portfolio returns?
- which one has a stronger explanatory power on portfolio returns, BTM or firm size?
- is the Fama and French Three Factor Model applicable on the Ghanaian market?
- does the Fama and French Three Factor Model explains portfolio returns better than the CAPM?

1.5 Significance/Implications

The CAPM is widely used to predict asset expected returns by both researchers and practitioners in various situations, such as portfolio management, evaluation of asset performance, and capital budgeting. If the CAPM inaccurately predicts stock returns, then it results in sub-optimal resource allocation decisions which in turn negatively affect the investors' wealth. For instance in Ghana, Osei (2002) identified that CAPM model explains only about 30% of the relationship between the returns of the stocks and the market returns which is very weak. Since this study compare the CAPM to the Three Factor Model of Fama and French, it will make it possible to choose the one that explains portfolio returns better which will enable investors predict expected returns.

This study contributes to the finance literature by providing evidence from Ghana on the explanatory power of BTM and size effect (Three Factor Model) on average portfolio returns. Finally, this study is also likely to stimulate research interest in this area of finance in Ghana.

1.6 Scope and limitation of the study

This study is limited to only non-financial firms listed on the Ghana Stock exchange between January 1997 to December 2009. The use of only non-financial firms is consistent with previous studies like Fama and French (1992) and Nartea and Ward (2009). The reason for this is, for financial firms high leverage is normal and probably does not have the same meaning as for non-financial firms, where high leverage more likely indicates financial distress. Over the study periods six Size - BTM portfolios (SL, SM, SH, BL, BM and BH) were formed instead of twenty-five (25) portfolios in the case of Fama and French (1992). SL portfolio consists of stocks with Small size and Low BTM. S as used in the portfolio name stands for Small size, B stands for Big size, L stands for low BTM, M stands for Medium BTM and H stands for High BTM. The number of stock in the sample increased from eleven (11) stocks in 1997 to twenty-one (21) stocks in 2009.

Our study is limited in the sense that the Ghana Stock Exchange is small compared to the US market and it is also illiquid. Most of the firms in the sample hardly paid dividend and for that matter most of the excess returns computed were negative.

1.7 Overview of Chapters

This research is presented in the following manner: Chapter one (1) presents the background to the study, statement of the problem, the study's objectives and its significance, limitation of the study, and organization of the study. Chapter two (2) covers review of relevant literature. Chapter three (3) elaborates on the methodology that was employed in gathering data whilst Chapter four (4) presents the findings of the study. It also presents the analysis of the data collected. Finally chapter five (5) details summary of findings, conclusions and recommendations made.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature relating to factors that explains stock returns. Section one introduces the CAPM and the debates surrounding the CAPM. Some studies confirm the validity of the CAPM in predicting the stock returns, whereas others argued that the CAPM cannot explain the portfolio stock returns alone. Following this, the other types of the CAPM are reviewed. Section two reviews literature on Book-to-Market (BTM) ratio. This is followed by review of literature on size effect and price-earnings ratio in sections three and four respectively. The fifth section, which concludes this chapter, outlines the conceptual framework as well as the model used.

2.1 CAPM

The Capital Asset Pricing Model (CAPM) has the most widely recognized model for explaining stock prices and expected return. It states that Systematic Risk is the main factor that influences expected return. CAPM of Sharpe (1964), Lintner (1965) and Black (1972) marks the birth of asset pricing theory. Many decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios.

The key element of the CAPM model is that it separates the risk affecting an asset's return into two categories. The first type is called unsystematic or company-specific risk. The long-term average returns for this kind of risk should be zero. The second kind of risk, called systematic risk, is due to general economic uncertainty. The CAPM states that the return on assets should, on average, equal the yield on a risk-free bond held over that time plus a premium proportional to the amount of systematic risk the stock possesses.

The treatment of risk in the CAPM refines the notions of systematic and unsystematic risk developed by Markowitz in the 1950s (Markowitz, 1950). Unsystematic risk is the risk to an asset's value caused by factors that are specific to an organization, such as changes in senior management or product lines. For example, specific senior employees may make good or bad decisions or the same type of manufacturing equipment utilized may have different reliabilities at two different sites. In general, unsystematic risk is present due to the fact that every company is endowed with a unique collection of assets, ideas, personnel, etc., whose aggregate productivity may vary.

Modern Portfolio Theory states that unsystematic risk can be mitigated through diversification (Markowitz, 1950). That is, by holding many different assets, random fluctuations in the value of one will offset opposite fluctuations in another. Systematic risk is risk that cannot be removed by diversification. This risk represents the variation in an asset's value caused by unpredictable economic movements. This type of risk represents the necessary risk that owners of a firm must accept when launching an enterprise. Regardless of product quality or executive ability, a firm's profitability will be influenced by economic trends.

In the CAPM, the risk associated with an asset is measured in relation to the risk of the market as a whole. This is expressed as the stock's beta (β), or correlation to the market average. The returns of an asset where β = 1 will, on average, move equally with the returns of the overall market. Assets with β < 1 will display average movements in return less extreme than the overall market, while those with β > 1 will show return fluctuations greater than the overall market.

The CAPM model is as follows:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

R_f = return on the risk-free asset

R_m = return on the market portfolio, which comprises all the capital assets, thus, stocks, bonds, real estate, etc., with each weighted according to the proportion of its current market value

β_i = a measure of security *i's* responsiveness to movements in the market portfolio

The CAPM model shown above predicts that only the attribute of security (β_i) determines differences in expected return, thus $E(R_i) = f(\beta_i)$

The (Rm- Rf) term is called the market risk premium, which measures the excess market return required by the investor to hold the market portfolio instead of a risk-free asset. According to the CAPM, an asset's expected return should depend only on its systematic risk, since the unsystematic risk of the asset could be diversified by portfolio selection. Sharpe (1964) and Lintner (1965) used beta to measure the systematic risk and reported a positive linear relationship between beta and asset expected returns.

There are certain assumptions embedded in the CAPM. These assumptions consist of the following:

- all investors focus on a single holding period, and seek to maximize the expected utility of their terminal wealth
- all investors can borrow or lend an unlimited amount at a given risk free rate of interest
- investors have homogeneous expectations
- all assets are perfectly divisible and perfectly liquid
- there are no transactions costs
- there are no taxes
- all investors are price takers and
- the quantities of all assets are given and fixed (Brigham and Ehrhardt, 2005).

The assumptions have been described as being over simplified and unrealistic in practice and hence even makes empirical testing of the model very problematic. Black, Jensen and Scholes (1972) tested the validity of CAPM using cross-sectional monthly stock returns on U.S. stock market for the period commencing from 1926 to 1966 and discovered that there exist a direct positive relationship between beta and stock expected return. Their study revealed that the beta had a positive trend during the test period, and concluded that the beta was an important determinant of stock returns. Similarly, Ang and Chen (2003) showed that the CAPM performed remarkably well in the long run. They used U.S. stock market monthly data from 1963 to 2001 and developed the conditional CAPM with latent time-varying betas and concluded that the standard unconditional CAPM could explain the spread between the portfolio returns. Fama and French (2004) indicated that the CAPM was useful to predict the individual asset return.

Osei (2002) carried out a study in Ghana which aimed at describing the asset pricing characteristics of GSE using the CAPM model. The study used sixteen (16) out of the twenty-one (21) listed stocks. The study establishes that thirteen (13) out of the sixteen (16) stocks studied had systematic risk lower than the market risk. Three stocks have betas greater than the market beta of one. Five out of the thirteen (13) stocks with systematic risk lower than the market risk have negative betas. Their t-values are also not significant. The study further reported that there were considerable intra-industry differences in systematic risk values of the listed stocks. His study concluded that on the average the market returns explain about 30% of the variations in the returns of the individual stocks listed on the Ghanaian exchange.

2.1.1 Arguments about the CAPM

There is empirical evidence that supports a linear relationship between beta and stock expected returns (Black et al., 1972; Ang and Chen, 2003, Osei, 2002). However, there are several empirical evidences that showed that the CAPM cannot fully explain the portfolio asset returns, and that the beta has little or no explanatory power in predicting the asset returns. Fama and French (2004) pointed out that, though the CAPM was useful in predicting the individual asset return it was invalid because the portfolio stocks returns could not be explained by the CAPM.

The early challenges to the CAPM validity came from Roll (1977), who argued that the CAPM test could not be constructed theoretically unless there was an exact composition of the true market portfolio with certainty. Roll argued that the real proxies would be highly correlated with each other. However, the only testable hypothesis of CAPM was the market portfolio mean-variance-efficient where the linear relationship between asset returns and beta was based solely on the mean-variance-efficient of the market portfolio, but the real market portfolio did not support the hypothesis.

Megginson (1996) confirmed Roll's critique and pointed out that the most damaging critique of the CAPM was Roll's 1977 criticism. Shanken (1987) showed similar results to Roll's critique; the unambiguous inference about the validity of the CAPM was not attainable, regardless of whether one used the Centre for Research in Security Prices (CRSP) equal-weighted stock index or the U.S. long term government bond index in a multivariate proxy and multiple correlations between the true market portfolio and proxy assets.

Kandel and Stambaugh (1987) focused on the multiple-correlation between the proxy and the market portfolio and found that if the two market portfolios returns were highly correlated, the central assumption of the mean-variance-efficient of CAPM was reversed. They therefore rejected the validity of the CAPM.

Fama and French (2004) disagreed with Roll's critique. They argued that, in the normal efficient market, the expected returns and beta of the portfolio is the minimum-variance condition (the lowest possible portfolio variances in which certain portfolios contain the risky stocks, and there are no risk-free assets). Fama and French argued that investors under the minimum-variance condition market have the chance to form the mean-variance-efficient portfolio when they contained reasonable proxies.

Even though the traditional model is still being used and taught empirical studies have also disproved its validity. The CAPM has been largely criticized because of the assumptions on which it was developed.

While the assumptions made by the CAPM allow it to focus on the relationship between return and systematic risk, the idealized world created by the assumptions is not the same as the real world in which investment decisions are made by companies and individuals. For example, real-world capital markets are clearly not perfect. Even though it can be argued that well-developed stock markets do, in practice, exhibit a high degree of efficiency, there is scope for stock market securities to be priced incorrectly and, as a result, for their returns not to plot on to the SML.

The assumption of a single-period transaction horizon appears reasonable from a real-world perspective, because even though many investors hold securities for much longer than one year, returns on securities are usually quoted on an annual basis.

The assumption that investors hold diversified portfolios means that all investors want to hold a portfolio that reflects the stock market as a whole. Although it is not possible to own the market portfolio itself, it is quite easy and inexpensive for investors to diversify away specific or unsystematic risk and to construct portfolios that 'track' the stock market.

A more serious problem in reality that contradicts one of the assumptions of CAPM is that, it is not possible for investors to borrow at the risk-free rate (for which the yield on short-dated Government debt is taken as a proxy). The reason for this is that the risk associated with individual investors is much higher than that associated with the Government. This inability to borrow at the risk-free rate means that the slope of the SML is shallower in practice than in theory. Overall, it seems reasonable to conclude that while the assumptions of the CAPM represent an idealized rather than real-world view, there is a strong possibility, in reality, of a linear relationship existing between required return and systematic risk.

CAPM has been challenged on the following grounds that, it is likely that other sources of risk exist (Omitted variable bias in the estimates of β_i) and the market portfolio is unobservable, thus, $R_{m,t}$ will be proxied by an observed market portfolio (say, GSE all-share index).

Notwithstanding all these criticisms about the CAPM, what makes it attractive is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk (Fama and French, 2004). Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications. The CAPM's empirical problems may reflect theoretical failings, the result of many simplifying assumptions. But they may also be caused by difficulties in implementing valid tests of the model. For example, the CAPM says that the risk of a stock should be measured relative to a comprehensive "market portfolio" that in principle can include not just traded financial assets, but also consumer durables, real estate, and human capital.

2.1.2 Extensions of CAPM

After the traditional CAPM model was propounded, several researchers have tried either modifying the model or coming out with a completely different model.

Black (1972) modified the original CAPM to derive a more general model of asset pricing in which *Rf* is replaced by $E(R_o)$ where $E(R_o)$ is the expected return on a minimum variance portfolio whose returns are uncorrelated with those of the market portfolio.

Litzenbergen and Ramaswany (1979) provided an extension of the CAPM model by including other attributes apart from β*i*, such as dividend yield. Thus:

$$E(R_i) = f(\beta_i, DY_i)$$

Breeden (1979) employed Merton's (1973) model which is the multi-beta Intertemporal CAPM (ICAPM) by extending the CAPM in a multi-goods and continuous-time model known as the consumption-oriented CAPM (CCAPM). The difference between Breeden's model and the original CAPM is that Breeden used the real consumption rate to calculate the beta. Breeden, Gibbons, and Litzenberger (1989) conducted empirical tests on the CCAPM. The CCAPM basic prediction is that the beta should be significantly positive related to the expected return of assets. However, Breeden, Gibbons, and Litzenberger found that the hypothesis of a positive linear relationship between beta and expected returns was rejected. They gave three reasons for the rejection of the CCAPM hypothesis. First, the data should be monthly, not be quarterly. Second, the Great Depression during 1929 to 1939 had negative effect on the CCAPM. Third, the market portfolio weights (the percentage of the risk-free assets and the risk assets) contained uncertainty and should be included in the estimation.

Gibbons and Ferson (1985) developed the CAPM with a multiple risk model, namely the conditional CAPM. They argued that previous CAPM studies did not follow the basic theory of conditional information. Gibbons and Ferson conducted the test using the daily stock data of the Dow Jones 30 from 1962 to 1980 and confirmed the hypothesis of the conditional CAPM. Their results showed a linear relationship between the beta and the portfolio expected stock returns.

Tinic and West (1986) presented a four-parameter model that added another two variables, the beta square and standard deviation, and reported that the beta had a significant nonlinear relationship with expected returns in the CRSP index. Furthermore, the adjusted R-squared in their model increased compared with the original CAPM. Their results indicated that the four parameter model could provide an accurate prediction of portfolio expected returns.

According to the traditional CAPM model, only beta is related to the asset returns. However, Fama and French (2004) argued that the CAPM could not be used to predict portfolio asset returns. The beta was insufficient in explaining the expected returns, and the CAPM model requires other variables to increase the explanatory power of the expected returns (Fama and French, 1992). They argued that firm size and book-to-market ratio could sufficiently explain the cross-sectional variation in average stock returns. Later, Fama and French (1993) presented the three-factor model, which could explain the cross-sectional stock returns better than the CAPM.

2.2 Book-to-market Ratio (BTM) Effect

BTM attracted much attention after several empirical studies have refuted the strength of the CAPM in explaining stock returns. BTM ratio effect is one of the most well-known and accepted "anomalies" of the stock market. This was first documented by Stattman (1980) and Rosenberg et al. (1985). These studies found that stocks with high book-to-market equity ratios (BE/ME) on average exhibit higher returns than would be warranted by their CAPM betas. Though size effect has gained much popularity, according to Fama and French (1992) BTM has a stronger explanatory power on stock return than the size effect.

A large number of studies, using US and international data, have demonstrated that this ratio has a significant explanatory power for cross section average stock returns and that these returns are higher for stocks with high book-to-market ratios. Evidence of BTM effect has been provided by studies such as Fama and French (1992; 1998) using US data, Chan, Hamao and Lakonishok (1991) using Japanese data and Maroney and Protopapadakis (2002) using data from other national markets.

The BTM effect states that stocks with a high BTM ratio earned higher returns than stocks with a low BTM ratio. The difference between the high BTM ratio stocks' earning and low BTM ratio stocks' earning is the value premium (Fama and French, 1992).

Chan et al. (1991) revealed that there was a significant positive relationship between the BTM ratio and assets' expected returns for the period 1971 to 1988 in the Tokyo Stock Exchange.

Chan et al. used 64 portfolios to test the relationship between four variables (earnings yield, size, BTM ratio and cash flow yield) and the portfolios' returns. The evidence showed that the high positive BTM ratio firms were about 1.1% higher than the low positive BTM ratio firms.

They further reported that the coefficients of the BTM ratio variable have a significant positive sign. Further, there was no specific effect in January when using the BTM ratio to predict stock returns. Finally, the authors tested the CAPM and found the beta could not explain the cross-section stock returns in the Japanese stock market during their testing period. They concluded that the BTM ratio had a significant impact on the stock expected returns.

Fama and French (1992) tested the relationship between assets' expected returns and size, BTM ratio, leverage, and EP ratio on the New York Stock Exchange, American Exchange, and National Association of Securities Dealers Automated Quotation System from 1962 to 1989. They reported that the BTM ratio had a strong role in explaining the cross-sectional stock average returns. Fama and French (1993) stated that the BTM ratio, which could explain stock average returns, was related to economic fundamentals. They claimed that firm with a high BTM ratio had a low stock price relative to book value, which means low earnings on assets for the firm. Fama and French (1995) discussed the fundamental economic reason for the BTM ratio effect where high BTM ratio firms were distressed. The high BTM ratio stocks were less profitable compared with low BTM ratio stocks in the short-term. However, in the long-term, the high BTM ratio stocks yielded higher profitability than the low BTM ratio stocks.

Daniel, Titman and Wei (2001) investigated the U.S. and Japanese stock markets from 1975 to 1997 and concluded that the cross-section stock returns were directly related to the BTM ratio. The authors reported that the difference between the high BTM ratio stock returns and the low BTM ratio stock returns was 0.99% per month in the Japanese stock market, and 0.35% in the U.S. stock market. Their results showed that the BTM ratio had a stronger power to predict average cross-sectional stock returns in the Japanese stock market than the U.S. market.

Chen et al. (2007) applied a different method to test the BTM ratio effect on the Chinese Stock Market. They ran the cross-sectional stock returns regression by rearranging the risk variable into several principal components. They found that the cross-section stock returns were positively related to the BTM ratio on the Chinese Stock Market. However, the BTM ratio effect could be replaced by other factors that could predict the stock returns more accurately than the BTM ratio. Chen and Zhang (1998) also found that the BTM ratio could explain stock returns. However, they pointed out that the BTM ratio might not be sufficient to explain the stock expected return in a high-growth market.

The literature, in general, supported the BTM ratio as a distress factor, but there exist a number of disagreements about the BTM ratio as a risk proxy. For example, Daniel and Titman (1997) argued that the BTM ratio effect is the firm's risk characteristics rather than the risk factor in generating stock expected returns. They applied the Fama and French (1993) data and portfolio returns and found that high BTM ratio stocks had high average returns that did not depend on the return patterns. This implies the assets expected returns are related to their firms' characteristics and have no relationship with the covariance returns of the BTM ratio. Daniel and Titman rejected the CAPM hypothesis. They argued that the beta could not explain the cross-sectional stock returns when either forming the portfolios by size or by the BTM ratio.

Another disagreement of BTM ratio as risk factor came from the Lakonishok et al. (1994) study. They argued that the high BTM ratio anomaly was due to investor overreaction. Lakonishok et al. stated that investors are over-optimistic about well performing stocks and over-pessimistic about stocks with poor performance in the previous year. The BTM ratio captured systematic errors in investors' expectations about future returns. Therefore, Lakonishok et al. concluded that the BTM ratio should not be proxy for the risk factor.

There are two competing explanations for the BTM effect. One interpretation, consistent with the efficient-market hypothesis, is that the ratio is a proxy for risk and thus the relationship found between this ratio and stock returns. In other words, the higher the ratio the greater the risk and hence the risk premium required by the investor (Fama and French ,1992). Specifically, Fama and French (1996) and Vassalau and Xing (2004) argue that the ratio is a proxy for financial distress or default risk.

The other interpretation for BTM effect is that it is indeed an anomaly thus a violation of Efficient Market Hypothesis. Lakonishok, Shleifer and Vishny (1994) argue that cognitive biases and investors agency costs are the reasons for this market anomaly.

2.3 Size Effect

The relationship between size and average returns is known as the "size effect" (also called small firm effect) and this was first documented by Banz (1981). Following the discovery of the size effect, researchers have subjected this anomaly to much scrutiny and analysis. They have tried to find the reason for this effect. In attempted to explain the size anomaly, two strongest explanations have been discovered and they are the risk measurements explanation and the higher transaction costs explanation.

Banz (1981) and Reinganum (1981) were among the first to study the relationship between size and stock returns. They found that firm size, or market capitalization, measured as the market value of equity (ME), possess significant influence on the stock returns, the smaller (low ME) size firms earn higher return than the larger (high ME) firms. Banz (1981) argued that, on average, small firms earned higher returns than large firms. In a sample period of 50 years, ranging from 1926 to 1975, he used common stocks monthly data on the New York Stock Exchange. Banz applied three stock market indexes to test the firm size effect. The first was the CRSP equal weight index, followed by the CRSP value weight index and the third was a combination of equal weight, value weight and corporate return data, and government bonds return data. The results depicted a nonlinear stable relationship between size and stock expected returns in the three market indexes. On average, the small firms' earnings were 0.4% higher than large firms' earnings per month. Banz concluded that firm size should be a risk proxy for the CAPM. In addition, the author argued that the size effect did not have a theoretical foundation and questioned whether there were unknown factors correlated to firm size. Nevertheless, Banz agreed with Klein and Bawa's (1977) explanation that there was insufficient information available to investors causing them to limit their portfolio diversification. Investors do not have a desire to hold small firms stock since the small firms might get higher undesirable returns.

Reinganum (1981) confirmed Banz's findings and argued that there was a significant inverse relationship between firm size and asset abnormal returns. However, Reinganum's testing period was shorter than that of Banz. Reinganum used quarterly return data from 1975 to 1977 from the New York Stock Exchange and American Stock Exchange stocks. The author stated that the CAPM was inadequate in predicting the expected returns and that firm size could be the risk proxy factor.

Stoll and Whaley (1983) also confirmed that the size effect existed in a holding period of three months or more on the New York Stock Exchange during 1955 to 1979. They also pointed out that the transaction costs were higher for the investors holding small firms stocks compared with large firms stocks. In order to discover the transaction cost effect, Stoll and Whaley examined the CAPM applied to monthly stock returns the transaction cost deducted. They found small firms received higher returns than large firms. They concluded that the transaction cost could explain size effect.

Keim (1983) claimed that the small firms earning high returns could be caused by the January effect and that the relationship between the size factor and expected returns was significantly negative. He applied this to sample stocks listed on the New York Stock Exchange from 1963 to 1979. Keim found that nearly 15% of the size effect premium (small firm returns are smaller than large firm returns on average) was caused by January abnormal returns, and were higher than in the other months.

Roll (1981), Handa, Kothari and Wasley (1989) and Chan and Chen (1988) rejected the size effect and showed the small firm effect was caused by bias or incorrect methods. For example, Roll (1981) argued that small firm effect was caused by infrequent trading and firm size could not be a risk factor. The author used the Standard and Poor's 500 index, New York Stock Exchange index, and American listed common stocks data to examine the small firm effect.

The sample period was from 1962 to 1977. The author found by comparing the daily and semi-annual results that the beta and the mean returns increased irregularly. The daily mean returns of Roll's portfolio were slightly larger than the daily mean returns of the index, but the semi-annual mean returns were two times larger than the daily returns. The beta also increased about 50% from daily to semi-annual. Based on these results, the author pointed out investors would be not concerned about firm size whether small or large, when the risk and returns were equal. Roll further found that there was positive correlation between firm size and frequent trading. Therefore, the small firm effect was due to less-frequent trading and the small firm effect was a bias in risk measurement.

According to Handa et al. (1989), the small firm effect is correlated with the return interval (daily, monthly and annual) used to estimate beta. The beta changes with the asset expected return interval since the variance of the return on the market portfolio did not change proportionately as the asset expected return interval changed. The sample included all the stocks monthly data from 1926 to 1982. They formed 20 portfolios by firm size, and then used the buy-and-hold equally weighted return to test the beta and size effect against the return interval. Handa et al. (1989) found that the beta changes could predict the expected return interval and that annual betas are more efficient in explaining stock returns than monthly betas. In addition, Handa et al. used regression to examine monthly and annually firm size coefficients and beta. The results showed that the coefficients of firm size were not statistically significant but the betas had significant explanatory power. Therefore, they concluded that the CAPM was efficient in predicting assets' expected returns and the size effect could be explained by the beta.

There are a number of reasons why size is likely to capture some dimension of risk. Chan et al. (1985) observed that the earning prospects of small capitalization firms are more sensitive to macroeconomic risk factors than are those of large capitalization firms; in particular, they seem to be more exposed to production risks and changes in the risk premium. Chan and Chen (1991) argued that the higher sensitivity of small firms to macroeconomic events is because many small firms are what they called "marginal firms", i.e., firms with poor past performance that are financially distressed, which manifests itself in high market-imposed financial leverage and cut- downs in dividend payouts. Thus, size can be seen as a negative proxy for the risk of financial distress.

Fama and French (1995) on the other hand presented the economic fundamental reason of the firm size effect and they reported that small firms earned higher returns than large firms in the U.S. stock market. Fama and French (1992) confirmed Banz's findings and pinpointed firm size as an important determinant of average stock returns in addition to BTM.

Berk (1995) rebutting the critiques of size effects argued that the size-related regularities in asset prices should not be regarded as anomalies. He stated that a true anomaly would have been, if an inverse relation between size and return was not observed.

Chan and Chen (1988) stated that the size effect was related to the beta if beta is measured accurately and there is no size effect. The authors found the size effect existed, but was not stable over time. The small firm effect was due to imprecise measurement of beta. Therefore, firm size did not have additional power to explain the returns. However, Jegadeesh (1992) cast doubt on the assertion of both Chan and Chen (1988) and Handa et al.'s (1989) conclusions. The author argued that if the portfolios were formed by size then the beta could not explain the cross-section returns appropriately. The author further reported that firm size had statistically significant effect on assets' returns, where small firms had higher return on average than large firms. Jegadeesh further argued that neither Handa et al. (1989) nor Chan and Chen (1988)'s findings could satisfactorily explain expected returns' variations. Fama and French (1992) also stated that the beta cannot absorb the size effect. They formed their portfolio by size and found a strong relationship between the size factor and assets' expected returns.

Reilly and Brown (2006) described size effect as an important stock market anomaly, which could not be explained by standard theory so far.

In the light of the existing literature, this study would want to assess if size effect exist on the Ghanaian Stock Exchange.

2.4 Price Earnings Ratio (PE) Effect

One of the most-widely reported figures in the financial press is the price to earnings (P/E) ratio and it is also one of the methods used to determine the value of stocks. Traditionally, the P/E ratio has been assumed to be an indicator of the quality of an investment; a relatively low P/E ratio implies a good investment, whereas a relatively high P/E ratio indicates a "poor" investment prospect (Aga and Kocaman, 2006). Given the apparent widespread market interest in the P/E ratio, considerable academic research has investigated the role of the ratio in market valuation of securities.

Stocks with low price-earnings multiples (often called "value" stocks) appear to provide higher rates of return than stocks with high price-to-earnings ratios as first shown by Nicholson (1960) and later confirmed by Ball (1978) and Basu (1977). This finding is consistent with the views of behavioralists that investors tend to be overconfident of their ability to project high earnings growth and thus over- pay for "growth" stocks (Kahneman and Riepe, 1998). The finding is also consistent with the views of Graham and Dodd (1934), first expounded in their classic book on security analysis and later championed by the legendary U.S. investor Warren Buffett. Similar results have been shown for price/cash flow multiples, where cash flow is defined as earnings plus depreciation and amortization (Hawawini and Keim, 1995).

Basu (1983) provides evidence that P/E ratios can be used to construct portfolios which outperform the market and Ohlson (1983; 1989a) employs analytical framework to relate market prices of equity securities to capitalized earnings. Given the wide acceptance of the P/E ratio in practice and the academic interest in P/E ratio has also augmented hence it is no great surprise that many studies have studied the P/E ratio effect on stock returns.

McWillams (1966) and Breen (1968) found that stocks with low P/E ratios experienced greater rates of return based on their cross sectional studies. However, they did not explicitly take risk into consideration. Basu (1977) and Peavy and Goodman (1983) found that the risk-adjusted returns were higher for lower P/E stocks. Furthermore, Peavy and Goodman (1983) showed that the low P/E stocks provided superior risk-adjusted returns after taking into account firm size, industry effects and infrequent trading.

A study on Johannesburg Stock Exchange by Auret and Sinclaire (2006) also agreed to the P/E ratio effect on stock return by identifying an inverse relationship with stock returns.

2.5 Conceptual framework

According to financial theory, stock market only rewards investors for systematic risk they bear. Unsystematic risks on the other hand are not compensated for since they can be diversified (Markowitz, 1959). On this basis was the CAPM propounded such that the return on stock is determinant on its sensitivity to the general market return measured by its beta. This is the most renowned model used to establish the relationship between risk and return. This model has come under attacked since a number of empirical studies have invalidated its potency.

CAPM has been widely used in pricing the risk inherent in an asset; it is a rather narrow risk pricing model which is based on a single market risk factor (beta) in that it compensates investors for the systematic risk they assumed. Nonetheless, it has been receiving its fair shares of challenge and criticism for not being able to accurately predict asset returns due to its shortcoming of failing to incorporate non-market risk factors relevant to the asset price movement.

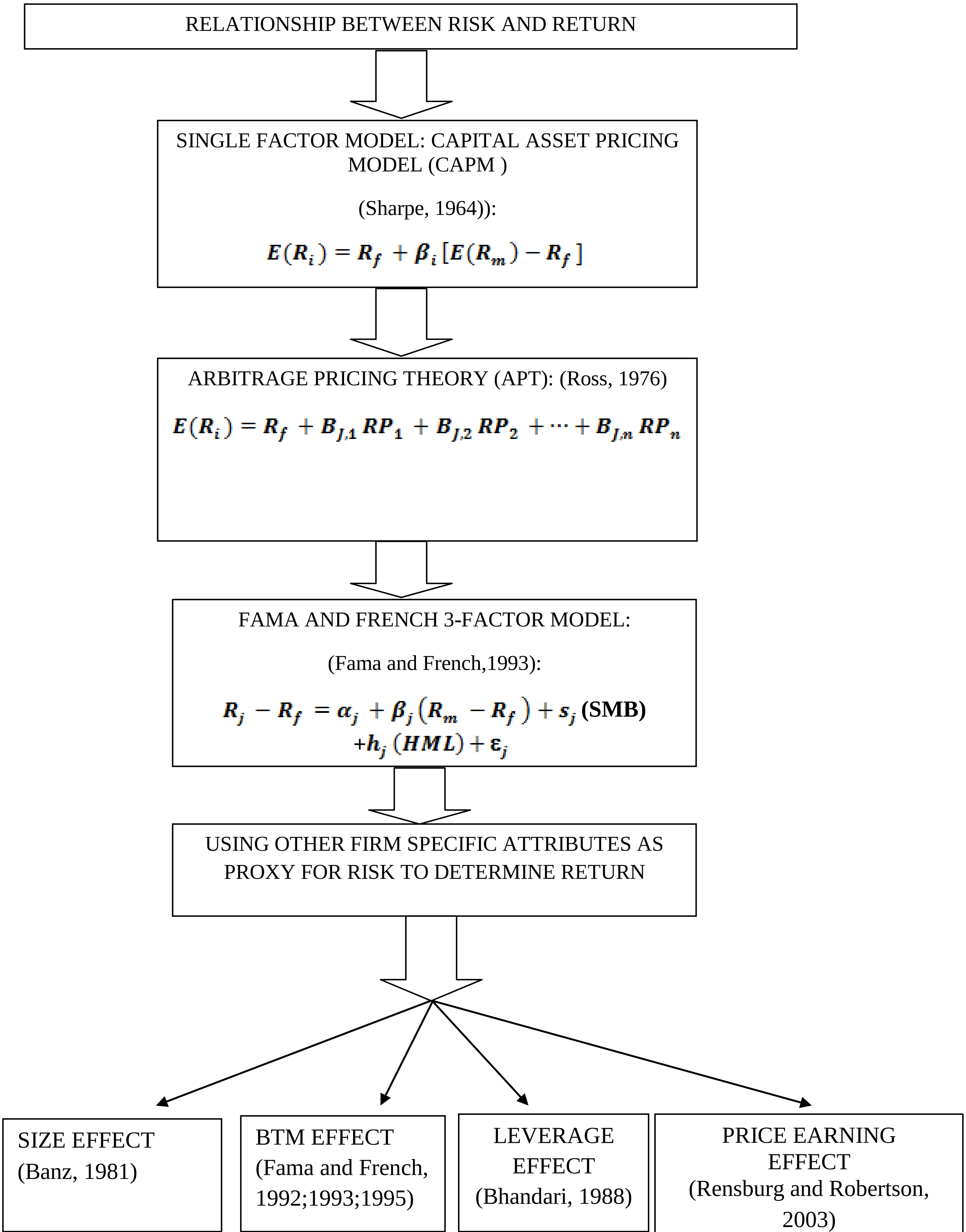
Aside the traditional CAPM model, the APT model by Ross (1976) is also one of such models used to establish the relationship between risk and return on a stock. The general idea behind APT is that two things can explain the expected return on a financial asset and they are macroeconomic/security-specific influences and the asset's sensitivity to those influences.

There are an infinite number of security-specific influences for any given security including inflation, production measures, investor confidence, exchange rates, market indices, or changes in interest rates. It is up to the analyst to decide which influences are relevant to the asset being analyzed. This theory has also been challenged on several grounds.

Another class of researchers have rather focused attention on how firm specific attributes influence returns. Basu (1983) suggested that the predictive power of non-market (firm-specific) factors is better than beta alone when it comes to predicting stock returns. Banz (1981) identified what has come to be known as size effect. Levy (1978) found that the firm's unsystematic risk such as earnings-to-price ratio is a key predictor to stock returns. Bhandari (1988) found that leverage is just as important in predicting stock returns. Amit and Wernerfelt (1990) highlighted the material impact of firm-specific risk by identifying an inverse relationship between a firm's market value and its level of unsystematic risk.

Researchers such as Fama and French (1992), Daniel and Titman (1997), Strong and Xu (1997) and Drew (2003) have documented the power of BTM in explaining stock. Hence this study assesses the explanatory power of BTM on stock return from the perspective of an emerging economy.

Figure 2.1: Conceptual framework: Factors /Models found in literature used to explain stock Return



Source*:* *Researcher's Design*

Figure 2.1 above illustrates the various determinants (factors) and models used to explain stock return as per existing literature. This study focuses on testing CAPM and Fama and French Three Factor model to achieve its objectives. The study uses the Fama and French (1993) framework but follow Drew et al. (2003).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter describes the method and data employed in achieving the objectives of the study. The study follows the Drew et al. (2003) method using the Fama and French (1993) framework to examine the portfolio return in a small sample stock market. The chapter also presents the hypothesis development and the portfolio formation for testing the Three Factor Model.

3.1 Data

The data for this study includes the stock returns of firms listed on the Ghana stock exchange from 1997 to 2009. The study period was chosen because around this period the Ghanaian stock exchange witnessed a lot development which improved on efficiency of the exchange. Some the developments were increase in the days the exchange trades in a week from two days trading to three trading days a week. It was also around this same time that capping of stock prices ceased. By capping our exchange controlled the extent to which price could change in day. This was stopped in 1994 when AngloGold Ashanti got listed on our exchange. For these reasons, this study considered a test period after all these changes hence period starting from 1997 to 2009.

Consistent with prior research, the sample includes only non-financial firms that traded on the GSE during January 1997 to December 2009 period. This includes both dead (delisted) and surviving companies during the study period. The data set shows missing values for delisted shares only after the de-listings, which helps eliminate the problem of survivorship bias and also augments the data set (Auret and Sinclaire, 2006). Financial firms are excluded because the high leverage that is normal for these firms probably does not have the same meaning as for non-financial firms, where high leverage more likely indicates financial distress. The sample size increases from eleven (11) non-financial firms in 1997 to twenty-one (21) non-financial firms in 2009. Over the study period (1997 to 2009) monthly stock prices and dividends relating to non-financial firms were obtained from the GSE which were used in computing the monthly stock returns. A stock's share price in month *t* is defined as the closing purchase price on the last trading day in the month.

Accounting data used in computing ratios such as Book to Market ratio (BTM) and market value are obtained from GSE fact books. In order to derive a stocks BTM ratio for time t, we obtained the book value of common equity (Shareholder's fund) and the market value of equity from the GSE facts book. The BTM ratio was computed as the book value of common equity divided by the market value of equity. Like Drew et al. (2003), we first obtained the market value of equity at the end of December in year t-1. Second, we used the book value of common equity in year t-1 divided by market value of equity at year t-1 as the BTM ratio in year t. These BTM ratios are used to sort stock yearly to get the BTM partition of high, medium and low. The BTM ratio is generated as follows:

$$BTM = \frac{\text{book value of equity}_{(t-1)}}{\text{Market value of equity}_{(t-1)}}$$

The market values which are used for sorting the stock returns in terms of size are the market value of equity as at December each year. The market value of equity is derived as the product of the stock price as at December of year t and the number of shares outstanding at the same time as shown below;

$$\text{Size} = (\text{number of ordinary shares outstanding X the price per share})$$

3.2 Empirical Model

In this study, we examine the Fama and French three factor model and CAPM on the Ghanaian stock market. The study also compares the explanatory power of these two models to find out which model can predict stock excess returns accurately.

3.2.1 The CAPM

One of the objectives of this study is to examine whether the Fama and French (1993) Three Factor Model is superior to the CAPM in explaining stock returns. The CAPM uses beta to value the systematic risk. The model is as follows:

$$PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_{m,t} - R_{f,t}) + \varepsilon_i$$

Where:

$PR_{j,t} - R_{f,t}$ is the excess portfolio return at time t;

$R_{m,t} - R_{f,t}$ is the excess market return factor at time t;

α_i is the intercept term;

b_i is the slope for the excess market return factor; and

εi is the error term.

To be consistent, we also used the six BTM-size portfolios returns as the dependent variable in the CAPM and the independent variable is excess market return. The Rm is the value weighted market return, which uses b_i to measure the relationship between the excess market return factor and the excess stock return.

3.2.2 Three-factor Model

This study follows the Drew et al. (2003) method; they adopted the Fama and French (1993) framework to examine small sample stock markets. Fama and French (1993) developed the three-factor asset pricing model as a variant of the CAPM model by adding the firm size factor and the BTM ratio factor and argued that the three-factor model was better in predicting asset returns than the CAPM. The three-factor model is as follows:

$$PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + \varepsilon_i$$

Where:

$PR_{j,t} - R_{f,t}$ is the excess portfolio return at time t;

$R_{m,t} - R_{f,t}$ is the excess market return factor at time t;

α_i is the intercept term;

b_i is the slope for the excess market return factor;

s_i is the slope for the SMB;

h_i is the slope for the HML; and

ε_i is the error term.

3.3 Forming the BTM-size Portfolios

This study followed Drew et al. (2003) in forming annual portfolios. Yearly stocks are first sorted from smallest to biggest in terms of market capitalization. After the sorting, the whole sample is divided into two groups by firm size (market value). Using the mid-point of the market value of the sample stocks at the end of December, the small size portfolio(S) contains firms whose market value of equity was less than the mid-point of the market value of equity. The big size portfolio (B) contains firms whose market value of equity was bigger than the mid-point of the market value of equity.

The stocks are then sorted independently by their BTM ratios, again each year, into three BTM partitions designated as low (L), medium (M) and high (H). The BTM partitioning is based on the breakpoints for the bottom 30%, middle 40% and the top 30% of the BTM values for the GSE stocks in the like of Nartea and Ward (2009).The low BTM ratio portfolio contains 30% of the lower BTM ratio stocks whilst the high BTM ratio portfolio also contains 30% of the higher BTM ratio stocks. From the intersections of the two size and three BTM partitions six size/BTM portfolios are formed and they are as follows: SL, SM, SH, BL, BM, and BH. In this case, the BH portfolio contains stocks that are in the large-size portfolio and also in high-BTM ratio stock portfolio. These six stock portfolios were reorganized at the end of December each year, since both market value and BTM ratio change at the end of the year.

This study is different from that of Fama and French (1993) in that whilst this study formed six portfolios, they rather formed twenty-five portfolios. The difference in the number of portfolios created is because the number of listed firms on the Ghanaian market is smaller than those on the US stock market used by Fama and French. This is also consistent with other adaptations of Fama and French (1993) for small markets (Drew and Veeraraghavan, 2003; Drew et al., 2003).This study considered only 156 months i.e. 1997 to 2009 since our exchange is very young.

3.4 Independent Variables

The independent variable in CAPM is the excess market returns. The excess market return is the difference between the market return and the risk-free rate. Like Nartea and Ward (2009) and Fama and French (1993), $\boldsymbol{R_M}$ which is the market return is calculated as the value weighted market return of all stocks in the six portfolios including returns on negative book to market stocks, which were excluded from the sample while forming the size-BM portfolios. The formula for the monthly market rate of return is as follows:

$$R_{m,t} = \frac{\sum_{i=1}^{n}(\text{No of shares outstanding} * P_{i,t-1}) * R_{it}}{\sum_{i=1}^{n}(\text{No of shares outstanding} * P_{i,t-1})} - 1$$

Where: n is the number of stocks

Like Fama and French (1993), the market excess returns were calculated from the market monthly return minus risk-free rate. Since there is no 1-month treasury bill in Ghana, the 91-day Treasury bill rate is used as a proxy for the risk free rate as Michailidis (2007).

There are three independent variables in the three-factor model. The first independent variable in the three factor model is the firm size factor (SMB), which is the difference between the monthly simple average returns of the small-size stock portfolios (SL, SM, and SH) and the monthly average returns of the large-size stock portfolios (BL, BM, and BH). SMB is derived as follows:

$$\text{SMB} = \frac{(SL + SM + SH)}{3} - \frac{(BL + BM + BH)}{3}$$

The second variable HML is the BTM ratio factor (HML) defined as the difference between the portfolios' average returns on the two high-BTM ratio stock portfolios (SH and BH) and the portfolios' average returns on the two low-BTM ratio stock portfolios (SL and BL).

$$\text{HML} = \frac{(SH + BH)}{2} - \frac{(SL + BL)}{2}$$

These two factors which are size factor and BTM ratio factor are proxies for sensitivity to an underlying risk factor, and both of them are expected to be positively related to stock excess returns.

3.5 Dependent Variable

Following Drew et al. (2003), six BTM-size portfolios are formed to obtain the dependent variable of the CAPM as well as the three-factor model which is the excess return on these portfolios. Portfolio returns are computed as the equal weighted returns of the stocks in each portfolio. These equal weighted returns on portfolios are computed for each of the six portfolios that are formed at the end of each year consistent with the work of Nartea and Ward (2009). This is done over a 12-month period after the portfolio formation date. For example, portfolios formed as of December 1997 are tracked in 1998. This produces a series of monthly returns over the period 1997 to 2007 for each of the six size/BM portfolios.

The formulas below are used to derive the monthly returns ($R_{i,t}$) as well as the portfolio returns ($PR_{i,t}$).

$$R_{i,t} = \frac{P_{it} - P_{i,t-1} + D}{P_{i,t-1}}$$

Where: P_{it} is the closing stock price for stock i at the end of the current month t; whereas $P_{i,t-1}$ is closing stock price for stock i at the end of the previous month t-1 and $R_{i,t}$ is the stock monthly returns.

$$PR_{i,t} = \frac{\sum_{i=1}^{n} R_{i,t}}{n}$$

Where $R_{i,t}$ is the monthly return of stock i in a portfolio at time t

N is the number of stocks in a portfolio at time t

3.6 General Testing Methodology

The study used times series data and as it is required with time series data before any meaning regression can be run diagnostic test must be carried out to ensure that certain underlining assumptions are met. In terms of diagnostics, we tested for Unit root which is meant to test for stationarity of the data set using the two famous methods which are Augmented Dickey Fuller (ADF) unit root test and Phillips –Perron (PP) test. We also tested the residual for the presence of serial correlation and heteroskedasticity using Breusch-Godfrey test and White test respective.

After the diagnostic test, the various models of the study were tested starting with the CAPM. The CAPM assertion is that, there is a positive relationship between stock excess returns and the systematic risk. This means that the beta is statistically significantly different from zero. Furthermore, the intercept term must be equal to zero and statistically insignificant. Therefore, under these conditions, the CAPM could be used to explain excess asset returns. In contrast, the Three-factor model states that the size factor has a negative relationship with stock excess returns that is small size portfolios are expected to have higher returns and hence positive coefficient on the size factor whereas big size firm are expected to have lower returns and hence negative coefficients. The BTM ratio factor is positively relative to the stock excess returns. This implies high BTM portfolios have positive coefficients whereas low BTM portfolios have negative coefficients. The excess market return factor should be positively related to stock excess returns. The intercept term should also be statistically equal to zero. Fama and French (1993) argued that a well-specified capital asset pricing model's intercept term should not be statistically different from zero.

We ran the ordinary least squares (OLS) regression using the excess market return (market return minus risk free rate) as the independent variable and the excess portfolio returns as dependent variable to test the CAPM on the Ghanaian stock market. Second, to examine the three-factor model, we ran the OLS regression using excess market returns, size factor (SMB) and the BTM ratio factor (HML) as independent variables to examine the excess portfolio returns. We thus obtain the slopes and intercepts for each portfolio and the t-statistics, which are used to test whether the slopes and intercepts of the model for the six portfolios are statistically significant for both CAPM and the three-factor model. The adjusted R^2s are used to compare the explanatory powers of the two models.

3.7 Development of the Hypotheses

There are two hypotheses in this study. First to test whether there is a firm size effect and BTM effect on the Ghanaian stock market. The literature documents a negative relationship between firm size and stock return (Banz, 1981; Wang and Xu, 2004), and that a high BTM ratio stock indicated that the company is under stress, so the stock should be more risky and the stock may yield high returns to the investor (Chen et al. 2007). Therefore, our hypotheses are that all the slopes of market excess factor, firm size factor and the BTM ratio factor are statistically different from zero, and the intercepts are different from zero. If the t-statistics show the slopes are significant and the intercepts are insignificant, then the Fama and French three-factor model is confirmed in the Ghanaian stock market and the investor can use it to form a stock portfolio.

Secondly, we compare the explanatory power of the three factor model with that of the CAPM. In order to do so, we begin by testing the CAPM model on the Ghanaian stock market. The hypotheses are the coefficients of market excess factor are significantly different from zero and intercepts are also significantly different from zero. If the null hypotheses of the slopes are accepted and the intercepts null hypotheses are rejected, then the CAPM can be used to predict stock excess return on the Ghanaian stock market. We then use the adjusted R^2 to compare the two models' explanatory power. If the Fama and French three factor model has larger R^2 than the CAPM, then we can conclude that the Fama and French model is better in predicting stock excess returns than the CAPM for the Ghanaian stock market.

CHAPTER FOUR

ANALYSIS OF RESULT AND DISCUSSION OF FINDINGS

4.0 Introduction

This chapter presents the analysis of the results and discusses the findings of the study. Included in this chapter are the descriptive statistics of the dependent variables, the stock excess returns, and the independent variable effect including beta, firm size and the BTM ratio. The regression results of the three-factor model and the CAPM are also reported.

4.1 Summary of the number of non-financial stocks in the sample portfolios

Table 4.1 presents the number of non-financial firms that traded during the study period which were included in this study. The number increased from (11) eleven in 1997 to (21) twenty-one in 2009. This represents about 91% increase over the 13-year period. This shows that on the average over the study period our exchange recorded one non-financial firm listing every 1.3years specifically every 1year four months a new non-financial firm got listed. Looking at the small number of firms that are listed on the exchange, more effort must be put in place by the relevant authorities to ensure that many more unlisted firms get listed. It is even a step in the right direction that the GSE has decided to make it possible for SMEs to get listed on the exchange. This will go a long way to augment the number of listed firms on the exchange.

The Table 4.1 also shows the number of stocks in each of the six portfolios each year. Over the study period the portfolio BH had the smallest number of stocks which was 17 in total, thus an average of 2 (1.3)stocks every year whilst BM had the largest number of stocks of 46 stocks with an average of 4 (3.5) stocks every year.

Table 4.1: The number of non-financial stocks in the sample portfolios

No. of listed non - financial firms	11	11	12	12	11	14	16	16	17	21	18	21	21	
Number of stocks in the size-BM sorted portfolios														
PORTFOLIO	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
S/L	1	1	1	2	2	1	2	1	1	1	1	3	3	21
S/M	2	2	3	2	1	3	1	2	2	6	5	3	2	33
S/H	2	2	2	2	3	3	5	5	4	3	3	4	5	43
B/L	2	3	3	2	1	3	3	2	4	7	5	3	3	41
B/M	3	2	2	2	3	2	4	5	5	3	2	6	7	46
B/H	1	1	1	2	1	2	1	1	1	1	2	2	1	17
TOTAL	11	11	12	12	11	14	16	16	17	21	18	21	21	201

4.2 Summary statistics

Table 4.2 presents the stock monthly mean returns of the six BTM-size portfolios, their standard deviations and t-statistics of the mean returns from 1997 to 2009 for the Ghanaian stock market.

Table 4.2: Stock monthly excess returns for six BTM-size portfolios from 1997 to 2009 and their test showing whether their means are significantly different from zero.

Variable	Obs	Mean	Std. Dev.	Min	Max	t-statistic
sl	156	0.006517	0.049038	-0.23077	0.372549	1.6598*
slmrf	156	-0.07684	0.05473	-0.27839	0.230949	(17.5363)***
sm	156	0.028448	0.066968	-0.16573	0.337082	5.3057***
smmrf	156	-0.05491	0.066755	-0.3024	0.205415	(10.274)***
sh	156	0.030068	0.119158	-0.14478	1.123543	3.1517***
shmrf	156	-0.05329	0.12073	-0.27645	0.990543	(5.5132)***
bl	156	0.023408	0.076681	-0.17167	0.374449	3.8128***
blmrf	156	-0.05995	0.077866	-0.23655	0.310944	(9.6164)***
bm	156	0.02705	0.085282	-0.14964	0.46255	3.9616***
bmmrf	156	-0.05631	0.086628	-0.27422	0.407217	(8.1187)***
bh	156	0.031599	0.093915	-0.25	0.474926	4.2024***
bhmrf	156	-0.05176	0.091689	-0.33633	0.34326	(7.0509)***
mrmrf	156	0.05884	0.053042	0.18408	0.174373	13.8564***
hml	156	0.031742	0.153333	-0.43227	0.881215	2.5856***
smb	156	-0.01702	0.144277	-0.90568	0.644016	-1.6601*

** p<0.1, ** p<0.05, *** p<0.01*

Legend: (sh - return of portfolio with small size but high btm, sm- return of portfolio with small size but medium btm, sl - return of portfolio with small size but low btm ,bh- return of portfolio with big size but high btm, bm- return of portfolio with big size but medium btm, bl- return of portfolio with big size but low btm ,mr - market return whilst shmrf ,smmrf ,slmrf, bhmrf ,bmmrf, blmrf, mrmrf are their excess returns respectively, thus shmrf represents the returns of portfolio sl minus risk free rate)

The data in Table 4.2 shows that both the small and large size portfolios' stock returns have a positive mean and their t-statistics are all significant at 1% significance level except for SL portfolio and SMB which are significant at 10%. However their excess returns have a negative mean this might have been caused by the fact that we use 91-day Treasury Bill rates instead of the 30-day Treasury Bill rates when dealing with monthly returns. The t-statistics are also significant at the 1% significance level. This means that both monthly stock returns as well as their excess returns are significantly different from zero. The mean return on HML is positive which confirms the positive BTM effect whereas the mean return on the size factor (SMB) is negative. The BTM factor HML produces an average premium of 3.17% per month whilst Fama and French (1993) recorded a marginal 0.4%.Our average SMB return (the average premium for size-related factor in returns) is -1.7% per month whilst Fama and French (1993) recorded an average of 0.43% per month. The average value for excess market return is 5.88% whereas Fama and French (1993) recorded average premium of 5%.Though there is a slight variance when it comes to the magnitude of the premium and signs among some of the variables, wholistically Ghanaian market exhibits some of the characteristics identified by Fama and French(1993;1995) on the US market.

4.3 Unit root test result

The unit root test is conducted to check the stationarity property of the series. Stationarity is an important characteristic of times series data since estimating non stationarity series may lead to spurious results and invalid regression techniques. There are several methods for testing the presence of unit roots. The most widely used methods are the Augmented dickey-Fuller (ADF) test and Phillips-Perron (PP) test, which are both applied here.

Table 4.3 shows the results of the ADF and PP test for each variable. The results indicate that all the variables are stationary in the level form of the data.

Table 4.3: Results of Unit Root test using ADF test and Phillips-Perron

	Dickey-Fuller test for unit root Number of obs = 155			**Phillips -Perron test for unit root Number of obs = 155**	
	Interpolated Dickey-Fuller				
	Variable	Test statistic	MacKinnon approximate p-value for Z(t)	Test statistic	MacKinnon approximate p-value for Z(t)
Z(t)	mrmrf	-6.724	0.0000	-6.615	0.0000
Z(t)	slmrf	-9.086	0.0000	-9.353	0.0000
Z(t)	smmrf	-11.625	0.0000	-11.691	0.0000
Z(t)	shmrf	-8.897	0.0000	-8.74	0.0000
Z(t)	blmrf	-7.305	0.0000	-7.274	0.0000
Z(t)	bmmrf	-8.965	0.0000	-9.29	0.0000
Z(t)	bhmrf	-8.515	0.0000	-8.488	0.0000
Z(t)	HML	-10.997	0.0000	-10.9924	0.0000
Z(t)	SMB	-9.628	0.0000	-9.744	0.0000

See legend of table 4.2 for definitions of slmrf, smmrf, shmrf, blmrf, bmmrf, bhmrf, mrmrf

Table 4.4 Diagnostic Test

	CAPM		FAMA AND FRENCH 3 FACTOR MODEL	
	Serial Correlation LT Test	**White Test**	**Serial Correlation LT Test**	**White test**
sl	1.371**	183.3731***	5.442***	183.3731***
sm	0.019	64.7331***	1.631***	64.7331***
sh	0.068	41.6783	0.082	41.6783
bl	5.442***	98.5049***	1.932***	98.5049***
bm	1.425***	92.8093***	3.309***	92.8093***
bh	0.059	51.4032	5.436***	51.4032

See legend of table 4.2 for definitions of slmrf, smmrf, shmrf, blmrf, bmmrf, bhmrf, mrmrf

In order to test the residual for the presence of Serial correlation and heteroskedasticity, the study used Breusch-Godfrey test and White test respectively. The result of tests on residuals shown above in Table 4.4 suggested existence of first order serial correlation and some heteroskedasticity. Rather than transform the variables to remove these we heeded the advice of Dagenais (1994), Mankiw (1995) in Aboagye (2008) who argue that such transformation may introduce bias in coefficient estimates. To deal with the problem of heteroskedasticity and serial correlation we ran a robust OLS regressions which according to Stock and Watson (2003) deals with these problem.

4.4 Correlation among the independent variables

In order to check for the presence of multicollinearity among the independent variables, a correlation matrix is generated which is shown on Table 4.5.From the table it can be inferred that there is the absence of multicollinearity among the independent variables of which are the excess return on the market (MRMRF), the BTM factor (HML) and the size factor (SMB) since their correlation coefficients are less than 0.5.It can be inferred that there is a positive correlation between SMB and HML but SMB correlates inversely with MRRF(excess market returns).It can be seen that the correlation between MRRF and HML is stronger than the one between MRRF and SMB .But there exist a marginal positive correlation between SMB and HML factors.

Table 4.5: Correlation matrix among the independent variables

Variables	smb	hml	mrmrf
smb	1.0000		
hml	0.075	1.0000	
mrmrf	-0.082	0.3207	1.0000

4.5 Correlation among the dependent variables and the independent variables

Table 4.6 below shows the correlation between the dependent variables and the independent variables. The correlation coefficients quantify the relationship between the variables and also describe the strength and directions of the relationships. From the table it can be inferred that there exist a strong positive correlation between excess market returns and all the six size-BTM sorted portfolios. This implies that there exist a strong relationship between the excess market returns (beta) and the portfolio returns. The correlation coefficient ranges from 0.5016 on SL portfolio to 0.722 on BL portfolio. All the coefficients are also significant at 1% significance level.

It can also be observed that HML has a negative weak correlation of -0.3237 with low BTM portfolio (SL) and – 0.1786 with BL but there exist a positive and strong correlation of 0.5893 on a high BTM portfolio (BH). This is highly significant at 1%.The other high BTM portfolio which SH also has a strong positive correlation with BTM factor though it is not significant. However, HML has a positive relationship with excess market returns.

SMB on the other hand has positive correlation with all small size portfolios (SH, SM, SL) but has negative correlation with big size portfolios (BH,BM, BL) and they are significant at 10% and 1% significance level as shown on table 4.5. This indicates the size effect that returns positive loadings on small portfolio and negative on big portfolios. However, SMB has a negatively weak and insignificant correlation with excess market returns.

Table 4.6: Correlation matrix of the dependent variables and the independent variables

	Slmrf	**smmrf**	**Shmrf**	**Blmrf**	**Bmmrf**	**Bhmrf**	**mrmrf**	**hml**	**smb**
Slmrf	1								
Smmrf	0.3246***	1							
Shmrf	0.1498*	0.2644***	1						
Blmrf	0.3204***	0.3455***	0.4807***	1					
Bmmrf	0.3261***	0.2388***	0.3002***	0.5004	1				
Bhmrf	0.1305	0.3294***	0.1184	0.1089	0.3088***	1			
Mrmrf	0.5016***	0.6103***	0.6940***	0.722***	0.7037***	0.5353***	1		
Hml	-0.3237*	0.1139	0.5606	-0.1786	0.0505	0.5893***	0.3207***	1	
Smb	0.1683*	0.2218***	0.4148*	-0.1869***	-0.4813***	-0.4791***	-0.082	0.075*	1

* p<0.1, ** p<0.05, *** p<0.01

4.6 Regression on the CAPM

The CAPM is universally accepted as a technique for evaluating assets. It gives us a precise prediction of the relationship that we should observe between risk of asset and its expected return. However, Fama and French (1992) and other researchers have reported that the market beta has little or no ability in explaining the variation of stock returns, instead firm size and BTM effect seem to describe the variation in a meaningful manner. Though this study aims at testing how well BTM and size effect explain stock returns in Ghana, it is just appropriate that the CAPM is first tested hence the study commences by testing CAPM on six size-BTM portfolio returns in Ghana.

Table 4.7: Regression results on CAPM: $PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_{m,t} - R_{f,t}) + \varepsilon_i$

	slmrf	smmrf	shmrf	blmrf	bmmrf	bhmrf
α_i	-0.0350***	-0.0168***	-0.00463	-0.00316	-0.00061	- 0.0329***
	(-9.90)	(-4.20)	(-0.88)	(-0.64)	(-0.12)	(-6.54)
b_i	0.631***	0.741***	1.016***	1.080***	1.097***	0.555***
	(13.94)	(14.61)	(15.06)	(17.15)	(17.16)	(8.72)
N	156	156	156	156	156	156
R-sq	0.56	0.581	0.597	0.656	0.658	0.331
adj. R-sq	0.557	0.578	0.594	0.654	0.656	0.326

T-statistics in parentheses * p<0.1, ** p<0.05, *** p<0.01

Table 4.7 presents the regression results for the CAPM. We regressed the excess portfolio returns on the excess market returns, the only explanatory variable for the six BTM-size portfolios. The excess market returns were calculated from the market return less the risk-free rate. The excess portfolio returns were computed from the portfolio return less the risk-free rate.

For CAPM to be efficient in explaining returns the beta which is the coefficient of the excess market return (market premium) should be significant and where a times-series regression is used for testing the CAPM the intercept should be insignificant thus it should be statistically not different from zero. From our CAPM result it can be observed that the b which is the beta is positive and significant at 1% significance level for all the six size/BTM portfolios. The betas for SL, SM and SH are 0.631, 0.741 and 1.016 respectively giving an average beta of 0.796 for small size portfolios whereas the betas for BL, BM and BH are 1.080, 1.097 and 0.555 respectively resulting in an average beta of 0.910667 big size portfolios. However, the average beta for the six portfolios is 0.85333. Our results show that market factor has a significant positive relationship with stock excess returns on the six BTM-size stock portfolios.

The result also shows that the coefficients of the small firm portfolios are lower than those of the big firm portfolios; and there is a difference of 0.11466 between the average big firm portfolios slope and the average small firm portfolios slope. Similarly, the average slope for the low BTM ratio portfolios market factor is 0.07 higher than that for the high BTM ratio portfolios market factor. The intercepts were significant for all six portfolios at 1% significance level. This implies that though beta is significant it cannot explain variations in stocks alone, this invariably means that there are other factors which explain the variation in return which are not captured in the beta. The R^2 ranges from 33.1% to 65.8% with an average R^2 of 56.4% whilst the average of the adjusted R^2 across the portfolio is 56.1%.

Osei (2002) tested the CAPM on the GSE and identified the beta to be significant but concluded that the CAPM is able to explain only 30% of the variation in stock returns. This study however differs from Osei's study in that it assessed the CAPM using portfolio sorted by their sizes and BTM. This study observed that CAPM on the average is able to explain 56.4% of the variations in portfolio returns and that the remaining 43.6% may be explained by other factors such as BTM effect and the size effect. This result is therefore consistent with that of Drew et al. (2003) who did a similar study from an emerging economy's perspective and concluded that beta alone is not able to explain stock returns sufficiently.

4.7 BTM Effect (HML)

Similar to the work of both Drew et al. (2003) and Fama and French (1993), we found that beta alone could not explain the stock returns sufficiently. Several studies have shown BTM and size effects capture an aspect of risk which is not included in the beta hence these factors can account for the unexplained part of return (Wang and Xu, 2004; Stattman, 1980; Banz, 1981).Unfortunately, the Ghanaian Stock market lacks evidence on the BTM and size effect hence the need for these effects to be tested on our market. In order to assess the explanatory power of BTM in the presence of beta, we ran a regression using beta and HML factor as independent variables. This was also meant to examine whether the BTM ratio factor plus the market factor model could improve the explanatory power of the CAPM.

Table 4.8 Regression results of the six BTM-size portfolios' excess portfolio returns against the BTM ratio factor (HML) plus market excess return factor from 1997 to 2009

$$PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_m - R_{f,t}) + h_i HML_t + \varepsilon_i \quad .... (2)$$

	Slmrf	Smmrf	Shmrf	Blmrf	bmmrf	bhmrf
α_i	-0.0300***	-0.0213***	-0.00511	0.0162***	0.0029	-0.00471
	(-8.67)	(-5.19)	(-0.96)	(-3.76)	(0.55)	(-0.85)
b_i	0.671***	0.660***	1.018***	1.189***	1.137***	0.920***
	(15.66)	(13)	(15.24)	(22)	(17.19)	(13.13)
h_i	-0.0910***	-0.0477**	0.0696**	-0.304***	-0.0449	0.415***
	(-6.13)	(-2.71)	(2.88)	(-15.54)	(-1.88)	(16.4)
N	156	156	156	156	156	156
R-sq	0.617	0.528	0.638	0.802	0.662	0.782
adj. R-sq	0.612	0.522	0.633	0.8	0.658	0.779

t statistics in parentheses * $p<0.1$, ** $p<0.05$, *** $p<0.01$

From Table 4.8 when the HML factor was added into the CAPM it was observed that beta was still significant across all six portfolio at 1% significance level and the adjusted R^2 values for the six BTM-size portfolios increased by 10.65% on average .The coefficients of the BTM factors for SL, BL, BH are statistically different from zero at the 1% significance level but portfolios SM and SH are significant at 5% significance whereas portfolio BM is insignificant. Additionally, it is important to note that the coefficient is negative for SL, SM, BL, BM portfolios and the rest portfolio is positive (SH ,BH). Fama and French (1995) show that BTM and slopes on HML proxy for relative distress. Weak firms with persistently low earnings tend to have high BTM ratio and positive slopes on HML; strong firms with persistently high earnings have low BTM and negative slopes on HML.

Consistent with the findings of Fama and French (1995), this study identified that the slopes on HML are positive for the two high BTM portfolio firms which are SH and BH which are significant at 1% and 5% respectively, whereas the slopes on HML for the portfolios thus SL, SM, BL were negative and also significant. In all this study found out that five (5) out of the six portfolios was significant. The work of Fama and French (1993) study showed that 24 of their 25 portfolios were significant. Drew et al. (2003) found that four of their six portfolios were significant. Furthermore, our results show the average high BTM ratio portfolios' slopes (0.2423) are higher than the average low BTM ratio portfolios' slopes (0.1975). This provides the evidence that the BTM ratio effect exists on the Ghanaian stock market.

It can also be observed that, with the addition of the BTM factor (HML) the R^2 and the adjusted R^2 increased indicating that, HML adds to the explaining of portfolio returns. Interestingly, all the intercepts are negative for portfolios SL, SM, SH and BH but it is positive for BL and BM. The intercepts on the other hand are significant for portfolios SL, SM and BL but are insignificant for SH, BM and BH portfolios. Since the intercepts are not insignificant for all the portfolios we conclude that though the BTM factor and the market factor explain excess returns on portfolio they are not enough to capture all the variation of the portfolio excess returns hence other factors may account for the unexplained part of excess returns.

4.8 Size Effect

According to Banz (1981) and Reinganum (1981) study, there is a significant negative relationship between firm size and asset returns that is small firm portfolios have higher returns than big firm portfolios. This is what has become known as the size effect. Based on the size effect, small firm portfolios are expected to have positive slope on SMB whilst the big firm portfolios coefficients are expected to have negative slopes on SMB.

Consistent with the findings of Fama and French (1995) the small portfolio firms (SL, SM and SH) have positive size factor loadings and they are significant at 1%. The slope of the size factor increases from SL of 0.0752 to SM of 0.0984 to SH of 0.159, implying that small firm portfolios with high BTM ratios exhibit high size effect sensitivity. With the big firm portfolios the slopes the SMB are all negative but only the slopes of BM and BH are significant at 1%.From the this result it can be observed that beta is still significant across all the portfolios at 1% significance level. This shows that size effects explain some aspect of return which is not explained by beta hence size effect adds to the explanation of portfolio returns in Ghana. This finding is similar to that of Banz (1981) who concluded that size, measured by market equity, adds to the explanation of the cross section of average returns provided by market beta.

Comparing with the regressions for the CAPM, the adjusted R^2 value has increased on the average by 6.6% with the addition of the size factor. The intercepts on the other hand are significant for portfolios SL, SM and BH but are insignificant for SH, BM and BL portfolios. Since the intercepts are not insignificant for all the portfolios we conclude that though the size factor and the market factor explain excess returns on portfolio they are not enough to capture all the variation of the portfolio excess returns.

Table 4.9 Regression results of the six BTM-size portfolios' excess portfolio returns against the Size factor (SMB) plus market excess return factor from 1997 to 2009

$$PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_m - R_{f,t}) + s_i SMB_t + \varepsilon_i$$

	Slmrf	smmrf	Shmrf	Blmrf	bmmrf	Bhmrf
α_i	-0.0320***	-0.0120**	0.00475	0.00298	-0.00339	-0.0292***
	(-9.51)	(-3.21)	(1)	(0.59)	(-0.72)	(-5.87)
b_i	0.666***	0.790***	1.117***	1.077***	1.011***	0.601***
	(15.56)	(16.69)	(18.55)	(16.87)	(17.04)	(9.59)
s_i	0.0752***	0.0984***	0.159***	-0.00133	-0.195***	-0.0563**
	(5.88)	(6.96)	(8.81)	(-0.07)	(-10.78)	(-2.95)
N	156	156	156	156	156	156
R-sq	0.621	0.657	0.708	0.652	0.742	0.409
adj. R-sq	0.616	0.652	0.704	0.647	0.739	0.402

t statistics in parentheses * p<0.1, ** p<0.05, *** p<0.01

4.9 Comparing the BTM Effect to the SIZE Effect using their adjusted R^2 value

According to Fama and French (1992) though size effect has attracted more attention, BTM has a consistently stronger role in explaining returns. Against this background, this study then sought to compare the explanatory power of BTM and size effect using their adjusted R^2.

Figure 4.1: Shows the adjusted R^2 of regression of market factor and BTM and regression of market factor and size.

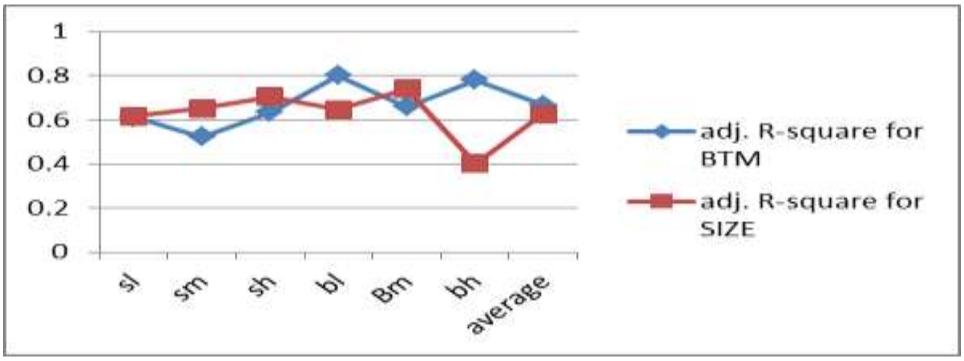


Table 4.10 Adjusted R^2 of regression of market factor and BTM and regression of market factor and size.

Portfolio	sl	Sm	sh	bl	Bm	bh	average
adj. R-square for BTM	0.612	0.522	0.633	0.8	0.658	0.779	0.667333
adj. R-square for SIZE	0.616	0.652	0.704	0.647	0.739	0.402	0.626667

From figure 4.1 and table 4.10, it can be observed that for most of the portfolios (SL, SM,SH and BM) the size effect was stronger than the BTM effect but for two portfolios which are BL and BH BTM effect became stronger than size effect. But on the average the BTM effect was stronger than the size effect in that the average adjusted R^2 for the regression with BTM factor was 66.73% whilst that with the size factor is 62.67%.This finding is consistent with that of Fama and French (1992) who emphasized that BTM has a stronger explanatory power on return than the size effect.

4.10 Fama and French 3 Factor model

Table 4.11 shows the regression results of the excess stock returns for the six BTM-size portfolios on the Ghanaian stock market from 1997 to 2009. Contrary to our expectation only two portfolios (sh and bm) have their intercept being insignificant. This implies that for these two portfolios, SH and BM; beta, BTM effect and size effects are able to explain all the variations in expected portfolio returns. But this not so for portfolios SL,SM,BL and BH since their intercepts are significant implying that other factor still explain part of variation in returns. The SH and BL portfolios have positive intercepts whilst SL, SM, BM and BH have negative intercepts. The fact that some of the intercepts are statistically differently from zero (significant) makes it difficult for the three-factor model to be accepted as being able to capture all risk and hence explain all variations in portfolio returns. Notwithstanding that, the three-factor model performs better in explaining the cross-section portfolio excess returns on Ghanaian stock market than the CAPM. This result is consistent with the Drew et al. (2003) finding and Fama and French (1993).

All the market factor slopes are positive and significant at the 1% level. The average slope is 0.932667, which is close to 1. Drew et al. (2003) also reported significant market factor slopes. This indicates that the market factor is also highly related to portfolio excess return, which plays an important role in explaining stock excess returns.

The slopes of the BTM ratio factor are positive and significant at the 1% level of significance for the two high BTM portfolios (SH and BH) whilst SL, BL and BM portfolios are negative and significant. Only SM has an insignificant positive slope. Fama and French (1993) study showed that 24 of their 25 portfolios were significant. Drew et al. (2003) found that four (4) of their six (6) portfolios were significant whilst our study found five (5) out of the six (6) portfolios as significant Furthermore, our results show the average high BTM ratio portfolios' slopes are higher than the average low BTM ratio portfolios' slopes. This provides the evidence that the BTM ratio effect exists on the Ghanaian stock market. Our results reveal that the BTM ratio effect is stronger than the firm size effect on our stock market during the testing period like Fama and French (1992). Drew et al. (2003) however reported that the BTM ratio effect is weak in their study.

The six portfolios' coefficients of the size factor are highly significant at the 1% level of significance. The slopes of the three small firm portfolios are positive and significant. In contrast, all the big firm portfolios' coefficients are negative. Our result shows that the small firm portfolios have positive slope coefficients, whereas those for the big firm portfolios are negative. It also reveals that the coefficients of the big portfolios decrease from BH to BL. Fama and French (1993) pointed out that the small firm portfolios' returns were higher than those of big firm portfolios when they formed the portfolios by the BTM ratio. The firm size affects the returns on the Ghanaian stock market and the high coefficient of size factor implies a high return for small firms' stock.

The significant difference between our results and those of Fama and French (1993) and Drew et al. (2003) is the lower adjusted R^2 value. Fama and French presented adjusted R^2 values between 0.83 and 099 in their 25 portfolios. Drew et al. (2003) reported adjusted R^2 values between 0.79 and 0.92. In contrast, the adjusted R^2 values reported in our study are between 0.652 and 0.805. The low adjusted R^2 values imply the explanatory power of the three-factor model on the Ghanaian stock market is not as good as the U.S stock market for the sample period tested.

Table 4.11 Regression results of Fama and French 3 factor model

$$PR_{j,t} - R_{f,t} = \alpha_i + b_i(R_m - R_{f,t}) + h_i HML_t + s_i SMB_t + \varepsilon_i$$

	slmrf	smmrf	shmrf	blmrf	bmmrf	bhmrf
α_i	-0.0267***	- 0.0120**	0.0098	0.00903*	-0.00122	-0.0166**
	(-7.95)	(-3.05)	(1.04)	(2.13)	(-0.25)	(-2.93)
b_i	0.706***	0.794***	1.175***	1.101***	1.040***	0.780***
	(16.8)	(16.2)	(18.580)	(20.74)	(17.1)	(11.03)
h_i	-0.104***	0.0163	0.157***	-0.267***	-0.0656**	0.370***
	(-7.01)	(0.94)	(7.01)	(-14.21)	(-3.12)	(14.77)
s_i	0.0671***	0.103***	0.244***	-0.0947***	-0.196***	-0.207***
	(5.43)	(7.16)	(13.150	(-6.07)	(-11.16)	(-9.96)
N	156	156	156	156	156	156
R-sq	0.668	0.659	0.78	0.809	0.755	0.8
adj. R-sq	0.661	0.652	0.776	0.805	0.75	0.796

See legend of table 4.2 for definitions of slmrf, smmrf, shmrf, blmrf, bmmrf, bhmrf, mrmrf

4.11 Comparison of the Three-factor Model and the CAPM

In order to show whether the Fama and French (1993) three-factor model could present a better explanation for stock returns than the CAPM on the Ghanaian stock market, we need to compare the adjusted R^2 value and the intercept term of each model. Drew et al. (2003) showed the three-factor model had significantly higher R^2 values than the CAPM model in the Shanghai stock market. Figure 4.2 shows that our portfolios' adjusted R^2 values of the Three-factor model are higher than the portfolios adjusted R^2 value of the CAPM. The Three-factor model can explain the stock excess returns better than the CAPM, which confirms the Fama and French and Drew et al. findings. Our results show that when we run the regression on the CAPM, all of the six BTM-size portfolios' intercepts are significant at the 1% level.

This indicates that other factors are affecting the stock excess returns such as size factor and BTM ratio. However, all the portfolios' intercepts are not significant at the 1% level for the three-factor model. Therefore, our results are consistent with Fama and French's (1993) findings that the three-factor model can explain excess stock returns better the CAPM.

In summary, the significant coefficients s_i and h_i in the three-factor model confirm that the small firm effect and the BTM ratio effect existed on the Ghanaian stock market from 1997 to 2009. In addition, the non-significant intercepts of the three-factor model reveal that the three-factor model is able to capture the variation of the stock excess returns better than the CAPM. The adjusted R^2 value also increased by about 17.9% on average, indicating that the three-factor model predicts stock returns better than the CAPM.

Figure 4.2 The adjusted R^2 value of the CAPM and three factor model

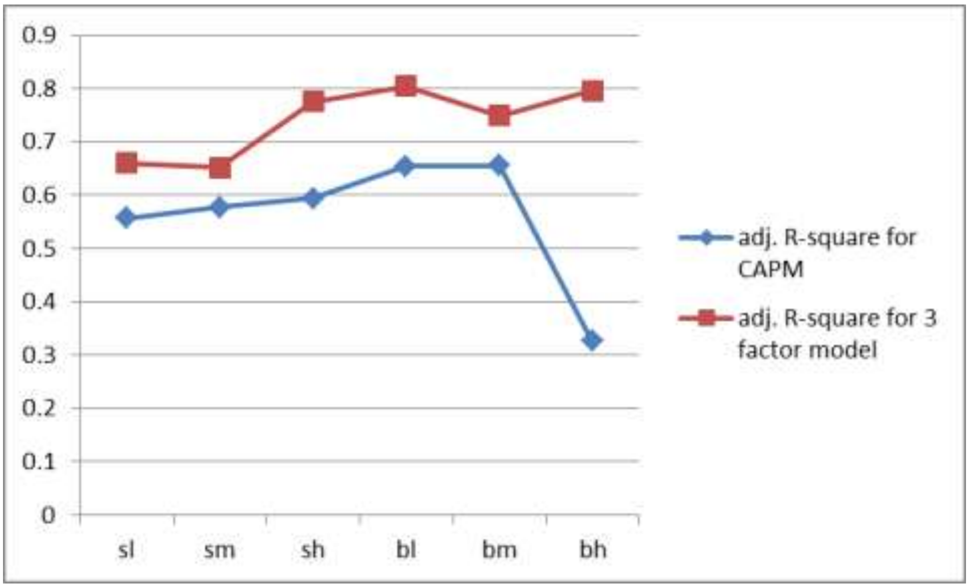


Table 4.12 Adjusted R^2 of regression of CAPM and Fama and French 3 factor model.

Portfolio	**sl**	**sm**	**sh**	**bl**	**bm**	**bh**	**average**
Adj. R-square for CAPM	0.557	0.578	0.594	0.654	0.656	0.326	0.561
Adj. R-square for 3 factor model	0.661	0.652	0.776	0.805	0.75	0.796	0.740

See legend of table 4.2 for definitions of sl, sm, sh, bl, bm and bh

Table 4.12 above shows the adjusted R-squares for CAPM and The Fama and French three factor model for the six Size-BTM portfolios formed. The adjusted R-square is used to assess the strength of the two models. Comparing their adjusted R-squares it is noticed that for all the portfolios the adjusted R-squares of the three factor model are higher than those of the CAPM indicating that the Three Factor model with an average adjusted R-square of 74% is a stronger model in explaining portfolio returns than the CAPM which has an average of 56.1%.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.0 Introduction

This chapter presents the summary of the findings and draws conclusions and makes appropriate recommendations based on the findings of the study. The chapter also delineates the limitations of the study. The chapter ends by giving possible future research directions.

5.1 Main Findings

Table 5.1 shows the expected sign for the three-factor model and the CAPM. The table is the summary of the regressing results of both models. The results are most consistent with the Fama and French (1993) and Drew et al. (2003) studies.

Table 5.1 shows the sign and significance for the three-factor model and the CAPM

	Signs of the intercept/slope	Are all the parameters significant?
The CAPM		
A	Negative	No
B	Positive	Yes
Fama and French Three – factor Model		
α	Mixed	No
β	Positive	Yes
s	Mixed (as expected)	Yes
h	Mixed (as expected)	No

5.1.1 Summary the findings on the three-factor model and the CAPM

This study set out to confirm the existence of BTM and size effects and also to test the Fama and French model using Ghanaian data with the aim of contributing to the scanty existing literature verifying the applicability of the model in small and emerging markets.

The three-factor model regression results demonstrate that this model can be used on the Ghanaian stock market to predict stock return better than the CAPM. The fact that not all the intercepts of the three factor model are insignificant indicates that the three-factor model does not also fully explain all the variations in portfolio returns in Ghana. Although the magnitude of the slopes vary from that of Fama and French (1993), the average value of the slopes reveal that there are BTM ratio and size effects on our stock market during the testing period.

Moreover, the betas are positive and significant playing important roles in explaining the stock returns. This implies that beta cannot be underestimated when talking about determinants of expected returns on the Ghanaian stock market. It shows that BTM effect and size effects add to the explanation of expected returns given by beta. This finding is inconsistent with that of Fama and French (1992) who contended that the beta is flat in explaining returns.

Similar to Drew et al. (2003) and Fama and French (1993), our study also showed some significant negative slopes. The significantly negative size factor slopes in the Fama and French (1993) study belonged to the large firm portfolios, and the negative BTM ratio factor slopes were concentrated on the low-BTM ratio portfolios and this consistent with our findings. In this study, the BL, BM and BH portfolios have negative size factor slopes and the

SL, BL and BM portfolio factor have negative BTM ratio factor slopes. On the other hand, the coefficients of the market factor have a significant positive relationship with stock excess returns. However, the intercepts are also significantly different from zero, which indicates that beta only cannot fully capture the variation of the portfolio stock excess returns. The explanatory power of the three-factor model is also higher than the CAPM as indicated by their average adjusted R^2 values.

In testing the three-factor model, the regression results show that some of the size and BTM ratio coefficients for the six BTM-size portfolios are significant. It reveals that the size, BTM ratio and market excess return factor play important roles in predicting portfolio excess returns. Moreover, we cannot accept that three-factor model is fully sufficient in explaining portfolio returns because not all the intercepts are equal to zero which indicates that for some portfolios (SL, SM, BH and BL) other factors apart from beta, BTM and size account for variation in returns. Researchers like Amihud (2002) and Nartea and Ward (2009) have identified others such as illiquidity and momentum respectively as other determinants of expected returns. These factors could account for the unexplained portion of our returns since most emerging markets are predominantly illiquid.

Similarly, for the CAPM, we identify the intercepts of some of the portfolios as significant implying that other factor add to variation of returns. This provides evidence that the CAPM could not sufficiently predict excess return accurately on the Ghanaian stock market during the test period as well as the three-factor model. But their adjusted R^2 made us concluded that the three-factor model is able to capture risk better and hence superior to the CAPM in explaining portfolio returns.

Furthermore, this study found out that BTM had a stronger explanatory power on portfolio returns than the firm size effect which is similar to the findings of Fama and French (1992).

5.2 Conclusion

This establishes that we found out that beta risk is not the only risk needed to explain the variation in average portfolio returns invariably implying that CAPM is not fully sufficient in explaining returns. We then assessed if factors such as BTM and Size capture some aspect of risk and therefore add to explaining the variation in returns. Based on our findings we conclude that indeed BTM and size capture aspect of risk not captured by beta and hence are able to add to the explanation of returns.

This study further concludes that BTM had a stronger explanatory power on portfolio returns than the firm size effect which is similar to Fama and French (1992) findings. Based on our results from the CAPM and the three factor model, we again conclude that none of the two models is able to fully explain all the variations in portfolio returns since none of them had all intercepts being significant equally to zero. Notwithstanding that, comparison of their adjusted R squared indicated that Fama and French three factor model is better in explaining variation in portfolio returns on our exchange than the CAPM. However, there are some limitations that may have impacted on our results. This may include the small nature of our exchange and the fact that stocks are not very liquid.

5.3 Limitations

5.3.1 Computing the BTM Ratio

There is a limitation in computing the BTM ratio in our study. First, we followed the Drew et al. (2003) method to obtain the BTM ratio, which used book value of common equity at December year t-1 divided by market value of equity at December year t-1 as the BTM ratio at year t. Moreover, we examined portfolio excess return from March of t-1 to February of t of each year because listed firms in Ghana are required to published their audited financial statements by March of each year. However, Fama and French (1993) used book value of common equity at fiscal year ending t-1 divided by market value of equity at fiscal year ending t-1 to calculate the BTM ratio at year t. They tested stock returns from July of year t to June of year t+1. These differences might affect the relationship between firm size and BTM ratio and average returns.

5.3.2 Length of the Sample Period and the Number of Stocks

The sample period for our study is only 13 years from January 1997 to December 2010. Since the Ghanaian stock market was established in the early 1990s there were a few listed firms at the start and the original data source is limited hence we decided to start our study from 1997 by that our market was little bit organized. The Fama and French (1993) study had 38 test periods. Comparatively, our test period was shorter but it is similar to the application of Fama and French model on small markets like Drew et al (2003).

The other limitation is that the number of stocks in our study is smaller than in Fama and French (1993). The number of listed firms ranges from a minimum of 11 companies in 1997 to 21 companies in 2009. Fama and French (1993) reported that there was an average of 3100 listed firms per year in their sample. Therefore, Fama and French were able to sort their data into 25 portfolios compared with only six portfolios in our study. The smaller number of stocks may be the reason of the low degree of variation of the stock excess returns. The low adjusted R^2 value suggests that the three-factor model can only explain a limited amount of variation of stock return.

5.4 Recommendation

The findings of this study bring some implications for investors who are willing to take on additional risks with the aim of making extra returns. This study suggests that asset management companies as well as investors are advised to consider the firm size and Book to market equity in addition to beta in order to make expectation on return on portfolios in Ghana.

It is salient to make it clear that though the CAPM explains some variations in expected return, it is not totally sufficient in explaining the entire variation in return so is the Fama and French three factor model. But comparatively the Fama and French three factor model does better than the CAPM hence it is recommended that the Fama and French three factor model should be taught in schools and also used in practice.

5.5 Future Research Directions

5.5.1 The Fundamental Economic Reason of the Three-factor Model

Fama and French (1995) claimed the size factor and BTM ratio are related to stocks' profitability. However, there is no study to test the whether the firm size and BTM ratio are related to profitability on the Ghanaian stock market. There are two reasons our results cannot fully support Fama and French (1995) findings. First, the length of the test period in our study is short, only 13 years. Second, the number of firms used per year was also small because we limited ourselves to only non-financial firms. Future researchers can examine whether the size and BTM ratio are related to stocks' profitability on the Ghanaian stock market to find out whether the high-BTM ratio stocks are less profitable compared with the low-BTM ratio stocks and whether small stocks have lower earning to book value ratio than large stocks. Secondly, future researchers can carry out a similar study using all listed firms (both financial and non-financial firms) since some studies have concluded that when both financial and non-financial firms are used the result is not any different.

Lastly, future research can assess the impact of momentum and illiquidity on expected returns on our exchange.

5.5.2 The Length of Sample Period

Future researchers can use a long sample period in examining the three-factor model on the Ghanaian stock market. The short test period in our study may be the reason why the adjusted R^2 of the three-factor was not as high as that of Fama and French(1995), and during the short test period the stock price is stable, which also affects the explanatory power of the three-factor model. Therefore, future studies should attempt to employ longer sample periods in the analysis.

5.5.3 Characteristics of the Ghanaian stock market

The three-factor model is successful in predicting stock excess return in the US stock market. However, there is no strong evidence to support this model in Ghana but from the result it is conversing that the three factor model does better in explaining variation in portfolio returns than the traditional CAPM. The Ghanaian stock market is still growing and therefore has distinct characteristics from other developed markets like the U.S. stock market. For example, the Ghanaian stock market is smaller than the U.S. stock market. In the early stage of the Ghanaian stock market, the stock price is not as volatile as the U.S. stock prices.

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