Firm Size, Book-To-Market Equity and the Stock Returns: Analysis of Nigerian Stock Market

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Abstract
Although the Capital Asset Pricing Model (CAPM) has been one of the most useful and frequently used theories in determining the required rate of return of a security, the application of this model has been controversial since early 1960s. The CAPM was introduced by Jack Treynor, William Sharpe, John Lintner and Jan Mossin independently, building on the earlier work of Harry Markowitz on diversification and Modern Portfolio theory. This study employs Fama and French (1993) multifactor model to investigate the significance of firm size and book-to-market ratio in explaining variations in returns of stocks listed on the Nigerian equity market using monthly stock data of 59 randomly selected Nigerian stocks from 2012 to 2015 collected from the Nigerian Stock Exchange. The empirical results of the classical Ordinary Least Square (OLS) regression analysis of the test of the multifactor model found that value effects are not priced but size effects are significantly priced. To the contrary, robust OLS confirms both size and value effects, suggesting that investors are rewarded for taking both size and value risk.

Keyword: *CAPM, firm size, book-to-market equity, stock market, Nigeria*

1. Introduction

The widely accepted Capital Asset Pricing Model (CAPM) independently developed by Jack Treynor (1961,1962), Sharpe (1964), Lintner (1965a,b) and Mossin (1966), postulates that the market portfolio is mean-variance efficient; implying that there exist a linear relationship between a portfolio's expected return and its market beta; and that no other factors are necessary to explain expected returns. This relationship is defined by what is known as the security market line (SML), where the systematic risk is compared with the risk and return of the market and risk-free rate of return in order to calculate a required return for the security and hence a fair price (Watson and Head, 1998). Fama and MacBeth (1973) confirm that indeed no measure of risk systematically affects average return other than the CAPM beta. Black, Jensen and Scholes (1972) (hereafter BJS) establish the validity of the beta factor in explaining stock returns. Although, the two-pass method of BJS and Fama-French also suffers from an inheret statistical deficiency known as the error-in-variance problem, which according to Dimson and Mussavian (1999) arises because the second-pass independent variables (i.e., the beta) are themselves estimates from the first-pass regression. Given the model's (CAPM) prevalence, it has been one of the most empirically scrutinized models in finance; and several contradictions have been revealed, one of which is the marginal explanatory power of market equity on security returns. However, recent evidences have shown that other factors have consistent and significant effect on common stock returns. For example, Statman (1980), Reinganum (1981), Rosenberg et al. (1985), Lakonishok and Shapiro (1986), Chan et al. (1991), Fama and French (1992, 1998), Daniel et al. (1997), Patel (1998), Chui and Wei (1998), Rouwenhorst (1998), and Claessens et al. (1998), report that market beta has little or no ability in explaining the behaviour of expected stock returns, and firm size and book-to-market play significant role in explaining the behaviour of expected stock returns. Basu (1977) documented a negative relationship between price-earning (P/E) ratios and stock returns. Fama and French (1992) find that two factors, market equity (M/E) ratio of book equity to market equity (BE/ME) capture much of the cross-section of every equity returns. Other empirical research has discovered strong seasonality in stock returns. Banz (1981), Keim (1982); Keim (1985) and Reinganum (1983) report that January returns are higher than in any other month in the USA. Litzenberger and Ramaswamy (1979) show a significant positive relationship between dividend yield and stock returns on common stock. De Bondt and Thaler (1985) found that past stock losers in the US outperformed past winners, a phenomenon, which they christened the "stock market overreaction effect". But even more controversial has been the documented evidence of the predictability of stock returns on the issue of whether size is of importance to stock returns and other metrics of the company. The size effect is defined as the empirical observation that clearly identifiable segment of stocks with low market capitalization have higher returns than stocks of large firms. The "size" of a firm as measured by the market value of its common stock equity has been observed to have a significant inverse relationship with stock returns in capital asset pricing models that are specified to explain total return. Subsequent studies focus on explaining the size effect. Since the late 1990s, a remarkable paradox has developed in research on the size effect. Strong (2004) traditionally defined market capitalization as the current share price multiplied by the number of outstanding shares. Tyson (2003) opined that the total market value (capitalization) of a company's outstanding stock defines the categories that define the stocks that the fund invests in. He went further to state that, historically, small companies pay less dividend but appreciate more, and have more volatile share prices but tend to produce slightly higher total returns. In the case of larger companies, stocks tend to pay greater dividends and on average are less volatile and produce slightly lower total returns than small company stocks. Total return is measured before tax, information costs, and transaction costs. Total return is defined as stock price appreciation (capital gains) plus dividend yield (dividend income), both adjusted for number of shares outstanding, where t indexes time and there is no index for firms:

$$R_t = \frac{P_t N_t - P_{t-1} N_{t-1}}{P_{t-1} N_{t-1}} + D_t N_t / P_{t-1} N_{t-1}$$

(1.1)

The market value of equity, sometimes referred to as firm "size" is defined as share price multiplied by the number of common stock shares outstanding:

$$ME_t = (P_t)(N_t)$$

(1.2)

This anomaly, now known as the size effect, seminal work performed by Banz (1981), show that the size of firm and the return of its common stock are inversely related (stocks with lower market capitalization (small stocks) tend to have higher average returns). The findings were said to offer no theoretical foundation for this relationship, but it shown to be accurate; and his models appear to address the possible econometric problems involved. Therefore suggests that size may be proxy for other factors that were not tested but are correlated to size. Fama and French (1992) show that the book-to-market ratio of individual stocks has the ability to explain cross-sectional variation in stock returns. A study by Kothari and Shanken

(1977) use a Bayesian framework to document that the book-to-market ratio of the Dow Industrial Index predicts market return over the period 1926-1991. They provide evidence that the book-to-market ratio sometimes predict negative expected returns. Fama (1991) summarizes the studies that provide evidence of return predictability. Similar to the conjecture of Ball (1978), and more recently, Berk (1995), Sharathechandra and Thompson (1994), and Pontiff and Schall (1998) argue that book-to-market ratio captures information about expected future returns because book-value proxies for expected cash-flows. This study attempts to investigate the behaviour of expected stock returns with respect to the two popularly known firm level characteristics: firm size and book-to-market equity in Nigerian context on some selected companies listed in Nigerian Stock Exchange from the period span from 2006 to 2016, by applying the Fama and French (1993) procedure, which propose a three-factor model to capture the patterns in U.S. average returns associated with size and value versus growth. That is, we examine stock returns, with two goals. The first is to detail the size and value patterns in average returns. Our second goal is to examine how well (1) and (2) capture average returns for portfolios formed on size and value. The objective of this study is to examine whether the variation in stock return is explained by firm size and BE/ME in Nigerian context on selected companies listed in the Nigerian Stock Exchange for the period from 2006 to 2017 by applying the Fama and French (1993) procedure. The rest of the paper is structured as follows: Section 2 reviews the related literature. Section 3 explains the data, hypothesis and methodology. Section 4 provides the empirical results and section 5 presents the conclusion.

2. Literature Review

2.1 Theory

The CAPM assumes that the expected return from an asset is a function of its price variance. This figure is usually reported as beta and is synonymous with risk. This relationship is thought to be linear and positive, hence the adage “high risk, high return”. Several assumptions were made by Jack Treynor (1961, 1962), Sharpe (1964), Lintner (1965a,b) and Mossin (1966) when they independently developed the CAPM.

First they assume an investor’s portfolios will maintain a constant proportion between risky and risk-free asset. A second assumption is that all investors can lend or borrow money at the risk-free rate. Assuming these things to be true, they devised the following equation:

$$E(R) - r_f = \beta(R_m - r_f), \quad (2.1)$$

Or,

$$\mu_j - r = \theta_m \sigma_{jm} \quad (2.2)$$

Where,

μ_j = expected return on any asset j

r = the risk free rate

σ_{jm} = covariance of stock return with return on the market portfolio ($\beta, beta$)

θ_m = measure of aggregate risk aversion.

The existence of the size effect and book-to-market equity has some specific implications for both the CAPM and the efficient market hypothesis.

This equation states that any return that exceeds the risk-free rate, also known as risk premium, will be proportional to the stock’s beta. Since beta and risk aversion (risk-free rate) are the only variables on the right hand equation, any theory that suggests another factor consistently affects return would require the rejection of the CAPM. Banz (1981) opined that the size of a firm and the return on its common stock are inversely related. A more established theory known as the efficient market hypothesis (Fama, 1970, 1991) also conflicts with Banz (1981) findings.

The Efficient Market Hypothesis (EMH) has been the main starting point for many financial papers. The hypothesis was founded by Eugene Fama (1970). The main point of the EMH is that it will be impossible to beat the market, gaining a higher return on their stock than other people. This hypothesis is based on the idea that all available information is directly reflected in the stock price, therefore making it impossible to make a profit by having more information than other traders (about the size and value of the firm). When new information arises, the news spreads very quickly and the stock price will be adjusted to the news instantly. If this hypothesis is true, then it will be useless to study past stock returns or search for under valuated companies, because you will not be able to gain a higher return. If the news is unpredictable, then the stock returns of tomorrow will be random. The hypothesis was heavily criticized. People discarded the theory as a useless with no real information about how markets function in real life. Fama, the inventor of the EMH model, has not lost faith in the model by saying, "stating that the markets were a victim of the crisis and not the cause". Further research might be needed, but it is unlikely that a trusted hypothesis like the EMH will be discarded so easily. When security prices at all times reflect all available, relevant information, the market in which they are traded is said to be efficient. Since the size of a company is public information, buying stocks on the basis of firm size should not lead to higher return. However, Banz's (1981) study indicated otherwise.

2.2 Fama and French (1993) Three-Factor Model

The Fama and French (1993) three-factor asset pricing model was developed as a result of increasing empirical evidence that the Capital Asset Pricing Model (CAPM) performed poorly in explaining realized returns. They find that this expanded model captures much of the cross-section of average returns among US stocks.

The Fama and French (1993) three-factor model augments the single-market risk factor in the capital asset pricing model (CAPM) with two mimicking portfolios designed to capture additional risk premiums relating to book-to-market equity and firm size as risk factors.

The model says that the expected return on a portfolio in excess of the risk-free rate is explained by the sensitivity of its return to three factors: (i) the excess return on a broad market portfolio; (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB); and, (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low book-to-market (HML).

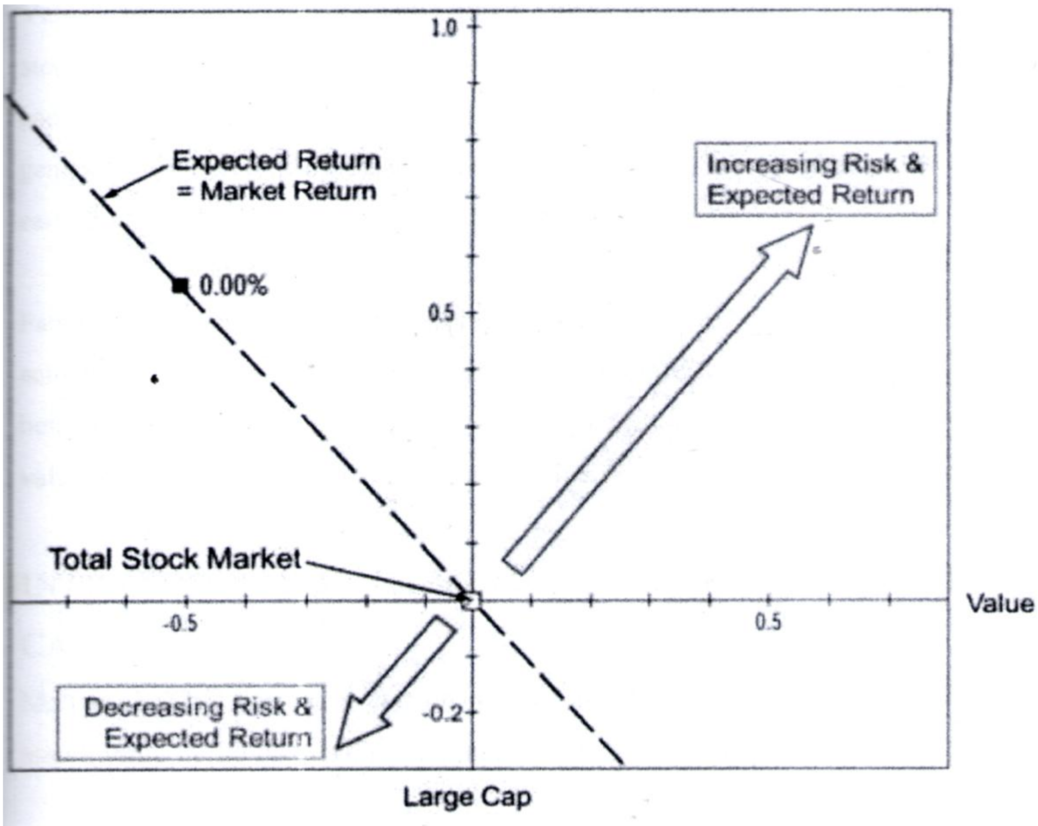

Figure 2.1: Three-Factor Pricing Model-Risk Axes
Source: bogleheads.org

Recent work of Fama and French (1996, 2006) questions the "real world application" of the CAPM theorem and its ability to explain stock returns as well as value premium effects.
In more detail, the Fama and French (1993) three-factor asset pricing model separates stock returns into three distinct risk factors:
Beta — a measure of volatility of a stock in comparison to the market; the risk of owning stocks in general; or an investment's sensitivity to the market. A beta of 1 means that the security will move with the market. If the beta of any investment is higher than the market, then the expected volatility is also higher, and vice versa.
Size — the extra risk in small company stocks. Small company stocks (small cap) tend to act very differently than large company stocks (large cap). In the long run, small-cap stocks have generated higher returns than large-cap stocks; however, the extra return is not free since they have higher risk.
The SMB Factor: Accounting for the size premium, SMB, which stands for Small minus Big, is designed to measure the additional return investors have historically received by investing in stocks of companies with relatively small market capitalization. This additional return is often referred to as the "size premium".

Value —is the value in owning out-of-favour stocks that have attractive valuations. Value stocks are companies that tend to have lower earnings growth rates, higher dividends and lower prices compared to their book value. In the long run, value stocks have generated higher returns than growth stocks, which have higher stock prices and earnings, albeit because value stocks have higher risk.
The HML Factor

HML, which is short for High Minus Low, is constructed to measure the "value premium" provided to investors for investing in companies with high book-to-values (essentially, the value placed on the company by accountants as a ratio relative to the value the public market placed on the company, commonly expressed as B/M).

2.3 Constructing the Three-Factor Model

By combining the original market-risk factor and the newly developed factors, we have the commonly used Fama and French (1993) Three-Factor Model. Analogous to the CAPM, this model describes the expected return on an asset as a result of its relationship to three risk factors: market risk, size risk and "value" risk.

$$r_A = r_f + \beta_A \left(r_M - r_f\right) + s_A SMB + h_A HML \quad (2.3)$$

$$\text{Return} = \alpha + \beta_1\left(R_m - R_f\right) + \beta_2(R_S - R_B) + \beta_3(R_H - R_L) + \varepsilon \quad (2.4)$$

The equilibrium relation of Fama and French (1993) TFPM is:

$$E(R_i) - R_f = b_i \left(R_m - R_f\right) + s_i(SMB) + h_i(HML) \quad (2.5)$$

$$\mu(\ddot{r}_i) - r_f = b_i\left[\mu(\ddot{r}_M) - r_f\right] + s_i * \mu\left(S\ddot{M}B\right) + h_i * \mu(H\ddot{M}L) \quad (2.6)$$

This assumes that the excess return of security i over the risk-free interest $[\mu(\ddot{r}_i) - r_f]$ rate is a linear function of three factors:

1. The excess return of a broad market index (as a proxy of the market portfolio) over the risk-free rate $\left[\mu(\ddot{r}_M) - r_f\right]$,
2. The difference between the expected returns on a portfolio of small and large stocks $\mu\left(S\ddot{M}B\right)$ ("small minus big"),
3. The difference between the expected returns on a portfolio of high and low book-to-market stocks $\mu(H\ddot{M}L)$ ("high minus low").

The model states that the expected return on a risky asset i, $[E(R_i)]$, in excess of risk-free rate (R_f) is explained by three factors: the market premium $(R_m - R_f)$, the difference between the return on a portfolio of small stocks and the return on a portfolio of large-size stocks, SMB (small minus big) and the difference between the return on a portfolio of high B/M stocks and the return on a portfolio of, HML (high minus low).

The sensitivities of the three factors or quantities of risk $b, s, and\ h$ are the slopes of the following regression model:

$$E(R_i) - R_f = \alpha_i + b_i(R_m - R_f) + s_i(SMB) + h_i(HML) + e_i \quad (2.7)$$

Where:

The coefficient b_i measures the elasticity of the stock return in the market return. The coefficients s_i and h_i have substantially the same interpretation, except they are not normalized to "1", but to zero.

The coefficients in this model have similar interpretations to the CAPM above. β_A is a measure of the exposure an asset has to market risk (although the beta will have a different value from the beta in a CAPM model as a result of the added factors); s_A measures the level of exposure to size risk and h_A measures the level of exposure to value risk.

Notwithstanding the descriptive efficacy of the Fama-French (1993) model in accounting for the cross-sectional variation of U.S. stock prices ex post, a key concern remains the extent to which the book-to-market equity ratio and firm size do in fact act as proxy for risk Unlike the CAPM which was derived from underlying assumptions, the Fama and French model was derived empirically. Chan and Chen (1991) offer support for a risk-based explanation for the book-to-market effect, arguing that high values of the ratio are likely to indicate firms that are financially distressed. Since the Fama and French (1993) study, there have been many studies using different sample periods on US data and samples in different countries confirming the existence of the size and book-to-market equity effects.

2.4 Empirical Review

In the 1980s the relationship between firm-level characteristics (size and book-to-market ratio) and stock returns is extensively investigated in developed, developing and group of countries. The findings of the literature suggest that there is a significant linkage between firm specific factors and stock returns in the countries examined.

The size effect was first documented by Banz (1981) and Reinganum (1981) who found a return premium on small stocks during the 1936-1975 period for the stocks quoted on the NYSE. The size effect or size premium was later confirmed by Blume and Stambough (1983) and Brown et al. (1983) in USA and Australia respectively.

Fama and French (1992) showed that a powerful predictor of returns across securities is the ratio of book value to the firm’s equity to the market value of equity. They found that after controlling for the size and book-to-market effects beta seemed to have no power to explain average security returns. Bodie et al. (2009) opined that this finding is an important challenge to the notion of rational market because it seems to imply that a factor that should affect returns – systematic risk – seems not to matter, while a factor that should not matter – the book – to market ratio – seems capable of predicting future returns.

However, a study by Kothari, Shanken and Sloan (1995) finds that when betas are estimated using annual rather than monthly returns, securities with high beta values do in fact have higher average returns. Moreover, the authors find a book-to-market effect that ia attenuated compared to the results in Fama and French and furthermore is inconsistent across different samples of securities. They conclude that the empirical case for the importance of the book-to-market ratio may be somewhat weaker than the Fama and French study would suggest.

Developed Countries

Fama and French (1992) report that the market beta has little or no ability in explaining the variation in stock returns on US stock on selected non-financial firms and on the other hand they find that the variation of cross-sectional stock returns can be captured by two firm characteristics: firm size and book-to-market equity during the period of 1962 to 1989. According to Fama and French (1992), the associated risk premium of the size and book-to-market variables is easily measurable, significantly negative and positive, respectively.

Andreas and Eleni (2004) empirically examine the Fama and French (1993) three factor model using Japanese data over the period of 1992 to 2001. The findings reveal significant relationship between the three factors and the expected stock returns in the Japanese market. Further, it clearly shows that the market factor has the most explanatory power in explaining the variation of stock returns. The explanatory power of the size factor (SMB) dominates the explanatory power of the BE/ME factor (HML) when the testing portfolios consist of small stocks and the opposite occurs when the testing portfolios consist of big stocks.

Bryant and Eleswarapu (1997), for the period from 1971 to 1993 and Pinfold, et al. (2001), for the period from mid-1993 to March 2001, documented a BM effect but a weak size effect in US stocks. On the other hand, Vos and Pepper (1997) reported strong size and BM effects over the period 1991-1995, while Li and Pinfld (2000), replicating Vos and Pepper (1997) for the period starting at the end of 1995 to June 1999, did not find a book-to-market effect. Chui and Wei (1998) and Daniel et al. (1997) find that book-to-market equity plays a significant role in explaining the cross-sectional variations of stock returns in the Japanese market.

Developing Markets

Drew and Veeraraghavan (2002) present evidence of the size and value premium for the case of Malaysia using multifactor model approach. They report that the factors identified by Fama and French (1993), better explain the variation in stock returns in Malaysia. Drew et al. (2003) also report a firm size effect and a less pervasive book-to-market effect in the Shanghai stock market. Senthilkumar (2009) employed Fama and MacBeth (1973) cross-sectional regression model in selected Indian industries in examining behaviour of stock return in size and book-to-market effect in the entire markets ratio. They find that no size effect in all the groups. When the test allow the both variables, the negative relationship between size and average return is less significant; the inclusion of market-to-book equity seems to absorb the role of size in selected Indian stock returns.

Anuradha (2007) investigates the above two most popular factors on stock returns in the CSE and reports the negative size to return relation and positive BE/ME to return relation. Mahawanniarachchi (2006) also reports that there is significant negative relationship between size and individual stock returns and positive relationship between BE/ME, market and individual stock returns. Further, it reports that size, market and BE/ME factors have significant explanatory powers in explaining the Sri Lanka stock returns.
Chaturika, Seneviratne and Nimal employed Fama and French (1995) three-factor model to investigate the size and book-to-market factors in explaining equity returns and earnings in CSE. Findings of the study suggest that the earnings (i.e., sales and earnings growth) of a firm are associated with three factors, but it doesn't provide any reliable link between the behaviour of three factors in earnings and stock returns in the CSE. Additionally, they recognize that market factor is capable in predicting the future stock returns of firms than the size and BE/ME in the CSE.

Samarakoon (1998) test the relation between stock returns and fundamental variables. This study employed two methodologies: the first is informal test which examine average returns and averages of fundamental variables for portfolios formed on the basis of size alone, beta alone and size and beta. The second is a formal asset pricing test which uses the Fama and MacBeth (1973) cross-sectional regression procedure. In the formal tests, returns are regressed on β, size book-to-market equity, leverage and earnings-price ratio, both individually and jointly, in every month in the cross-section. The result show that, inconsistent with the central prediction of the Capital Asset Pricing Model, the relation between average returns and beta is strongly negative. From size and BE/ME are not related to average returns in any significant manner.

Group of Countries

Fama and French (1998) and Patel (1998) document a premium for small firms and value stocks in 17 emerging market countries. These results differ from Claessens et al. (1998) who reports a premium for large firms and growth stocks in an earlier sample of 19 emerging markets.

Rouwenhorst (1998) shows that the return factors in 20 emerging markets are qualitatively similar to those documented. On the contrary, Chui and Wei (1998) show that book-to-market equity can explain the cross-sectional variation of expected stock returns in three out of five Pacific Basin Emerging markets, while the size effect is significant in all markets except Taiwan. Maroney and Protopapadakis (2002) test the three factor model (Fama and French, 1993) on different equity markets of Australia, Canada, Germany, France, UK and US. The size effect and the value premium survive for all the countries examined. They conclude that the size and BE/ME are international in character. The positive relationship of stock returns with BE/ME and the negative relationship with size remains in the model.

Mirela and Madhu (2002) investigate the robustness of the tree-factor model of Fama and French (1993) for equities listed in three main European markets, namely France, German and United Kingdom and provides evidence that the beta of the CAPM alone is not sufficient to describe the variation in average equity returns for the three of the markets concerned.

However, Kothari et al. (1995) rague that a substantial part of the premium is due to “survivor bias”; the data source for book equity contains a disproportionate number of high BE/ME firm that survive distress, so the average return for high-BE/ME firms is overstated. But a number of studies have weakened and even dismissed this survivorship argument. For example, Fama and French (1993) find that the relation between BE/ME and average return is strong for value-weight portfolios. As value-weight portfolios give most weight to larger stocks, any survivor bias in these portfolios is trivial.

Another argument is that the results of Fama and French (1993) are due to data snooping, where researchers’ fixation with search for variables that are related to average return, will find variables, but only in the sample used to identify them (MacKinlay, 1995). This criticism of the three-factor model does not hold.

Some other recent Empirical Review

Since the Fama and French (1993) study, there have been many studies using different sample periods on the US data and samples in different countries confirming the existence of the size and book-to-market equity effects.

Maroney and Protopapadakis (2002) tested the Fama and French three-factor model on the stock exchange of Australia, Canada, France, Japan, the UK and the US. The size effect and the value premium survive for all the countries examined. They conclude that the size and BE/ME effects are international in character.

Faff (2001) uses Australian data over the period 1991 to 1999 to examine the power of the Fama and French three-factor model. He finds strong support for the Fama and French three-factor model, but also finds a significant negative rather than the expected positive premium to small size stocks. Faff (2001) concludes that his results appear to be consistent with other recent evidence of a reversal of the size effect.

Graunt (2004) studies the Fama and French three-factor model in the Australian setting and provide further out-of-sample (non US) tests of the model. The study covers the period 1991 to 2000 and investigates firms listed on the Australian Stock Exchange. The explained variation as measured by the adjusted R^2 is also much higher compared with the CAPM. The author concludes that the three-factor model provides a better explanation of observed Australian stock returns than the CAPM.

Drew and Veeraghavan (2002) present evidence of the size and value premium for the case of Malaysia. The report that the factors identified by Fama and French explain the variation in stock returns in Malaysia and are not sample specific. The analysis was restricted to firms with available returns data from December 1992 to December 1999. The findings show that small and high book-to-market equity stocks generate higher returns than big and low book-to-market equity stocks in Malaysia. Returns on SMB and HML are substantially higher than those of the market. Their results also show that the explanatory power of the variables is powerful throughout the sample period and not solely in January. They therefore reject the presence of the turn-of-the-year (TOY) effect.

Kamau (2013) applies the CAPM and Fama and French three-factor model on stocks listed in the Nairobi securities exchange over six year period from January 2008 to December 2013. The finding reveals the applicability of CAPM and is therefore recommended as a stock valuation model for stocks listed in the NSE. On the other hand, research finding reveals that Fama and French three-factor model has very limited potential in explaining variations on the return of portfolios. Statistical results show that there is a relationship between average return and the size of the portfolios. In other words, big size portfolio overwhelm small size portfolio on realized excess returns. The study recommends that cost of capital estimates would be more accurate using a multiple factor model such as the Carhart four-factor model rather than the Fama and French three-factor model.

Dimson et al. (2003) tested for the presence of value effect in the London Stock Exchange for the period of 1955 to 2000 using monthly stock data from the London Share Price Database (LSPD) maintained at the London Business School. To investigate value effect in the equity market, six portfolios were formed based on the intersection of two size sorted groups and three book-to-market sorted groups. Controlling for size the study examined the significance of the value premium (HML) among different groups of stocks in the equity market over the sample period. The results of the study revealed significant value premium among small market capitalization and big market capitalization stocks, indicating that stocks with high book-to-market ratio significantly explain the variations of excess returns of various groups of stocks in the equity market.

Malin and Veeraraghavan (2004) empirically investigated the multifactor model of Fama and French (1996) on the three major European equity markets: France, Germany and the UK. Using monthly stock data and accounting data on market size and book value from 1991 to 2001 collected from Data Stream, they formed six portfolios based on size and book-to-market equity ratio for each of the three European equity markets. The monthly returns of each of the six portfolios were regressed against three explanatory variables: $R_m - R_f$ (excess market return), SMB (Small minus Big) for size effect and HML (High minus Low) for value effect. In both France and Germany, the results of the study recorded positive and high significant coefficient for only size effect (SMB) at 1% level of significance. For United Kingdom, the result shows the of big-size portfolios were significant, revealing a big firm effect in the London Stock Exchange during the sample period against the small-firm effect found by Fama and French (1992 study in US equity markets.

Morelli (2007) empirically examined the explanatory strength of beta, size and book-to-market value in explaining cross-sectional returns of 300 randomly selected UK stocks from July 1980 to June 2000. Using monthly adjusted stock data collected from the London Share Price Database (LSPD) and accounting data on book and market value of stocks taken from Data Stream, 3-month UK Treasury Bill Rate as the risk free interest rate and a simple value weighted average of the selected 300 firms as a proxy for the market portfolio, the study examined the role of beta (as predicted by CAPM), firm size and book to market value (as predicted by Fama and French multifactor model) in explaining expected UK stock returns during the period. The results of the study show that beta and firm size are not significant risk factors in explaining stock returns over the sample period. The book-to-market ratio was found by the study to be significant at 1% level of significance. This identifies book-to-market ratio as the major risk factor explaining stock returns in the London stock Exchange from 1980 to 2000.

Bhatnagar and Ramlogan (2012) empirically compared the performance of the Capital Asset Pricing Model and the Fama and French three-factor model in explaining variations in returns of all stocks listed on the London Stock Exchange from April 2000 to June 2007 using monthly adjusted stock prices, market and book value of equity, 3-month UK Treasury bill rate as proxy for the risk-free interest rate and value-weighted portfolio of all stocks for the market portfolio. The empirical results of the Ordinary Least Square regression analysis found beta to be statistically insignificant at 5% level of significance. The study found both size effect (SMB) and value effect (HML) statistically significant, providing evidence that the Fama and French three-factor model explains UK stock returns during the period.

Cakici and Tan (2014) examine size, value and momentum effects in UK and 22 other developed equity markets from January 1990 to December 2012. The study estimated the following four non-market factors for each of the 23 developed equity markets: the market portfolio, the SMB (size) portfolio, the HML (value) portfolio and the WML (momentum) portfolio following Fama and French (2012) methodology. The results of the study failed to establish significant size premia in any of the 23 developed equity markets, indicating that over the period covered by the study the size factor (SMB) offered insignificant explanation to variations in stock returns in all the 23 equity markets. the results for value premium (HML) confirm positive relationship between the variable and stock returns in all the 23 equity markets and highly significant in nine of the sixteen European equity markets, all Asian Pacific equity markets, Japan and Canada. For the momentum factor (WML), the results show nine out of the sixteen European markets including UK equity market, returned significant momentum premia. In the Asian Pacific region and Japan, only two equity markets returned significant momentum premia. The results also show that the Canada momentum factor is positive and significant.

Liu et al. (1999) and Hon and Tonks (2003) reported the significance of momentum factor in explaining variations in returns of stocks listed on the London Stock Exchange. Liu et al. (1999) shows that over the period of 1977 to 1996 past winner stocks significantly offered future abnormal returns. The study shows that adjusting separately for systematic risk, size, book-to-market equity (BE/ME) ratio does not eliminate momentum abnormal returns.
Hon and Tonks (2003) extended the data on UK returns back to 1955. The results of the study confirmed the presence of momentum effect in the UK equity market over the entire period of 1955 to 1996. However, the study noted that momentum cannot be regarded a general feature of the UK equity market over the whole sample period. The results show insignificant momentum effect for 1955 to 1976 sub-period and significant momentum effect for 1977 to 1996 sub-period. The study concluded that momentum effect is only apparent over certain time period in the UK equity market and as such cannot be regarded as a general feature of the equity market.

Suh (2009) opined that the Fama and French three-factor model has explanatory power in highly volatile markets, but where market volatility is low, the CAPM is just as effective as the Fama and French three-factor model. This may be an indication that the Fama and French three-factor model will be more effective in developing economies, where it is consistently found that markets are most volatile (Rouwenhorst, 1999).
South Africa may be classified into the group of developing economies (Bird and Vaillancourt, 2008). A study of the Fama and French three-factor model on the JSE by

Besiewicz and Auret (2010), finds that the model is a better predictor of actual share returns than the CAPM. It appears that the size and the value premiums of the model should at least be long standing on the JSE based on previous studies of what factors are able to explain the variability in share price return in South Africa (Van Renburg, 2003; Auret and Sndaire, 2008: Besiewicz and Auret, 2009).

Fama and French (1995) further investigate the size and B/M effects' relationships with earnings and find that small firms as well as high B/M firms generally exhibit lower earnings. The findings are consistent with the thesis that these stocks yield higher returns because they are riskier. In 2006, Fama and French published a paper connecting the factors of their model to financial theory.

3. Methodology

3.1 Sample and Data Collection

This paper aims to investigate the behaviour of expected stock returns with respect to two popularly known firm level characteristics: firm size and book-to-market ratio in Nigerian context. Firm size and book-to-market equity (BE/ME) as independent variables to examine the behaviour of stock returns in Nigeria. This study employs Fama and French (1993) cross-sectional regression procedure to individual securities. For the purpose of this study, data of 59 companies listed on the Nigerian stock market for the period 2012 to 2015 are selected randomly. And selected companies are most stocks traded frequently (at least for four years). Data of selected variables have been collected from annual reports of the 59 companies and Nigerian Stock Exchange Fact Book.

3.2 Hypothesis

In order to achieve the objective of the study, the following hypotheses have been generated:

$\boldsymbol{H_1}$**:** There is no positive effect of firm size on stock returns.

$\boldsymbol{H_2}$**:** There is a negative effect of book-to-market equity on stock returns.

3.3 Model Specification

This model is basically an expansion of the CAPM. As can be seen in the CAPM formula below, there is a market risk factor. The problem with the CAPM was that it seemed that two classes of stock did better than the market as a whole; small caps and value stocks. Because of this, Fama and French decided to add two more factors to the model, size and value. Because the first part of the formula is nearly the same, I will mainly explain the SMB and the HML in this paragraph. The beta in the three factor model is analogous to the beta used in the CAPM, but they are not the same. Because there are two more factors explaining the return on the portfolio. SMB is short for Small market capitalization Minus Big. The SMB measures the (historical) excess returns of small caps over big caps. The HML, stands for High book-to-market ratio Minus Low. The HML, measures the (historical) excess returns of value stocks over growth stocks. Value stocks are stocks with a high book-value-to-price ratio.

Consequently, growth stocks are stocks with a low book-value-to-price ratio. This results in the following formula:

$$E(R) = R_f + \beta_3 \left(R_m - R_f\right) + b_{smb} * SMB + b_{hml} * HML + \mu_t$$

Where:

$E(R)$ = Expected return on assets

R_f = Risk-free rate

β_3 = Beta of the assets

R_m = Return of the stock market
b_{smb} = Coefficient SMB
SMB =Small (cap) Minus Big
b_{hml} = Coefficient HML
HML = High (book/price) minus Low

According to the model, the expected return on a portfolio in excess of the risk-free rate is explained by the sensitivity of its return o three factors: (i) The excess return on a broad market portfolio; (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB): and, (iii) the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to=market stocks (HML).

3.4 Construction of variables

Variables	Equation
Returns	$R_{i,t} = R_f + \beta_3 \left(R_m - R_f\right) + b_{smb} * SMB + b_{hml} * HML + \mu_t$
Market capitalization	$ME_{i,t} = P_{i,t} * SO_{i,t}$
Book-to-market	$B/ME_{i,t} = BE_{i,t}/ME_{i,t}$

Figure 3.1: Construction of Variables.

First, we create the monthly return variable $R_{i,t}$ for every constituent. Due to the use of monthly close prices in order to create returns, a number of return generating and price adjusting factors are missing, such as stock splits and dividend issues.
Second, we create the market capitalization variable $ME_{i,t}$ using market data by taking the product of the closing price and the amount of shares outstanding of each constituent i at the end of every month t. This variable is proxy for the size of the firm and is used to create portfolios based on size
Third, we create the book-to-market variable $B/ME_{i,t}$ using both the market and accounting data. The common and ordinary book value of equity is divided by the market capitalization variable, which represents the market value of equity. This ratio represents the value risk factor and firms with a higher book-to-market ratio are relatively undervalued by the market and firms with a low book-to-market ratio are relatively overvalued by the market.

3.5 Factors

The risk factors are created by assigning the returns of the stocks to a particular portfolios weighted by their market capitalization. Depending on the factor loading of the portfolio (whether it is a portfolio with stocks with the highest or lowest amount of a given variable) it will be chosen to either sell or buy the portfolio. The equally weighted combination of the bought and sold portfolios results in a risk factor.
We start with the value factor HML_t , which is created using six double-sorted portfolios using the book-to-market ratio and the market capitalization. The portfolios are created using the 30th and 70th percentile breakpoints for the book-to-market ratio and the median is used as a breakpoint for the market capitalization. The stocks with the highest and lowest 30 percent book-to-market values are used to create the H and L portfolios, respectively. These portfolios are once again sorted based on the market capitalization of the firms.
First, the size factor $SMB_{B/M,t}$ is created using double-sorted portfolios based on the market cap and the book-to-market ratio. This portfolio is created the same way as those used in the previously created risk factor by using the 30th and 70th percentile as a breakpoint for the portfolios based on the breakpoint for the portfolios based on the book-to-market ratio. The

return of a size factor is then calculated by subtracting the equally weighted returns of the portfolios with the largest market cap BL_t, SH_t and BM_t from the equally weighted returns of the portfolios with the smallest market cap SL_t, SH_t, and SM_t. The return of the size factors created are now combined using equal weights resulting to the total size factor SMB_t.
Lastly, the market factor from the capital asset pricing model of Sharpe (1964), Lintner (1965) and Black, et al (1972) is created by taking the sum of the value-weighted returns from all the constituents every month. Including this factor in the model will ensure that the returns obtained as compensation for exposure to market risk are accounted for, so that these are not incorrectly explained for by one of the other risk factors or left unexplained.

4. Results

The study first examines the time-series properties of size portfolio, value portfolio and sample returns using statistical values and line graphs. The graph for each of these variables including market return is presented below.

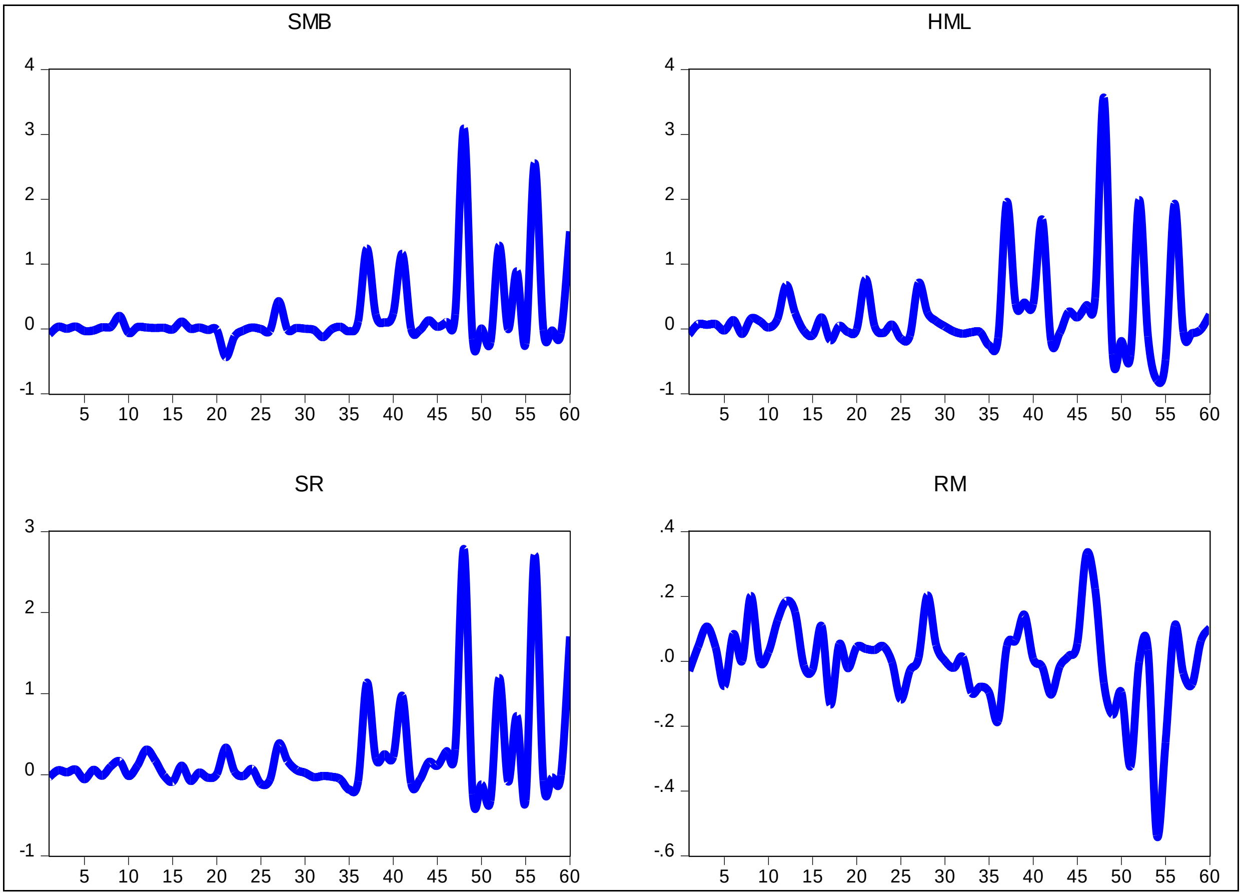

Figure 4.1: Monthly Evolution of Size, Value, Sample and Market Returns

As sighted above, the factor portfolios and the sample portfolio returns have similar characteristics. They all rise/fall at the same time periods. At the initial period they were apparently stable, while market return swig sharply. It is also observed that when the market return was falling in the middle of 2016, factor and sample portfolio returns were rising. There is evidence that value portfolio return has the highest value, and at the end of 2016 when the market return attempt to be declining, returns on factor and sample portfolios were rising. These can also be examined using the descriptive statistics, which are shown in table 1.

Table 4.1-Descriptive Statistics

Statistics	SMB	HML	SR	RM
Mean	0.202893	0.225363	0.213542	0.002567
Maximum	3.088508	3.565022	2.782066	0.329621
Minimum	-0.435278	-0.785469	-0.320570	-0.536821
Std. Dev.	0.610178	0.691657	0.592248	0.132281
Skewness	3.151203	2.766434	3.058101	-1.088172
Kurtosis	13.24671	11.89829	12.57689	6.929238

Source: Eview 9 Computation

Value portfolio has the largest average return followed by sample and size portfolios. This means factor portfolios have better return than market portfolios. In addition, value portfolio has the widest range, while market portfolio has the lowest range. By the value of standard deviation, value portfolio appears to be the most volatile portfolio. The factor and sample portfolios are positively skewed, but the market portfolio is negatively skewed. In this regard, rational investors should sort their portfolio by size and value rather than looking at the overall market. However, all the portfolios are leptokurtic in nature. There is a clear indication of future volatility of value. It is important; we look at the correlation between each peer of these variables. This is presented in table 2.

Table 4.2-Correlation Matrix

	SMB	HML	SB	RM
SMB	1.000000			
HML	0.602556	1.000000		
SR	0.704196	0.893804	1.000000	
RM	0.308752	0.710308	0.636066	1.000000

Source: Eview 9 Computation

The correlation coefficients between sample portfolio return and value portfolio return is close to 89 percent, while that of size and sample portfolio is approximately 70 percent. This means the factor portfolio returns increase with increase in sample portfolio return. Size portfolio has very weak correlation with market portfolio, but to the contrary, value has strong correlation coefficient. Sample and market has positive correlation. This means my selected sample size responds positively to the market. However, size and value have seemingly low correlation coefficient motivating a good stance for OLS estimation, which is reported in table 3.

Table 4.3-OLS Estimation of Size-Value-Sample Return Relationship

Variable	Coeff	Std-Error	T-stat	P-value
SIZE	0.196794	0.013024	15.11026	0.0000
VALUE	-0.001313	0.014842	-0.088463	0.9298
C	0.081669	0.041605	1.962945	0.0546

Source: Eview 9 Computation

Table 3 presents the cross-sectional pricing identification of size and value factors based on OLS estimation technique. As shown in the table, the coefficient of size is positive and significant at 1 percent level, while value factor is insignificant and inverse. This suggests that there are significant size-effects confirming the a-priori claims that size effects govern average return. The market pays premiums to investors who invest in size portfolio, but the investments in value portfolio do not command significant risk premium. These results are contestable, since value risk in the study of Fama and French (1995) was significantly priced. Thus, we employ robust OLS for further investigation, and the results are reported in table 4.

Table 4.4-Robust OLS Estimation of Size-Value-Sample Return Relationship

Variable	Coeff	Std-Error	T-stat	P-value
Size	0.139448	0.000700	199.0980	0.0000
Value	0.046207	0.000798	57.89057	0.0000
C	0.003028	0.002237	1.353519	0.1759

Source: Eview 9 Computation

The robust OLS results are more realistic than those of the classical OLS for the following reasons: (1) The coefficients of size and value factors are significant and positive. (2) The constant term is insignificant meaning that the size and value factors are sufficient to explain variations in average return. These findings are analogous to the position of Fama and French (1995). Therefore, my findings have confirmed that investments in size and value portfolios command significant risk premiums, and investors investing in these portfolios are rewarded for taking these non-diversifiable risks. It is clear that two OLS's give conflicting position. While the traditional OLS reports that there are only size effects, robust OLS reveals that there, are both size and value effects. In view of this, I subject the models to post estimation tests serial correlation, root mean squared error and coefficient of determination. Table 5 provides the results of these tests.

Table 4.5-Test of Robust OLS against Traditional OLS

Test Type	Statistic	P-value
Robust OLS-Serial Correlation	0.0685	0.79
Tradition OLS- Serial Correlation	0.211510	0.81
Robust OLS-RMSE	0.505	
Tradition OLS- RMSE	0.304	
Robust OLS-R-Squared	0.81	
Tradition OLS- R-Squared	0.88	

Source: Eview 9 Computation

The serial correlation test with respect of each technique shows that there is absence of serial correlation. So the residuals obtained from either regression equation do not exhibit serial correlation. The coefficient of determination or R-squared value is larger in the traditional OLS than the robust OLS, meaning that the traditional OLS has the more explanatory power than the robust OLS. In the same veil, the traditional OLS has the smallest value of root mean squared error. The test indicates that in a relative term, the traditional OLS is better that the robust OLS.

5. Conclusion

The study provides an empirical investigation on the link between size factor, value factor and average return, with aim of identifying priced and non-priced risks. The test based on the classical OLS shows that value effects are not priced but size effects are significantly priced. The implication of this is that diversification to the hold value stocks does not yield rewards. But market pays premiums to holders of size portfolio. To the contrary, robust OLS confirms both size and value effects, suggesting that investors are rewarded for taking both size and value risk. This is in tandem with the study of Fama and French (1995).

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APPENDIX

	SMB	HML	SR	RM
Mean	0.202893	0.225363	0.213542	0.002567
Median	0.010007	0.039828	0.028741	0.009552
Maximum	3.088508	3.565022	2.782066	0.329621
Minimum	-0.435278	-0.785469	-0.320570	-0.536821
Std. Dev.	0.610178	0.691657	0.592248	0.132281
Skewness	3.151203	2.766434	3.058101	-1.088172
Kurtosis	13.24671	11.89829	12.57689	6.929238
Jarque-Bera	361.7885	274.4805	322.8119	50.43846
Probability	0.000000	0.000000	0.000000	0.000000
Sum	12.17358	13.52176	12.81252	0.154012
Sum Sq. Dev.	21.96671	28.22498	20.69472	1.032394
Observations	60	60	60	60

	SMB	HML	SR	RM
SMB	1.000000	0.602556	0.704196	0.308752
HML	0.602556	1.000000	0.893804	0.710308
SR	0.704196	0.893804	1.000000	0.636066
RM	0.308752	0.710308	0.636066	1.000000

OLS RESULTS

Dependent Variable: ARS
Method: Least Squares
Date: 04/05/18 Time: 00:05
Sample: 1 59
Included observations: 59

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.196794	0.013024	15.11026	0.0000
VALUE	-0.001313	0.014842	-0.088463	0.9298
C	0.081669	0.041605	1.962945	0.0546

R-squared	0.883161	Mean dependent var	0.213542
Adjusted R-squared	0.878988	S.D. dependent var	0.899418
S.E. of regression	0.312878	Akaike info criterion	0.563505
Sum squared resid	5.482002	Schwarz criterion	0.669142
Log likelihood	-13.62339	Hannan-Quinn criter.	0.604741
F-statistic	211.6461	Durbin-Watson stat	2.126934
Prob(F-statistic)	0.000000		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.211510	Prob. F(2,54)	0.8100
Obs*R-squared	0.458595	Prob. Chi-Square(2)	0.7951

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 04/05/18 Time: 00:06
Sample: 1 59
Included observations: 59
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.000774	0.013397	0.057774	0.9541
VALUE	0.001207	0.015334	0.078685	0.9376
C	-0.000264	0.042226	-0.006258	0.9950
RESID(-1)	-0.070272	0.138446	-0.507575	0.6138
RESID(-2)	-0.059212	0.136092	-0.435087	0.6652

R-squared	0.007773	Mean dependent var	4.70E-17
Adjusted R-squared	-0.065726	S.D. dependent var	0.307437
S.E. of regression	0.317379	Akaike info criterion	0.623498
Sum squared resid	5.439391	Schwarz criterion	0.799561
Log likelihood	-13.39320	Hannan-Quinn criter.	0.692226
F-statistic	0.105755	Durbin-Watson stat	2.005614
Prob(F-statistic)	0.980026		

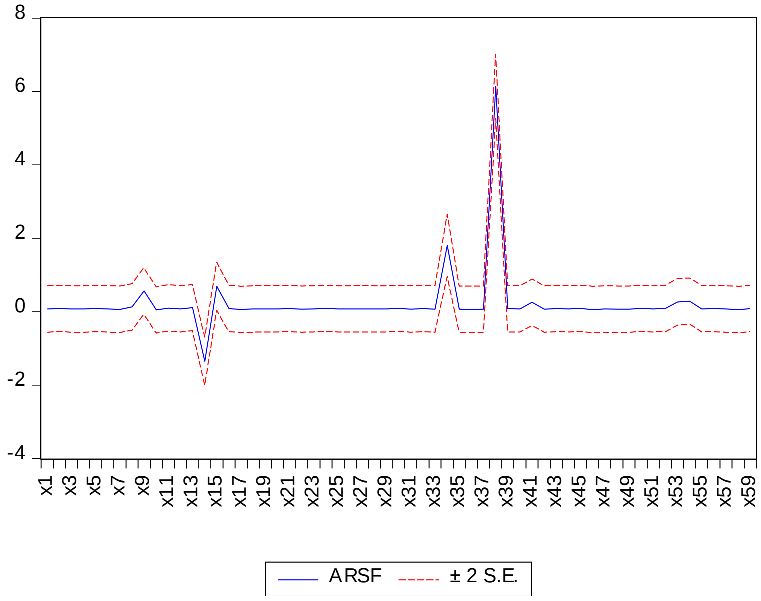
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.555489	Prob. F(2,56)	0.5769
Obs*R-squared	1.147726	Prob. Chi-Square(2)	0.5633
Scaled explained SS	11.63971	Prob. Chi-Square(2)	0.0030

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/05/18 Time: 00:07
Sample: 1 59
Included observations: 59

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.104329	0.059588	1.750844	0.0854
SIZE	-0.017240	0.018653	-0.924267	0.3593
VALUE	-0.005331	0.021257	-0.250773	0.8029

R-squared	0.019453	Mean dependent var	0.092915
Adjusted R-squared	-0.015567	S.D. dependent var	0.444662
S.E. of regression	0.448110	Akaike info criterion	1.281952
Sum squared resid	11.24493	Schwarz criterion	1.387589
Log likelihood	-34.81757	Hannan-Quinn criter.	1.323188
F-statistic	0.555489	Durbin-Watson stat	2.065109
Prob(F-statistic)	0.576920		



Forecast: ARSF	
Actual: ARS	
Forecast sample: 1 59	
Included observations: 59	
Root Mean Squared Error	0.304820
Mean Absolute Error	0.137130
Mean Abs. Percent Error	2897.299
Theil Inequality Coefficient	0.171074
Bias Proportion	0.000000
Variance Proportion	0.031052
Covariance Proportion	0.968948
Theil U2 Coefficient	2.930990
Symmetric MAPE	153.3703

ROBUST OLS

Dependent Variable: ARS
Method: Robust Least Squares
Date: 04/05/18 Time: 00:13
Sample: 1 59
Included observations: 59
Method: M-estimation
M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered)
Huber Type I Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
SIZE	0.139448	0.000700	199.0980	0.0000
VALUE	0.046207	0.000798	57.89057	0.0000
C	0.003028	0.002237	1.353519	0.1759

Robust Statistics

R-squared	0.817211	Adjusted R-squared	0.810682
Rw-squared	0.997319	Adjust Rw-squared	0.997319
Akaike info criterion	81.15702	Schwarz criterion	89.79957
Deviance	0.025049	Scale	0.017970

Rn-squared statistic	50433.44	Prob(Rn-squared stat.)	0.000000
Non-robust Statistics			
Mean dependent var	0.213542	S.D. dependent var	0.899418
S.E. of regression	0.518814	Sum squared resid	15.07340

SQUERED

Date: 04/05/18 Time: 00:15
Sample: 1 59
Included observations: 59

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |. |	. |. |	1	-0.033	-0.033	0.0685	0.793

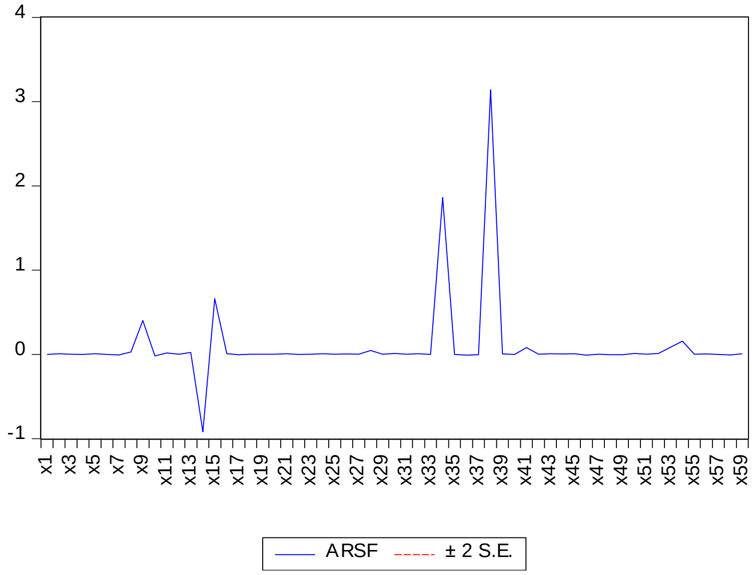
*Probabilities may not be valid for this equation specification.

UNSQUERED

Date: 04/05/18 Time: 00:17
Sample: 1 59
Included observations: 59

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |. |	. |. |	1	-0.053	-0.053	0.1714	0.679

*Probabilities may not be valid for this equation specification.



Forecast: ARSF
Actual: ARS
Forecast sample: 1 59
Included observations: 59

Root Mean Squared Error	0.505452
Mean Absolute Error	0.128576
Mean Abs. Percent Error	213.0430
Theil Inequality Coefficient	0.356439
Bias Proportion	0.054754
Variance Proportion	0.625707
Covariance Proportion	0.319539
Theil U2 Coefficient	0.424033
Symmetric MAPE	141.1649