International Journal of
Economics
(IJECON)

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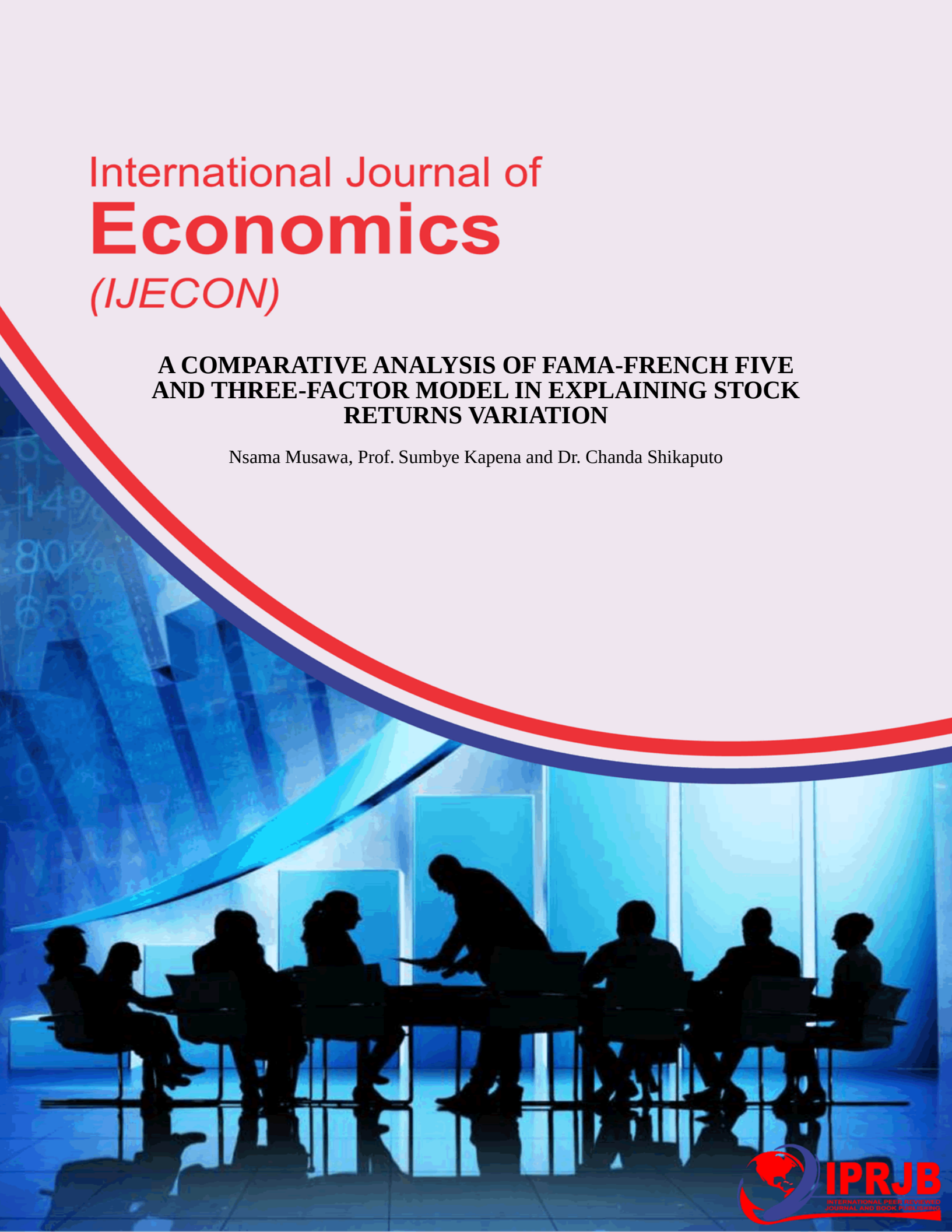

IPRJB
INTERNATIONAL PEER REVIEWED JOURNAL AND BOOK PUBLISHING

International Journal of Economics
ISSN 2518-8437 (Online)
Vol.3, Issue 1, No.3, pp 30 - 48, 2018

A COMPARATIVE ANALYSIS OF FAMA-FRENCH FIVE AND THREE-FACTOR MODEL IN EXPLAINING STOCK RETURNS VARIATION

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Abstract

Purpose: Several stock valuation models have been developed to explain the relationship between the expected returns on stock and its risk factors; among them is Markowitz's modern portfolio theory, the Capital Asset Pricing Model and Fama and French three factor model. This study tested how the five factor model compare with the three factor model in explaining stock return variation at the Lusaka Securities exchange.

Methodology: A deductive, quantitative research design and secondary data from the Lusaka Securities Exchange, which was taken as a case study was used. Data was analyzed using multiple regression.

Findings: The Five Factor model explained more variations than the three factor model in that the overall average Adjusted R-squared for the five factor model from all individual portfolio sorting was 0.9 compared to 0.63 for the three factor model.

Unique contribution to theory, practice and policy: The study is particulary unique as it is from a small, developing capital market, most studies are from developed markets.It has contributed to practice by practitioners at the Lusaka Securities exchange in explaining stock return variations.and for policy makers in the business word it implies that when finding the cost of equity they will be need to shift from using models like the Capital Asset Pricing Model and Fama and French three factor model.

Keywords: *Fama and French five factor model , Fama and French three factor model, Stock returns*

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1.0 INTRODUCTION

For decades, finance professionals, researchers, and practitioners have been studying possible ways to explain the relationship between the expected returns on stock and its risk factors. Many researchers have investigated the relationship between expected return and the risk factors associated with stocks. One of the earliest attempts in this regard was made in the 1960s, which led to the creation of the Capital Asset Pricing Model (CAPM) by Sharpe(1964), Lintner (1965), and Mossin (1966). However, an empirical study by Fama and French (1992) showed that the covariance of portfolio return and market return does not explain the changes on portfolio excess returns this led to the development of the Fama and French three factor model. Since then the three factor model has been taken to be the basic and widely used model in the family of factor models .Most recently however, Fama and French modified their three factor model into a five factor model (Fama and French 2015). The three factor model has only three factors, these are risk premium, size and book to market value while the five factor adds two more factors, profitability and investment. Researchers in various stock markets are empirically testing the latest Fama and French Five Factor Model .Testing the Fama and French Five factor model in comparison to the Fama and French three factor model was important because the three factor model is taken to be the basic and widely used model in the family of factor models closely related with the five factor model. This study tested the five factor model in comparison to the three factor model at the Lusaka Securities Exchange. The Lusaka Securities Exchange (LuSE) is the principal stock exchange of Zambia. Founded in 1993, it is located in Lusaka the capital city of Zambia. The LuSE is a member of the African Stock Exchanges Association. By the year 2015, it had 22 listed companies, an increase of 7 companies since 2006. Market capitalization of the Lusaka Securities Exchange (LuSE) at the end of 2015 was 64.3 billion Kwacha, or USD 5.9 billion, representing 26 percent of Zambian GDP. The LuSE share index has increased rapidly in recent years closing with 5,734.7 in 2015.

1.1 Research Purpose and Objectives

Capital markets play important roles in the economies of both developed and developing countries. Among these roles is the provision of resources for capital investment. For countries that are still in the process of developing, such resources are very important as they make it possible for big investments to be undertaken that would have a big push effect to the development process. At the same time, a reliable model that gives an accurate picture of the status and possible direction of the capital market is needed. A number of models for dealing with capital markets have been developed. At the cutting

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edge of these models is the Fama and French Five Factor model that is at the center of both academic and policy debate and is being empirically tested. This study is an effort to contribute to this debate by conducting a case study, where the Zambian capital market is the case. Hence the main objective of this study was to test how the latest Fama and French five factor Model fit the data from the Zambian capital market compare with the way the Fama and French three factor model as the lowest level of the FAMA model fit the same data**.**

2.0 LITERATURE REVIEW

Studies have been done to test the Fama and French five factor model in comparison with the three factor model in various stock markets. Foremost is the study by Fame and French (2015) that tested the performance of the five-factor model for the United States market using the data from July 1963 to December 2013. Their results suggested that a five-factor model performs better than the three-factor model of Fama and French (1993). They also showed that the model's performance is not affected by the way the factors are calculated. They concluded that with two additional factors the three factor model becomes redundant.

Supporting the superiority of the five factor model from the Australian market, Zheng, (2015) tested the performance of five-factor model in comparison to the three factor model. The average adjusted R square for the three factor model was 80.94% compared to the Five Factor model with 81.14%.

Chiah, Chai, Zhong, and Li, (2016) reinforces the finding of Zheng, (2015).They observed that the adjusted R square for the three factor model ranged from 0.59 to 0.65 with an average of 0.63 for individual portfolio sorting of Size - Book to market value, Size- profitability and Size- investment, compared to the five factor model were the adjusted R square ranged from 0.62, to 0.67 with an average of 0.65 from individual portfolio sorting of Size - Book to market value, Size- profitability and Size- investment.

Covering a period of 8 years from August 2007 to July 2015,The study from Vietnam by Nguyen, Ulku and Zhang (2015) tested the five factor model , the results of models showed that the Fama and French five factor model performed better than three-factor in explaining the average returns. The observed average adjusted R square for the three factor model was 89.58 % compared to 90.45% for the Five Factor model. This showed that the five factor model explained more variation than the three factor model. Similar results were found by Shaker and Harshita (2014) in their study of a comparison of asset

pricing models in the Egyptian Stock Market.

Hou, Xue, and Zhang (2016) compared the performance of the Fama and French (2015) five-factor model, with the Hou, Xue, and Zhang (2014) q-factor model, and their variations in the Korean stock market. The adjusted five-factor model outperformed the other factor models in digesting various anomalies in the Korean market.

Cakici (2015) tested the five factor model in comparison to the three factor model using data from 23 countries in North America, Europe, Japan, and Asia Pacific and applied the Fama and French methodology. The sample period was December 1989 to December 2014. The study found strong evidence for the five-factor model in North America, Europe, and Global markets ,similar to the results for the U.S. stock market. However the five-factor model was not consistently better than the three-factor model for Japan and Asia Pacific.

In another study, Singh and Yadav (2015) tested and compared the performance of the three factor model and the five factor model of Fama and French on the Indian stock market. They observed that the five factor asset pricing model of Fama and French (2015) performed better than the three factor model when the underlying portfolios were based on profitability and investment; however the performance of the five factor model was similar to the three factors when based on size. This result suggested that the five factor model performs better than the three factor model when the underlying portfolios are formed on variables not considered in the three factor model. They explained that the underlying reason could be that the two additional factors in the five factor model were based on profitability and investment, therefore adding them in the model better captured the returns for portfolios formed on profitability and investment. The four factor model without an investment factor had the highest explanatory power when the portfolio was not based on investment. For portfolios based on investment sorts, the five factor model had the highest explanatory power. The study was based on the constituent companies of CNX and covered a period of fifteen years – from October 1999 to September 2014.

In another similar study, Martins and Eid, (2015) tested the five factor model in Brazilian market. Their results showed that the Fama and French Five Factor model performed better than previous works in the three-factor model. However, market, SMB and HML factors still performed similarly as previous works as indicated.

Van Veen, (2016) tested the five factor model for European equities listed on the S&P Euro index for the period 2000 to 2016, the research concluded that the five-factor asset pricing does not hold for the 2000 to 2016 time period in the Euro zone, but that the

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three-factor model does hold even though the average returns and risk premiums for the value factor were relatively low.

From the above it can be observed that most of the studies testing the five factor model have been done from the developed stock markets and few from the developing stock markets. This study fills this gap by testing the five factor model at the developing stock market from Africa

3.0 RESEARCH METHODOLOGY

3.1.Research Approach

There are two main research approaches, namely inductive and deductive. Inductive approach means collecting data and developing a theory as a result of data analysis. Deductive approach means confirming a theory. According to Trochim, (2001) researchers who use the deductive approach might begin with thinking up a theory about the topic of interest. Then narrow down into more specific hypotheses that can be tested. They narrow down even further by collecting observations to address and test the hypotheses to confirm (or not) the original theories. This study used deductive approach. The approach was premised on the understanding that the main objective of the study was to test the already existing theory derived from the Fama and French (2015) five factor model.

3.2 Research Design

Within the research methodology or process framework, research strategy is the "general plan of how the researcher will go about answering the research questions and objectives", (Saunders *et al.* 2009). In the context of the current study, the word is taken to be synonymous with research design. For this study, the research strategy used was a case study approach. It was a case study because the Lusaka securities exchange was used as a case for in-depth study.

3.3 Research Method

A research method is a technique used to gather evidence or conduct research (Creswell (2015)). This study used the quantitative method to statistically test the Fama –French five factor model and the three Factor model using data from the Lusaka Securities Exchange.

3.4 Research Population and Sample

At the time of the study, the Lusaka Securities Exchange had a population of 22

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companies listed. Due to the small size of the population, the study intended to capture all the 22 companies; however a sample of 16 firms out of 22 firms listed were conveniently sampled. The 16 companies were picked because they had traded at the Lusaka Securities exchange by 2008 and their financial data was available. Of the 6 that were not picked 3 were listed after 2008 while the other 3 had limited financial data.

3.5 Statistical Analysis

This study sougt to find the how the factors in the models effected the stock returns therefore variation in factors that stock returns there fore multiple regression analysis was used to test the suitability of the Fama and French (2015) five factor model relative to the three factor model using Eviews 7 software. Further from the literature reviewed, most studies (See Fama and French (1993, 2015), Chiah, Chai, Zhong, and Li, (2016), Chiah, etal, (2016)) on this subject have tested the Fama and French five factor model Using regression analysis.

4.0 DATA

The data for this study ranged from 2008 to 2014. The market and financial data was gathered from Lusaka Securities Exchange while the treasury bills rate were collected from bank of Zambia. The data set used included annual stock closing prices which were used to calculate the individual stock expected returns found by dividing the stock price in the current year by the stock price in the previous year, this is similar to Fama and French (1992), where the same formula was used. Other data included annual treasury Bills rates obtained from Bank of Zambia which was used as a proxy for risk-free rates of returns. Annual Lusaka Securities Exchange market price index as a proxy for return on the market portfolio and the, market capitalization found by multiplying the shares outstanding at the year-end by the share price. From the financial statement the following was obtained; Book-to-market equity (denoted by B/M) which is the ratio of book equity to market equity at the year end. Book equity was picked from the financial statements while the market equity was market capitalization of each company (Chiah, Chai, Zhong, and Li, (2016), Fama and French (1992, 2015)). Profitability (denoted by OP) was the ratio of earnings before taxes to book equity at the year end. This definition is in line with the definition of Fama and French (2015) who defined profitability as the annual revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses, all divided by book equity. Investment (denoted by Inv) was the change in total assets of the previous year end divided by total assets at the end of the current year (Chiah, Chai, Zhong, and Li, (2016), Fama and French (1992, 2015))

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4.1. Portfolio Construction

In order to first establish the explanatory power of the five-factor model, in the spirit of Fama and French (1993, 2014), three types of portfolios namely, size and book-to-market, size and profitability, and size and investment portfolios were formed and the expected returns from these portfolios were used as the dependent variable in the test. The portfolios were constructed in the following manner. At the end of each year stocks were allocated to five Size groups (Small to Big) using Lusaka Securities Exchange market capitalization breakpoints. Stocks were also allocated independently to five Book to Market (B/M) groups (Low to High), again using Lusaka Securities Exchange breakpoints. The intersections of the two sorts produce 25 value-weight Size-B/M portfolios. Table 1 shows averages of yearly returns in excess of the Bank of Zambia Treasury bill rate based on first portfolio type size and Book to Market value. The second and third sort, size- profitability and Size-investment were constructed in the similar manner to the size book values only that instead of book value profitability and investment was used. The profitability variable was calculated by finding the ratio of profit before tax and book value which was denoted by shareholders' equity. The investment variable was calculated by finding the change in total assets from the year end of year t-1 to year end of year t, divided by total assets at the year end of year t-1. Table 1 shows averages of yearly returns in excess of the Bank of Zambia Treasury bill rate based on size –book to market, profitability and investment. These were used as a dependent variable.

Table 1: Average yearly returns in excess of the Bank of Zambia Treasury bill rate based on

Size	B/M Low	2	3	4	High B/M
Small	0.79	0.77	0.86	0.77	0.84
2	0.88	0.88	1.00	0.89	0.95
3	0.72	0.71	0.83	0.70	0.77
4	0.84	0.83	0.92	0.83	0.88
Big 5	0.89	0.88	0.96	0.87	0.93

Size	Profit Low 1	2	3	4	5 High
Small 1	0.92	1.02	0.94	1.06	1.12
2	0.87	0.97	0.87	1.01	1.08
3	0.91	1.01	0.94	1.05	1.10
4	0.91	1.02	0.96	1.06	1.12
Big 5	0.84	0.93	0.84	0.97	1.01

Size	Investment Low 1	2	3	4	5 High
Small 1	1.05	1.02	1.05	1.13	0.99
2	0.92	0.86	0.89	0.98	0.85
3	1.06	1.02	1.08	1.14	0.99
4	0.90	0.92	0.98	1.03	0.89
Big 5	0.92	0.89	0.91	0.98	0.87

Source (compiled by the authors)

4.2 Factors Definition and Formulation

Having calculated the excess average return (representing the dependent variable ER-RF), the next step was to construct the five factors (representing independent variables). This study closely followed the empirical design of prior research in order to enhance comparability.

The risk premium factor (Rm-Rf) was calculated by subtracting the bank of Zambia annual treasury bills rate from the Rm factor which was calculated by dividing the Lusaka Securities Exchange closing price index for the previous into the current year's price index (Rm1/Rm0) this is similar to Eraslan (2013), Muthoni (2013) and Fama and French (1992) were the same formula was used.

To construct the SMB (Size), HML (Book/Market), RMl (profitability) and

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CML (investment) factors, the study closely followed the methodology outlined in Fama and French (1993, 2014,15), and Brailsford et al. (2012). To create the SMB (small minus big) and HML (high minus low) factors, six portfolios from the intersections of two size and three book-to market portfolios were formed. To do this, at the end of each year, stocks were first ranked according to their market capitalization. They were then allocated into two size portfolios using the median. The largest 8 stocks in terms of market capitalization were classified as large and the remaining 8 stocks were classified as small. In this approach, large stocks comprised about 93 %, while small stocks comprised approximately 7% of the total market capitalization.

Second, the big stocks were divided into 3 groups using the 30th and 70th percentile of the book-to-market ratio which is the ratio of book equity to market equity at the year end. Following Brailsford et al. (2012b) stocks with book-to market ratios below or equal to the 30th percentile were classified as growth stocks (represented by BL) and stocks with book-to-market ratios higher than the 70th percentile were classified as value stocks(represented by BH). The remaining was classified as neutral stocks (represented by BN). In the same manner, small stocks were divided into 3 groups using the 30th and 70th percentile of the book-to-market ratio Stocks with book-to market ratios below or equal to the 30th percentile were classified as growth stocks (represented by SL) and stocks with book-to-market ratios higher than the 70th percentile were classified as value stocks (represented by SH). The remaining stocks were classified as neutral stocks (represented by SN).This independent size and book-to-market sorts resulted in six portfolios (SL, SN, SH, BL, BN and BH).Basing on individual stock annual expected return, average value-weighted returns on each of the six portfolios were calculated .This procedure was done for each of the seven years under review. From that, two mimicking portfolios, SMB BM (this was called SMB BM because it is based on market to book value) and HML were created. SMB BM was the average return on the three small size portfolios, minus the average return on the three big size portfolios (Small Minus Big). HML was the average return on the two high book-to-market portfolios, minus the average return on the two low book-to-market portfolios (High Minus Low), these factors from the six size and book-to-market portfolios captured the return premiums associated with size and book-to-market. The two formulae below summarize how SMB BM and HML were calculated.

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SMBB/M= (SH+ SN+ SL)/ 3 – (BH+ BN+ BL) / 3

HML= (SH+ BH) / 2 – (SL+ BL) / 2 = [(SH– SL) + (BH - BL)] / 2

Following the same approach as the book to market, portfolios relating to profitability and investment were created only that Profitability and investment were used in place of book to market value. From the profitability, two mimicking portfolios, SMBOP (this was called SMBOP because it is based on profitability) and RMI were created. SMBOP was the average return on the three small size portfolios, minus the average return on the three big size portfolios (Small Minus Big). RML was the average return on the two robust profitability portfolios, minus the average return on the two weaker profitability portfolios (Robust Minus Weak), these factors from the six size and profitability portfolios captured the return premiums associated with size and profitability. The two formulae below summarize how SMBOP and RMl were calculated.

SMBOP= (SR+ SN+ SW) / 3 – (BR+ BN+ BW) / 3

RMW= (SR+ BR) / 2 – (SW+ BW) / 2 = [(SR– SW) + (BR - BW)] / 2

From the investment, two mimicking portfolios, SMB Inv (this was called SMB Inv because it is based on investment) and CMl were created. SMB Inv was the average return on the three small size portfolios , minus the average return on the three big size portfolios (Small Minus Big). CMl was the average return on the two aggressive investment portfolios, minus the average return on the two conservative investment portfolios (Aggressive Minus Conservative), these factors from the six size and investment portfolios captured the return premiums associated with size and investment. The two formulae below summarize how SMB Inv and CMA were calculated.

SMBInv= (SC+ SN+ SA) / 3 – (BC+ BN+ BA) / 3

CMA= (SC+ BC) / 2 – (SA + BA) / 2 = [(SC– SA) + (BC - BA)] / 2

The overall SMB factor defined as the average returns of the three SMB portfolios.(SMB BM, SMB OP and SMB Inv) was calculated basing on the formula below

SMB= (SMBB/M+ SMBOP +SMB Inv) / 3

Table 2: shows the summary of the five factors Risk (Rm-Rf), Size(SBM),Book to market(HML),Profitability(RMl) and Investment (CMl) calculated for the period 2008 to 2014.

Table 2: summary RM,SBM, HML, RMW and CMA for the period 2008 to 2014

Year	Risk (Rm - Rf)	Size (SBM)	Book-Market (HML)	Profit(RML)	Investment(CML)
2008	1.29	-0.47	-0.02	1.58	0.43
2009	0.96	-0.16	0.28	-0.08	0.27
2010	0.94	0.26	0.59	0.08	0.04
2011	1.03	0.08	-0.02	-0.09	0.01
2012	0.83	0.12	0.35	0.13	0.11
2013	1.26	-0.35	0.11	0.51	-0.56
2014	1.2	-0.37	0.2	0.16	0.2

Source (compiled by the authors)

4.3 Diagnostic Tests

Before running the regressions diagnostic tests for the variables were done. During the regression analysis, important assumptions for a valid regression was elaborated and tested in order to ensure that the final regression models were not flawed. The diagnostic tests included the following, firstly testing for normality of the dependent variable and secondly testing the independent variables for multicollinearity. Further heteroskedasticity, autocorrelation, normality tests for the residuals were done after each model was estimated

5.0 RESULTS

While the Fama and French Five factor model incorporates the five factors (risk premium, size,book to market value, profitability and investment).The three factor model has only three factors, risk premium, size and book to market value. Testing the Fama and French Five factor model in comparison to the Fama and French Three factor was important because the three factor model is taken to be the basic and widely used model in the family of factor models closely related with the five factor model. This being the case, in the event that the five factor model performs worse than the three factor model, it can be safely concluded that it would also perform worse than the four factor model, the four factor model being a higher (and more improved version) than the three factor model. Table 3 below shows the summary of the statistical tests for the five and three factor model.

Table 3: Summary of statistical tests for the five and three factor model from individual portfolios

		Five Factor	Three Factor
Statistical Test	**Portfolio sorting**		
Average Adjusted R square	Size BM	0.79	0.60
	Size Profit	0.96	0.70
	Size-Investment	0.96	0.57
	Average	0.90	0.63
Significant intercepts	Size BM	20	19
	Size Profit	23	25
	Size-Investment	22	20
	Average	22	21

5. 1 Adjusted R-Squared

The first test was to compare which of the two models was explaining more of the variation in the dependent variable the expected return. The Adjusted R square from both models was compared to assess this. The average Adjusted R-squared test for the five factor model was 0.79 for the size BM portfolios and 0.96 for both the size profit and investment portfolios, the overall average from the 3 portfolio sorting was of 0.9 .For the three factor model it was 0.60 for the size BM portfolios, 0.70 for the size profit and 0.57 for investment portfolios. The overall average from the three portfolio sorting was of 0.63. Table 4 which is at the end gives the details of the detailed adjusted R square tests for each of the 25 portfolios sorting and each of the three sorting namely Size –Book to market, Size –profitability and Size –Investment.

5.2 Intercepts

The second test was to check if both models completely captured all the variation in expected returns. If an asset pricing model completely captures expected returns, the regression intercept is indistinguishable from zero (equal to zero) (French 1992, 2015).

The intercepts from each of the 25 individual portfolio sorting were compared for both models. As can be observed from table 3 above, the three factor model left 19, 25 and 20 significant alphas from portfolio sorting for Size –Book to market, Size –profitability and

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Size –Investment respectively an average of 21. While the Five factor model left 20,23 and 23 significant alphas from portfolio sorting, for Size –Book to market, Size – profitability and Size–Investment respectively an average of 22. Table 5 which is at the end gives the details of the detailed intercept tests for each of the 25 portfolios sorting.

5.3 Discussion of the Results

The Adjusted R-squared test indicated that the five factor model was better than the three factor model for practical purposes because its Adjusted R-squared average of 0.9 was higher than the 0.63 for the three factors Model from all individual portfolio sorting. This results are similar to Chiah, Chai, Zhong, and Li, (2016), Nguyen, Ulku and Zhang (2015)

Both models, absolute intercept were not equal to zero. This means that both the Fama and French five factor and the three factor model do not completely explain the variation in excess return in the Zambia case. This is in line with Fama and French who stated that ,If an asset pricing model completely captures expected returns, the regression intercept is indistinguishable from zero (equal to zero) (French 1992, 2015). Similar results were found by Singh and Yadav (2015) , Cakici, (2015) and Zheng, (2015) .

5.4 Practical Implications

This research has tested the Fame and French Five factor model in comparison to the Fama and French three factor model. The Adjusted R-squared test indicated that the Five Factor model is better than the three factor model. Therefore on this score, the model does well as far as the Zambian capital market is concerned and can be used for practical purposes by practitioners at the Lusaka Securities exchange to explain stock return variations.Further it can be used by finance manager to estimate the cost of equity wich is one of the major components of the cost of capital.

5.5. Limitations and Recommendations

The limitation of the study relates to the study period.The study used a period of 7 years. extending the period would have better, but this would have meant limiting the number of companies as only about 13 companies were listed by the year 2005 as the Lusaka securities exchange is a small market. Hence a seven year period was deemed appropriate in order to capture more firms that were listed on the Lusaka Securities Exchange later than 2007. This period is comparable to that used by similar research like Chandra, and Idrus (2015) in the study of testing Fama and French three factors model within the Context of Indonesia Stock Exchange (this study took four

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year),Shaker and Elgiziry (2014) in their study of a comparison of asset pricing models in the Egyptian Stock Market(this study took 5 years) , Nghiem (2015), in the study of Risk-return relationship.

This research focused on quantitative market and firm factors that influence stock prices, further research should be done on qualitative factors that influence stock prices. Secondly, this research focused on one stock market (the Zambian stock market), further research for the five factor model should be done for other stock markets in the sub-Sahara and Africa as a whole. Thirdly, although findings for this research reinforces the support for the superiority of the Fama and French (2014-15) five factor model in explaining variation in stock returns. It is not clear if it also improves the forecasting power, therefore more research focusing on the forecasting power of the latest five factor model should be done in other stock markets worldwide to confirm if it is any better than the CAPM and the three factor model in forecasting stock market trends.

6.0 CONCLUSION

This research has tested the Fame and French Five factor model in comparison to the Fama and French three factor model. Using the data from the emerging capital market. The Adjusted R-squared test indicated that the five Factor model is better than the three factor model in explaining variation in stock returns because it's Adjusted R-squared had an overall average of 0.9 while that for the three factor had 0.63 .Based on the findings from quantitative data, it is clear that the Fama and French Five Factor model is better than the three factor model in explaining variation in expected returns of the Zambian data. Therefore on this score, the model does well as far as the Zambian capital market is concerned and can be used for practical purposes.

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TABLES

Table 4: Adjusted R-Square from all three individual portfolio sorting for the Five factor Model and the three factor model

Table 4 Pannel A: Adjusted R-Square Five factor Model

B/M R squared

Size	B/M Low	2	3	4	High B/M
Small	0.6134	0.7950	0.8855	0.8965	0.7643
2	0.9356	0.9635	1.0000	0.9944	0.9561
3	0.3246	0.4741	0.7964	0.6384	0.5298
4	0.6736	0.9250	0.9725	0.9843	0.8463
Big 5	0.7473	0.7730	0.8846	0.7126	0.7370

R squre

Size	Profit Low	2	3	4	High profit
Small	0.9399	0.8719	0.9385	0.9869	0.9844
2	0.9743	0.8998	0.9678	0.9947	0.9884
3	0.9876	0.9997	0.9833	0.9691	0.9979
4	0.9881	0.9446	0.9958	0.9975	0.9910
Big 5	0.9087	0.9885	0.8991	0.8278	0.9745

Ad R squre

Size	Invest Low	2	3	4	High Invest
Small	0.9998	0.9948	0.9818	0.9883	0.9936
2	0.9830	0.9917	0.9999	0.9154	0.8856
3	0.9857	0.9944	0.9985	0.9276	0.8959
4	0.9754	0.9974	0.9958	0.9388	0.9390
Big 5	0.9786	0.9660	0.7320	0.9985	0.9445

Source: (compiled by the author)

International Journal of Economics
ISSN 2518-8437 (Online)
Vol.3, Issue 1, No.3, pp 30 - 48, 2018

Table 4 Panel B: Adjusted R-Square three factor Model

R square

Size	B/M Low	2	3	4	High B/M
Small	0.3383	0.6879	0.8253	0.7770	0.4958
2	0.8335	0.4422	0.7329	0.7796	0.6839
3	0.2756	0.0857	0.4731	0.5480	0.4291
4	0.4741	0.4189	0.6729	0.7909	0.8213
Big 5	0.7173	0.4803	0.7340	0.8296	0.6512

Profitability R sqaure

Size	Profit/Low	2	3	4	High Profit
Small	0.8060	0.5868	0.8227	0.6277	0.5707
2	0.9405	0.6719	0.8649	0.9103	0.6336
3	0.9473	0.8588	0.8336	0.9430	0.5660
4	0.4815	0.3536	0.5163	0.8533	0.7785
Big 5	0.4658	0.4597	0.3837	0.7752	0.7489

Investment Adj R sqaure

Size	invest/Low	2	3	4	High Invest
Small	0.3239	0.5464	0.5723	0.6794	0.2782
2	0.9680	0.6620	0.8981	0.7535	0.4463
3	0.3578	0.9610	0.9921	0.8904	0.8770
4	0.6299	0.4445	0.5805	0.6474	0.2129
Big 5	0.5539	0.3064	0.4437	0.3962	0.0113

Source (compiled by the author)

International Journal of Economics
ISSN 2518-8437 (Online)
Vol.3, Issue 1, No.3, pp 30 - 48, 2018
www.iprjb.org

Table 5 :Regression Intercepts from all three individual portfolio sorting for the Five factor Model and the three factor Model

Table 5 Panel A Regretion intercepts Five factor Model

Regression Intercepts

Size	B/M Low	2	3	4	High B/M
Small	-2.2979*	-1.0679*	-2.71927*	-2.9121*	-3.4229*
2	0.8662	2.1358*	1.2387*	1.0838*	0.0374
3	0.3592	1.5696*	1.0764*	-0.4803	-0.9094*
4	0.7735*	-1.5874*	-3.1269*	-3.289*	-3.7778*
Big 5	1.1097*	2.1937*	0.7095*	0.5327*	-0.4148

*significant at 0.05 leve

Intercepts

Size	Profit Low	2	3	4	High profit
Small	-1.3605*	-2.1114*	-1.6326*	-1.8174*	-0.6230*
2	-0.7978*	-1.5394*	-1.2167*	-1.2078*	-0.0081
3	-0.7160*	-1.4739*	-1.0201*	-1.1168*	0.0825*
4	-0.6672*	-1.4138*	-0.9534*	-1.1310*	0.0190
Big 5	-0.1957*	-0.7957*	-0.6913*	-0.6985*	-0.0264

Investment Intercepts

Size	Invest Low	2	3	4	High Invest
Small	-1.8413*	-0.6829*	-1.9855*	-2.39746*	-0.0039
2	-0.9978*	0.1040*	-1.2467*	-1.7841*	0.5299*
3	-1.9276*	-0.7887*	-1.8957*	-2.5852*	0.0293
4	-0.7330*	0.3100*	-0.8572*	-1.5773*	0.8565*
Big 5	-1.4018*	-0.2657*	1.0748*	-2.0605*	0.3291*

Source (compiled by the author)

International Journal of Economics
ISSN 2518-8437 (Online)
Vol.3, Issue 1, No.3, pp 30 - 48, 2018
www.iprjb.org

Table 5 Panel A Regretion intercepts three factor Model

Intercepts

Size	B/M Low	2	3	4	High B/M
Small	-0.7354*	-0.6946*	-2.1114*	-1.8521*	-1.9999*
2	-0.1948	-0.2490	-1.2650*	-0.8737*	-1.4857*
3	-0.4025	-0.3204	-1.1259*	-1.5904*	-1.5667*
4	-2.2329*	-2.0893*	-3.4666*	-3.1686*	-3.1512*
Big 5	0.3393	0.3121	-0.9891*	-0.6460*	-1.2506*

*significant at 0.05 level

Panel B Size -profit 3 factor intercepts

Size	Prof /Low	2	3	4	High Profit
Small	-0.7147*	-0.6833*	-0.9173*	-1.3148*	-1.5136*
2	-0.6464*	-0.6347*	-0.5380*	-1.2864*	-1.6033*
3	-0.7258*	-0.6916*	-0.9492*	-1.2872*	-1.4738*
4	-0.9299*	-0.9187*	-1.3587*	-1.5564*	-1.8111*
Big 5	-0.4065*	-0.3998*	-0.3763*	-1.1170*	-1.1384*

*significant at 0.05 level

Investment Intercepts

Size	invest/Low	2	3	4	High Invest
Small	-0.7554*	-1.2845*	-1.7044*	-1.8621*	-0.0498
2	-0.8475*	-1.1135*	-1.4869*	-1.6461*	0.3117*
3	-0.8444*	-1.3325*	-2.1668*	-1.8682*	0.0006
4	-0.9312*	-1.4979*	-2.5091*	-2.0832*	-0.1866
Big 5	0.1680	-0.294125	-0.7439*	-0.8883*	1.0086*

*significant at 0.05 level