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Day of the week effect on stock returns and volatility in emerging and frontier markets in Africa.

Mbonoka, Faith Mbula
Strathmore Institute of Mathematical Sciences
Strathmore University

Day of The Week Effect on Stock Returns and Volatility In Emerging and Frontier Markets in Africa

124672– Faith Mbula Mbonoka

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Strathmore University
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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

Signature:
Date: 27/10/2021
Faith Mbula Mbonoka

This Research Project proposal has been submitted for examination with my approval as the Supervisor

Signature:
Date:
Dr. Samuel Tiriongo

Strathmore Institute of Mathematical Sciences
Strathmore University

Abstract

The study examines the day of the week effect on average stock returns and compares the daily price volatilities in emerging and frontier markets in Africa. The study focuses on eight key stock markets in Africa's emerging and frontier markets of Nigeria, Botswana, Egypt, Tunisia, South Africa, Kenya, Mauritius and Morocco for the period May 11th, 2018 to May 12th, 2021. Average stock returns generated from daily closing price indices are regressed against a measure of volatility while controlling for trading day effect. From the findings based on a static panel data regression analysis, there is a Monday effect evident across both the emerging and frontier markets. In addition, there is also evident statistically significant differences in the volatility patterns across the days of the week in the emerging and frontier markets. In particular, Thursday records the highest average volatility and Monday the least in the emerging markets, while Friday and Tuesday show the highest and lowest volatilities in the frontier markets respectively. The research findings contribute to empirical literature on risk-return analyses generating useful insights for investment decision making. Based on these findings, investors will be able to make better investment selections based on return and risk; possibly prompting them to consider day of the week in their trading strategies.

Keywords: Day of the Week Effect, Volatility, Emerging Market, Frontier Market.

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List of abbreviations

APT- Arbitrage Pricing Theory
CAPM- Capital Asset Pricing Model
ARCH- Autoregressive Conditional Heteroscedasticity
GARCH- Generalized Autoregressive Conditional Heteroscedasticity
OLS- Ordinary Least Squares
JSE- Johannesburg Stock Exchange
NGSE- Nigerian Stock Exchange
NSE- Nairobi Securities Exchange
BSE- Botswana Stock Exchange
SEM- Stock Exchange of Mauritius
EGX- The Egyptian Exchange
CSE- Casablanca Stock Exchange
BVMT- Tunisia Stock Exchange
EMH- Efficient Market Hypothesis
ASPI- All Share Price Index

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VT OMNES
VNVM SINT

Chapter 1

Introduction

1.1 Background of the study

Day of the week effect is one of the calendar anomalies that has been studied by researchers and documented in finance literature across various parts of the world. Bahadur & Joshi (2005) [7] defines day of week effect as the indication that the average daily returns and volatility of a stock is different for all the trading days, contrary to the efficient market theory. It is believed that one of the vital reasons for the day of the week effect is the settlement date. For example, if this date is two days later, it will take four days to complete a contract made on Friday due to the weekend as a result of which investors have an addition two days to use their cash in different markets (such as investment in money markets and gathering extra returns). Behavioral finance literature also suggests that firms release bad news that might have an effect on equity prices on the weekends but release good news straightaway. Thus, Monday returns are likely to be negative [19]; [30]. French (1980) [30] points out that "if firms fear panic selling when bad news is announced, they may delay the announcement until the weekend". Because of this strategy, firms give investors more time to digest bad news to prevent them from acting abruptly. Damodaran (1989) [19] also notes that firms more often than not report bad news nearer to the weekend, and particularly after the close of trading on Friday. This bad news affects the returns of the subsequent trading day that is typically Monday. This anomaly has however not been explained by any of the asset pricing models such as the CAPM and the APT.

Several empirical studies have recently used versions of the GARCH models to explore the time series behavior of stock prices in terms of volatility. French, Schwert, & Stambaugh (1987) [31] ; Akgiray (1989) [2] ; Baillie & DeGennaro (1990) [8]; Hamao, Masulis, & V.Ng (1990) [39]; Nelson (1991) [59];

studies examine if there is any day of the week effect on stock return volatility. When making investment decisions, it's critical to understand whether stock return volatility varies by day of the week, and whether a high (low) return corresponds to a correspondingly high (low) volatility for that day [46]. This is because returns do not represent just one part of the decision-making process. Another half that has to be taken under consideration when one makes investment decisions is the risk or volatility of returns. Investors look to maximize returns and minimizing variance in accordance with the Markowitz modern portfolio theory [53].The optimal portfolio is considered the efficient portfolio with the maximum expected utility, meaning that the portfolio with the highest return for a given degree of risk the investor is willing to undertake on the efficient frontier will or should be chosen. The day of the week effect anomaly is therefore identified in terms of market return and volatility. Recommendation of a specific pattern can prompt investors to use trading rules to manage their portfolio in order to achieve higher-than-average returns.

Empirical studies have found that the day of the week effect appears not only in the United States, which is the biggest capital market in the world, and other developed markets such as the United Kingdom, France, Canada, Australia, Japan, but also in emerging markets such as China, Malaysia, Hong Kong and Turkey [5]. Literature to date does not provide an adequate explanation for the day of the week effects phenomenon [5]. Additionally, there have been recent technological changes that allow electronic trades as well as developments in the management of a risk-warrant system that may not allow the relative importance of the day of the week effect to exist but may still persist [32].

Investors face a higher risk when investing in emerging markets[1] [1] ,as they are known to be highly competitive and industrialized leading to high returns for investors from investments. The higher the risk, the higher the return and this would result in greater volatility of interest rates. However, in frontier markets[2] investors face a lower risk [37] .Share prices tend to behave differently in these markets [86] .In Africa, South Africa, Egypt are examples of emerging markets while Kenya, Mauritius and Morocco are examples of frontier markets[3]. The day of the week effect was considered since it is the most prevalent in the African markets and due to changing market conditions; it is most likely to influence the volatility of stock prices [80] . Besides, volatility was considered since it is the main factor that differentiates a frontier market from an emerging market.

[1] Are those that are in the process of becoming a developed economy

[2] Are less advanced economies in the developing world

[3] A frontier market, on the other hand, is referred to a nation that is more developed than the least developed country, but less developed than the emerging market [9].

Using the Markov switching model, a study was conducted by Obalade & Muzindutsi (2017) [60] to determine the days of the week influence in African stock markets. The results demonstrated that the day of week impact exists in one regime but not in the other. In conclusion, [60] discovered that all the markets, except the Johannesburg Stock Exchange (an emerging market in Africa), had a higher tendency to become bearish[4] instead of bullish and therefore, active investment management can help investors to realize gains in most African stock markets during the bearish conditions. From the findings of this study, a market being bearish is not a contributor to the day of the week effect as all the stock markets selected displayed no day of week effect.

Du Toit, Hall, & Pradhan (2018) [23] focused on the effect of the anomaly in South Africa stock market. The study by [60] focused on all markets including South Africa and Ghana. The results of [23] revealed that the highest returns were observed on Monday and the lowest returns on Friday and thus, investors could outperform the market. Gbeda & Peprah (2018) [33] in a similar study, observed that the Ghana Stock Exchange had no effect on the day of the week, however the Nairobi Stock Exchange had a Friday effect. Therefore, previous studies were inconclusive if the day of the week effect was evident in the African stock markets, whether frontier or emerging.

Other anomalies, which have conjointly been studied, include weekend effect and January effect. These anomalies are usually a contradiction to the EMH projected by Fama (1970) [27] which states that at any point in time, stock prices mirror all the market information; the past, publicly controlled or privately held information, which no investor may make any arbitrage profits through insider information.

1.2 The Problem statement

Based on efficient market hypothesis theory, investors cannot outperform the market since the share prices mirror all the information available in the market [51]. However, the occurrence of anomalies allows investors to evaluate stock market returns and, as a result, determine when to purchase or sell their shares in order to maximize profits. Over the years, researchers have looked into how these anomalies influences stock returns in emerging and frontier economies. Local and international studies have been conducted on

[4] In a bear market, more investors are looking to sell than buy therefore leading to a drop in prices therefore a drop in returns.

the day of the week effect. A study on stock, bond and foreign exchange markets by Flannery & Protopapadakis (1998) [28], Tang (1977) [79] and Yamori & Mourdoukow (2003) [84] detected the presence of the day of the week effect while no significant differences in the returns during the days of the week were noted by Al-Jafari (2011) [3]. Joseph et al., (2013) [43] concluded that the Kenyan securities market was not an efficient market at the semi-strong level as investors would be able to foresee the market and profit abnormally by trading on publicly available information such as dividend releases. Most local studies focused on the Nairobi Securities Exchange, a frontier market, with little research on other emerging markets[5] and frontier markets[6]. This indicates a lack of empirical study on the subject. Furthermore, because the authorities have put in place rules and regulations that may or may not prevent the existence of anomalies, this study considers these markets. As a result, conducting this research contributes to a better understanding of why some markets have the day of the week anomaly while others do not. A study by Gkillas et. al, (2021) [35] discovered that the day of the week effect and insider trading had a substantial positive correlation. The current research therefore compares how the day of the week effect manifests itself in Africa's frontier and emergent markets.

1.3 Objectives of the study

1.3.1 General Objective

The general objective of this study is to determine the existence of the day of the week effect on stock returns and volatility in Africa's emerging and frontier markets guided by IMF(2008) [41].

1.3.2 Specific Objectives

The specific objectives of this research are;

(i) To determine and compare how the occurrence of the day of the week anomaly affects average stock returns in Africa's emerging and frontier markets.

(ii) To compare the volatility of stock returns over the trading days in Africa's emergent and frontier markets.

[5]Emerging; South Africa, Egypt
[6]Frontier; Kenya, Mauritius, Morocco, Tunisia, Botswana, Nigeria

1.4 Significance of the study

The study will be of value to many stakeholders. Firstly, this study will profit current and future investors by helping them formulate strategies that maximize their returns based on the day of the week. Investors will be able to identify when to purchase and when to sell in order to make a profit by understanding the volatility of stock prices on different days of the week. However, as identified by the Efficient Market Hypothesis (EMH), this anomaly tends to correct itself in the long as the prices of shares are dependent on all the information that is publicly available in the market and thus, the findings in this study will help current and prospective investors to understand this. Besides, rational investors will benefit from this study because they will learn how to track the performance of stock market.

Secondly, Government policymakers, such as the Capital Markets Authority, will profit from the study. They will specifically use the findings of this study to develop trading laws and regulations that will promote the expansion of Africa's emerging and frontier markets. Besides, these strategies will help them to mitigate market distortions.

Finally, the study will make a great contribution to the existing literature. Future scholars will use this study in their theoretical and empirical reviews.

1.5 Scope of the study

The scope of the study was frontier and emerging markets in Africa. The daily closing prices from the stock market Indices of South Africa, Egypt, Kenya, Botswana, Mauritius, Nigeria, Morocco and Tunisia were used to compute the stock return and the volatility between May 11th, 2018 and May 12th, 2021. The emerging markets studied were South Africa and Egypt, while the frontier markets were Kenya, Botswana, Mauritius, Nigeria, Morocco and Tunisia. For this study, public holidays were excluded. Only the days of the week effect was considered.

Chapter 2

Literature Review

2.1 Introduction

This chapter begins by reviewing the stock return models that have been established. The Capital Asset Pricing Model (CAPM), Arbitrage Pricing Theory, and Efficient Market Hypothesis are examples of these models. The focus was on recent research related to the research topic that have been conducted by other researchers. The day of the week, extensively addressed in this chapter, is an anomaly.

The day of the week effect has been analyzed in different stock markets around the world finding proof of returns and their volatilities in certain days of the week being significantly and systematically different from the other days of the week. Because the market remains bearish on Monday, it is normally regarded as a weak day, whereas Friday is considered bullish. The latter can be supported with the explanation given by Mehdian & Perry (2001) [55] that investors' trust is shaken by adverse news, which is usually announced over the weekend. This encourages them to sell their stock the following Monday. As Kiymaz & Berument (2003) [46] pointed out, knowing whether there are variations in stock return volatility by day-of-the-week patterns and whether a high (low) return is related with a comparable high (low) return for a specific day is critical. Maurice & Levi (1982) [54] claims that the day-of-week effect can be explained in part by the time lag between stock trading and settlements and clearance checks.

Finally, the study presented a conceptual framework, which was used to guide the research and show the relationship between the dependent and independent variables.

2.2 Theoretical Literature

2.2.1 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) [75] uses factor-driven strategies such as the risk premia and the smart beta to determine the cost of equity. When markets become highly volatile, a stock with a beta of greater than one will experience even greater volatility when compared to the market, which could result in high returns during upside volatility and low returns during downside volatility.

Several studies have used the capital assets pricing model to explain the risk and return of assets. Wang, Huang, &Hu (2017) [83] used the capital assets pricing model to gain an understanding of reverse engineering and real options in the Taiwan Stock Market, while Rojo-Suárez et al., (2020) [69] used CAPM to determine whether high trading activity enhances the validity of CAPM in the United Kingdom equity market by analyzing time varying betas, liquidities and anomalies in the equity market.

Further research on the model has documented inconsistent factors leading to the casting of doubt on the practicability and applicability of the CAPM model. The inconsistencies may be as a result of the market being inefficiency or because of misspecification of the static CAPM [27] . Reinganum (1981) [67], Sakouvogui & Nganje (2017) [72], Gospodinov, Kan, & Robotti(2019) [36] and Ball (1978) [11] on the contrary, find that the inconsistencies are caused by model misspecification and not market inefficiency. The size effect, value effect, leverage effect and earnings to price ratio effect are examples of some of the important inconsistent factors.

2.2.2 Arbitrage Pricing Theory

For APT, there are a number of non-diversifiable[1] risk variables that are systematic or macroeconomic in nature and, as a result, have an impact on all stock returns to some extent.

Several studies have used the arbitrage pricing theory to explain the anomalies that exist in equity markets. Huynh (2018) [40] used the arbitrage pricing theory to explain the anomalies in the Australian stock market, while Zaremba & Czapkiewicz (2017) [85] used the arbitrage pricing theory to digest the existence of anomalies in the emerging European markets.

APT is a one-period model in which each investor believes the stochastic features of capital asset returns are consistent with a factor structure.

[1] Different from CAPM as it only assumes one risk factor: market risk

Ross (1976) [70] claims that the expected returns on assets are essentially directly proportional to the factor loadings if equilibrium prices give no arbitrage possibilities over static asset portfolios. Ross (1976) theory's empirical reasoning is based on the exclusion of arbitrage. His demonstration demonstrates that in a market where investors maximize diverse forms of utility, the linear price connection is a necessary condition for equilibrium.

2.2.3 Efficient Market Hypothesis

The efficient market hypothesis developed by Fama (1970) [27] is defined as; at any point in time, stock prices mirror all the market information; the past, publicly controlled or privately held information, which no investor may make any arbitrage profits through insider information. He [27] also argues that an efficient market is made up of a large number of rational and profit-maximizing investors who work hard to predict future market prices of specific securities. If a market is efficient at any given time, a security's current price is a reasonable estimate of its underlying value.

In addition, the ideal market is one that would entail no transaction costs in the trading of securities and that all relevant information for market players may be received at no cost from a theoretical perspective [27]. Furthermore, all market participants would agree on the implications of current data for current prices and future price distributions. A perfectly frictionless market characterizes this situation, and prices would reflect all available information. However, in practice, these requirements are difficult to meet in their entirety. Furthermore, the efficient market hypothesis only considers whether stock prices at any given time accurately reflect all relevant information.

The weak form, semi-strong form, and strong form of market efficiency are the three types [27]. For a weak form efficient market, EMH states that stock returns are serially uncorrelated and have a constant mean. The market is termed semi-strong efficient when prices instantly reflect any new publicly available information. Lastly, if prices represent all sorts of information, whether publicly or privately available, a market is said to have a strong form efficiency. The weak-form tests study the information contained in historical prices, this explains why technical trading rules aren't always profitable and why daily stock returns have a low serial correlation. The semi-strong form tests how fast prices change or respond to the publicly available information (beyond historical prices) while the strong-form, the tests are based on the idea that no individual has a better return than others because he or she has exclusive access to certain information.

2.3 Empirical Studies

2.3.1 International Studies

Findings by French (1980) [30] were consistent with those of Cross (1973) [17]. French studied the Standard and Poor's composite index for the period 1953-1977. His findings revealed that returns were still dependent on the day of the week, with Monday mean returns being significantly negative and Wednesday to Friday mean returns being significantly positive.

French (1980) and Gibbon & Hess (1981) [34] conducted two independent studies. From their findings, the projected percentage changes for equities differed significantly depending on the day of the week. From 1962 through 1968, the study spanned approximately 4,000 trading days. The predicted percentage change on Monday was found to be negative, whereas the expected percentage change on Wednesdays and Fridays was found to be greater than on Tuesdays and Thursdays.

Lee, Pettit & Swankoski (1990) [49]during the study period of 1980 to 1988, the day-of-the-week effect was observed in the majority of Asian stock markets. Their findings were very similar to those of prior researchers [17], [27], and [34]. Hong Kong, Japan, Korea and Singapore had negative mean returns on Mondays, but particularly on Tuesdays. For S&P 500 however, Monday returns were significantly negative compared to the Asian stock markets for the period under study. The equally weighted US index, on the other hand, had generally negative Monday returns. This shows contrasting results. Besides, the studies were conducted in the United States equity markets, whereas the current study was conducted in the African equity markets.

The effect of the day of the week on the Paris Bourse was investigated by Solnik & Bousquet (1990) [77]. On Tuesday, they discovered a substantial and consistent negative return, which was similar to the findings of the studies on Australia and Japan. Barone (1990) [12] findings are also similar to the results of the Italian stock market which saw the biggest drop in stock prices in the first two days of the week, but it was more obvious on Tuesday. The above studies examined the day of the week effect in France, Australia, Japan and Italy, while the current study focused on Africa.

Choudhry (2000) [16] examined calendar anomaly in the Asian emerging markets, including India. According to his finding, Friday returns were significantly positive in the Indian stock market for the study period 1990-1995. This finding follows the majority of previous empirical findings by [17] and [34] in the US markets. These studies focused on calendar effects, which

can include the day of the week, the time of the year, the decade within the century, the time of the month, the time within the presidential cycle and so forth. On the other hand, the current study focused on only the day of the week. Furthermore, the studies were conducted in Asian emerging markets and the US markets, while the current study focus was only on the African markets.

2.3.2 Studies focusing on the selected markets

Local studies have additionally been conducted. For example, Kulavi (2013) [47] aimed to test whether the NSE has a day of the week effect and if there is a link between the day of the week and stock market volatility. Daily prices and market indices for the 50 listed companies at the NSE for the study period 2008-2012 were used in a descriptive research approach. The presence of day of the week was discovered, with the highest volatility on Monday and the lowest volatility on Thursday. The study focused on Kenya, whereas the current study focuses on South Africa, Egypt, Kenya, Botswana, Mauritius, Nigeria, Morocco and Tunisia. Analyzing them together assisted in determining whether the anomaly in one market has any relationship to the anomaly in another.

For the period 1990-2012, Kuria & Riro (2013) [48] looked at the effect of the day of the week, weekend effect, and monthly effect anomalies in Nairobi Securities Exchange (NSE). Several hypotheses were formulated for the t-test, F-test and the ANOVA. The study discovered that there is a seasonal influence at the NSE. Similarly, this study focused only on Kenya, while the current study focuses on other countries too such as South Africa, Egypt, Botswana, Nigeria, Mauritius, Tunisia and Morocco.

Sifuna (2012) [76] examined the day of the week anomaly at the NSE. Regression analysis where dummy variables represented the days of the week was used. The daily market capitalization was used to compute the stock return. The findings of the study discovered that the day of the week had no effect on stock returns for the years 2008-2011 and Stock return volatility is highest on Tuesday and lowest on Friday. Similarly, this study focused only on Kenya, while the current study focuses on other countries too such as South Africa, Egypt, Botswana, Nigeria, Mauritius, Tunisia and Morocco.

Rutto (2014) [71] through empirical observation aimed to ascertain the existence of the Monday effect on stock returns at the NSE. The study adopted descriptive survey design where companies that constitute the 20-share index were used as a sample drawn from the target population of the 62 companies that were listed at the NSE as at 31 December 2013. Secondary sources were used as a source of the data of the daily closing share prices.

Natural logarithm of daily relative mean index value was used to measure daily returns. Regression statistic was used to test the Monday effect on the stock prices at the NSE. Findings showed that daily stock returns fall after Friday with negative returns recorded on Mondays. Further, the findings confirmed the existence of the day of the week effect at the NSE. Similarly, this study focused only on Kenya, while the current study focuses on other countries too such as South Africa, Egypt, Botswana, Nigeria, Mauritius, Tunisia and Morocco.

Ndako (2010) [58] sought to assess the day of the week effect in the NGSE and JSE stock markets' mean and variance equations except for the Nigerian daily returns, which covered only the post-liberalization period due to a lack of data for the pre-liberalization period. The analysis spanned two periods: pre-liberalization and post-liberalization. From the findings, the day of the week effect was only evident on Fridays in the mean equation during Nigeria's post-liberalization period, but it was present on Tuesdays and Thursdays in the variance equation. During the pre-liberalization period in South Africa, Mondays and Fridays showed presence of day of the week. Thursdays exhibited day of week in the mean equation throughout the post-liberalization period, but it was only present on Fridays in the variance equation. A descriptive research design was used in this study. Daily pricing and market indexes for the JSE and NGSE from 1 January 1990 to 30 November 2010 were used.

Derbali & Hallara (2016) [21] studied the impact of the day of the week anomaly on the return and volatility of the Tunisian stock exchange index (TUNINDEX). The study employed a descriptive research design and data from the 31st of December 1997 to the 7th of April 2014. There was a significant beneficial influence on Thursdays and the return at time $(t-1)$ on the return and volatility of TUNINDEX in a threshold of 1%, according to the empirical findings. The analysis also discovered a strong negative effect on the TUNINDEX return and volatility on Tuesday.

Bundoo (2008) [15] goal of study was to look into the effect of the day of the week and the influence of January effect at the SEM. Wednesday and Friday effects were found to be positive and statistically significant. A Monday impact was also discovered; however, it was much lesser in magnitude. The January effect was discovered to be non-existent. The data used was from January 2004 to December 2006, and the study used a descriptive research method.

Kalidas et al., (2013) [44] studied the day of the week effect and the changes in the patterns of returns for several African stock markets; South Africa, Nigeria, Zambia, Botswana and Morocco. South Africa did not show any

day-of-the-week effects. However, Nigeria, Zambia, Botswana, and Morocco all showed inefficiency at varying levels of significance and return patterns. The study adopted a descriptive research design. Daily index data for South Africa, Zambia, Botswana, Nigeria, and Morocco were used for the period 2004 to 2012.

Aly, Mehdian& Perry (2004) [4] examined daily returns for the CMA Index from 1998-2001 to test for the Monday effect in the Egyptian equity market. The study adopted a descriptive research design. The Egyptian stock market's Monday returns were positive and considerable on average, but not considerably different from the rest of the week's returns. As a result, no evidence of daily seasonal patterns in the Egyptian stock market was discovered.

Since investors are normally risk-averse by nature [50] , they are not solely interested in the variation of their returns however additionally on its volatility. Following the fall of the Bretton Woods system, financial markets have experienced increased volatility in comparison to previous decades. Hence, financial theory has paid particular attention to the study of the evolution of volatility in stock markets and consequently has developed models, which analyze stock market volatility through a conditional variance component. Furthermore, as indicated by Ho and Cheung (1994) "a formal test on the variations of volatility across days of the week is interesting because it is important to know if the higher return on a particular weekday is simply a reward for higher risk on that day". Thus, when carrying out the decision-making process, rational financial decision makers concentrate not solely on returns however additionally on risk or volatility of returns.

Finding certain patterns in volatility could also be helpful in varied ways. Investors have a better insight when implementing investment strategies for hedging and speculative purposes. Financial advisors, financial managers, and bankers also benefit from them, for instance by determining a specific day for the initial stock issuance and as indicated by Engle (1993) [25] . Investors who detest risk may want to make changes to their portfolios by lowering their investments in assets whose volatility is expected to rise.

2.4 Conceptual Framework

2.4.1 Analyzing average stock return

There is a discussion about whether it is better to summarize return information in percentages rather than dollars because your return is independent of how much you invest [56]. Percentages show how much money we get for every dollar we put in. Average Return is given by the sum of each of

the values being considered divided by the total number of the values. The historical average of the individual values can alternatively be calculated as the total of the multiple one-period rates of return divided by the number of periods [42].

2.4.2 Analyzing stock return volatility

Understanding how to calculate and measure a return enables us to value risky assets. According to Fabozzi & Francis (1980) [26], risk in the financial field means the uncertainty that can be measured in terms of variance or standard deviation, which can also be interpreted as asset volatility. Volatility is a term used to describe the level of risk or uncertainty associated with the size of variations in a security's value. A security's value can potentially be spread out over a greater range of values if its volatility is higher. This means that the security's price can swing drastically in either way in a short period of time. Lower volatility indicates that the value of an asset does not vary substantially and is more stable. Quantifying the asset's daily returns is one technique to measure its variation. The degree of variability in an asset's returns is represented by historical volatility, which is based on past prices.

While variance represents the dispersion of returns around an asset's mean in general, volatility is a measure of that variance over a defined time period. As a result, we can report volatility on a daily, weekly, monthly, or annually basis. Beta coefficients, option pricing models, and standard deviations of returns are all examples of approaches to assess volatility.

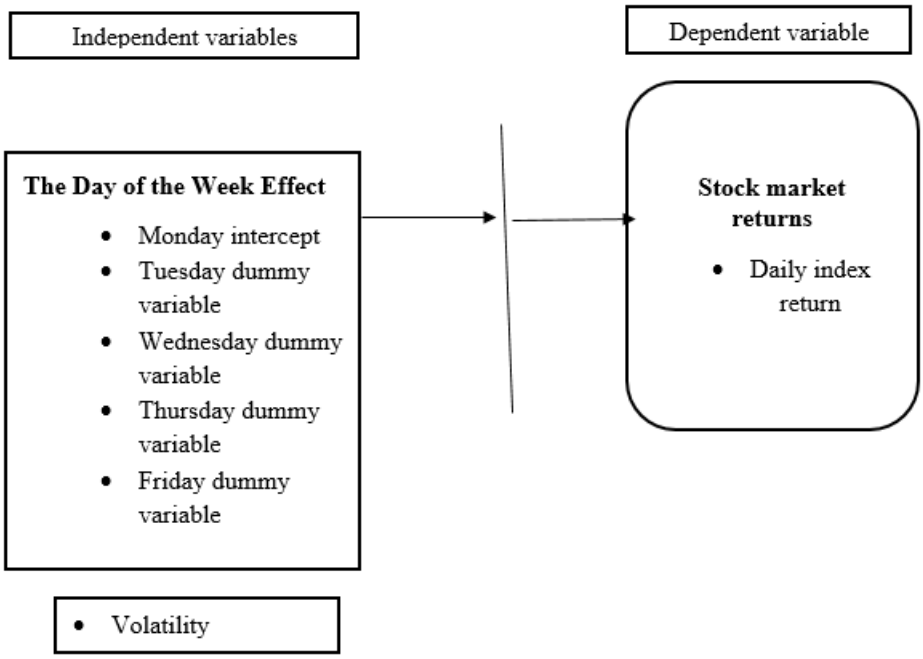
2.4.3 Other factors that affect stock returns

There are other factors that affect stock returns. One factor is supply and demand. Stock prices change every day by market forces. This is due to the change in share prices caused by changes in the supply or demand of the stock. If more investors want to buy a stock (demand) than sell the stock (supply), this leads to the increase in price which therefore leads to an increase in the stock returns and vice versa. Other factors include the Inflation rate, exchange rate, Treasury bill rate and Dividend Yield. Most studies done on Inflation conclude that expected inflation can either positively or negatively impact stocks, depending on the investor's ability to hedge and the government's monetary policy [74]. Increase in exchange rate decreases the expected returns [64]. When the economy is weak, companies post weak earnings and investors sell their stocks to put their money in conservative investments such as bonds and certificates of deposit. This causes bond prices to rise and stock prices to fall leading to low returns. When bond prices rise, yields drop. The Treasury Bill rate has a significant

impact on the asset returns of the various market segments, the NSE - 20 Share Price Index and all market returns as a whole [57].

2.4.4 Day of the week

A relationship is expected to occur between the day of the week effect and stock market returns. Varpio et al., (2020) [81] argues that a conceptual framework assists the researcher to clarify all the aspects of the study. A conceptual framework for the study is illustrated below on how the day of the week affects stock market returns and volatility in Africa's emerging and frontier markets. In addition to this, the figure conceptualizes that the day of the week effect was evident in some emerging and frontier markets in Africa and it influenced the volatility of stock market returns.



The daily index return is used as the dependent variable, and four daily dummy variables (Tuesday, Wednesday, Thursday and Friday) are used as the independent variables, to test for the day of the week effect. Conversely, typically represented by the intercept (Monday is picked as the reference category). The intercept is the average returns for Monday, the first trading day of the week, while the other dummy variables are the average deviation of returns from the intercept's average return (Monday's return).

Variable	Proxy definitions	How to measure
Independent		
Monday intercept	$\emptyset_1$	Average returns for the first trading day of the week
Tuesday dummy variable	D_{2t}	Average deviation of returns of Tuesday from the average return of Monday
Wednesday dummy variable	D_{3t}	Average deviation of returns of Wednesday from the average return of Monday
Thursday dummy variable	D_{4t}	Average deviation of returns of Thursday from the average return of Monday
Friday dummy variable	D_{5t}	Average deviation of returns of Friday from the average return of Monday
Volatility	σ	Standard deviation of Daily index return
Dependent		
Stock market returns	R_t	Daily index return

2.5 Research Gaps

In the last decade, various studies have been conducted on the day of the week anomaly internationally but little research has been done in Africa's markets specifically, the frontier and emerging markets. For instance, the researchers Karanovic & Bisera (2018) [45] analyzed the day of the week effect in Balkan markets, but not on in Africa's frontier and emerging markets. Obalade & Muzindutsi (2019) [61] focused on all calendar effects, but the current study focuses on only the day of the week anomaly. Previous

studies carried out examined the day of the week effect, the weekend effect and the monthly effect Kuria & Riro (2013) [48] in Kenya, but not other emerging and frontier African countries. In addition, the studies done on the selected countries by Derbali & Hallara (2016) [21], Bundoo (2008) [15], Aly, Mehdian, & Perry (2004) [4] also did not do a comparison to see how the day of the week manifests itself in these various markets. Therefore, inadequate research was done on this topic. The current study compares the evidence of the day of the week effect in Africa's frontier and emerging markets.

Chapter 3

Methodology

3.1 Introduction

This chapter shows the methods that are used to collect and analyze the data. It includes the research design, population of the study, sample, sampling frame, research methods and data analysis.

3.2 Research Design

Panel data design is adopted in this study.Panel data allows you to control for variables you cannot observe or measure like cultural factors or difference in business practices across companies; or variables that change over time but not across entities (i.e. national policies, federal regulations, international agreements, etc.) [63]. For this study, the researcher employed this research design to give important characteristics concerning "the day of the week effect of emerging and frontier markets in Africa".

3.3 Target Population

Zhao et al.,(2013) [87] argued that a population (target) contains of things that have similar characteristics and which are of interest to the researcher. The target population for this study includes emerging and frontier markets in Africa. Currently, there are two emerging markets and five frontier markets in Africa as listed by the MSCI classification of African equity markets.

3.4 Sample and Sampling Frame

The eight stock markets chosen as depicted in the table 3.1 are listed on the MSCI classification of African equity markets.

Stock Exchange	Frontier or Emerging
JSE (South Africa)	Emerging
EGX (Egypt)	Emerging
NSE (Kenya)	Frontier
BSE (Botswana)	Frontier
SEM (Mauritius)	Frontier
NGSE (Nigeria)	Frontier
CSE (Morocco)	Frontier
BVMT (Tunisia)	Frontier

Figure 3.1: Summary of Target Population

The sampling frame is the various emerging and frontier markets in Africa. A sampling frame specifies the elements of a target population from which a sample will be drawn.

3.5 Data Collection Methods and Procedures

This research used only secondary sources of data, which is retrieved from the various stock exchanges. The period of study is from May 11th, 2018 to May 12th, 2021.

3.6 Returns

A return is calculated for each day as the logarithmic change in the value of the index from the preceding day. Daily Returns in the market are expressed in the local currency for each country and are computed as Brooks (2008) [14]:

$$R_t = \log[P_t/P_{t-1}] \tag{3.1}$$

This is the continuously compounded return for the market for the period under study, where p_t is the close price at time t [14]. The log returns are preferred to relative returns because of their additive nature with respect to aggregation over different time periods [14].

3.7 Day of the week effect on stock returns

This study employs a Static Panel regression model on the daily effect equation. A static model is preferred to a dynamic model because, the independent variables are serially correlated and the composite error term is serially correlated and not independent of the lagged dependent variable.This therefore, gives inconsistent estimates of the coefficients for the pooled dynamic model. The bias persists regardless of the size of N, T and of any choice of instruments [78]. This inconsistency was first noted by Robertson & Symons (1992) [68] and examined more rigorously by Pesaran and Smith (1995) [65].

The accuracy and strength of three panel regression models; Pooled OLS Model, Fixed Effects Model and Random Effects Model are tested on the panel data, including the F test for individual effects [63], the Hausman test [63], and the Breusch-Pagan Lagrange multiplier (LM) test [63].

To examine the suitability of a pooled model to a fixed effect model, the F test is used [63]. The null hypothesis states that no significant panel effects exist, while the alternative hypothesis states that significant effects do exist. To assess the applicability of fixed effects and random effects models, the Hausman endogeneity test is used. Its null hypothesis is that random effects is present in panel data over the alternative hypothesis, fixed effects is present in data [63]. The Breusch-Pagan Lagrange Multiplier (LM) is employed to test for random effects as the final test in the model selection criterion. The null hypothesis claims that there is no variance across entities (no panel effects), whereas the alternative hypothesis states that panel effects do exist [63].

The daily effect equation used is;

$$R_{it} = \phi_1 + \phi_2 D_{2,it} + \phi_3 D_{3,it} + \phi_4 D_{4,it} + \phi_5 D_{5,it} + \phi_6 \sigma_{it} + \epsilon_{it} \tag{3.2}$$

Where;

R_{it}= the log returns of the market index

ϕ_1= intercept or (depicting the average return for the reference category)

ϕ_2 to ϕ_5 = the coefficients of the dummy variables

ϕ_6= coefficient of volatility

σ_{it}= volatility

$D_{2,it}$ to $D_{5,it}$= Dummy variable for Tuesday,Wednesday,Thursday and Friday.

ϵ_{it} = error term which is heteroskedastic and serially correlated if the independent variables are serially correlated [78].

The dummy variables represent the average deviation of return from our intercept, which is the average return on Monday.

The null hypothesis to be evaluated to see if the daily average returns across weekdays are comparable, implying that no day of the week exists is:

H_0: $\phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5$

H_1: at least one ϕ_i is different

A P-value of less than 0.05 for any day of the week means that at least one day has a substantial impact on the index return, indicating that the day of the week effect exists. All of the selected countries are subjected to the regression analysis.

3.8 Volatility

Volatility is a statistical measure of the variation of returns for a given security or market index. In most cases, the higher the volatility, the riskier the security. Standard deviation estimations from the past are frequently used to calculate current and future volatility [14]. This study adopted standard deviation of the logarithmic returns as the measure of volatility for the emerging and frontier markets.

$$\sigma = \sqrt{\sum_{i=1}^{n}[R_i - m]^2/[n-1]} \tag{3.3}$$

Where;
σ = standard deviation

R_i= price of returns

i = cross section(individual market)

m = mean of all observations

n = number of observations for the particular market

An F-test is also performed.This statistical test for differences is to confirm the status on the differences or similarities of the daily return volatilities if any.

Chapter 4

Results and Discussion

4.1 Analysis of statistics for stock returns

Figure A.1 in the appendix gives the summary statistics for the eight stock exchanges' daily data spanning the sample period May 11th, 2018 to May 12th, 2021. The daily mean return for the JSE and BVMT markets were found to be positive while those for the other markets were found to be negative. JSE has the highest positive mean return of 0.05% with the lowest mean negative return of -0.05% posted by EGX.

The variance for the Stock Markets returns are relatively small with the emerging markets having the highest; JSE having the highest variance of 0.00019 followed by EGX with 0.00015. All the daily returns for the Stock Markets are negatively skewed apart from JSE, NGSE and BSE which are positively skewed. In addition, all the daily returns for the Stock Markets exhibit high levels of kurtosis greater than three.

A low variance is associated with a lower risk therefore, a lower return. The positive and negative skewness of the returns lead to the conclusion that they are asymmetric. A level of kurtosis greater than three displayed by all the daily returns clearly indicate that the distribution is leptokurtic. The returns distribution is therefore not normally distributed, and this confirms the stylized fact that financial data is mostly non-uniform Radke (2005) [66]. The histograms in the Appendix A.2 and A.3 also show that the return distribution for all the stock markets are not normally distributed.

4.2 Day of the week

4.2.1 Model selection

	Test	p-value	hypothesis
Emerging	F-test	2.699e-11	no significant panel effects
	Hausman	2.2e-16	random effects is present

Table 4.1: Model selection (emerging)

	Test	p-value	hypothesis
Frontier	F-test	4e-07	no significant panel effects
	Hausman	0.4683	random effects is present
	Breusch-Pagan	2.2e-16	there is no variance across entities

Table 4.2: Model selection (frontier)

From the findings of 4.1 and 4.2 for the F-test, the null hypothesis that no significant panel effects can be rejected at the 5% decision criteria level for both the emerging and frontier market. This is because, the tests yielded a p-value of 2.699e-11, for the emerging market and a p-value of 4e-07 for the frontier market which are less than the 5% level of significance. Therefore, a fixed effect is the better model.

From the results of the Hausman endogeneity test, the null hypothesis that random effects are present in panel data can be rejected at the 5% level of significance for the emerging market because, the tests yielded a p-value of 2.2e-16 which is less than 0.05. Therefore, a fixed effect is the better model. However, the tests yielded a p-value of 0.4683 for the frontier, which is greater than 0.05. Therefore, Random effects model is the most applicable for the frontier market.

The null hypothesis can be rejected at the 5% level of significance for the the Breusch-Pagan Lagrange Multiplier (LM) for the frontier market because, the tests yielded a p-value of 2.2e-16 , which is less than 0.05. Therefore, panel effects are present.

Because there was evidence of significant effects, no Random effects or significant differences for the emerging market, it was determined that the Fixed Effect model is the best applicable regression model for the emerging market. Since this is the preferred model, the effect of Covid-19 is accounted for as the Fixed model allows for the existence of time-invariant unobservable.

However, because there was evidence of panel effects, Random effects and significant differences for the frontier markets, it was determined that the Random Effects model is the best applicable regression model for the frontier market. Since Random Effects is the most preferred, then this means that controlling for the Covid-19 effects during the study period is rendered redundant.

4.2.2 Static Panel Regression Results

Regression Results for the emerging and frontier markets				
	Emerging (Fixed)		Frontier (Random)	
	Coefficient	p-value	Coefficient	p-value
(Intercept)	0.0011666	0.0000165	0.0001111	0.1937557
Tue	-0.0000227	0.9513715	0.0000000	0.9998459
Wed	-0.0000454	0.9029189	-0.0000018	0.9879976
Thu	-0.0000481	0.8972234	-0.0000048	0.9672084
Fri	-0.0000198	0.9575966	-0.0000001	0.9992442
Sd	-0.1915724	0.00000009	-0.0927994	0.0000000
Multipe R^2	0.1976		0.028687	
Adjusted R^2	0.195		0.027646	
F-statistic	76.45		137.86	
p-value	2.22e-16		2.2e-16	
Observations	1568		4704	

Table 4.3: Static Panel Regression Results

From the findings of Table 4.3, all the other days are not significantly different from Monday as neither has a p-value less than 0.05 using a usual 5% decision criteria level for the emerging market. We therefore lack enough evidence to show that the Day has a significant effect on the daily returns of stocks at the emerging markets. Tuesday through to Friday record negative coefficients which implies that returns in these four days, are lower(though not significantly) than on Monday. Since all weekday parameters are non-significant the null hypothesis that the daily average returns across weekdays are on average equal cannot be rejected. This finding is in line with Kalidas, Mbululu, & Chipeta (2013) [44] and Aly, Mehdian, & Perry (2004) [4].

For the frontier market, Tuesday to Friday average returns are not significantly different from Monday's as neither have a p-value less than 0.05. We therefore lack enough evidence to show that the Day has a significant effect on the daily returns of stocks at the Frontier markets. Wednesday to Friday record negative coefficients which implies that returns in these three days, are lower than on Monday. Tuesday records a positive coefficient implying returns on Tuesday's are the highest. Since all the weekday parameters are not significant, the null hypothesis that the daily average returns across weekdays are statistically equal cannot therefore be rejected. This finding is in line with Kalidas, Mbululu, & Chipeta(2013) [44], Aly, Mehdian, & Perry (2004) [4], [15] and [21].

From the findings in Table 4.3, the R^2 for the emerging market is 0.1976 while that of the frontier market is 0.028687. R^2 of 0.1976 for the emerging market implies that 19.76% of the average daily return is explained by the day of the week and volatility, while the R^2 of 0.028687 for the frontier market implies that 2.87% of the average daily return is explained by the day of the week and volatility within the same period. The p-values for the F-statistics for the general models are 2.22e-16 and 2.2e-16 for the emerging and frontier markets respectively. They are both lower than the decision criteria level 0.05 which implies that the regression models used are significant.

4.3 Volatility of Stock Log Returns

	Mon	Tue	Wed	Thur	Fri
Emerging	0.004915	0.007653	0.005724	0.012473	0.006422
Frontier	0.002031	0.001487	0.001678	0.004334	0.004426

Table 4.4: Volatility by day of the week

N ; Emerging = 1568, Frontier = 4704

	Mon	Tue	Wed	Thur	Fri
JSE	0.011347	0.018652	0.012728	0.006854	0.016743
EGX	0.005372	0.005052	0.005049	0.024827	0.006882
NSE	0.003685	0.003720	0.003300	0.003576	0.004138
BSE	0.001748	0.001233	0.000701	0.013184	0.013320
SEM	0.002109	0.001168	0.001402	0.004270	0.006448
NGSE	0.003925	0.003414	0.003067	0.003718	0.004060
CSE	0.006337	0.004495	0.003941	0.005211	0.006486
BVMT	0.004588	0.004516	0.005432	0.004565	0.004755

Table 4.5: Volatility by day for each of the selected stock markets

Day	Emerging (p-value)	Frontier (p-value)
MonTue	0.2654	0.1426
MonWed	0.6977	0.3669
MonThur	0.02519	0.0005718
MonFri	0.4972	0.0004123
TueWed	0.4614	0.5672
TueThur	0.2208	2.739e-06
TueFri	0.655	1.853e-06
WedThur	0.05702	2.429e-05
WedFri	0.7693	1.679e-05
ThurFri	0.1009	0.9209

Table 4.6: F-test(statistical test for differences)

From the findings of Table 4.4, the emerging market records the highest volatility compared to the frontier market which is in line with the findings obtained by Ahmed et al.,(2018) [1]. This implies that the stock's price movement is relatively higher in the emerging market compared to the frontier market.

Thursday records the highest volatility compared to the other days of the week while Monday records the lowest in the emerging Market. Tuesday

records the lowest volatility compared to the other days of the week while Friday records the highest in the frontier market. This might be explained by large trade volumes where, on Thursday and Friday stocks are purchased in large quantities for the emerging and frontier markets respectively, while Monday and Tuesday stocks are sold in large quantities in the emerging and frontier markets respectively.

The volatilities of the frontier markets reveal that they are similar to emerging markets on a country-by-country basis, according to the findings of table 4.5.However, investors who would prefer to invest on a portfolio of emerging and frontier markets than the individual countries, should consider the whole portfolio's volatility. JSE, an emerging market records the highest volatility out of all the eight stock markets while BSE, a frontier market records the lowest volatility. This can be due to local investors rather than multinational investors, dominating frontier markets. That means they are less vulnerable to the surge of international sentiment, which can cause volatility by withdrawing capital when the world economy is weak and reintroducing it when it is strong. NSE, BSE, SEM, NGSE and CSE from the frontier market record the highest volatility on Fridays with the lowest recorded on Wednesdays apart from SEM which records the lowest on Tuesday.

From the findings of table 4.6 for the emerging market, only one p-value of F-test p = 0.025419 is less than 0.05. Therefore, there is a significant difference between the two volatilities of Monday and Thursday. For the frontier market, six p-value of F-test p = 0.0005718, 0.0004123, 2.739e-06, 1.853e-06, 2.429e-05 and 1.679e-05 are less than 0.05.Therefore,there is a significant difference between the volatilities of Monday and Thursday, Monday and Friday, Tuesday and Thursday,Tuesday and Friday, Wednesday and Thursday, and Wednesday and Friday respectively. According to the findings, frontiers have a distinct advantage over the emerging market.This is because, as noted above, the number of significant differences present among the frontiers are more than among the emerging markets. Thus, a stock in the frontier market will experience more price movement as opposed to a stock in the emerging market, as the volatilities are seen to significantly change by the day.

Chapter 5

Conclusions and Recommendations

5.1 Conclusions and Recommendations

5.1.1 Conclusions

The first objective of the study was to determine and compare the effect of the existence of the day of the week effect on average stock returns of emerging and frontier markets in Africa. It also sought to check if the daily average returns across the weekdays are relatively equal. From the findings, both the emerging and frontier markets displayed no day of week anomaly.

The highest return in the emerging market is recorded on Monday while the lowest is recorded on Thursday. This therefore makes Thursday the best day to buy stocks and Monday the best day to sell stocks in the emerging market. For the frontier market, Tuesday records the highest return while Thursday records the least return. This therefore, makes Tuesday the best day to sell your stocks and Thursday the best day to buy stocks in the frontier market. There's also a Monday effect present in both markets, though significant only in emerging markets. From the Monday effect, if the market was up on Friday, it will continue to rise on Monday. According to the research findings, in both markets, there's a rise in returns from Friday to Monday.

The second objective of the study was to compare the volatility of the stock returns among the days of the week for the emerging and frontier markets in Africa. From the findings, the volatility pattern across the days of the week for both the emerging and frontier market are not statistically similar. Thursday records the highest volatility while Friday records the lowest in

the emerging market.However, Tuesday records the lowest volatility while Friday records the highest in the frontier market. In addition, there are variations in volatility of stock returns by the day of the week and a high return is associated with a correspondingly low volatility for the two markets. For the emerging market, the highest return is recorded on Monday and lowest on Thursday. For the frontier market, the highest return is recorded on Tuesday and the lowest on Thursday.

The results above depict some weak (statistically insignificant) day of the week effects on stock returns across the emerging and frontier markets. It is also noted that the differences in stock return volatilities do not seem to be effectively passed-through to stock returns, implying some challenges or market rigidities inefficiencies present in these markets, more so among the frontier markets.

5.1.2 Recommendations

More volatility, according to the research findings, indicates a greater likelihood of a market decline, whereas lower volatility indicates a greater likelihood of a market rise. As a result, investors can use this long-term stock market volatility data to align their portfolios with the associated expected returns.

The study only considered eight countries; two from the emerging market and six from the frontier market. To improve the quality of the inferences, it is recommended that the data set be increased to incorporate more countries, more so the non-emerging-non-frontier markets to comprehensively define the idiosyncrasies across these markets. This is because larger sample sizes provide more accurate mean values, identify outliers that could skew the data in a smaller sample and provide a smaller margin of error.

The study only considered the effect of the day of the week anomaly and volatility on the stock returns within the same period (in a static model). There may be some dynamic effects, particularly of volatility on the stock returns.

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Appendix A

Appendices

A.1 Summary Statistics

	JSE(South Africa)	EGX (Egypt)	NSE (Kenya)	BSE (Botswana)	SEM (Mauritius)	NGSE (Nigeria)	CSE (Morocco)	BVMT (Tunisia)
Mean	0.00047	-0.00052	-0.00036	-0.00018	-0.00026	-0.00011	-0.000004	0.00007
Variance	0.00019	0.00015	0.00001	0.00007	0.00001	0.00001	0.00003	0.00002
Kurtosis	63.7715	511.5546	5.9648	369.7614	298.2389	7.2642	21.8591	5.4584
Skewness	0.0078	-20.5548	-0.5045	0.1482	-15.7571	0.4044	-2.6096	-0.1537
Minimum	-0.1474	-0.3068	-0.0272	-0.1644	-0.0776	-0.0187	-0.0490	-0.02375
Maximum	0.1464	0.0437	0.0150	0.1650	0.0067	0.0224	0.0242	0.0298
Observations	784	784	784	784	784	784	784	784

Figure A.1: Summary Statistics for Stock Returns

A.2 Histograms

A.2.1 Emerging Market

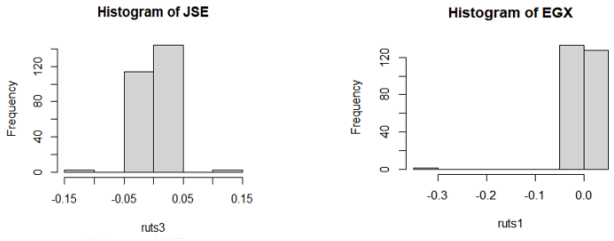

Figure A.2: Histogram graphs showing the return distribution for the Emerging stock markets

A.2.2 Frontier Market

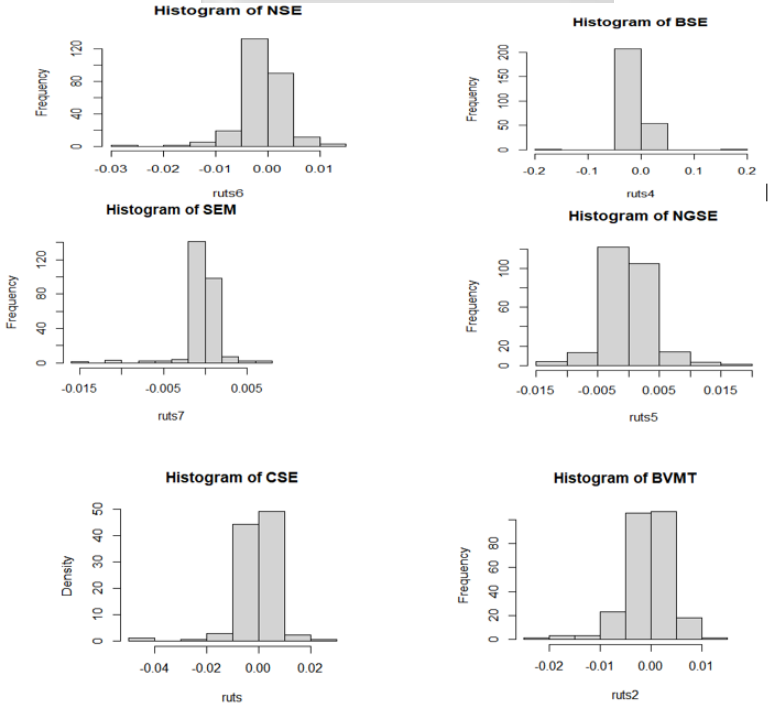

Figure A.3: Histogram graphs showing the return distribution for the Frontier stock markets