FACULTY OF COMMERCE, LAW & MANAGEMENT

MASTER OF MANAGEMENT (FINANCE AND INVESTMENT)

TOPIC: A STUDY OF EXCHANGE RATE VOLATILITY, STOCK AND BOND RETURNS IN DEVELOPING COUNTRIES

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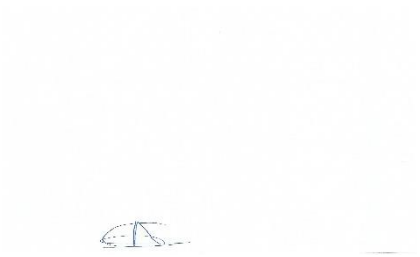
DECLARATION

I declare that this thesis has been written my Chioma Ama-Njoku unless where otherwise stated. This research has not been submitted to any third party or university for evaluation. This report is submitted to the University of Witwatersrand and may be used by the University in the manner they deem will be most fit.



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ABSTRACT

There has been reports of past movements in stock-bond and stock to exchange rate volatility transmissions. However, studies on volatility transmissions between exchange rate and bonds seem to be non-existent, hence the need to determine the relationship between all these three variables. This study analyzes the link between exchange rate volatility, stock and bond returns in selected countries including Nigeria, Ghana, Kenya, South Africa, and India, using monthly time series data for a period of 5-years (2008-2012). The ARCH (Autoregressive conditional heteroscedasticity) and the more advanced GARCH (Generalized autoregressive heteroscedasticity) models are employed to generate volatilities for exchange rate, stock and bond returns. This is done to take a deeper look at how exchange rates reacted in each country since the year 2007 of the global financial crisis. The test for stationarity, and the order of integration of the data were conducted to get rid of any spurious regression results, using the ADF (Augmented Dickey-fuller method) method.

The results showed a negative relationship between exchange rate and stock returns, but exchange rate volatility was insignificant for the stock market in Ghana, Nigeria and India. The relationship between the stock market and exchange rate volatility in Kenya and South Africa was positive. Bond returns were negatively correlated to exchange rate volatility in the Indian, Nigerian, and Kenyan markets, whereas, a positively relationship was found in South African bond market. The study concluded that although exchange rates can explain the cause of movement in stock prices, there are some other variables that cause a movement in stock returns and bond returns other than exchange rates such as inflation and money supply.

Keywords: Exchange rate volatility, stock return, bond return, ARCH/GARCH

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

The tendency of a foreign currency to appreciate or depreciate/ or movements in exchange rates are referred to as exchange rate volatility (Mburu, 2015; Ilhan, 2006). The impact it has on stock market return affects price stability, firm profitability, general economic stability, and has adverse implications on international trade (Benita and Lauterbach, 2004). Apart from exchange rates being an important common factor that drives stock returns, other factors include, dividend, stock prices of other countries, interest rates and employment (Kurihara, 2006). An appreciation of a domestic currency to a foreign currency paves way for cheaper selling prices in the foreign currency, which decreases sales in the foreign country and thus also decreasing future cash flows (dividends) of a company in that country, thereby, decreasing stock prices, and vice versa is the case. A decrease in future cash flows due to an exchange rate appreciation would cause a retrenchment of staff (employment rate will fall) and increases interest rates (vice versa is the case).

Indications of exchange rate volatility on any financial system mostly manifest through the stock market (Adjasi, Harvey and Agyapong, 2008), and portrays the economic conditions of a country. Exchange rate risks arise because of exchange rate volatility, which adversely affects the volume of international trade and the balance of payments accounts (Ilhan, 2006). International and trade decisions are hard to make due to the volatile exchange rates since volatility increases exchange rate risk (potential to lose money due to the change in exchange rates) (Suranovic, 2005). Hooper and Kohlhagen's (1978) theoretical analysis that risk-adverse traders suffer higher costs and less foreign trade due to exchange rate volatility support this.

The financial systems in most African economies and South Africa are exposed to volatile exchange rates (Ng'ambi, 2015). The Bretton Woods System collapsed in 1973 and since then, many countries have implemented a flexible exchange rate system (Omojimite and Akpokodje, 2010). As a result, world financial markets suffered from large movements in their nominal exchange rates. However, its impact on the exchange rate regime makes firms add risk premium to the cost of goods traded to increase the price and lower external trade, which would have significant implications on the trade and the growth of countries (Omojimite and Akpokodje, 2010).

A study conducted by Broda and Tille (2003) on the effect of the exchange rate regime in developing countries regarding the fluctuations in their terms of trade revealed that fluctuations in flexible exchange rates would offset movements in the exchange rates. However, a country with fixed exchange rates is likely to experience substantial swings in output (Alagidede and Ibrahim, 2016). The floating exchange rate system, most especially affects stock market in which investors are the greatest players. Exchange rates may appreciate or depreciate at any time depending on the rules and laws of a country. The competitiveness of a country's exports is reduced by the appreciation of its domestic currency, impacting negatively on the stock market (Yücel and Kurt, 2003). This also stimulates imports, as their costs will be cheaper and the exports becoming relatively expensive hence a loss incurring on stock prices.

In the 1980's, this was the primary cause for the adoption of an economic reform program, with exchange rate liberalization as a major component for most African countries (Akpokodje and Omojimite, 2010). According to Adjasi, Biekpe and Osei (2011), the reform programmes to liberalize exchange rate regimes continued in the mid-1990s in Ghana, Kenya, Tunisia, Mauritius, Uganda, Nigeria and South Africa, due to the drastic movements in the currency of these African countries. Presently, most sub-Saharan African countries such as Zambia, Ghana, Kenya, Uganda, have continued the liberalization reforms in two areas: international trade and exchange rate regimes (Mahle, Teferra and Khachatryan, 2013).

Exchange rate volatility is a function of financial liberalization[1] (Servén, 2003). Financial liberalization was put in place to eliminate the restrictions on financial markets and institutions by regulating the movement of currency to and from a country and its trade patterns, paving way for investment in financial assets such as bonds and stocks. In South Asian countries, there is a rise in the study in the way exchange rates relate with stock prices because of the liberalization of foreign capital and the adoption of floating exchange rate regimes (Alam, Nguyen, and Majumdar, 2009). This has paved way for international investment in, and a rise in volatility of foreign exchange markets (Rahman and Uddin, 2009; Phylaktis, and Ravazzolo, 2005).

[1] Financial liberalization (FL) is the deregulation of domestic financial markets and liberalization of capital markets. Retrieved from: http://www.romainranciere.com/research/palgrave.pdf

Monetary policy-oriented countries maintain their exchange rates in either pegged or floating exchange rate systems. Adoption of a variable exchange rate in most countries, intensified globalisation and economic cooperation, increased trade between countries, liberalized the economies and increased exchange rate volatility (Khosa, Botha and Pretorius, 2015). According to Dornbusch, (1998), Reisen and Soto (2001), there has been a stream of capital flows into Africa's capital market by some international investors which was powered by promising growth prospects in Africa. The authors discussed further on the benefits capital flows had on developing countries in relation to the following: alleviating poverty, promoting growth and economic development, financing savings gap, resource allocation and job creation.

In normal business operations, businesses and governments sometimes fund themselves by selling bonds. Bonds are long-term debt securities, which are issued by the public to either corporations or government to raise capital (funds). If a foreign investor wants to purchase a local bond, they will have to purchase it in its local currency. For example, a German Investor will have to purchase South African rand to buy South African government bonds listed on the Johannesburg Securities Exchange.

Bond markets are financial markets that allow the trade of debt securities in terms of buying and selling debt in the form of bonds[2]. There is a wide variation in the types of bonds that exist from callable bonds, zero-coupon bonds and floating rate notes to those mentioned by Oji (2015) such as: Sovereign bonds, corporate bonds, Treasury bonds, Islamic bond, Agency bonds, and Municipal bonds. Diaspora bonds are issued in; Ethiopia, India and Israel; Islamic bonds (sukuk bonds) issued in Nigeria, Gambia, Gabon, United Arab Emirates, Saudi Arabia, Malaysia, Indonesia; Sovereign bonds issued in Ghana, Rwanda, etc. However, most of these African developing countries also issue sovereign bonds. Factors that affect bond returns stem not from exchange rates alone, but also from other common factors including interest rates, inflation, duration of bond and others. Country specific factors such as domestic interest rates, inflation, interest rates in main currency areas, and external shocks also affect bond yields[3] (Gadanecz, Miyajima, & Shu, 2014).

[2] For more information on bond markets see:
http://www.stanlib.com/Individuals/knowledgecentre/Pages/Bondmarketsandbondmarketinstruments.aspx

[3] Bond yields and bond returns are terms that shall be used interchangeably to mean one and the same thing.

The rise for sovereign bonds[4] necessary to finance developing countries has in turn caused a rise in both debt and currency crises, due to the growth in value and coverage of international bonds (a rise from $8.91 to $61.47 billion in 2002) (Oji, 2015). However, the link between exchange rate policy and these crises is quite vague. According to Jahjah and Yue (2004), who are of the view that the values of sovereign bonds denominated in US dollar, euros, or other hard currencies and countries in which bonds are issued rely on exchange rate systems, are affected by devaluations or speculative attacks on exchange rate arrangements.

With respect to the issuance of sovereign bonds in developing countries, Reinhart (2002) showed that these countries experience a great deal of default and currency crises. Investigations conducted to determine the causes of sovereign debt spreads in sovereign loans. Some authors such as Eichengreen and Mody (1998), Kamin and Kleist (1999), Jahjah, and Yue, (2004) used data on individual bonds issued in developing countries to analyse bond spreads in primary markets and study the global bond market.

The means of financing African countries has been of outmost concern, especially as they have been experiencing steady state growth in their bond markets. This has made them remain undeveloped (Mu, Phelps and Stotsky, 2013). Without access to alternative sources of finance such as the bond market, African countries could find it difficult to maintain a stable state of economic growth in their financial markets. However, with well-functioning bond markets, African countries will experience improved intermediation between savers and lenders- users (Mu, Phelps and Stotsky, 2013).

The association of stock returns and bond returns lies upon investor preference. Investors who are more risk averse seek to invest more in bonds than stock, whereas, investors who are risk seekers invest more of their money in equity markets (stock market) and those who are risk neutral invest in both bonds and stocks. Investors who seek more risk aim to get a high return for the risk they have taken. An investor's decision on whether to choose between stocks and bonds depends on their evaluation of market and economic conditions. They would often place their capital on investments which seem to maximize returns for the risk taken. Stocks tend to rise in good times when there is high employment, strong corporate earnings and rising

[4] Sovereign bonds are bonds issued by government and are dominated in either the local currency of a country or its counterpart (foreign currency).

consumer prices. However, in periods of these high stocks, bonds fall out of favour and offer higher yields to meet up to the rise in stocks (FXStreet Expert Contributor, 2011).

Bond and stock returns are both affected by movements in interest rates. In their attempt towards depicting associations linking interest rate and stock prices, Arslaner, Karaman, Arslaner, and Kal (2014) showed that the decrease in the return and stock prices, increase in the opportunity cost of money for companies is due to higher interest rates (opposite holds for lower interest rates). However, they mentioned that interest rates are lowered due to a high money supply and this in effect causes an increase in inflation. The shift from fixed to floating exchange rate regime in Nigeria, Ghana, Kenya, India and South Africa have led to series of fluctuations in their exchange rates. Each country actively being involved in trade with each other, their exchange rates are highly volatile, the Rand being the most volatile of all other currencies. There has also been a rise in the use of bonds and stocks to better boost their financial systems and enhance economic growth.

This study will determine the link that exists between bond returns, stock returns and exchange rate volatility. Not much has been done on the correlation between bond markets to exchange rate volatility and stock returns. Hence, the purpose of this study is to determine if such relationship exists between the above-mentioned variables.

1.2. Problem Statement

Numerous investigations sought towards determining the positive/negative relations linking the stock market and the exchange rate market. These findings were structured more towards developed and emerging markets as opposed to developing markets (Agyapong, 2009; Aggrawal, 1981; Soenen and Hennigar, 1988). African markets are hardly researched, for instance Agyapong (2009) stated that the Ghanaian market being an emerging market has been one of the least researched. African markets are regarded as infants in the stock exchange market as they are characterized as having low market capitalization, with South Africa suffering from continuous volatile currencies over the past few years irrespective of the strong economic fundamentals (Mlambo, Maredza, and Sibanda, 2013).

According to Mishra (2004), the correlation between stock prices and exchange rate has no theoretical foundation. Similarly, Fama and French (1989) argue that the link between stock prices and Long-term bond yields is questionable and confusing. They relied on an argument that the correlation between the returns on stock prices and long-term bond yields is negative,

since an increase in expected long-term bond yields seemed more attractive to investments and the resultant effect of which an increase in expected future discount rates caused interest rates to rise while stock prices fell. An investigation conducted by Arslaner, Karaman, Arslaner and Kal (2014) showed that the tie between stock markets, bond markets, exchange rate markets, and the risk-adjusted excess return on the bond and stock markets depended on the over or under-valuation of domestic currencies.

There exist divergent views regarding the correlation of exchange rate volatility and stock and bond returns. A better understanding of the relationship between these three financial variables is therefore necessary judging from the viewpoints of the investors, policy-makers and academics. These investors seek to make profits from investments made in the share and financial markets from the interaction of exchange rates to stock returns, which seek to anticipate the future flows of these two financial variables (Huy, 2016).

Policy-makers aim to find out the relationship between these variables for valuation purposes. Understanding linkages of exchange rate volatility, stock and bond returns enables the hedging of any portfolio risk that would arise from their relationship. The controversy surrounding the link between exchange rate volatility, stock and bond returns makes this study interesting and challenging.

This study posits that in the selected developing countries there exists some relationship (positive and negative) between exchange rate volatility, stock and bond returns as not all portfolio risks can be diversified or hedged away and proceeds to illustrate the nature of these relationships.

1.3. Objective of Study

The main purpose of this study is to examine whether there is a relationship between exchange rate volatility, stock returns and bond returns in the selected developing countries

The specific objectives are:

- To examine the relationships between exchange rate movements, stock and bond returns in selected developing countries [Nigeria, Ghana, Kenya, South Africa, and India].
- To determine if other macroeconomic (e.g. Inflation and money supply) variables affect stock and bond returns in the selected developing countries.

1.4. Research Questions

This research answers primary questions of the existence of a correlation between exchange rate volatility, stock and bond returns in the selected developing countries.

These questions are as follows:

- Is there any linkage between exchange rate volatility, stock returns and bond return in selected developing countries?
- Are there other macroeconomic (e.g. inflation and money supply) variables that influence a change in behaviour in exchange rates stock and bond returns in the selected developing countries?

1.5. Research Hypotheses

H_0: Exchange rate volatility has no effect on stock and bond returns in developing countries.

H_1: Exchange rate volatility has a significant effect on stock and bond returns in developing countries.

H_0: Macroeconomic variables (inflation and money supply) have no effects on stock and bond returns in developing countries.

H_1: Macroeconomic variables (inflation and money supply) have a significant effect on stock and bond returns in developing countries.

1.6. Organization of Study

Following the introduction, chapter two shall expand on the literature of previous studies; theoretical and empirical literature shall be reviewed in regarding the link between exchange rate volatility, stock and bond returns in the selected developing countries. Chapter three shall discuss the methodology and the sources of data that have been used in the study. Chapter four shall estimate the regression analysis and discuss the results of the test carried out. Finally, the conclusion shall be looked at in Chapter five.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

This chapter explores the theoretical and empirical studies that were carried out to determine the association, effects, impact, and causes of exchange rate volatility, stock and bond returns in developing countries.

2.2. Theoretical Literature

This section discusses the theoretical models that are used to study the link existing between exchange rate volatility, bond and stock returns such as the flow-oriented theory, portfolio balanced theory, and the Asset price channels. Furthermore, we discuss the empirical literature of the relationship between these three variables, which are broken down into three major economies (emerging markets, developing countries and developed countries).

2.2.1. Flow-oriented model

This model, which was first discussed by Dornsburch and Fisher (1980), stipulates that the discounted future expected cash flows of a firm is a determinant of stock prices. This follows the efficient market hypothesis theory, which states that a firm's cash flow and stock prices are affected by the same variable. In other words, movements in its exchange rate affect a firm's level of output including the trade balance of an economy. Thus, the model reveals a causal link between stock prices and exchange rates and shows how movements of currency affects profit generation of a firm (Richards, Simpson, and Evans, 2007).

2.2.2. Stock-oriented/ Portfolio balance model

According to Frankel (1983), this model relates to how variations in the capital account of a country is used to explain changes in its stock market exchange rate. The model attempts to explain how the buying and selling of assets such as bonds and stocks determine movements in exchange rates and in currency, adversely affecting financially held assets. This means that if a local currency depreciates against that of a foreign currency, this will depress local stock prices such that investors move their funds from the local/domestic country currency to that of the foreign country currency, which thus causes the returns of the foreign country currency to increase.

In addition to the stock-oriented/portfolio balance model, Aggrawal (1981), Solnik (1987), and Krueger (1983) introduced the traditional approach as well as the portfolio adjustment approach. The traditional approach argues that an increase in stock prices, cheaper imports/exports of domestically produced goods as opposed to more expensive foreign produced goods was due to currency depreciation. The portfolio adjustment approach argues that when stock prices increase, there will be an appreciation of currency and foreign investment (capital inflow), whereas, when stock prices decrease stockholder's wealth will also fall, causing low demand for money, low interest rates, and depreciation in currency because of capital outflows.

However, Arslaner, Karaman, Arslaner, and Kal (2014) noticed that those approaches differ considerably with approaches from the economic school of thought after considering how exchange rates relate to interest rates. These approaches are broken down into the flexible prices approach (Classical School) and the sticky prices approach (Keynesian School). The Classical school proved the association of exchange rates to interest rates was of a positive nature, while the Keynesian school approach showed negative associations of exchange rates to interest rates.

2.2.3. Tobin's q-theory and Modigliani's life-cycle theory (Asset Price Channels)

The first theory relates to investment, while the later speaks on consumption. Howbeit, both theories are based on the monetarist view that results in lower stock prices under the contractionary monetary policy. The propensity to spend in the stock market and by the public is reduced because of a shortage of money supply, causing the prices of stocks to fall as the demand for equities decline. In contrast to this, bonds become more attractive to investors because of a rise in nominal interest rate compared to the latter decline of stock/ equity prices (Murzaieva, 2013).

According to Murzaieva (2013), the two theories (Tobin's q-theory of investment) and (Modigliani's life-cycle theory of consumption) behave differently such that, the first theory argues that the investment of firms has decreased because more stocks are used in financing new investment projects, inducing the contraction in output and employment. The latter argues that the propensity of households to consume is due to insufficient financial wealth which arises from lower stock prices, and this drives output and employment down. However, according to Murzaieva (2013), the classical view on the monetary transmission mechanism reveals the

existence of a pessimistic correlation linking interest rate and stock prices. However, the inverse relation linking bond prices and interest rate would mean that bond prices ought to be positively correlated to stock prices.

The Theories mentioned above show the different kinds of relationship that exist between stock, bond and exchange rates. Considering macroeconomic variables (money supply, inflation) that could affect the relationship between these three financial variables. It is explicitly explained in these theories how these macroeconomic variables react to changes in exchange rates, stock and bond prices.

2.3. EMPIRICAL LITERATURE

Studies have been carried out to determine how exchange rates relate to stock returns (e.g. Aggrawal, 1981, Soenen and Hennigar, 1988). The ARCH (Autoregressive Conditional Heteroscedasticity) model introduced by Engle (1982), and the GARCH (Generalised Autoregressive Conditional Heteroscedasticity) model by Bollerslev (1986), are used for estimating volatility of exchange rates, stock returns, and bond returns. This research shall look at previous work done in emerging markets, developing countries and developed countries.

2.3.1. Emerging Markets

The GARCH model has been used by Karoui (2006) to analyse the link between stock returns and exchange rate volatility in eighteen emerging economies (Argentina, Brazil, Chile, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Poland, Philippines, Russia, South Africa, South Korea, Taiwan, Thailand, and Turkey). Results from sector-wide indexed studies showed a positive link between exchange rate volatility and stock return volatility. However, Agrawal, Srivastav and Srivastava (2010) showed that there was a unidirectional causal relationship[5]. These results were defined by each country's difference in the economic stage, government policy, expectation pattern, etc.

Agrawal, Srivastav, and Srivastava (2010) to examine the causal relations that exist between volatility of the stock returns and the volatility of the Indian Rupee to US dollar (INR-USD) exchange rates in terms of their interdependency and causality used several methods. They converted series of data to their natural log forms and the Jarque-Bera test showed that the data

[5] Relationships of the same nature were found in the Bangladesh, Indian stock market and exchange rates. See: Muktadir-al-Mukit (2012). Effects of Interest Rate and Exchange Rate on Volatility of Market Index at Dhaka Stock Exchange. Journal of Business and Technology (Dhaka), 7 (2), 1, 18.

had a non-normal distribution. When testing the stationarity using the ADF test, these variables showed some form of stationarity in level form but negatively correlated.

The Granger causality test on the link between exchange rate and stock prices showed that stock prices led exchange rates in the short-run, whereas there was no relationship between the two variables in the long-run (Kutty, 2010). The result showed that stock market regulations/policies have a short-term impact on exchange rates; policy-makers of the Mexican economy should be prudent on the implementation of such policies or regulations.

Data extracted from seven East Asian countries by Pan, Fok, and Lui (2007) during the period 1988-98 showed a two-way causality between exchange rates and stock prices in Hong Kong before the 1997 Asian crises occurred, and a unidirectional causal relationship between these variables in Thailand, Japan, Malaysia, Korea and Singapore. However, there was no causality between these two variables in the Indian, Bangladesh and Pakistani markets (Rahman and Uddin, 2008; Rahman and Uddin, 2009).

In emerging markets, international bond funds have become of outmost importance to institutional investors (especially mutual funds) due to the implications the decisions on asset allocation have towards policies in developing countries, debt management and bond market developments. Such investors (mutual funds) prefer bonds that have specific country economic and financial characteristics (e.g. sound fundamentals and openness to trade). These sound fundamentals arise in the form of fiscal discipline, high reserves, and favourable current account position, which reduces the countries' balance sheet risk, strengthens their repayment capacity and lowers their leverage position. The latter (openness of trade) speaks of enhancing the capacity of the country and increasing investors, familiarity with the countries' bonds (Xiao, 2007).

According to Min et al (2003), panel data used to investigate how important liquidity and solvency variables are to dollar-denominated bond spreads of fixed income securities for eleven emerging economies in Latin America and Asia for the period 1990 to 1999. The results derived from their investigation was that most of the variations in the bond spread in these economies were explained by two variables, liquidity and solvency in such a way that when export earnings fall and import expenditures rise, there is increased short-term liquidity problem and substantial drops in GDP, causing longer periods of illiquid and insolvent problems. However, Min et al (2003) also found out that the bond spreads in emerging economies in the United States were determined by interest rates, inflation rates and real

exchange rates, while a negative relationship between yield-maturity was reflected in the Latin countries.

2.3.2. Developing Countries

The results of the study on the relationship of exchange rates with stock market returns in seven African countries (Ghana, Kenya, Mauritius, Tunisia, Egypt, Nigeria, and South Africa), using the VAR model and the Co-integration. The tests revealed that appreciation of exchange rates led to increases in stock prices in the long run, whereas deprecation of exchange rate led to a reduction in the stock market returns in the short-run (Adjasi and Biekpe, 2005). The South African Stock market seems to be a safe place for foreign investment, although, the relationship between exchange rates and the stock market was weak (Mlambo, Maredza and Sibanda, 2013).

The empirical results of the analysis of the link between foreign exchange rates and stock market using the multivariate open-economy model, showed a weak relationship between the two variables. Stock markets were depressed because of the increase in the dollar, while a decrease in exchange rates boosted the stock market (Dimitrova, 2005). However, according to Sohail and Hussain (2009) there arose negative correlations in the short-run stemming from CPI to stock returns, whereas, industrial production index, money supply, and exchange rates caused a significantly positive relationship in stock returns in the long-run. This led them to conclude that depreciation of the domestic currency caused an increase of the returns of a firm and a spike in its stock prices and some positive relations of export-driven companies.

Erbaykal and Okuyan (2007) conducted further studies on 13 developing countries (Brazil, Czech, China, Indonesia, Philippine, South Korea, India, Hungary, Malaysia, Mexico, Chilli, Thailand, and Turkey), at different time periods and using available data. They applied the Granger causality and Co-integration test on these countries' data. The results revealed that in six of them stock prices and exchange rates were negatively correlated. However, there were causal relations in eight of the economies (one-way causal relation from stock prices to exchange rates for five economies and the rest showed a two-way causal relationship).

The paper by Umoru and Asekome (2013) on the association between exchange rates and stock prices using Granger Causality test, indicated a two-way co-integration relation linking both variables in the Nigerian stock market, whereas in the study conducted by Mishra (2004), there exists no Granger causality between the two variables. Similarly, Qayyum and Kemal (2006)

performed the same test on the two variables and their results showed that exchange rate movements cause the stock market returns in some economies, while in others, stock market returns cause exchange rate movements. They conclude by pointing out that returns in one-market affects returns in the other market.

A study conducted by Adjasi, Harvey and Agyapong (2008) using the EGARCH (Exponential Generalised Autoregressive Conditional Heteroscedasticity) model, showed that exchange rate volatility and stock market returns are negatively related and in addition the presence of volatility shocks on the exchange rate and the stock returns on the Ghanaian stock exchange market. Additionally, the authors verified the effect of other macroeconomic variables[6] on stock market volatility and provided evidence that there exists a statistically notable relation linking the stock market and the macroeconomic variables with a presence of volatility shocks in each variable.

Monthly data from Malaysia during the years 1977-1998 were used by Ibrahim and Aziz (2003) to investigate the link between exchange rates and stock prices. The study revealed a negative relation between exchange rates and stock prices. Likewise, US data was used by Ozair (2006) and Vygodina (2006) to determine the correlation of the two variables. Ozair (2006) showed no causal linkage in these variables. In the same light, Umoru and Asekome (2013) found no co-integration between the two variables. However, Vygodina (2006) and Agrawal, Srivastav, and Srivastava (2010) proved that causality existed from large-cap stocks to exchange rates. A study conducted on the linkages between exchange rate and stock market prices of the Malaysian stock market, deduced the existence of a negative short-run and long-run relationship (Vyas, Prasad, and Mishra, 2014; Ihsan, Baloch, and Kakakhel, 2015).

A further study was done by Rjoub (2012) on the Turkish stock prices and exchanges rates, considering the US stock prices in the world market in both the long and short-run. Different results were shown for the three tests (co-integration, Granger causality and impulse tests) conducted. The co-integration revealed that there was a long-run relationship, whereas, a bidirectional relationship existed between exchange rates and the Turkish stock prices when the Granger causality test was performed (Bagh et al., 2017). The Impulse response test

[6] Those included in that study are such as Money supply (MS), Treasury bill rate (TR), Inflation (CPI), and the trade deficit (DT).

revealed that there were temporary shocks found in the Turkish stock prices, exchange rates and US stock prices.

Using the Johansen co-integration test to determine the effect of exchange rates on stock market prices in Nigerian markets for periods ranging from 1985:1-2009:4, results showed that in the short-run there existed a positive relationship between these variables as compared to the negative relationship in the long run (Olugbenga, 2012; Abiola, and Olusegun, 2017). The granger causality test that was conducted on the Nigerian stock market by Olugbenga (2012) revealed that exchange rate volatility and the structural adjustment programme could explain movements in its stock market performance in 1986.

In relation to the relationship between stock and bond returns, a study by Murzaieva (2013) was conducted for the period 2003-2013 using both daily and biweekly data of the stock market index (MICEX) and the government bond market index (RGBI) for Russia. A multivariate version of the GARCH model (DCC-GARCH) was used to depict the conditional stock-bond correlation. The asymmetric versions of GARCH (EGARCH and TGARCH) have been used to estimate volatility for stock-bond returns. The findings of these tests were that the correlation between stock and bond returns reveal a significant component of time variability, while the conditional correlations of the estimated daily returns revealed some atom of positive correlations between the two variables with the presence of a noisy component, thus no clear tendencies were considered over the years (Murzaieva, 2013). For the bi-weekly returns, a decreasing trend for the period 2003-2007 was seen in the co-movements between stocks and bonds. However, in the year 2008 the trend began to strengthen to show a positive stock-bond correlation and thereby rejecting the existence of the Flight-to-quality hypothesis on the Russian markets.

2.3.3. Developed Countries

A study conducted by Morley and Pentecost (2000) on G-7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States), showed that the weak relationship between exchange rates and stocks prices was due to the exchange controls that took effect in the 1980s. This agrees with the results of the study by Nieh and Lee (2001) on these G-7 countries during the period from October 1, 1993 to February 15, 1999, which showed that there was no relationship between these variables for each of the countries in the long run. However, a one-day relationship was found in some of the countries.

According to Caporale, Ptittas, and Spagnolo (2002), a causal relationship existed between stock prices and exchange rate volatility. Bhar and Hamori (2003) used a different methodology by applying the mean and variance approach. Their results revealed that the stock market in all the G-7 countries are related to the U.S. stock market, however, volatility spillovers in Japan are bi-directional. Japan causes other countries in mean while these countries respond in variance (Bhar and Hamori, 2003). The paper by Alaganar and Bhar (2003) revealed that the mean and variance have stronger causal relationship in the financial sector returns and short-term interest rates in the G-7 countries.

A similar study conducted by Smith and Nandha (2003) for the period 1995-2001 on the relationship between these variables in Pakistan, Bangladesh, India and Sri-Lanka revealed that there existed no long-run relationship between them but rather a unidirectional causality was found between the exchange rates and the stock prices in India and Sir-Lanka. The effects of exchange rate volatility for the period 1980-2008 on stock returns in the United States were carried out using the squared residuals from the Autoregressive moving average (ARIMA) model (Mlambo, Maredza, and Sibanda, 2013). This proved that hedging instruments are of little or no value in preventing exchange rate volatility from affecting trade volume. A negative effect was found on stock returns in the United States because of exchange rate volatility (Sekmen, 2011). Li (2002) conducted a study to understand the link between stock and bond prices in G7countries using monthly and daily data. The results showed an increasing growth in correlation from mid-1990, revealing a reversion in values to almost zero in the year 2001.

Covering longer periods of time using monthly data (from the year 1855-2001) and monthly/annual data (from the year 1871-2000) from the UK and US markets, Jones and Wilson (2004); Yang, Yinggang, Zijun (2009) studied the linkage between stock and bond prices. Their study revealed that indeed there existed a dynamic relationship between the two variables in these markets. However, there were fluctuations in the relationship between stock and bond prices in both the US and the European market. Recently data was analysed by scholars revealed stronger fluctuations in correlation between stock and bond returns over time in the US market and European markets (Chou and Liao, 2008; Aslanidis and Christiansen, 2012).

There is diversity of opinion on the link and relationship between economic variables amongst economists who suggest that in foreign exchange markets, traders rely on interest rates and stock prices (economic fundamentals) when valuing exchange rates (Cheung and Chinn, 2001).

However, Kal, Arslaner, and Arslaner (2013), showed that there is more than one form of relationship between exchange rates, interest rates, stock prices, gold prices and oil prices. The Markov-switching Autoregressive model (MS-AR) was used to capture the regime- switching behaviour between the variables. There are several ways to manage the movement in currencies such as the use of Gold. In the past, Gold has been the standard means of trade until the 1970s when this standard collapsed due to the debt default and high oil prices.

Studies have been conducted on the relationship between prices of gold, crude oil, the USD-INR exchange rate and the Indian stock market using the DCC- GARCH (standard, exponential and threshold) models for the dynamic linkages and symmetric and asymmetric Non-linear causality tests for the lead lag linkages. For example, Jain and Biswal (2016) attested to the fact that there exists a direct relation between these variables such that a fall in the gold and crude oil prices causes a fall in the Indian rupee and the benchmark stock index (Sensex).

This study has reviewed some literature relating to the relationship between the variables exchange rate, stock and bond returns in several markets in the developing and developed countries. The literature shows that there are mixed views on the exact relationship between these three variables. Some of the researchers were of the view that there is a positive, negative or no relationship at all. Both theoretical and empirical studies were assessed. It is clear from the literature that there is no theoretical consensus on the direction of the relationship between these three variables using the different models. The study, therefore, will use the ARCH and GARCH models to determine the relationship between exchange rate volatility, stock and bond returns in the selected developing countries.

CHAPTER THREE

3. METHODOLOGY

3.1. Introduction

This chapter discusses the use of the ARCH and GARCH model in analysing the relationship linking exchange rate volatility, stock and bond returns in the selected developing countries namely, Nigeria, Ghana, Kenya, South Africa, and India. The analysis considers some macroeconomic variables that can influence the link between these variables positively or negatively. Such macroeconomic variables include Inflation index (CPI), and Money Supply (M2).

3.2. Data collection

Secondary data was used in this study. The sources of these include Bloomberg terminal which was used to find the monthly price series of stock prices, exchange rates, money supply (M2), and inflation (CPI) of each country for a 5-year period beginning from 31 Dec 2008 till 31 Dec 2012. Bond Prices (10-year government bond yield) will be retrieved from investing.com. All exchange rates are defined as the domestic currency per dollar (e.g. for India it will be Indian-Rupee (INR)/USD, and so on). Stock market prices will be benchmarked by the Morgan Stanley Capital International (MSCI) index. This MSCI tracks the performance of stocks in the index and measures its performance in an area. However, data on the 10-year government bond yield was only available for 4 countries, namely; Nigeria, Kenya, India and South Africa.

The data on the monthly stock and bond returns (expressed in their domestic currency) are computed as the logarithm of the prices (continuously compounded returns) of these assets between the two consecutive days using the formula below:

$$D_r = In\ (P_t/P_{t-1}) \qquad (3.1)$$

Where; D_r = Daily stock/bond returns

P_t = Today's stock /bond prices

P_{t-1} = Previous day's stock/bond prices

In = Natural logarithm

3.3 Model Specification and Estimation

Tables were used to represent this data and excel spreadsheets were used to organize the data series for accuracy and consistency of the results/analysis. The correlation matrices generated show both positive and negative relationships between the independent and dependent variables. The coefficient of determination, $R^{2,}$ has been calculated (Mburu, 2015). The R^2 has its value ranging from 0 to 1 and 100 x R^2 measures the percentage variation in the dependent variable explained by the independent variable. Higher values of R^2 show greater dependence between the independent and dependent variable.

Previous study by Engle and Granger (1987) revealed that most time series data are non-stationary and can become stationary after first order integration. Analysis of non-stationary time series data results in spurious regressions (Granger and Newbold, 1974). Furthermore, Gujarati (2003) defined stationary time series data as one who's mean, and variance are constant. The most widely used econometric models in the analysis of time series data are the GARCH and ARCH models which was used to intensively examine the relationship between these variables. Analysis of time series data accounts for internal structures such as autocorrelation, trend and seasonal variations. Since this research is using time series data, tests to remove any spurious results and detect stationarity of data will be conducted using the ADF method.

3.3.1. Estimation of Volatility patterns

The frequency and severity in which market prices of investment fluctuate is known as volatility. According to Hull (2010), a variable's volatility is denoted as the standard deviation (σ) of the variable's return per unit of time (continuously compounded). The unit of measurement for volatility is in either days or years (unit of time). The standard deviation is carried out on the continuously compounded returns per day or per year, such that [$\sigma\sqrt{T}$] can be written as the standard deviation of the total return earned in time (T) expressed with continuous compounding:

$$\text{In } (S_T / S_0) \qquad (3.2)$$

S_T – Value of the market variable at time T

S_0 – Value of the market variable today

T – Unit of measurement (in days/years)

Volatility measurements are based on two financial calculations: the historical and implied volatility. Implied volatility is derived from market perceptions of future occurrence of exchange rate movements, whereas, historical volatility is measured from past values of exchange rates. Preferably, in this research we have estimated volatility based on historical data. According to Abdalla (2012), historical data is a more accurate means of assessing financial markets and economies that are stable and not under any form of restructuring. Below is the method that shall be used to estimate historical data:

$$U_i = In\ (S_i / S_{i-1}) \qquad (3.3)$$

Where; S_i – Value of the market today

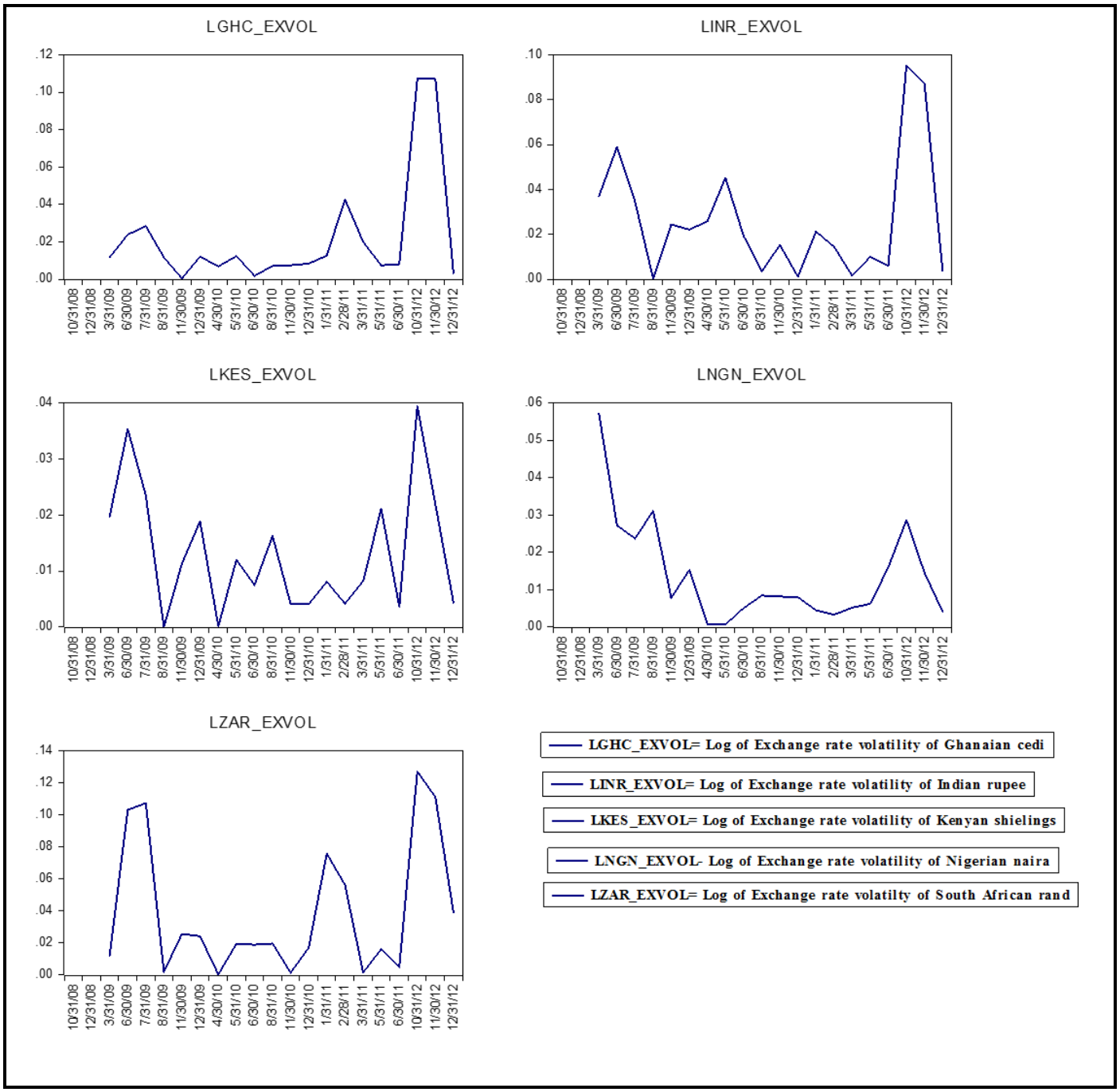
S_{i-1} – Value of market yesterday

U_i – Return during i^{th} period

Volatility is often measured using standard deviation. However, in this research volatility is calculated using the moving average method considering a 2-day period standard deviation of the logarithm of returns on exchange rate prices for each country.

There is an upward trend movement in the exchange rate volatility of each country's currency, with the exception in the Nigerian currency market. However, the data series do not exhibit forms of stationarity in them as they cross the mean value (zero-mark line), revealing periods of volatility clustering as a rise in volatility is followed by rise volatility in other periods and a fall in volatility is followed by the same fall in volatility in other periods. This is shown in figure 3.1 below.

Figure 3.1: Graph Representing Exchange rate volatility



Source: Data compiled from Bloomberg

3.3.2 Model Specification (ARCH/GARCH model)

According to Engle (1982), the ARCH model proposes that the variance of the residuals at a point in time depend on the squared error terms from the past periods. In relation to this, Hull (2010) says that these models are recognised for not being constant in nature.

The ARCH models

There is in existence several features used to describe the way in which series of financial asset returns react such as 'volatility clustering' or 'volatility spooling'. Most widely used is the term volatility clustering which refers to periods of high and low market uncertainty. The ARCH model better defines features of volatility clustering and can be used to model financial asset return series (Brooks, 2008). This econometric model considers the mean and variance effect of the data series. Equations specifying the (conditional) variance and mean is described below:

Let $\{u_t\}$ be a series with E (u_t) =0, and Variance of u_t denoted as σ_t^2; where

$$\sigma_t^2 = var(u_t) = E[u_t^2 | u_{t-1}, u_{t-2}, \dots] \quad (3.4)$$

In considering the (conditional) mean, let the dependent variable be described as (y_t) such that we will be able to describe how this variable varies over time by using the following equation:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + u_t \quad u_t \sim N(0, \sigma_t^2) \quad (3.5)$$

Considering autocorrelation, the conditional variance of the error term (σ_t^2) depends on previous squared error (ARCH (1)):

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 \quad (3.6)$$

Equation (3.5) and (3.6) are used for this process to accommodate the GARCH process in this research.

The GARCH model

This model is more close-fitted, avoids overfitting of variables, and does not overlap the non-negativity constraints, unlike the ARCH model. The conditional variance depends on different

lags, such that the equation follows a one-period ahead estimate of the variance based on the past information (Brooks, 2008).

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (3.7)$$

The GARCH (1, 1) process is used to depict the relationship between these three financial variables. This process can be written in a form such that the number of observations allows an infinite number of past errors to affect the current conditional variance:

$$\sigma_t^2 = \gamma_0 + \alpha_1 u_{t-1}^2 (1 + \beta L + \beta^2 L^2 + \cdots) \quad (3.8)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 u_{t-1}^2 + \gamma_2 u_{t-2}^2 + \cdots, \quad (3.9)$$

The GARCH (q, p) process is an ARCH process that is of an infinite order with coefficients of various syllabuses. This model is an extension of the GARCH (1, 1) model and reveals how parameterised current conditional variance depends on q lags of the squared errors and p lags of the conditional variance:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 + \cdots + \alpha_q u_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \beta_2 \sigma_{t-2}^2 + \cdots + \beta_p \sigma_{t-p}^2 \quad (3.10)$$

This equates to: $\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha\, u_{t-i}^2 + \sum_{j=1}^{p} \beta\, \sigma_{t-j}^2$ (3.11)

To analyse the relationship between exchange rate volatility, stock and bond returns, this paper will employ the use of OLS method. Equations (3.13 & 3.14) specify the model estimated by OLS. The independent variables in this model are exchange rates, inflation (CPI), money supply (M2), while the dependent variables are Stock and bond market Returns. The coefficient (β) is different for each country.

$$\mathrm{L}Y_t = f(\mathrm{L}EXvol_t, \mathrm{LMS}, \mathrm{LCPI}) \quad (3.12)$$

$$\mathrm{LY_t} = \alpha + \beta_1 \mathrm{LEX}vol_{\mathrm{t}} + \beta_3 \mathrm{LCPI} + \beta_2 \mathrm{LM2} + \varepsilon_{\mathrm{t}} \quad (3.13)$$

$$\mathrm{LGB_t} = \alpha + \beta_1 \mathrm{LEX}vol_{\mathrm{t}} + \beta_3 \mathrm{LCPI} + \beta_2 \mathrm{LM2} + \varepsilon_{\mathrm{t}} \quad (3.14)$$

Where: $\mathrm{Y_t}$ = Stock market performance measured using MSCI index

GB_t=10 Year Government Bond Yield

α = constant variable (stock performance not influenced by macroeconomic variables)

β = coefficient of independent variables

LEXvol_t = (Log) Exchange rate volatility

LMS= (Log) Money supply (M2)

LCPI= (Log) Inflation rate

ε_t= White noise term

L = Natural Logarithm

The basic assumption behind the use of the ARCH/GARCH model is that they are homoscedastic (the squared error terms in the least squares model is the same at any given point) in nature. In cases where these error terms defer across various observations (known as heteroscedastic), ARCH/GARCH model them as variances. Unlike the GARCH model that has squared residuals that never reach the zero mark, the ARCH model has squared residual that reach the zero-mark point. So far, all models have been explained in detail revealing the way in which they are being estimated.

CHAPTER FOUR

4. MODEL ESTIMATION AND INTERPRETATION OF RESULTS

4.1. Introduction

In this section, we estimate and analyse comprehensively the data that has been derived from the various sources listed above to enable our determination of the correlation between exchange rate volatility, stock and bond returns[7]. Secondary data from Bloomberg and a few key leading macroeconomic indicators, which affect stock and bond market performance, have been generated for this research. Firstly, a descriptive statistic is used to measure the linkage of independent and dependent variables, followed by a correlation matrix for each country.

4.2. Estimation of regression analysis

4.2.1. The Descriptive Statistics

A descriptive Statistics has been used to summarize a given data set and they comprise of measures/ moments of a random variables such as the Mean, Standard Deviation, Kurtosis, and Skewness. Correlation matrix and the Jarque-Bera test (test for normality of data series) are used to measure the strengths and weaknesses found in the relationship between the financial variables. Skewness and kurtosis have been used to determine the nature of departure from normality. The first is a measure how symmetrical a distribution can be, while the latter measures the thickness of tails in normal distributions. Any variable is said to have a normal distribution with kurtosis of 3 and a skewness of 0. However, excess kurtosis arises when a variable has kurtosis more than 3, while a normal distribution with kurtosis more than zero are said to possess characteristics of mesokurtic in them (Brooks, 2008). Kurtosis of more than 3 is said to be leptokurtic (more peakedness), heavy tails and weak shoulders, whereas, those with kurtosis of less than 3 is said to be platykurtic (less peakedness), weak tails, and heavy shoulder (Ho and Yu, 2015).

Variations/dispersions of the independent variables to the dependent variables, looking at the average performance of these variables are shown in table 4.1 below. The higher the standard deviation of a variable, the further away observations are from the mean of that data set and vice-versa is the case. Represented below is table 4.1 showing descriptive statistics of the stylised facts of asset returns. Stock market of India shows the highest average return with an

[7] Bond prices retrieved from investing.com site: https://www.investing.com/

equivalently higher risk attached to it, whereas, bond returns for Kenya are slightly much riskier as compared to Nigeria. The null hypothesis for the Jarque-Bera test is that the distribution is normal and using a significance level of 5%, we are best able to interpret the results of this test. Based on the J-B tests, if the probability value of a variable is above the significance level of 5%, it is normally distributed.

GHANA

Statistics from the table show a J-B value for exchange rate volatility of Ghana deviating from normal distribution with the value of 27.1309. Similarly, the skewness and the kurtosis for this variable EXVOL (exchange rate volatility) represent a nature of departure from normality, with a highly significant probability value. The kurtosis value of 6.5807 relating to exchange rate volatility reflects positive kurtosis and suggests that there is peakedness in this variable. Skewness of 2.2212 reveals that this variable exchange rate volatility deviates from the mean, has a positive skewness and shows asymmetry in the EXVOL. The stock market for Ghana shows a normal distribution and that there is symmetry in stock returns.

INDIA

The J-B statistics shows that each of the variables (exchange rate volatility, stock returns and bond returns) deviate from a normal distribution (7.0251, 21.7121, 83.14122). This is seen from the skewness and kurtosis and the highly significant probabilities of each variable less than its significance level of 5% and does not show a normal distribution.

KENYA

There is a unique set of statistics revealed for this country. The J-B stats follows a normal distribution for each variable from exchange rate volatility, stock returns and bond returns. It is noted that exchange rate volatility with kurtosis of 3.005 is indeed mesokurtic (a normal distribution). However, the skewness is slightly further form its normal distribution with a value of 0.8949. The stock and bond returns show that the null hypothesis of normal distribution is accepted as the probability values are above the 5% significance level.

NIGERIA

The results for this country can be related to that of India. The exchange rate volatility and bond returns show positive skewness, while stock market returns show a negative skewness. High levels of peakedness are revealed with positive kurtosis, signifying that they are leptokurtic in nature for two variables, exchange rate volatility and bond returns. Stock market returns are normally distributed with a P-value above 5%. However, the J-B value shows the extent of deviation from its normal distribution.

SOUTH AFRICA

Exchange rate volatility and stock returns show J-B stats that re relatively close to their mean values, signifying that they are normally distributed as their probabilities (P-value) are above the 5% significance level. The kurtosis value of 2.457 for exchange rate volatility show a normal distribution and is mesokurtic in nature, whereas, the skewness is not far from it normality level by 0.9891 representing a positive skewness. The bond returns are highly significant and does not show a normal distribution.

Table 4.1: Descriptive Statistics of Exchange rate volatility, Stock and Bond Returns[8]

	Variables	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P-Value
GHANA	LGHC _EXVOL	0.022	0.0307	2.2212	6.5807	27.1309	0.0000
	LGHC_MSCI	0.001	0.1277	-0.3855	4.2636	1.8259	0.4013
INDIA	LINR_EXVOL	0.0263	0.0272	1.3611	4.0098	7.0251	0.0298
	LINR_GB	0.0213	0.0707	2.7586	11.3266	83.1422	0.0000
	LINR_MSCI	0.0305	0.133	1.4384	7.2164	21.7121	0.0000
KENYA	LKES_EXVOL	0.0132	0.0111	0.8949	3.005	2.6698	0.2632
	LKES_GB	0.0059	0.1624	0.5301	3.4556	1.1098	0.5741
	LKES_MSCI	0.016	0.0948	0.1455	3.7428	0.5304	0.7671
NIGERIA	LNGN_EXVOL	0.0138	0.0139	1.6947	5.7335	15.7998	0.0004
	LNGN_GB	-0.0011	0.1252	0.5285	5.8587	7.7411	0.0208
	LNGN_MSCI	0.0072	0.1572	-0.4134	5.425	5.4701	0.0649
SOUTH AFRICA	LZAR_EXVOL	0.0391	0.042	0.9891	2.457	3.5066	0.1732
	LZAR_GB	-0.0069	0.0746	-0.8355	5.8511	9.1011	0.0106
	LZAR_MSCI	0.0332	0.0893	0.947	4.7112	5.4296	0.0662

Source: Data compiled from Bloomberg

[8] Note: EXVOL= Exchange rate volatility; GB= 10-year Government Bond yield; MSCI= Stock market Index; L= Natural Logarithm; GHC= Ghanaian cedi; INR= Indian rupee; KES= Kenyan shillings; NGN= Nigerian naira; ZAR= South African rand

4.2.2. Correlation Matrix

The correlation of two variables taken against each other is the same no matter the order in which it is done. However, the correlation between any variable and itself is 1. For this cause, the analysis tables below derived show the correlations between the independent and dependent variables for each country. There exists both weak negative and positive correlation linking the different stock, bond market, exchange rate volatility, inflation and money supply. Inflation negatively affects bond returns in Nigeria, Kenya, India and South Africa, and positively affects exchange rate volatility in all these countries including Ghana.

The correlation of stock return and inflation shows that in Kenya and Nigeria stock market inflation is positively correlated to stock returns, whereas, in the Ghanaian, Indian and South African market inflation is negatively correlated related to stock returns. The exchange rate volatility shows positive correlations to stock return in the stock market of Kenya and South Africa but possess negative correlations in the stock market of Ghana, Nigeria and India. This relates to the positive correlation that exists among money supply and stock returns in the Ghanaian, Kenyan, Nigerian, and South African markets. It can be seen from table 4.3 below that in the South African and Nigeria stock market, bond returns are positively correlated to money supply and negatively correlated in Kenya. In the South African market, bond returns are positively correlated to stock returns, while, in the Indian, Kenyan and Nigerian markets they are negatively correlated to each other.

Table 4. 2: Correlation between Variables in Different Countries[9]

GHANA				
	LGHC_CPI	LGHC_EXVOL	LGHC_M2	LGHC_MSCI
LGHC_CPI	1			
LGHC_EXVOL	0.2426	1		
LGHC_M2	-0.4254	0.0767	1	
LGHC_MSCI	-0.4543	-0.3272	0.2383	1
INDIA				
	LINR_CPI	LINR_EXVOL	LINR_GB	LINR_MSCI
LINR_CPI	1			
LINR_EXVOL	0.5926	1		
LINR_GB	-0.1544	-0.0588	1	
LINR_MSCI	-0.2139	-0.0380	-0.0919	1

KENYA					
	LKES_CPI	LKES_EXVOL	LKES_GB	LKES_M2	LKES_MSCI
LKES_CPI	1				
LKES_EXVOL	0.5385	1			
LKES_GB	-0.0102	-0.1458	1		
LKES_M2	0.7143	0.5868	-0.3207	1	
LKES_MSCI	0.3081	0.3337	-0.1641	0.6739	1
NIGERIA					
	LNGN_CPI	LNGN_EXVOL	LNGN_GB	LNGN_M2	LNGN_MSCI
LNGN_CPI	1				
LNGN_EXVOL	0.2612	1			
LNGN_GB	-0.0158	-0.1868	1		
LNGN_M2	0.6040	-0.0784	0.0729	1	
LNGN_MSCI	0.4273	-0.3969	-0.1614	0.3428	1
SOUTH AFRICA					
	LZAR_CPI	LZAR_EXVOL	LZAR_GB	LZAR_M2	LZAR_MSCI
LZAR_CPI	1				
LZAR_EXVOL	0.4367	1			
LZAR_GB	-0.5143	-0.2871	1		
LZAR_M2	-0.5027	-0.2094	0.3348	1	
LZAR_MSCI	-0.2342	0.0134	0.0132	0.8839	1

Source: Data compiled from Bloomberg

4.2.3 Testing for ARCH effects

The ARCH test conducted to determine if the data series is fit for the GARCH model. This coincides with Brooks (2008), who was of the view that it is necessary to conduct an ARCH test to ensure that the GARCH model fits the data. This test regresses the squared residuals on

[9] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; MSCI= Stock market Index; L= Natural Logarithm; GB= 10-year Government Bond yield; GHC= Ghanaian cedi; INR= Indian; KES= Kenyan shillings; NGN= Nigerian naira; ZAR= South African rand

its lagged values and a constant. The result of the autocorrelation of the squared residuals has been determined using the ARCH test. They are represented by the Obs*R-Squared values.

There is a very slim chance of the existence of heteroscedasticity in all stock and bond markets for the countries listed below. The p-value for each market is more than that at 5% level of confidence. From the analysis, it can be said that we fail to reject the null hypothesis of no heteroscedasticity (Homoscedasticity).

Table 4.3: Results of ARCH tests

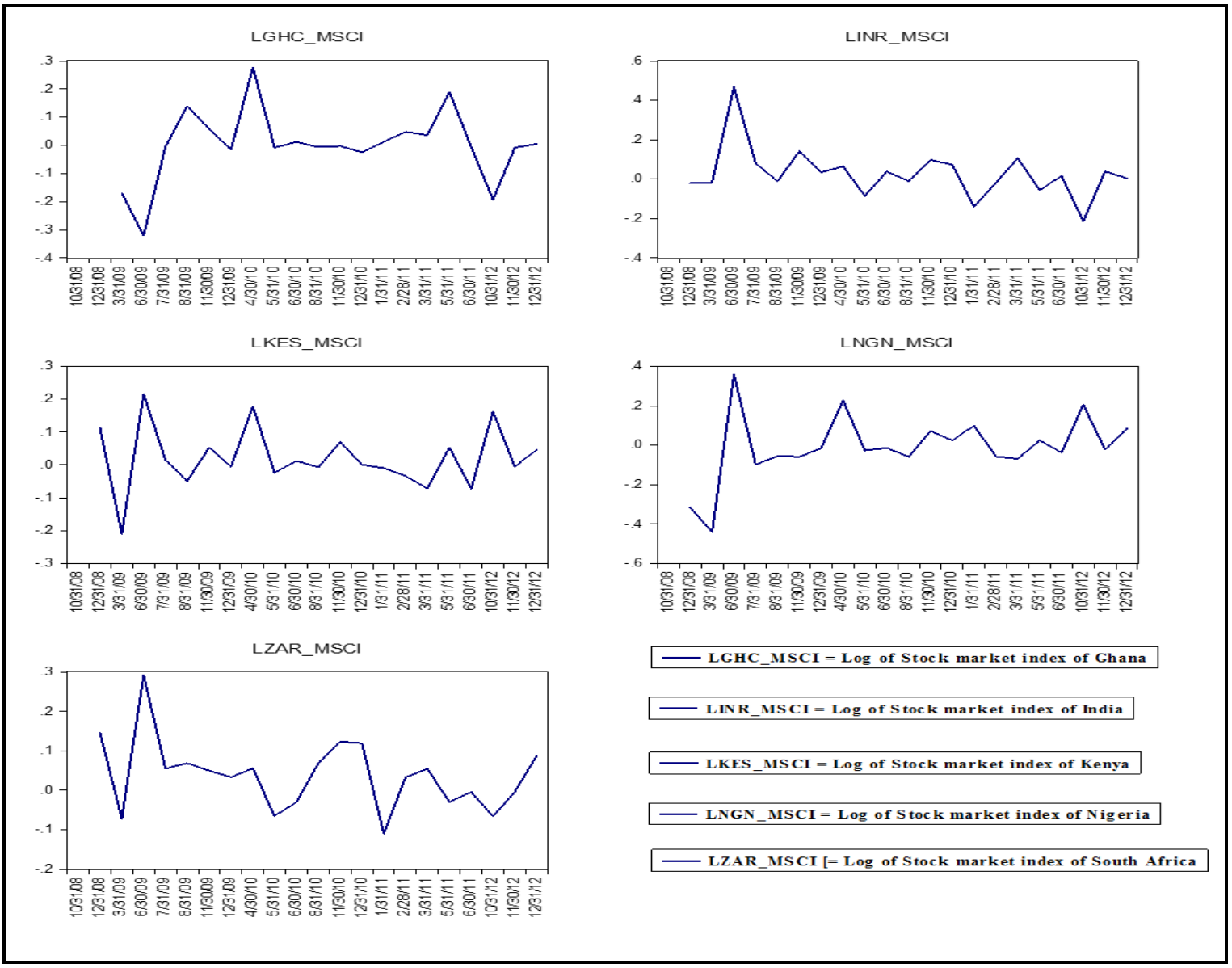
	GHANA			
	Heteroscedasticity Test: ARCH			
STOCK	F-statistic	0.4599	Prob. F (1,17)	0.5068
	Obs*R-squared	0.5004	Prob. Chi-Square (1)	0.4793
	INDIA			
	Heteroscedasticity Test: ARCH			
	F-statistic	0.1243	Prob. F (1,17)	0.7287
STOCK	Obs*R-squared	0.1379	Prob. Chi-Square (1)	0.7103
	Heteroscedasticity Test: ARCH			
	F-statistic	0.3704	Prob. F (1,17)	0.5508
BOND	Obs*R-squared	0.4052	Prob. Chi-Square (1)	0.5244
	KENYA			
	Heteroscedasticity Test: ARCH			
STOCK	F-statistic	0.20612	Prob. F (1,17)	0.6556
	Obs*R-squared	0.22761	Prob. Chi-Square (1)	0.6333
	Heteroscedasticity Test: ARCH			
BOND	F-statistic	0.0399	Prob. F (1,17)	0.8441
	Obs*R-squared	0.0445	Prob. Chi-Square (1)	0.8330
	NIGERIA			
	Heteroscedasticity Test: ARCH			
STOCK	F-statistic	0.0856	Prob. F (1,17)	0.7734
	Obs*R-squared	0.0952	Prob. Chi-Square (1)	0.7577
	Heteroscedasticity Test: ARCH			
BOND	F-statistic	0.5732	Prob. F (1,17)	0.4594
	Obs*R-squared	0.6197	Prob. Chi-Square (1)	0.4312
	SOUTH AFRICA			
	Heteroscedasticity Test: ARCH			
STOCK	F-statistic	0.4984	Prob. F (1,17)	0.4898
	Obs*R-squared	0.5411	Prob. Chi-Square (1)	0.4620
	Heteroscedasticity Test: ARCH			
BOND	F-statistic	0.1839	Prob. F (1,17)	0.6734
	Obs*R-squared	0.2034	Prob. Chi-Square (1)	0.6520

Source: Data compiled from Bloomberg

4.2.4. Regression Analysis

Graphical Analysis depicting the linkage between the independent and dependent variables may be a bit misleading in the viewer's eyes. Further analysis was done estimating the regression line of these variables for each country using the ARCH/GARCH model tests. If a series of data is not stationary, it would be inappropriate to use such model estimating the link between the independent and dependent variables using the ARCH and GARCH models. This would require that the data series be converted to stationarity by differencing. In this case, each of our variables have exhibited stationarity (sometimes after differencing) and the ARCH and GARCH test can now be conducted on them (or their differenced). Firstly, we will have to run a regression for each country. Below are a set of simplified tables representing the effect of the ARCH-GARCH tests (1 ARCH and 1 GARCH). From the graphs (Figure 1) showing the logarithm returns of the stock (MSCI) index and bond yield (GB), exhibit aspects of stationarity and linearity (running through a zero mark) in their series. However, they show movements up and down revealing that increases in stock prices causes a rise in stock returns and low stock prices causes a drop in stock returns in the stock and bond market of each country.

Figure 4.4: Graph Representing Stock returns



Source: Data compiled from Bloomberg

Figure 4.5: Graph Representing Bond returns

Source: Data compiled from Bloomberg

4.2.5 Unit Root Test

This is a test performed to show whether a time series variable is stationary or not and contains a unit root. In this test there are two hypotheses involved, the null hypothesis (H0: series contains a unit root), and the alternative hypotheses (H1: series is stationary). This is shown in the equation below (Brooks, 2008):

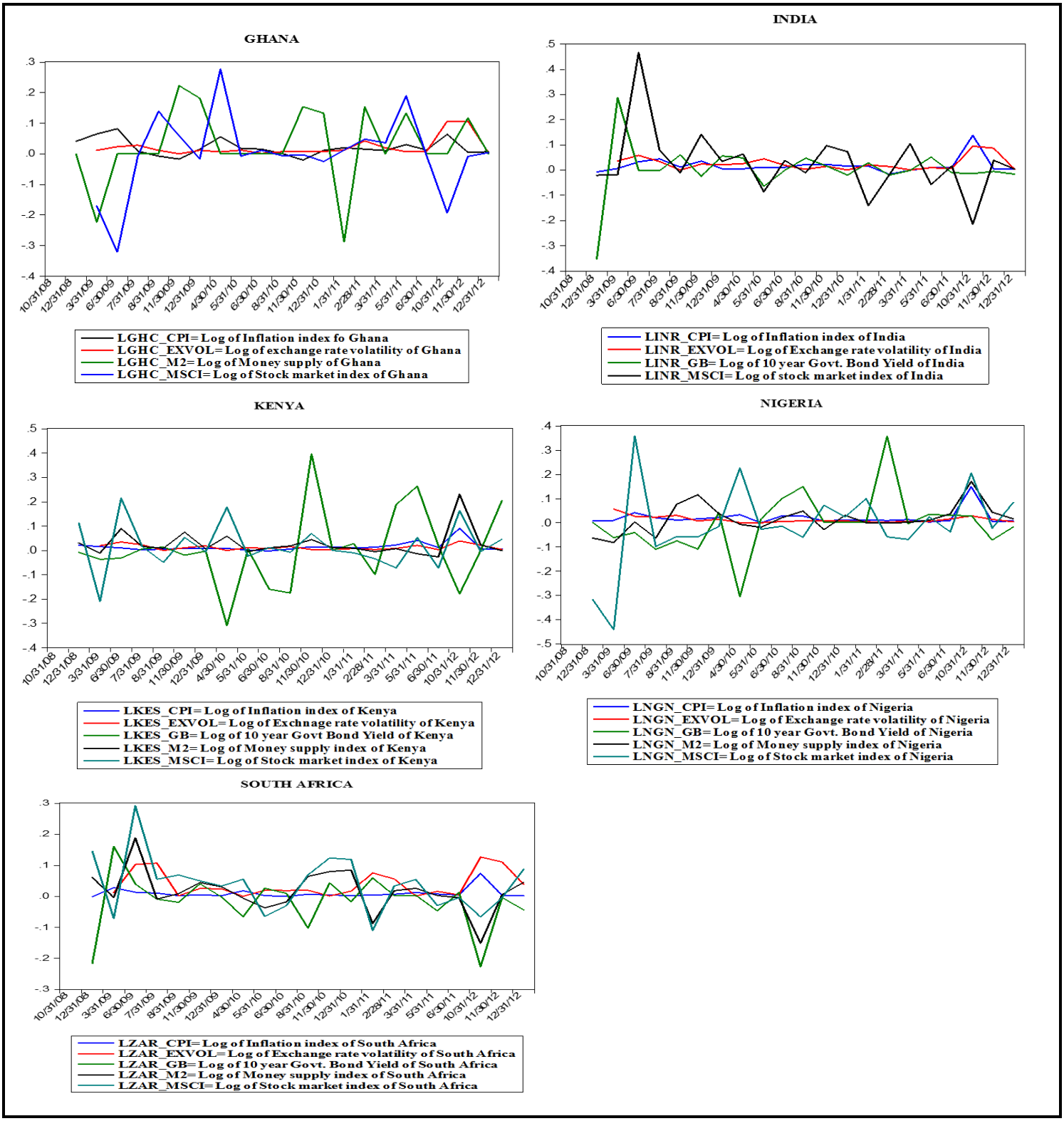
$$y_t = \emptyset y_{t-1} + u_t \qquad (4.2.1)$$

Such that $\emptyset = 1$(null hypothesis) and $\emptyset < 1 or\ \emptyset = 0$(alternative hypothesis).

The trend analysis conducted on the returns (log of prices) of each country's variables. This shows that the movement in the series is of one that revolves around a constant (zero) mean

and there are no traces of trend patterns in each series. However, we can see that in each series there are sharp spikes, alerting us that indeed a relationship exists between these variables. This is shown in the graphs below in figure 4.6:

Figure 4.6: Graph representing Trend Analysis of Variables



Source: Data compiled from Bloomberg

Table 4.7 below represents the results of the ADF test conducted to determine if the series and its variables are stationary. This was done because the series are stationary and are mean reverting, thus, no need to include an intercept and/or a trend. All variables in both South Africa and Nigeria show stationarity at level, and thus integrated of order 0- I (0). Unlike the other variables in the other countries that have been differenced once or twice before, they become stationary. The returns of all these variables are stationary and the ADF test below shows their results with no intercept and no trend since they follow a linear pattern. Exchange rate volatility for Ghana becomes stationary only when differenced the second time with a p-value of 0.0003, test statistic above that at the 5% critical value of -4.4150 and thus is integrated of order 2–I(2).

Table 4.7: Results of ADF test for Stationarity of Variables[10]

NO TREND, NO INTERCEPT						
GHANA						
Variables	Level (t-stat)	p-value	Critical Values (5% Level)	1st Difference	p-value	Critical Values (5% Level)
LGHC_MSCI	-3.5888	0.0012	-1.9602			
LGHC_EXVOL	1.4683	0.9579	-1.9644	-1.4841	0.1244	-1.9663
LGHC_CPI	-2.4516	0.0172	-1.9591			
LGHC_M2	-4.6696	0.0001	-1.9591			
INDIA						
Variables	Level (t-stat)	p-value	Critical Values (5% Level)	1st Difference	p-value	Critical Values (5% Level)
LINR_MSCI	-4.3226	0.0002	-1.9591			
LINR_EXVOL	-2.1599	0.0329	-1.9602			
LINR_CPI	-3.3826	0.0019	-1.9591			
LINR_GB	-1.5312	0.1146	-1.9644	-5.9340	0.0000	-1.9644
KENYA						
Variables	Level (t-stat)	p-value	Critical Values (5% Level)	1st Difference	p-value	Critical Values (5% Level)
LKES_MSCI	-7.8054	0.0000	-1.9591			
LKES_EXVOL	-1.3250	0.1642	-1.9628	-5.4176	0.0000	-1.9628
LKES_CPI	1.3310	0.9464	-1.9644	-4.2637	0.0002	-1.9614
LKES_GB	-4.2822	0.0002	-1.9591			
LKES_M2	-4.2348	0.0002	-1.9591			
NIGERIA						
Variables	Level (t-stat)	p-value	Critical Values (5% Level)	1st Difference	p-value	Critical Values (5% Level)
LNGN_MSCI	-5.4222	0.0000	-1.9591			
LNGN_EXVOL	-3.8237	0.0007	-1.9602			
LNGN_CPI	-3.4235	0.0017	-1.9591			
LNGN_GB	-4.0958	0.0003	-1.9591			
LNGN_M2	-3.0717	0.0040	-1.9591			
SOUTH AFRICA						
Variables	Level (t-stat)	p-value	Critical Values (5% Level)	1st Difference	p-value	Critical Values (5% Level)
LZAR_MSCI	-4.5531	0.0001	-1.9591			
LZAR_EXVOL	-2.0220	0.0440	-1.9602			
LZAR_CPI	-3.5642	0.0012	-1.9591			
LZAR_GB	-6.9561	0.0000	-1.9591			
LZAR_M2	-4.3013	0.0002	-1.9591			

Source: Data compiled from Bloomberg

[10] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; MSCI= Stock market Index; L= Natural Logarithm; GB= 10-year Government Bond yield; GHC= Ghanaian cedi; INR= Indian rupee; KES= Kenyan shillings; NGN= Nigerian naira; ZAR= South African rand

4.2.6. Multilinear regression analysis

This section looks at how each of the variables (money supply, inflation, exchange rate volatility) react towards stock and bond returns using OLS models. Regression analysis is very flexible in the sense that the dependent variable is said to be random/ and or stochastic (has a probability distribution), whereas the independent variables are fixed/ and or non-stochastic in nature (Brooks, 2008).

There are four assumptions for OLS estimators such as linearity, no perfect multicollinearity, error terms should be homoscedastic and lastly, error terms should be independent of the explanatory variables. The homoscedasticity assumption of OLS models, stating that errors are constant may be misleading as time series data display periods of unusually high volatility followed by stages in which there is no movement at all (relative quietness). Hence, this defeats the constant variance assumption. The interpretation of the stock and bond returns below shows unsteady/ unequal movements in each variables correspondence to stock and bond returns. OLS estimates are said to have ineffectively estimates, such that interferences based on its coefficients are unreliable and unaccepted due to the rejection of the null hypothesis after conducting the ARCH test. Hence, the GARCH (1, 1) model has been used to examine the relationship between these financial variables.

a) Interpretation of Regresstion Anaysis (Stock Return**)**

From the analysis below, there is a 50% chance of an increase in stock returns for a percentage increase in money supply and a 201% increase in the Ghanaian stock retuns as a result of a percentage increase in inflation (all others held constant). Exchange rate volatilty reveals an inverse relationship with stock returns such that a percentage increase in this variable results to a 7.2% decrease in stock returns of the market. Exchnage rate volatility and Inflation depict a significant negative impact on the stock returns of Kenya. This is shown by a 9.5% and 1.85% decrease of a percentage change in exchange rate volatility and Inflation. Money supply shows are significantly large increase in the stock returns of Kenya by 222% from a percentage change in money supply.

Stock market returns increase as both exchange rate volatility and money supply increases revealing that stock return in Nigeria is positively related to exchnage rate volatility and money supply. Inflation negatively related to stock return as a percentage increase in inflation decreases stock retuns by 148%. The Indian stock market shows positive relations with

exchange rate volatility and inflation; however, stock returns rise by a massive 124% because of a one percent increase in inflation and a 1.8% increase to exchange rate volatility. Indeed the results above tally with the statement that “South African currency is volatile” such that a one percentage increase in exchange rate volatility leads to a 35.5% decrease in stock returns. Money supply follows suit such that a percentage increase in M2 causes a 33.7% decrease in stock returns. Regardless, inflation reveals some outrageous result, a percentage increase in inflation leads to an 898% increase in stock retuns.

Table 4.8: Multilinear regresstion analysis (Stock Return)[11]

Dependent Variable: LGHC_MSCI			
Method: Least Squares			
Variable	Coefficient	t-statistic	P-value
C	0.0113	0.2776	0.7849
LGHC_EXVOL	-0.0723	-1.6616	0.1161
LGHC_CPI	2.0177	1.6612	0.1161
LGHC_M2	0.5004	1.9376	0.0705
R-squared 0.2644; Adjusted R-squared 0.1264			
Dependent Variable: LINR_MSCI			
Method: Least Squares			
Variable	Coefficient	t-statistic	P-value
C	-0.0196	-0.7087	0.4881
LINR_EXVOL	0.0182	0.4458	0.6614
LINR_CPI	1.2449	1.5431	0.1412
R-squared 0.2353; Adjusted R-squared 0.1454			
Dependent Variable: LKES_MSCI			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	0.0016	0.0316	0.9751
LKES_EXVOL	-0.0953	-0.5903	0.5632
LKES_CPI	-1.8512	-0.7951	0.4382
LKES_M2	2.2209	2.5687	0.0206
R-squared 0.3388; Adjusted R-squared 0.2148			
Dependent Variable: LNGN_MSCI			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	0.0456	1.4125	0.1769
LNGN_EXVOL	0.0180	0.2492	0.8063
LNGN_CPI	-1.4828	-1.1282	0.2758
LNGN_M2	0.2020	0.4410	0.6651
R-squared 0.0766; Adjusted R-squared -0.0965			
Dependent Variable: LZAR_MSCI			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	-0.2473	-0.9057	0.3785
LZAR_EXVOL	-0.3557	-1.5541	0.1397
LZAR_CPI	8.9854	1.2286	0.2370
LZAR_M2	-0.3373	-0.1125	0.9118
R-squared 0.1520; Adjusted R-squared -0.0070			

Source: Data compiled from Bloomberg

[11] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; MSCI= Stock market Index; L= Natural Logarithm; GHC= Ghanaian cedi; INR= Indian Rupee; KES= Kenyan Shillings; NGN= Nigerian Naira; ZAR= South African Rand

b) Interpretation of Regression Analysis (Bond Returns)

The result of the bond market returns in India reveal that a percentage increase exchange rate volatility leads to a percentage increase in bond returns by 0.58%, which seems relatively insignificant. Though there is a positive relationship between exchange rate volatility and bond return, the percentage increase does not suffice enough to enable us to determine the exact effect exchange rate volatility has on bond returns in India. A percentage increase in inflation results in a decrease in bond return by 42%, holding all other variables constant. An increase in exchange rate volatility by a percentage would lead to a decrease in bond returns by 1.1% holding inflation and money supply constant. The Kenyan bond markets are largely determined by macroeconomic variables such that an increase in money supply results to a decrease in bond returns by 182%, holding inflation and exchange rate volatility constant. As inflation rises so do the returns on bonds by 365%.

Nigeria follows the same principal as Kenya such that a percentage increase in exchange rate volatility results in an 8.9% decrease in bond returns. Increase in money supply by 1%, results to a decrease in bond returns by 5.4%. The good news is that a percentage increase in inflation causes a direct increase on bond returns by 96%. South African bond market does not seem to be making headlines. A percentage increase in exchange rate volatility and money supply results to an increase in bond returns by 0.7% and 5.4%, while an increase in money supply leads to a decrease in bond returns by 172%.

Table 4.9: Multilinear regresstion analysis (Bond Return)[12]

INDIA			
Dependent Variable: LINR_GB			
Method: Least Squares			
Variable	Coefficient	t-statistic	P-value
C	0.0262	1.1249	0.2762
LGHC_EXVOL	0.0058	0.1694	0.8674
LGHC_CPI	-0.4212	-0.6197	0.5437
R-squared 0.0254; Adjusted R-squared -0.0891			
KENYA			
Dependent Variable: LKES_GB			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	0.0050	0.0879	0.9310
LKES_EXVOL	-0.0113	-0.0619	0.9514
LKES_CPI	3.6506	1.3809	0.1863
LKES_M2	-1.8269	-1.8609	0.0812
R-squared 0.2008; Adjusted R-squared 0.0509			
NIGERIA			
Dependent Variable: LNGN_GB			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	0.0133	0.2902	0.7753
LNGN_EXVOL	-0.0895	-0.8689	0.3977
LNGN_CPI	0.9616	0.5154	0.6133
LNGN_M2	-0.0545	-0.0839	0.9342
R-squared 0.0540; Adjusted R-squared -0.1233			
SOUTH AFRICA			
Dependent Variable: LZAR_GB			
Method: Least Squares			
Variable	Coefficient	t-Statistic	P-value
C	0.0236	1.2145	0.2422
LZAR_EXVOL	0.0079	0.4897	0.6310
LZAR_CPI	-1.7228	-3.3080	0.0044
LZAR_M2	0.0542	0.2542	0.8026
R-squared 0.5019; Adjusted R-squared 0.4086			

Source: Data compiled from Bloomberg

[12] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; L= Natural Logarithm; GB= 10-year Government Bond; INR= Indian Rupee; KES= Kenyan shillings; NGN= Nigerian Naira; ZAR= South African Rand

4.2.7. Analysis of Stock Returns

The mean equation and variance equation below describe the link between the dependent and independent variables.

The mean Equation

A percentage change in a variables coefficient causes a percentage change of either sign (-/+) in stock returns. All variables in the stock market of Ghana, India, Kenya, Nigeria and South Africa insignificantly affect stock returns. However, the analysis shows a significant relation amongst the inflation in India, exchange rate volatility and inflation in Nigeria, and money supply in Kenya and South Africa.

The sign of inflation (CPI) in the stock market of India and Nigeria is negative revealing that a 1% increase in inflation will cause a decrease in stock returns by 1.67 and 2.97. A rise in money supply in the stock market of Kenya and South Africa causes a rise in stock returns. This is because an increase in money supply increases liquidity and causes a favourable movement in stock returns upwards (Mlambo, Maredza, and Sibanda, 2013). The exchange rate volatility in the Nigerian stock market shows that a percentage point increase in the exchange rate volatility will decrease stock market returns.

The variance Equation

The variance equation represents the volatility of the GARCH (1, 1) model, the various countries domestic currency volatilities, and the money supply (M2). A negative relationship revealed in all the countries between exchange rate volatility and stock returns. This reveals that there exists a negatively insignificant link between exchange rate volatility and stock returns such that an increase by one percentage point of exchange rate volatility will cause a decrease in stock returns.

As was noted by Ibrahim and Aziz (2003) and Adjasi, Harvey and Agyapong (2008), the association of exchange rates to stock prices in the Malaysian and Ghanaian stock exchange market revealed that a negative relationship with the presence of shocks, existed between exchange rate volatility and stock market returns. An increase in money supply will cause an increase in stock returns in the stock market of Ghana, and a decrease in this same money supply will cause a decrease in the stock market of Nigeria, Kenya, and South Africa.

Table 4.10: GARCH (1, 1) model for Stock Returns[13]

GHANA			
Dependent Variable: LGHC_MSCI			
Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	Coefficient	z-statistic	P-value
C	0.0581	1.1616	0.2454
LGHC_EXVOL	-1.0500	-1.6304	0.1030
LGHC_CPI	-1.6767	-1.4254	0.1540
LGHC_M2	0.1877	0.4790	0.6320
Variance Equation			
C	0.0581	1.1616	0.2454
RESID (-1) ^2	-0.1451	-0.5128	0.6081
GARCH (-1)	0.4976	0.5096	0.6103
LGHC_EXVOL	-0.0971	-0.6535	0.5134
LGHC_M2	0.0023	0.0314	0.9750
R-squared 0.2573; Adjusted R-squared 0.1180			

NIGERIA			
Dependent Variable: NGN_MSCI			
Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	coefficient	z-statistic	P-value
C	0.0293	0.4853	0.6275
LNGN_EXVOL	-6.2106	-2.3414	0.0192
LNGN_CPI	2.9740	3.1638	0.0016
LNGN_M2	-0.4684	-0.5764	0.5644
Variance Equation			
C	0.0083	0.6047	0.5454
RESID (-1) ^2	-0.0445	-0.1367	0.8913
GARCH (-1)	0.4961	0.4539	0.6499
LNGN_EXVOL	-0.0521	-0.0722	0.9424
LNGN_M2	-0.0731	-0.3895	0.6969
R-squared 0.4499; Adjusted R-squared 0.3471			

KENYA			
Dependent Variable: LKES_MSCI			
Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	Coefficient	z-statistic	P-value
C	0.0065	0.1513	0.8797
LKES_EXVOL	-0.5010	-0.2494	0.8031
LKES_CPI	-1.7774	-0.5471	0.5843
LKES_M2	1.4751	1.7495	0.0802
Variance Equation			
C	0.0026	0.5225	0.6014
RESID (-1) ^2	0.0286	0.0706	0.9437
GARCH (-1)	0.5128	0.4817	0.6300
LKES_EXVOL	-0.0385	-0.1173	0.9066
LKES_M2	-0.0176	-0.1512	0.8798
R-squared 0.5042; Adjusted R-squared 0.4112			

SOUTH AFRICA			
Dependent Variable: ZAR_MSCI			
Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	coefficient	z-statistic	P-value
C	-0.0059	-0.3208	0.7484
LZAR_EXVOL	0.2224	1.2587	0.2081
LZAR_CPI	1.6726	1.1457	0.2519
LZAR_M2	1.3819	5.1767	0.0000
Variance Equation			
C	0.0006	0.9920	0.3212
RESID (-1) ^2	0.0691	0.2597	0.7951
GARCH (-1)	0.4722	0.6628	0.5074
LZAR_EXVOL	-0.0057	-0.5218	0.6018
LZAR_M2	-0.0081	-1.2795	0.2007
R-squared 0.8433; Adjusted R-squared 0.8134			

INDIA			
Dependent Variable: LINR_MSCI			
Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	Coefficient	z-statistic	P-value
C	0.0409	1.5989	0.1098
LINR_EXVOL	-0.0035	-0.0061	0.9952
LINR_CPI	-1.6742	-2.0740	0.0381
Variance Equation			
C	0.0012	0.7229	0.4697
RESID (-1) ^2	-0.1379	-1.0442	0.2964
GARCH (-1)	0.9757	3.7489	0.0002
LINR_EXVOL	-0.0313	-0.3674	0.7133
R-squared -0.0170; Adjusted R-squared -0.1365			

[13] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; MSCI= Stock Market Index; L= Natural Logarithm; GHC= Ghanaian Cedi; INR= Indian Rupee; KES= Kenyan Shillings; NGN= Nigerian Naira; ZAR= South African Rand

4.2.8. Analysis of Bond Returns

The mean equation and variance equation below describe the link between the dependent and independent variables.

The mean Equation

A percentage change in a variables coefficient causes a percentage change of either sign (-/+) in bond returns. All variables in the bond market of Ghana, India, Kenya, Nigeria and South Africa insignificantly affect bond returns, except for inflation in the bond market of South Africa. A rise/fall in these variables will cause the same rise/fall in bond returns.

A negative relationship can be seen in the bond market in India and Nigeria between exchange rate volatility, inflation and bond returns, whereas, the Kenyan bond market shows a positive but insignificant relationship are found between exchange rate volatility, inflation and bond returns. This relates to the result derived from Min et al (2003) after investigating the importance of liquidity and solvency variables to dollar-denominated bond spreads of fixed income securities for eleven emerging economies in Latin America and Asia for the period 1990 to 1999. A negative relationship was found between yield-maturity in the Latin America However, a 1% point increase in the money supply in Nigerian and South African bond market will cause an increase of 0.18 and 1.38 in the bond returns.

The Variance Equation

The variance equation shows volatility of the GARCH (1, 1) model, the various countries domestic currency volatilities, and the money supply (M2). The volatility of the exchange rates shows a weak and negative effect on bond return. This is in line with a negative and statistically insignificant relationship between money supply (M2) and bond return (LGB) such that a decrease in money supply by one percentage point will cause a decrease in bond return for all the markets in our data series. Through the introduction of the traditional approach as well as the portfolio adjustment approach, Aggrawal (1981), Solnik (1987), and Krueger (1983) revealed that an appreciation of a currency and foreign investment (capital inflow) causes a fall (decrease) in demand for money thus decreasing the money supply. The table in figure 4.11 below shows this:

Table 4.11: GARCH (1, 1) model for Bond returns[14]

KENYA				INDIA			
Dependent Variable: LKES_GB				**Dependent Variable: LINR_GB**			
Method: ML - ARCH (Marquardt) - Normal distribution				Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	Coefficient	z-statistic	P-value	Variable	coefficient	z-statistic	P-value
C	-0.0015	-0.0377	0.9699	C	0.0088	0.2142	0.8304
LKES_EXVOL	1.2100	0.3738	0.7085	LINR_EXVOL	-0.1281	-0.0994	0.9208
LKES_CPI	1.8910	0.8042	0.4213	LINR_CPI	-0.0334	-0.0223	0.9822
LKES_M2	-1.5643	-1.3766	0.1686	**Variance Equation**			
Variance Equation				C	0.0029	1.4077	0.1592
C	0.0164	0.5735	0.5663	RESID (-1) ^2	-0.0646	-1.5378	0.1241
RESID (-1) ^2	-0.1465	-0.4821	0.6297	GARCH (-1)	0.4330	2.2553	0.0241
GARCH (-1)	0.6391	0.7135	0.4755	LINR_EXVOL	-0.0380	-1.4263	0.1538
LKES_EXVOL	-0.5182	-0.5205	0.6027	R-squared -0.0507; Adjusted R-squared -0.1743			
LKES_M2	-0.0228	-0.1128	0.9102				
R-squared 0.1746; Adjusted R-squared 0.0198							
NIGERIA				**SOUTH AFRICA**			
Dependent Variable: LNGN_GB				**Dependent Variable: ZAR_GB**			
Method: ML - ARCH (Marquardt) - Normal distribution				Method: ML - ARCH (Marquardt) - Normal distribution			
Variable	Coefficient	z-statistic	P-value	Variable	coefficient	z-statistic	P-value
C	0.0194	0.4512	0.6518	C	0.0070	0.2641	0.7917
LNGN_EXVOL	-1.1719	-0.3285	0.7425	LZAR_EXVOL	0.0752	0.2021	0.8398
LNGN_CPI	-0.6277	-0.5620	0.5741	LZAR_CPI	-2.5730	-2.6797	0.0074
LNGN_M2	0.1804	0.3028	0.7621	LZAR_M2	0.0716	0.2758	0.7827
Variance Equation				**Variance Equation**			
C	0.0119	0.8084	0.4189	C	0.0023	0.8726	0.3829
RESID (-1) ^2	-0.1818	-2.0550	0.0399	RESID (-1) ^2	-0.0131	-3.0253	0.0025
GARCH (-1)	0.5406	0.5844	0.5590	GARCH (-1)	0.4970	1.4675	0.1422
LNGN_EXVOL	-0.2761	-0.8418	0.3999	LZAR_EXVOL	-0.0287	-0.8753	0.3814
LNGN_M2	-0.0221	-0.1784	0.8584	LZAR_M2	-0.0116	-0.3699	0.7115
R-squared 0.0175; Adjusted R-squared -0.1668				R-squared 0.2443; Adjusted R-squared 0.1026			

Source: Data compiled from Bloomberg

So far, this chapter has taken an in depth look at the various ways in which a time series data can be made stationery such as the use of an ADF and unit root tests. The ARCH model performed revealed that our data showed no evidence of heteroskedasticity, thus, the OLS model was then used to depict the relationship between exchange rate volatility, bond and stock returns. But due to inefficiency of the OLS estimates and its outdatedness, GARCH model has been used to clear the problems found in OLS estimates.

[14] EXVOL= Exchange rate volatility; CPI= Inflation Index; M2= Money Supply; GB= 10year Government Bond; L= Natural Logarithm; INR= Indian Rupee; KES= Kenyan Shillings; NGN= Nigerian Naira; ZAR= South African Rand

CHAPTER FIVE

5. Conclusion

This study aimed at analysing the interconnectedness of exchange rate volatility, stock and bond returns in five developing countries. This relationship considered the ARCH–GARCH model estimating volatility patterns and its response to negative and positive shocks, tests to detect heteroscedasticity (ARCH test) and stationarity (ADF test) of variables.

Our findings were inconclusive and revealed that there existed a weak negative and positive correlation between the dependent (stock and bond returns) and Independent (exchange rate volatility, inflation, and money supply) variables. However, an inverse relationship was revealed such that an increase in one would cause a decrease in the other. Exchange rate volatility was positively correlated to stock market returns in Kenya, and South Africa but positive exhibited a negative relationship to stock market returns in Ghana, Nigeria, and India. Bond returns in Kenya, Nigeria, and India were negatively correlated to exchange rate volatility and positively correlated in the South African market. These relationships were all weak and insignificant nature.

In summary, this research determines that the link between exchange rate volatility, stock and bond returns is of a weak and negative nature. Indian, South African, Ghanaian, and Kenyan exchange rates exhibiting high levels of volatility during 2011-2012, whereas the volatility of the Nigerian currency is lower during that period and gradually rising. However, the limitation that was found in this study was that 10-year government bond yield was missing for Ghana, and no money supply (M2) data was found for India.

The relevant authorities in each of these countries should adopt measures that will control the drastic movements of exchange rate, cash reserves and liquidity that will stabilize its exchange rates, stock and bond markets rates to benefit investors, policy makers and better develop the economy. Further study may be conducted on other macroeconomic variables that may possibly affect each of these financial variables (exchange rate volatility, stock and bond return) individually. It would also be interesting to research on the relationship between bond returns and exchange rate volatility and stock returns in various African economies.

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